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Los Osos Wastewater Project

Revised Project Report
Design Documents

March 24, 2003

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MONTGOMERY WATSON HARZA

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Los Osos Wastewater Project
Revised Project Report

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MONTGOMERY WATSON HARZA

To:	Bruce Buel	**Date:**	March 24, 2003
From:	Steve Hyland SJH	**Client:**	LOCSD
Subject:	Los Osos Wastewater Project Revised Project Report	**Job No.:**	1481166.010101

Enclosed are 12 sets of the Revised Project Report (30 Percent Design Submittal) for the Los Osos Wastewater Project for LOCSD staff, Board members, and JLWA. An additional 8 sets are transmitted to Boyle Engineering for the forthcoming Value Engineering Study to be conducted the week of April 7, 2003. This submittal was prepared to fulfill the requirements of the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002.

The Revised Project Report includes the following volumes:

- Design Documents
- Collection System Drawings
- Pump Stations / Wells / Effluent Disposal Drawings
- Wastewater Treatment Facility Drawings

The table of contents for each volume is included with its respective volume. Note that the collection system drawings for Area D will be delivered in approximately one week. As we have discussed, the Area D effort has lagged Area A, Area B, and Area C efforts because the septic tank survey and associated ground survey information for Area D was not available until early to mid-March.

Also attached to this transmittal is a project description for general reference.

Please contact Steve Hyland at (805) 528 – 9385 if you have any questions.

Distribution

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Can Quach
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Tim Cleath / Spencer Harris – C&A
Bill Thiessen – Brown-Buntin Associates

Los Osos Wastewater Collection, Treatment, and Disposal System

Project Description

Introduction

The community of Los Osos is located along the central coast of California on the southern edge of Morro Bay in San Luis Obispo County as shown in Figure 1.

Figure 1 - Project Location

Los Osos is a predominately residential community with 14,600 residents. The community's drinking water system is composed of a series of groundwater wells in the Los Osos area. The community's wastewater system is composed of individual septic tanks with associated leachfields or pits. The Los Osos Community Services District (District) is the government body responsible for wastewater management within the community.

Project Background

Groundwater resources in the Los Osos area are divided into four distinct aquifers. The fault dividing the community into east and west also divides the groundwater resources into an east-side aquifer and a west-side aquifer. In addition, an aquatard further divides both the eastside and westside aquifers into an upper and lower aquifer. In general, the upper aquifer is within 150 feet of the ground surface and the lower aquifer is below approximately 190 feet of the ground surface. Most of the community's drinking water wells draw groundwater from the lower aquifers.

Elevated levels of nitrate are present in the upper aquifers of the groundwater basin on both the eastside and westside of the community. High nitrate levels in drinking water are a public health concern, particularly for newborns where it can cause "blue baby syndrome". To protect public health, the California Department of Health Services (DHS) has established a drinking water limit of 10 mg/l nitrate (as N) in drinking water supplies.

In the early 1980's, nitrate levels in the upper aquifers within Los Osos exceeded the drinking water limit of 10 mg/l (as N). In several areas, water quality data suggested that that a buildup of nitrate was occurring in the upper aquifers. The primary source of nitrate contamination was identified by the RWQCB to be septic tanks and their associated leach fields. As a result, the RWQCB amended its Basin Plan and adopted Resolution 83-13 prohibiting the use of septic tanks with leach fields and seepage pits within the Prohibition Zone of Los Osos.

Facility Description

The recommended project presented in the final Project Report includes a wastewater collection system with pump stations and standby power facilities, a wastewater treatment facility, and an effluent disposal system with harvest wells. A description of these project components is presented below.

Collection System. The Los Osos wastewater collection system will be a conventional gravity sewer with pump stations. The gravity sewer system will include approximately 200,000 lf of predominantly 8-inch diameter sewer mains. Six wastewater submersible pump stations and approximately 20 pocket pump stations have been identified at this time. Each submersible pump station will be provided with standby power facilities. The pocket pump stations will not require standby power capability.

The collection system will be divided into four geographic areas based on drainage characteristics. The basis of design for the wastewater collection system will be to design the main sewers, trunk sewers, and laterals in a manner that will maximize gravity connections and to minimize pumped connections for customers. The sewers for a given drainage area will be routed to pump stations that will be designed to convey the collected wastewater via force main to subsequent gravity sewers for ultimate delivery to the wastewater treatment facility. The pump stations and standby power facilities will be designed with communication to the SCADA system.

Treatment Facility. The wastewater treatment facility (WWTF) will be located in the center of the Los Osos community and will be designed to be incorporated into an adjoining park setting in close proximity to community facilities. The treatment facilities will be enclosed, buried, or screened. Building enclosures will be designed with exterior architectural treatment and acoustical treatment. Confinement, ventilation, and treatment of potential odor sources will be provided.

The basis of design for the WWTF will be to treat an ultimate design dry weather flow of 1.4 mgd with an average daily BOD, suspended solids, and ammonia concentration of 340 mg/l, 390 mg/l, and 56 mg/l, respectively. The peak wet weather flow will be 1.6 mgd with peak daily BOD, suspended solids, and ammonia concentration of 350 mg/l, 400 mg/l, and 58 mg/l, respectively.

The WWTF will be designed to meet the Waste Discharge Requirements summarized below and Title 22 Requirements for disinfected tertiary recycled water.

Constituent	Units	Monthly (30-day) Average	Daily Maximum
Settleable Solids	ml/l	0.1	0.5
BOD, 5-Day	mg/l	30	100
Suspended Solids	mg/l	30	100
Total Nitrogen (as N)	mg/l	7	10

The WWTP will consist of the following facilities:

- Headworks. The headworks will consist of influent pumping of the raw wastewater that reaches the plant via gravity sewer that will combined with raw wastewater that reaches the plant via pump station force mains. The raw wastewater will be pretreated with screening and grit removal. The influent pump station wet well, screening area, and grit removal area will be enclosed and ventilated to contain and capture potential odors.

- Septage Handling Facility. The septage handling facility will consist of truck unloading, holding tank, and transfer pump to meter the septage to the Headworks for treatment. The septage holding tanks will be enclosed and ventilated to contain and capture potential odors.

- Extended Aeration Basins. Two extended aeration basins will be provided for treatment of the pretreated wastewater. Each basin will include denitrification basins for nitrate removal. The aeration basins will be buried and earth-covered to provide an area for above-grade dog park. The area above the buried aeration basins will be equipped with a subsurface drainage system to provide subsurface drainage.

- Clarifiers. Two secondary clarifiers will be provided for settling the mixed liquor from the extended aeration basins. The clarifiers will be equipped with return activated sludge pumps, waste activated sludge pumps, and secondary scum pumps located in the

secondary gallery. The secondary gallery will be designed to accommodate access to and removal of the mechanical equipment.

- Filters. Filters will be provided to provide tertiary treatment of the secondary effluent. The filters will be enclosed to house ancillary equipment for coagulation.

- UV Disinfection. UV disinfection modules will be provided adjacent to the filters to disinfect the filtered effluent. The UV disinfection system will be enclosed within the building housing the filters.

- Effluent Pump Station. An effluent pump station will be designed to convey the disinfected tertiary recycled water to the effluent disposal system sites – percolation fields and potential reclaimed water irrigation sites. The tertiary effluent will also be used to meet utility water needs for the WWTP and adjacent landscape irrigation demands. The effluent pump station will be housed in the tertiary building for the filter/UV disinfection equipment.

- Solids Handling. The solids handling facilities will consist of thickening, stabilization, and dewatering processes for the biological solids produced by the liquid treatment processes. Thickening of the waste activated sludge will be accomplished with two gravity belt thickeners with washwater pumps and thickened sludge transfer pumps. Stabilization will consist of aerobic digestion tanks with blowers. Dewatering will include two belt presses with sludge feed pumps, washwater pumps, dewatered cake conveyance and storage. A polymer storage, activation, and feed system will be provided to condition the sludges prior to the thickening and dewatering operations.

  The solids handling equipment will be housed in a two-story building with the gravity belt thickeners and belt presses installed on the upper floor. The discharge of dewatered sludge from the belt presses will be conveyed to a loading aisleway in the lower floor of the building. Potential odor areas within the solids handling building will be enclosed and ventilated to contain and capture foul air.

- Odor Control. An odor control system consisting of a biofilter with fans and ductwork will be provided. The biofilter will be designed to treat any foul air that is contained and captured from the process areas previously described. The biofilter will be concrete lined and consist of compost media with geotextile, underdrain, and wetting system.

- Acoustical Mitigation. Acoustical treatment will be provided to mitigate noise generated from the new WWTF. Noise levels from the new facilities will be predicted and acoustical treatment designed to provide reasonable noise levels at the WWTF boundary consistent with ambient values. In addition, occupational noise levels inside the new facilities will be evaluated for worker protection.

- SCADA. A Supervisory Control and Data Acquisition (SCADA) system will be designed to serve the WWTF. In addition, the SCADA system will also serve the collection system pump stations and associated standby power facilities, the effluent

disposal system, and the harvesting wells. Communication between the WWTF and the remote sites will be provided with radio telemetry and/or fiber optic cable.

- Operations Building. An Operations Building consisting of a SCADA/control room, laboratory, office, conference room, restrooms, shower and locker rooms, and storage will be provided. The occupied spaces of the Operations building will be heated and cooled.

- Sitework. The site of the WWTF will include grading, paving, fencing, yard piping, and utilities. Grading, storm drainage piping, and a stormwater retention basin will be provided to control surface runoff from the site and subsurface drainage collected above the buried extended aeration basins. Paving will be provided for roadways, parking, and sidewalks. Underground piping for interconnection of liquid treatment and solids handling processes and support utilities will be included.

- Landscaping. Landscaping will be provided to screen the WWTF structures and the perimeter of the WWTF site. Provisions for landscaping future site improvements for community amenities at the Tri-W site will be included. Irrigation will designed for the use of disinfected tertiary recycled water produced by the WWTF in compliance with Title 22 Regulations.

- Architectural. The design of the above-grade buildings will incorporate architectural treatment of the exterior elevations. The architectural treatment will be compatible with the landscaping design for the WWTP site and surrounding areas.

Effluent Disposal System. Effluent disposal will be accomplished with a percolation (subsurface distribution) system. The percolation system will be divided into a number of application fields. The application fields will consist of horizontal perforated piping or vertical disposal wells. The connection to each percolation zone will be equipped with an isolation valve, flow control valve, and flow meter.

Approximately ten monitoring wells will be provided to allow periodic measurement of groundwater levels and to obtain groundwater samples at key locations in the vicinity of the percolation sites. The turnouts for potential water reuse sites will be equipped with an isolation valve. The flow meter and flow control valve for each application field will be designed with communication to the SCADA system.

The effluent disposal system will be designed with a transmission pipeline from the WWTF to percolation fields and potential water reuse sites. The transmission pipeline design will be closely coordinated with the design of the effluent storage and pump station at the WWTF.

Water Harvesting Facilities. Six harvest wells will be installed to extract groundwater at critical locations to prevent groundwater mounding and potential daylighting in low-lying areas. The harvesting wells will be designed with communication to the SCADA system.

Section 1

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	March 24, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Steve Hyland John Bergen Jack Osborn Dennis Gellerman Linda Tripp Tony Kieth Kyle Harris Can Quach David Wilcoxson	**Job No.:**	1481166.023501 1481166.033579 1481166.043579 1481166.053579
Subject:	Design Criteria – Revision 1		

Preface

The Design Criteria Technical Memorandum (TM) presented herein was prepared to fulfill the requirements of Subtask 2.01 - Coordination, Subtask 3.01 - General, Subtask 4.01 - General, and Subtask 5.01 – General under Task 2 – Collection System, Task 3 – Pump Stations / Wells, Task 4 – Wastewater Treatment Facility, and Task 5 – Effluent Disposal, respectively, in the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002.

Introduction

The Design Criteria TM is intended to summarize the key design criteria that will serve as the basis of design for the Los Osos Wastewater Project. The design criteria presented herein are subject to revision based on review and comment by the District and consultants. The design criteria will be further refined as the final design effort advances.

The design criteria are presented in sections corresponding to the four major design tasks – Collection System, Pump Stations / Wells, Treatment Facility, and Effluent Disposal. Please contact Steve Hyland at (805) 528 – 9385 if any additional clarification or detail of the design criteria is desired.

Collection System

This section presents design criteria for the collection system gravity sewers and force mains. The design criteria are based upon the LOCSD Standard Plans and Specifications dated October 30, 2001. Sewer improvements are described in Chapter 3 of the District standards. (Note that Chapter 4 - Water Improvements includes certain design criteria that can be applied to force mains and has been referenced accordingly.) Any changes to the District standards are noted. For ease of reference to the District standards, the same numbering system is used.

Gravity Sewers

3.1 Design Standards

A. Design Flow

1. Average dry weather flow will be 69 gallons per capita per day and 2.5 persons per benefit unit in lieu of 300 gallons per day per single family residence.
2. Peaking Factor (PF) per Gifft equation from WEF MOP No. 9 is

   $$PF = 5 / P^{(1/6)}$$ where P = population in 1000s of tributary area

   in lieu of PF = 2.5, except that PF will not be greater than 5.0.
3. Peak hour dry weather flow will be the average dry weather flow times the peaking factor.
4. Allocation for I/I contribution will be 17 gallons per capita per day.
5. Peak hour wet weather flow will be the sum of the average dry weather flow times the peaking factor (peak hour dry weather flow) plus the I/I contribution.
6. At peak hour wet weather flow, the hydraulic depth will be less than or equal to 0.5 sewer diameter per District standards.

B. Grades

1. Minimum velocity will be 2.0 feet per second at peak hour dry weather flow.
2. Minimum sewer grades per District standards except that 6-inch sewers will not be used and minimum slope for 8-inch sewers will be 0.0033.
3. Sewer laterals will use 0.25-inch per foot slope except that 0.125-inch per foot will be considered on a case by case basis.

3.2 Location and Alignment

C. Separation from Water Mains

1. Horizontal clearance between existing water mains and the sewer will be 15 feet where feasible to facilitate the future replacement of existing water mains.

D. Depth

1. Minimum cover of 36-inches for pipelines on secondary roads and 48-inches for pipelines in primary roads in lieu of 60-inches.
2. House lateral minimum cover at the property line of 36-inches. Minimum cover less than 36-inches will be considered on a case by case basis.

3.3 Pre-treatment

1. Provide grease traps for all restaurants and other oil and/or grease producing facilities.
2. Provide monitoring manholes (for inspection and manual wastewater sampling) for all industrial facilities (garages, laundries, metal working shops, etc.). Monitoring manholes shall be provided with a Palmer-Bowlus flume and ultrasonic flow meter as directed by the District Engineer. An automatic wastewater sampler shall also be provided as directed by the District Engineer.

3.4 Gravity Sewers

A. PVC Sewers

1. Maximum pipe SDR shall be 26 instead of 35.
2. Use integral bell and spigot type with elastomeric gasket only.

B. DIP Sewers

1. Ductile iron pipe (DIP) may be used in situations where less than minimum cover is available on case by case basis. DIP will be factory-fused polyethylene lined.

C. Sewer Size

1. Shall be 8-inch minimum diameter in lieu of 6-inch.

F. Trenching and Backfill

1. Bedding depth below the pipe shall be 9-inches in lieu of 6-inches.
2. Bedding type has a higher percentage of fines than MWH normally uses. Discuss use of well graded 0.5-inch or or 0.75-inch minus material such as Class 2 aggregate base with District and Fugro.
3. Provide 90% relative compaction in pipe zone.
4. For wet and/or soft trench bottom areas, over-excavate a minimum of 12 inches and provide foundation material (1-inch to 3-inch drainrock) wrapped in geotextile.
5. Referring to Detail W-10, trench cross-section change 6-inch minimum and 8-inch maximum clearances to 8-inch and 10-inch, respectively.
6. Provide warning tape 12 inches above pipe for PVC gravity sewers.
7. Discuss with District and Fugro changing 12-inch minimum 95% compacted zone at top of trench to 24-inch to 36-inch minimum, at least in primary roads.

8. Detail shows 2-inch asphalt concrete on 6-inch aggregate base. Discuss project minimum pavement restoration section with District and Fugro.

3.5 See Force Main Design criteria below.

3.6 Sewer Laterals

1. Laterals from the sewer main will be installed with minimum 3-feet of cover. Less than 3-feet of cover will be considered on a case by case basis.
2. Use "stacked" lateral (wye is vertical and use an 1/8 bend at the top then extend horizontally to property line) for deep sewer, e.g. over 12-15 feet depth.
3. Use "flat" lateral (wye is horizontal) for shallow sewer where available depth to serve property owner is limited. Invert of "flat" lateral at the property line will be approximately 1.0 feet above the invert of its respective sewer main.
4. Will develop three standard details for sewer laterals – District standard, stacked, and flat.

C. Large Laterals

1. Laterals 6 inches and larger shall be connected to the sewer main at a manhole.

E. Cleanouts

1. Discuss use of two-way cleanout at property line instead of District one-way cleanout.

G. Curb Marking

1. Consider use of concrete marker marked "S" for areas without curbs. In all cases install 2x2 redwood stake at end of lateral to facilitate location for homeowner lateral connection.

3.7 Sewer Manholes.

1. No clean-outs shall be used.
2. Manholes shall be PVC lined from manhole bench elevation (bottom of barrel sections) to the underside of the manhole frame.
3. Coat manhole bench with epoxy Polybrid, or equal.

C. Future Stub Outs.

1. Provide terminal manhole for sewers less than 200 feet in lieu of clean-out. Provide terminal manhole for all sewers greater than 200 feet in length.

D. Manhole Elevations.

1. Do not provide any drop through manhole in lieu of 0.15-feet drop where single sewer passes through manhole with no change in alignment.
2. Use 0.10-foot drop through manhole in lieu of 0.15-feet drop where sewer alignment direction changes or at junction manholes.

E. Cast in Place Bases.

1. Use 9 inches of crushed rock under base.

1. Straight Runs. Cut out portion of pipe within manhole from springline up.

F. Precast Manhole Base.

1. Use 9 inches of crushed rock under base.
2. Use mastic type joint sealant only.

G. Drop Manholes.

1. Change 30 inches invert elevation difference to 36 inches.
2. Install cross fitting on drop pipe instead of tee. Extend vertical leg of cross to grade and install clean-out valve box.

3.8 Laying Sewer Pipe. No changes.

3.9 Discharge into Sewers. No changes.

3.10 Testing of Sewer Mains.

B. Deflection Test.

1. District standard specifies 7% deflection but not stated if initial or long term deflection. Use 5% initial and 7.5% long term deflection (with typical 1.5 deflection lag factor). Require long term deflection test at 11 months after installation.

Force Mains

The following force main design criteria shall be used. For ease of comparison to the District standards, the same numbering system is used:

3.5 Sewage Pump Stations (Force Mains (FM)).

1. Use C-900 pipe as per District standard except use PE lined DIP for less than minimum cover situations.
2. Use PVC or PE lined DIP fittings for PVC FMs and PE lined DIP fittings for PE lined DIP FMs.
3. Provide pressure clean-outs at 1,500 feet spacing.
4. Provide blow-offs at low points where crown of pipe at low point is below the invert of any reach of upstream pipe.
5. Provide combination air and vacuum release valves (CARV) at all high points. All CARVs will be housed in precast vaults with activated carbon canister for odor control.
6. The profile of force mains should be carefully considered to avoid the installation of blow-offs and CARVs where possible. The discharge of any blow-offs or CARVs should be routed to a nearby gravity sewer manhole.

7. FM isolation valves are not proposed due to small diameter and comparatively short runs.
8. Consider "Valmatic" ARV's as opposed to float type (Apco, Crispin, etc.). CARV's shall be provided with a carbon canister odor control unit.
9. Discuss with District the need for pigging stations at pump stations.
10. Design the force main hydraulics for a range of pipeline friction losses. Use Hazen-Williams values ranging from C = 110 to C = 140.
11. Minimum velocity of 2 fps, maximum velocity of 10 fps.
12. FM minimum cover of 3 feet in secondary roads and 4 feet in primary roads.
13. Minimum 4-inch diameter for pump station FMs and minimum 2-inch diameter for pocket pump station FMs.
14. FM alignment may be curved (vertically and horizontally) as allowed by District water main standard.
14. Use restrained joint system in lieu of thrust blocks. DIP restrained joints shall be flanged or mechanically restrained such as TR-Flex by US DIP. MJ joints are not acceptable as restrained joints.

Pump Station and Wells

The facilities included in this section are submersible pump stations with standby power facilities, pocket pump stations, and harvest wells. The preliminary locations of the submersible pump stations and the harvest wells are shown in Figure 1 and Figure 2, respectively. The number and location of pocket pump stations will be determined as the collection system design progresses.

Submersible Pump Stations	
Pumps	Two to three submersible pumps, design capacity met with one standby pump
Wet Wells	Pre-cast reinforced concrete with cast-in-place PVC liner, 8 to 10 feet diameter, depth as required, access hatch at grade.
Valve Vaults	Pre-cast reinforced concrete, houses discharge swing check valves and isolation eccentric plug valves. access hatch at grade.
Standby Power Building	Diesel engine-generators, mounted on double containment fuel storage tank, housed in block building with intake louver and exhaust plenum, acoustical treatment of building, intake, and plenum. Building will house submersible pump control panel, motor control center, and switchgear. Natural gas driven engines will be used to meet separation criteria where required.
Backup	Provisions for connection of trailer mounted engine-generator set or trailer mounted pump.

Pocket Pump Stations	
Pumps	Two to three submersible grinder pumps, design capacity met with one standby pump.
Wet Wells	FRP wet well for routine duty. FRP wet well installed in pre-cast reinforced concrete storage well with cast-in-place PVC liner, 8 to 12 feet diameter, depth as required, access hatch at grade. Storage well to provide 12 hour detention of average day wastewater flow.
Valve Vaults	None
Standby Power	None permanently installed.
Backup	Provisions for connection of trailer mounted engine-generator set or trailer mounted pump.

Harvest Wells	
Pumps	One submersible well pump.
Casing	Size, depth, and perforations to be determined.
Well house	Building with masonry block construction, provisions for sodium hypochorite disinfection and addition of corrosion inhibitor.
Standby Power	None permanently installed unless adjacent to standby power facility for a submersible pump station.
Backup	Provisions for connection of trailer mounted engine-generator set.

Submersible Pump Stations – Preliminary Design Criteria						
Description	No. of Pumps (a)	Pump Station Capacity	Pump Capacity	Pump TDH	Est. Pump Size	Est. Generator Size KW
		(gpm)	(gpm)	(ft)	(hp)	(kw)
Lupine	2 + 1	1000	500	140	30	100
West Paso (b)	2 + 1	1800	900	150	60	200 (b)
Baywood (b)	1 + 1	310	310	20	3	
East Ysabel	1 + 1	170	170	120	10	30
East Paso	1 + 1	330	330	40	7.5	60
Mountain View	1 +1	130	130	45	3	30
Sunny Oaks	1 + 1	120	120	50	3	30

(a) x + y, where x = number duty pumps and y = number of standby pumps
(b) West Paso and Baywood pump stations share common standby power facility at 3rd Street well site.

Pump Stations / Wells – Landscaping

Site Feature	Supplier	Materials / Special Features	Code
Perimeter Landscape	Local Native Plant Nursery	Native Trees, Shrubs, & Grasses	None

Pump Stations / Wells – Structural

Refer to the Treatment Facility section for structural design criteria.

Pump Stations / Wells – Architectural

Occupancy Type: F (assumed)

Proposed construction type: V

Proposed Construction Materials: Reinforced concrete, masonry, wood roof trusses and sheathing.

Space Summary: The pump station standby power buildings and well houses will be constructed of concrete masonry units, incorporating split faced, fluted and/or colored units to achieve the desired appearance. The roof structure is intended to be pitched wood trusses, sheathed and with plywood and covered with architectural asphalt singles. The interior floors will be sealed concrete, the concrete block walls will also be sealed. All exposed mechanical equipment, piping, and appurtancences will be painted to harmonize with the structure.

Pump Stations / Wells – HVAC

Refer to the Treatment Facility section for HVAC design criteria.

Pump Stations / Wells – Electrical

Refer to the Treatment Facility section for electrical design criteria.

Pump Stations and Wells - SCADA

A. Control

1. On-Site Remote Telemetry Unit (RTU) consisting of a small Programmable Logic Controller (PLC) in a suitable enclosure located in either the Standby Power Building or Pedestal Mounted next to the Pump Station.

2. Manual On/Off control will also be provided at each location.

B. Telemetry

1. Individual radio at each station will communicate with master radio located potentially at Wastewater Treatment Plant. Potential use of fiber optic link will be explored.

2. Use of District's existing water towers at 10^{th} and 16^{th} streets will be explored for radio repeater stations.

C. Operator Workstations

1. Man Machine Interfaces (MMI's) will be provided to monitor and control the pump stations.

2. Initial work indicates that workstations will be located at the Wastewater Treatment Plant, Downtown District Office, and 8^{th} Street Water Maintenance Yard.

3. Each workstation will consist of a PC suitable for the application, loaded with Supervisory Control and Data Acquisition (SCADA) software that will operate in an "Open Architecture" Microsoft Windows 2000 environment.

4. An option will be explored to link each location via a fiber optic backbone to ensure maximum reliability.

5. The Workstations will provide pump status monitoring capability for each station with limited control, such as reset and acknowledgement of alarms and potential manual start/stop of individual pumps.

D. Instruments

1. Continuous level monitoring in wastewater pump stations used for pump control with a high-level float switch for alarm condition notification.

2. Monitor the power source at each location for loss of utility or failure of standby power equipment communicated back to the central monitoring facilities.

E. Standards

1. ANSI/ISA Symbols, Tagging and Numbering conventions per ISA S5.1

F. Interlocks

1. Interlocks deemed critical to the protection of personnel and major equipment will be hardwired to the MCC with interposing relays providing isolated inputs to the PLC.

2. Interlocks and control devices not deemed critical for the protection of personnel and major equipment will be wired to the PLC.

3. All interlocks will be in affect when equipment is operated via the PLC.

4. The critical interlocks only will be in affect when equipment in operated from the HOA station.

Treatment Facility

Treatment Facility – Process Design Criteria

Description	Value	No.
Flow		
Average Day Dry Weather	1.3 mgd	
Peak Day Wet Weather	1.6 mgd	
Peak Hour	4.4 mgd	
Wastewater Loading		
Population Served	18,428	
Average Day BOD	0.20 lb/cap/day	
	340 mg/l	
Peak Day BOD	0.25 lb/cap/day	
	350 mg/l	
Average Day TSS	0.23 lb/cap/day	
	390 mg/l	
Peak Day TSS	0.29 lb/cap/day	
	400 mg/l	
Average Day TKN	0.033 lb/cap/day	
	56 mg/l	
Peak Day TKN	0.042 lb/cap/day	
	58 mg/l	
Septage Loading		
Septage BOD	5,000 mg/l	
Septage SS	15,000 mg/l	
Septage TKN	500 mg/l	
Avg Day Flow	1700 gpd	
Peak Day Flow	3,000 gpd	

Recycle Flows		
Grit Overflow	50 gpm	
Filter Backwash	75 gpm	
Thickening-GBT	100 gpm	
Dewatering-Belt Filter Press	50 gpm	
Influent Pump Station		
Pump Type	Submersible	2 + 1
Headworks		
Flow Meters	Magnetic	1
Grinder	Channel	2
Screen Type	Auger/Sieve	2
Screen Opening	0.25 inch	
Screenings Production	11 cf/MG	
Grit Removal	Mechanical Vortex	1
Detention Time	40 sec	
Diameter	8 ft	
Grit Pumps	Recessed Impeller	2
Grit Classifier	Gravity / Auger	1
Grit Production	25 cf/MG	
Septage Handling		
Pretreatment Unit	Screen	1
Storage Tank	4,000 gal	
Biological Treatment		
Pre-Anoxic Denitrification		2
HRT	3 - 4 hr	
Mixing	Submersible	
Mixed Liquor Recycle Rate	100 - 400 %	

Aeration Basins		2
Depth	15-18 ft	
Hydraulic Residence Time (HRT)	24 hr	
RAS Recycle Rate	50 - 100 %	
Aeration Type	Surface Aerator	
Secondary Clarifiers		2
Average Day Overflow Rate	300 gal/sf/day	
Peak Hour Overflow Rate	450 gal/sf/day	
Clarifier Diameter	60 ft	
Sidewater Depth	15 ft	
Tertiary Filters		4
Type	Continuous Backwash	
Maximum Hydraulic Loading Rate	5 gpm/sf	
Coagulant	Alum/Polymer	
Disinfection		
Type	Low Pressure UV	
UV Dose	100 mws/cm2	
Effluent Transmittance	55%	
Lamp Life Factor	0.5	
Minimum No. of Lamps	240 lamps	
No. of Banks	6	
No. Lamps per Bank	56	
Total No. of Lamps	336 lamps	
Effluent Pump Station		
Broderson Zone	1100 gpm	
Service Zone	1100 gpm	
Pump Type	Vertical Turbine with VFD	

Sludge Thickening

Type	Gravity Belt Thickeners	2
GBT Operation	6 hr/day , 5 day/wk	
Thickened Sludge	5-7 % DS	
Belt Width	1 meter	
Hydraulic loading	150 gpm/meter	

Aerobic Digestion

Hydraulic Residence Time	20 days	
Number of Cells	4	
Aeration Type	Coarse Bubble	
Blower Type	Multistage Centrifugal	
Blower Size	2000 cfm	

Sludge Dewatering

Type	Belt Press	2
Operation	6 hr/day, 5 day/wk	
Belt Width	1 meter	
Hydraulic Loading	50 gpm/meter	

Odor Control

Type	Biofilter
Headworks	15,000 cfm
Secondary Treatment	10,000 cfm
Solids Handling	15,000 cfm
Biofilter Loading Rate	3 cfm/sf
Biofilter Area	13,000 sf

Treatment Facility – Landscaping

Site Feature	Supplier	Materials / Special Features	Code
Multi-Use Path	Site Constructed	Landscape - Turfgrass & Trees	None
	Site Constructed	Pathway - Resin Paving provides all weather surface and permeability	SLO Co.
On-Site Drainage Detention Basin	Local Native Plant Nursery	Landscape - Native grasses, sedges, & forbs that re-seed annually	None
	Geoweb or equal	Bank Stabilization - Mechanically Stabilized Earth (MSE) allows for steepened banks	SLO Co.
	Not Selected	Security Fencing - must meet local codes.	SLO Co.
	Site Constructed	Access - Service access provided for seasonal maintenance.	SLO Co.
Off-site Drainage - Sedimentation Basin	Local Native Plant Nursery	Landscape - Native grasses, sedges, & forbs that re-seed annually	None
	Geoweb or equal	Bank Stabilization - Mechanically Stabilized Earth (MSE) allows for steepened banks	SLO Co.
	Not Selected	Security Fencing - must meet local codes.	SLO Co.
	Site Constructed	Access - Service access provided for seasonal maintenance.	SLO Co.
Off-Site Drainage - Percolation Area Multi-Use Playfield	Site Constructed	Landscape - Turfgrass & Trees	None
"Arroyo" Drainage Channel	Site Constructed	Must convey 100 year storm event.	SLO Co.

Dog Park	Site Constructed	Landscape – Wood chips	None
	Not Selected	Security Fencing - must meet local codes.	SLO Co.
	Site Constructed	Seating/Benches & Shade/Wind Protection	None
Landform/Berm-Wall	TBD	Retained earth system surrounding plant operations. Final design under refinement	SLO Co.
Interpretive Exhibits (Optional)	TBD	Constructed of phenolic resin based material with digital images laminated into surface	None
Footbridge (Optional)	On-site Eucalyptus	Constructed from salvaged on-site eucalyptus trees	SLO Co.
Perimeter Landscape @ Well sites	Local Native Plant Nursery	Native Trees, Shrubs, & Grasses	None
Perimeter Landscape @ Broderson site	Local Native Plant Nursery	Native Trees, Shrubs, & Grasses	None

Treatment Facility - Structural

S01 Governing Codes and Standards

A. Uniform Building Code (UBC)

B. Building Code Requirements for Reinforced Concrete (ACI 318-95) and Commentary (ACI 318R-95)

S02 Design References

A. Manual of Steel Construction Allowable Stress, 9th Edition American Institute of Steel Construction (AISC)

B. Environmental Engineering Concrete Structures (ACI 350R-89)

S03 Design Methods and Assumptions

A. Reinforced Concrete

1. Non-hydraulic structures: Strength Design Method in accordance with ACI 318-96.
2. Below-grade and hydraulic structures including top slabs: Strength Design Method in accordance with ACI 350R-89.

B. Structural Steel

1. All steel designs will be in accordance with AISC - 9th Edition.
2. All steel welding qualification and workmanship will be in accordance with American Welding Society (AWS).

S04 Design Criteria

A. Design Live Loads

1. Roof	20 psf
2. Truck traffic area	HS20 loading
3. Stairs, landings, walkways	100 psf
4. Equipment room or pump room	200 psf
5. Motor room	150 psf
6. Slab-on-grade	250 psf
7. Storage area	150 psf
8. Electrical/control rooms	250 psf
9. Other areas	100 psf

B. Lateral Loads

1. Earthquake loads per UBC Zone 4 with I = 1.5 and in accordance with the recommendations of the Geotechnical Report.
2. Wind load per UBC with basic wind speed of 70 mph, exposure C, and I = 1.15.

C. Uplift Loads

1. Factor of Safety (against buoyancy) of 1.10 for 100 year flood condition.
2. Factor of Safety (against buoyancy) of 1.50 for normal condition.

D. Grating and Cover Plate

1. Deflection will be limited to 1/4 inch for 100 psf live load or 1/240 of clear span, whichever is smaller.
2. Weight of grating or plate segments will be limited to 80 pounds maximum, unless otherwise noted.

E. Geotechnical Criteria

1. Fugro has prepared a draft Geotechnical Report. Recommendations in the report will be incorporated in the structural design when available.

S05 Materials

A. Concrete Strength

1. All structural applications - 4,000 psi.
2. Curb, gutter, and civil applications - 3,000 psi.
3. Unreinforced concrete - 2,000 psi.

B. Concrete Finish (except architectural surfaces)]

1. Formed surfaces - none
2. Water bearing slabs with slope less than 10% - steel trowel
3. Water bearing slabs with slope greater than 10% - light hair broom
4. Non-water bearing slabs - light hair broom

C. Concrete Finish (architectural surfaces)

1. Interior floor slabs and slabs - steel trowel
2. Walls - Per architectural schedule

D. Reinforcing:

1. All applications - Grade 60.

E. Masonry:

1. Block: ASTM C90 Grade N-1; f^1m = 1,500 psi, fully grouted.
2. Mortar Type M, F^1c = 2,500 psi.
3. Grout: F^1c = 3,000 psi.

F. Steel:

1. Standard shapes and plates - ASTM A36.
2. Structural tubing - ASTM A500, Grade B.
3. Structural pipes - ASTM A53, Grade B.
4. All bolted connections for structural frames will be friction type using A325 bolts. Other connections for platforms, stairways, etc. will be A307 bolts.
5. All steel framing for platforms and stairways will be hot dip galvanized.

G. Stainless Steel:

1. General uses - Type 316.
2. Submerged or corrosive areas - Type 316 .

H. Welds: E70XX electrodes

I. Structural aluminum: Allow 6061-T6

J. Grating and Cover Plate

1. Unless noted otherwise, all gratings and cover plates will be aluminum.
2. Gratings and cover plates under traffic area will be galvanized steel.
3. Fiberglass grating will be used in the chemical areas.

I. Handrails

1. Unless noted otherwise, all handrails will be aluminum.

Treatment Facility - Architectural

General

The building structures will be designed using the 1998 California Building Code as the governing code. Other code references will be addressed including: 1998 California Code, 1998 California Pluming Code, 1998 California Fire Code, NFPA 1995 – National Fire Code, 1995 Energy Efficiency Standards and other code criteria mandated by the local authorities having jurisdiction.

Operations Building –

Occupancy Type: B

Proposed construction type: II

Proposed Construction Materials: Concrete or Concrete masonry units to harmonize with the surrounding treatment facility structures.

Proposed Square footage: 2500 sq. ft.

Space Summary: Reception area, offices, conference room, restrooms, showers & locker rooms, maintenance/parts room, lab, and SCADA control room.

Space Description: The Operations building will serve as the administrative office and the prime area of public interface. The interior finishes will be standard, durable commercial quality fixtures and furnishings including, painted walls, carpeted offices and administrative areas, tiled restrooms, lockers and showers, and other durable floor, wall and ceiling finishes as required for the function of the facility.

Other Waste Water Treatment Buildings –

Occupancy Type: F (assumed)

Proposed construction type: II

Proposed Construction Materials: Reinforced concrete and masonry

Space Summary: The remaining structures at the main waste water treatment facility will house the equipment and machinery to process and treat waste. The exterior appearance of the facilities will be designed to blend with the natural landscape and provide a park-like setting on the adjacent grounds. The use of textures, colors, and massing elements will be incorporated into the design to achieve the desired outcome.

Treatment Facility - HVAC

H01 Governing Codes and Standards

A. California Mechanical Code

B. California Building Code

C. California Plumbing Code

D. SMACNA - 1996 Edition

E. California Title 24 Energy Code - 1996 Edition

F. NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities - 1997 Edition

H02 Design References

A. ASHRAE Handbooks – 2001 Fundamentals

B. SMACNA Duct Design Standards - Latest Edition

C. Industrial Ventilation - 21st Edition

H03 Design Methods and Assumptions

A. All ventilation equipment will be located indoors.

B. Outdoor design temperature design based on ASHRAE summer 0.1% design

H04 Design Criteria

A. Airchange Rates

1. Air change rates based on NFPA 820.

B. Temperature Controlled Spaces

1. Electrical Rooms - 85°Fdb ± 5°F maximum room temperature. Cooling only. No heating.
2. Process Areas – No cooling or heating, ventilation only.
3. Control/Computer Room - 72°F db ± 2°. Cooling and heating.
4. Operations Building - 72°F db ± 2° winter, 74°F db ± 2° sum Cooling and heating.

D. Airflow Velocities

1. Louvers - face velocities approximately 500 FPM.
2. Scrubber duct velocities approximately 800-1,500 FPM.
3. Ventilation duct velocities approximately 700-1,000 FPM.
4. Conditioned air duct velocities approximately 500-1,000 FPM.

E. Fire Protection Systems

1. Hydrant locations - To be determined.

2. Sprinkled locations and systems - To be determined.
3. Dry chemical extinguishing locations and systems - To be determined.
4. Portable fire extinguishing locations - To be determined.

H05 HVAC Equipment

A. Cooling & Heating Equipment

1. Indirect/direct evaporative coolers for electrical rooms.
2. Heat pump for operations building.

H. Controls

1. DDC controls for control / computer room HVAC.
2. Electronic and electric relay controls for ventilation, indirect/direct evaporative coolers, and heat pump HVAC systems.

H06 Materials of Construction

A. Exposed ductwork will be FRP or PVC with 316 SS supports.

B. Ventilation fans with FRP or stainless steel construction.

C. Electric motors with premium efficiency. Frame type based on area classification.

D. Buried ductwork will be high density polyethylene or PVC pipe.

Electrical

E01 Governing Codes and Standards

A. National Electrical Code (Latest Edition)

B. Uniform Building Codes (conduit spacing in structural elements - 3 times diameter spacing)

C. California Title 24 Building Codes

D. PUC General Orders 95 (overhead work) and 128 (underground work) in public spaces

E02 Design References

A. NFPA 101 (emergency lighting for occupied spaces)

B. NFPA 820 (Hazardous area classifications in WWTP)

C. NFPA 72 (Fire alarm and sensing requirements for occupied spaces)

D. IES Lighting Handbook (Latest Edition)

E. NFPA 110 (Emergency and Standby Power Systems)

F. IEEE 519 - 1992 (Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems)

G. The electrical systems for this project will be designed for general compliance with NEMA, ANSI, IEEE, and UL standards. In general, the design will be heavy-duty with industrial type with emphasis placed on safety, reliability, maintainability, and economics.

E03 Design Methods and Assumptions

A. Area Classifications

1. Hazardous and corrosive areas will be defined on the electrical drawings.
2. Hazardous areas will be defined in accordance with the National Electrical Code (NEC).
3. In general, the extent of hazardous and corrosive areas will be minimized by the use of good practical facility and equipment design and ventilation techniques. In addition, electrical equipment will be located outside these areas to the greatest extent possible.

B. Setup and Testing

1. Installation checks per manufacturers written instructions.
2. Mechanical and electrical adjustments and settings per manufacturer's written instructions.
3. Relay and protective device settings in accordance with the NEC and the short circuit and coordination study.
4. Functional testing of electrical equipment per manufacturer's written instructions.
5. Acceptance tests per NETA 1999 Acceptance Test Specifications.
   a. Short Circuit Coordination Studies (6.1)
   b. Switchgear and Switchboard Assemblies (7.1)
   c. Transformers (7.2)
   d. Cables (7.3)
   e. Switches (7.5)
   f. Circuit Breakers (7.6)
   g. Protective Relays (7.9)
   h. Instrument Transformers (7.10)
   i. Metering (7.11)
   j. Grounding Systems (7.13)
   k. Ground Fault Protection (7.14)
   l. Rotating Machinery - Motors (7.15)
   m. Motor Control (7.16)
   n. Engine Generators (7.22)

E04 Design Criteria

A. Unit Substations

1. Seismic zone 4 rated.
2. Oil filled transformers - 55/65 degree C rise with future forced air - OA/OA/FFA, with surge arrestor protected primary.
3. Primary - 12 kV - Delta.
4. Secondary - 480/277 volts, wye with solidly grounded neutral.
   a. General facility power - 480 volt - 3 phase
   b. Lighting and miscellaneous low voltage - 120/208 volt - three phase.

B. Power Distribution Equipment

1. Seismic zone 4 rated.
2. Enclosures:
   a. NEMA 3R for outdoors.
   b. NEMA - 1, 1A, or 12 for gasketed for indoor
3. Switchgear fully rated for short-circuit capacity.
   a. 12 KV - 500 MVA.
   b. 480 volt - 65 KAIC.
4. Switchboards - 65 KAIC for all voltages below 1000 volts.
5. Motor Control Centers
   a. 480 volts - 65 KAIC.
6. Panelboards
   a. 480 volts - 65 KAIC.
   b. 120/208 volts - 22 KAIC.
   c. Small individual dry type transformer panels - 10 KAIC.
   d. Dry-type CPTs TENV - epoxy encapsulated.
7. Local Control Panels and Controls
   a. Outdoor, corrosive, and wet areas - NEMA 4X
   b. Indoor - NEMA 12

C. Standby Generator Sets

1. Standby diesel engine generators, natural gas engine-generators, or natural gas microturbine generators will be provided with automatic transfer switches to supply emergency power for the plant critical load during the utility power outage.
2. Generators will be housed indoors with acoustical wall treatment.

3. Fuel storage tanks will be above grade and enclosed in a spill containment structure.

D. Electric Motors

1, Motors less than 1/2 hp will be 115 volts, single phase.

2. Motors 1/2 hp through 250 hp will be 460 volts, three-phase, unless otherwise specified.

3. Motors will be ODP, TEFC or otherwise as specified. All motors will be "premium efficiency" and rated for 1.15 service factor, class F insulation without exceeding class B temperature rise.

4. All motors used with variable speed controllers or solid-state starters will be designed with insulation systems in conformance to NEMA Standard MG 1, 1998, Section IV, Part 31.4.4, "Insulation Considerations." VFD driven motors will also be furnished with line reactors, suitably enclosed, for installation between the variable speed controllers and the motors. The line reactors will be designed to mitigate the effects of the steep-fronted voltage spikes at the motor termination produced by variable speed controllers on the motor insulation system.

E. Variable Speed Controllers

1. All VFDs will be pulse width modulated type.

2. VFDs controlling motors 50 hp and greater will be clean power type - 18 - pole or greater.

3. VFDs in all horsepower ratings will be used with motors with premium insulations systems in conformance to NEMA Standard MG 1 - 1998 - Section IV Part 31.4.4 and with line reactors connected between the controller and the motor.

4. VFDs will comply with IEEE 519 - 1992.

F. Ductbanks

1. PVC Schedule 40 ducts.

2. Steel reinforced concrete encased.

3. Medium voltage ductbanks - 12 KV.

4. Low Voltage ductbanks and control:

   a. Power and control - 480 VAC and below.

   b. Signal - NEC Class 2 and 3 circuits, communications, optical fiber.

G. Raceway

1. Exposed conduit - All exposed conduit shall be rigid galvanized except as noted.

   a. In corrosive areas PVC coated RGS will be utilized.

b. Flexible conduit will be liquid-tight with integral ground.

c. Exposed conduit will be 3/4-inch minimum size.

2. All conduit concealed, buried or encased in concrete will be Schedule 40 PVC. Encased conduit will be 1-inch minimum size and will have an outer diameter not exceeding 1/3 of the concrete slab thickness.

3. Where conduit emerges from concrete encasement, a PVC coated RGS elbow will be utilized for transition from the concrete.

4. All conduit systems will be installed with full-length copper grounding conductors, sized in accordance with NEC Article 250.

5. Wire fills will not exceed 90% of the allowable per Table 4, Chapter 9 of the 2002 NEC. This table is for Schedule 40 PVC and is designated as the basis for conduit cross sectional area for all wiring on the project since it has the smallest available cross section for all the types of conduit.

6. Intermediate metal conduit (IMC) or electrical metallic tubing (EMT) will not be permitted.

7. Fittings will be malleable iron or gray-iron with zinc plating for galvanized conduit and PVC for PVC conduit.

H. Cable Trays

1. Cable tray systems shall be composed of straight sections, fittings, and accessories as defined in the latest NEMA Standards Publication VE-1 - Ventilated Cable Tray.

a. The cable tray and fittings shall be hot-dip galvanized after fabrication.

b. Cable tray shall be ladder type with 9-inch spacing with a minimum loading depth of 6 inches and a nominal width as indicated.

c. Loading capacities shall meet NEMA weight classification with a safety factor of 1.5.

d. In corrosive locations, cable trays shall be aluminum.

e. Separate cable trays shall be utilized for the following services:

- 600 V power and 120 V control
- Instrumentation
- Miscellaneous

f. When these cable trays are installed adjacent to each other, minimum distance between two adjacent trays shall be not less than 6 inches.

I. Wire and Cable

1. Medium Voltage Cable

   a. 15 KV wire used in conduit and duct will be shielded, single or three conductor, EPR insulation rated at 105 degrees C for continuous service and 140 degrees C for emergency service.

   b. Insulation level will be 133%.

   c. Shield will be copper tape or corrugated drain wire type.

   d. Wire will be UL Type MV.

   e. Tray cable will be rated accordingly.

   f. All conductors will be copper. Aluminum conductors will not be permitted.

2. Low Voltage Power and Lighting Cable

   a. All wire rated for 600 volts in duct or conduit for all power and lighting circuits will be Class B Type XHHW cross-linked polyethylene conforming to UL 44.

   b. All conductors will be stranded copper. Aluminum or non-stranded wire will not be permitted.

   c. Wire size for power and lighting circuits will not be smaller than No. 12 AWG. Control wiring will not be smaller than No. 14 AWG.

3. Instrumentation Cable

   a. Instrumentation cable will be rated 600 volts.

   b. Individual conductors will be No. 16 AWG.

   c. Instrumentation cables will be composed of the individual conductors, an aluminum polyester foil shield, a No. 18 AWG stranded tined copper drain wire, and a PVC outer jacket.

J. Grounding

1. Grounding system will conform to applicable requirements of National Electrical Code Article 250 and local codes.

2. Materials

   a. Grounding loop conductors will be bare annealed copper conductors suitable for direct burial. Conductors will be #4/0 unless sized otherwise on Contract Drawings.

   b. Ground rods will be 3/4-inch diameter and 10 feet long unless sized otherwise on Contract Drawings.

3. Installation

   a. All raceways will include an insulated grounding conductor.

b. Connection to ground electrodes and ground conductors will be exothermic welded where concealed and will be bolted pressure types where exposed.

c. Copper bonding jumpers will be used to obtain a continuous metallic ground across non-conductive structural members.

4. Shield Grounding

a. Shielded power cable will be grounded at each termination in a manner recommended by the cable manufacturer.

b. Shielded instrumentation cable will be grounded at one end only; this will typically be at the "receiving" end of the signal carried by the cable.

K. Lighting and Receptacles

1. Lighting will be designed in compliance with the energy conservation standards set forth in the California Administrative Code Title 24.

2. Types of illumination sources:

a. Indoor - use fluorescent, energy saving fixtures with T-8, 32 watt, 48-inch lamps and electronic ballasts.

b. Outdoor - use HPS.

c. Fixtures to be enclosed and gasketed in all but NEMA-1 areas.

3. Illumination levels will be as follows:

Area	**Maintained Foot-candles**
Indoor process areas	30 FC
Outdoor process areas	5 FC
Electrical rooms	30 FC
Outdoor Substation areas	2 FC
Mechanical Equipment rooms	30 FC
Maintenance areas - general	50 FC
Maintenance areas - tasks	As required
Offices	70 FC
Restrooms	20 FC
Roadway lighting	0.5-1 FC
Control room	50 FC
Laboratory	75 FC
Parking areas	1.5 FC
Corridors	25 FC

4. Indoor areas will be provided with switchable circuits with a minimum number of non-switched lighting fixtures for personnel safety.
5. Lighting circuits will be 120 volts except for roadway fixtures which will be 480 volts.
6. Emergency and exit lights will be provided per NEC, NFPA 101. Use individual battery packs. Emergency lights will be hard wired. Cord and plug will not be acceptable.
7. Receptacle in wet, damp or outdoor area will be GFCI. Others will be spec grade NEMA 5-20R.
8. Welding and special purpose receptacles will be to match the District's standard or preference.
9. Receptacles will be spaced such that any location can be accessed with a 25-foot extension cord in all areas of the plant except offices.
10. Surface mounted switches and receptacles will be in cast enclosures matching the material of the conduit. Concealed switches and receptacles will be in sheet metal enclosures.
11. Covers will be hinged and weatherproof in damp and outdoor areas. Stainless steel covers will be used in finished areas.

Treatment Facility - SCADA

A. Control

1. Programmable Logic Controllers (PLC's) and or Remote I/O provided in suitable enclosures for the Influent Pump Station, Plant Drainage Pump Station, Headworks, Septage Handling, Secondary Treatment, Tertiary Treatment, Solids Handling, and Effluent Pump Station and communication link to potential Vendor PLC for UV system.
2. All control equipment shall be provided with Uninterruptible Power Supplies (UPSs) that will supply power for a minimum of 30 minutes during power failures.
3. Remote status and alarm monitoring will be provided to allow on-call operators to monitor the facilities on a 24-hour basis. Configuration and individual access ability will be developed during the design phase.
4. Local control stations will be provided near the equipment including a Hand-Off-Auto (HOA) selector switch and Lockout Stop (LOS) switches.
5. For Variable Frequency Drives (VFDs), a local speed potentiometer will be provided either with the local control station at the device or on the VFD control panel.
6. Typically SCADA will monitor the following items for each motor controlled device:
   a. Run Status
   b. Auto (HOA)/ Remote Status

c. Motor Trip (Overload) Status

d. Ready Status

B. Communication

1. All Building to Building connections will utilize Fiber Optic Cable (62.5/125 micron (core/clad) cable) (per IEC 793n94) with a minimum of six fibers per cable.
2. Interior building cabling will be Category 5E cable, with RJ-45 connectors.
3. All Ethernet cables (fiber and copper) will be terminated on appropriate patch panels.
4. MCC, VFD electrical monitoring – Device Net network.
5. PLC Data Communications - IEEE802.3 Ethernet with TCP/IP Protocol
6. Ethernet hub(s) will be provided to allow in the future other LOCSD facilities such as Water Services and weather stations to supply and access data from and to the Treatment plant.

C. Operator Workstations

1. Man Machine Interfaces (MMIs) will be provided to monitor and control the treatment facilities. Initial work indicates that workstations will be located at the Wastewater Treatment Plant, Downtown District Office, and 8th Street Water Maintenance Yard.
2. Each MMI will consist of a PC suitable for the application, loaded with Supervisory Control and Data Acquisition (SCADA) software that will operate in an "Open Architecture" Microsoft Windows environment. An option will be explored to link each location via a fiber optic backbone to ensure maximum reliability.
3. The MMIs will provide equipment status monitoring capability for each facility with limited control, such as reset and acknowledgement of alarms and potential manual start/stop of individual equipment items.
4. A data server (RAID 0) will be provided to collect plant status and alarm data for storage and distribution.
5. Each MMI will be provided with a 21" monitor.

D. Indicating light/MMI graphic colors

1. Per NFPA 79, will be as follows:
   a. Power On - White
   b. On/Running/Energized - Green
   c. Off/Stopped/De-energized - Red
   d. Caution conditions – Amber
   e. Abnormal/Alarm condition - Red (flashing)

E. Methods and Assumptions

1. Signal isolators will be provided where required to ensure sufficient component impedance capability, or where feedback paths may be generated.
2. Each control circuit and loop will be individually fused.
3. Individually wired analog loop signals transmitting data between field devices and control panels will be 4-20 mA. Signals within control panels can be converted to 1-5 volts DC.
4. Two-wire transmitters will be powered by redundant power supplies. Redundant loop power supplies will be configured in a fault tolerant manner and will be sized with a minimum of 50 percent spare capacity. Failure of either power supply will provide an alarm to the area PLC.
5. Four-wire transmitters will be powered from the nearest standby powered 120 VAC power distribution panel.
6. All instruments provided will be calibrated according to manufacturer recommended procedures. On-site pre-installation calibration tests will be conducted. Each instrument will be calibration checked at 0, 50, and 100 percent of span with test instrument accuracy traceable to the National Institute of Testing Standards. Instruments that cannot be site calibrated will be supplied with a manufacturer's calibration certification.
7. Instrumentation accuracy will be determined as a probable maximum error by calculating the square root of the sum of the squares of the published accuracy of all the components comprising each system/loop.
8. Individual instruments will have a minimum accuracy and repeatability attributed to the best in the industry for each of the applications.

F. Area Classifications

1. General Purpose: Enclosures will be NEMA 12 unless otherwise noted.
2. Outdoor locations: Instruments and control panels will have NEMA 4X (316 Stainless Steel) enclosures.
3. Damp locations: Locations indoors and 2 feet below grade or classified as damp locations will conform to outdoor location requirements.
4. Splash locations: Areas designated as splash-proof will have the same requirements as outdoor locations except the enclosure will be NEMA 4.
5. Corrosive locations: Enclosures will be stainless steel NEMA 4X and all electrical raceway hardware will be PVC coated. Each application will be checked for chemical compatibility.
6. Hazardous locations: Areas designated as hazardous will have electrical installations suitable for Class 1, Division 1 or 2, Group C or D locations as required per NFPA 820. The instrumentation and control design preference will be to locate controls and instruments outside of hazardous areas.

G. Instruments

1. Level-Continuous Storage Tanks, Wet-Wells; Ultrasonic

2. Level-Continuous Chemical Mixing Tank; Capacitance
3. Level Discrete Chemical, Dirty Liquids; Tilting Float
4. Level Discrete Clean Liquids; Displacer Float Type
5. Flow Closed Pipe Water, Chemical or Sludge; Magnetic
6. Flow Closed Pipe Air; Averaging Pitot Tube w/ Differential Pressure Transmitter
7. Temperature; RTD w/ Thermowell
8. Pressure/Differential Pressure Transmitters; Capacitor Sensing w/isolating diaphragm
9. Pressure Switches; Diaphragm Type, Adjustable Setpoint, Fixed Deadband
10. Gauge Seals for Solids and Sludge; Annular Seal (Equal to pipe diameter)
11. Gauge Seals for Chemicals; Diaphragm Type
12. Flow Switches; Thermal Dispersion

Effluent Disposal

The effluent disposal system consists of an effluent distribution pipeline that serves the various locations for subsurface disposal via percolation fields as shown in Figure 2. The effluent distribution pipeline will also be provided with turnouts for reclaimed water uses such as landscape irrigation as shown in Figure 3. The design criteria for the effluent distribution pipeline will be consistent with the design criteria for the collection system force main.

The locations of the effluent disposal sites were based on work conducted by Cleath & Associates. The locations were selected where the hydrogeology was suitable to prevent excessive mounding or daylighting. The hydrogeological work by Cleath established the amount of effluent that can be safely discharged at each location.

Alternatives to percolation fields will be evaluated. Alternatives to be considered include disposal wells and radial disposal fields.

A prototype percolation line installation and testing effort will be conducted on the Broderson site during final design to validate the application rates used for the effluent disposal design. An existing test well will also be available to test the application rate for the disposal well alternative.

The effluent disposal system will be designed with 100 percent redundancy to alternate dosing and resting of a given leachfield.

The effluent disposal system will be divided into multiple zones for flow control management. Each zone would be connected to the effluent distribution pipeline with an isolation valve, flow control valve, and flow meter. Each zone would be sized to handle between 23,000 to 74,000 gpd. A preliminary breakdown of the distribution by zone is presented in the following table.

Effluent Disposal – Design Criteria				
Description	**Capacity**	**Approx. Area**	**Number Of Zones**	**Capacity Per Zone**
	(gpd)	**(ft x ft)**		**(gpd)**
West Side				
Sea Pines	30,000	NA	1	30,000
Vista de Oro	20,000	80 x 200	1	20,000
Monarch Grove School	Standby	220 x 240	1	70,000
Pine	50,000	40 x 500	1	50,000
Broderson Ave	40,000	40 x 400	1	40,000
Borderson	800,000	270 x 1300	6	133,000
East Side				
Pismo	160,000	40 x 2300	2	80,000
Santa Maria / 18th	160,000	40 x 1700	2	80,000
Los Osos Middle School	Standby	20,000 sf	1	30,000
El Morro	175,000	40 x 1700	2	87,500
East Ysabel / Scenic	40,000	40 x 1000	1	40,000
South Bay	125,000	40 x 1400	2	62,500
Total	1,600,000		21	
Average zone capacity				76,000

Effluent Disposal – Landscaping

Site Feature	Supplier	Materials / Special Features	Code
Perimeter Landscape @ Broderson site	Local Native Plant Nursery	Native Trees, Shrubs, & Grasses	None

Effluent Disposal – SCADA

A. Control

1. On-Site Remote Telemetry Unit (RTU) consisting of a small Programmable Logic Controller (PLC) in a suitable enclosure located near each disposal site.
2. Will evaluate use of fiber optic cable installed with treated effluent pipeline for SCADA communication.

B. Telemetry

1. Individual radio at site will communicate with master radio located potentially at Wastewater Treatment Plant.
2. Use of District's existing water towers at 10^{th} and 16^{th} streets will be explored for radio repeater stations.

C. Operator Workstations

1. Based on initial work Man Machine Interfaces (MMI's) are to be located at the Wastewater Treatment Plant, Downtown District Offices and 8^{th} Street Water Maintenance Yard.
2. The MMI's will show flow monitoring and flow control valve control and status information sent to and from the effluent disposal sites, as well as all of the other information provided for the LOCSD facilities included in this project.

D. Instruments

1. Continuous magnetic flow metering for effluent disposal.
2. Power Monitoring
3. Monitor the power source at each location for loss of utility, which will be communicated back to the central monitoring facilities.

c.

George Milanes - LOCSD	Jack Osborn – MWH	Kevin Monroe – MWH
Liz Caldwell – LOCSD	Dennis Gellerman – MWH	Kyle Harris – RRM
Rob Miller – JLWA	Scott Burke – MWH	Carol Frank – MWH
John Bergen – MWH	Mallika Ramanathan - MWH	Can Quach – MWH
Jerry Michael – RRM	Linda Tripp – MWH	David Wilcoxson – MWH
Sandy Harwood - EDA	Kevin Kai – MWH	Tim Cleath – C&A
Mike Matson – RMC	Jerry Gantney - MWH	Jon Blanchard – Fugro
Les Wong – MWH	Tony Kieth - RRM	Jose Villalobos – V&A
		Bill Thiessen – B-B

Section 2

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	December 16, 2002
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Steve Hyland Kristin Field Dennis Gellerman	**Job No.:**	1481166.043579
Subject:	Wastewater Loading		

Preface

The Wastewater Loading Technical Memorandum (TM) presented herein was prepared to fulfill the requirements of Subtask 4.01 – General under Task 4 – Wastewater Treatment Facility in the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002. The review of wastewater loading was also prompted by concern of the Central Coast Regional Water Quality Control Board (RWQCB) staff that the BOD and TSS loading may be low.

Introduction

The Wastewater Loading TM is intended to update the projected BOD, suspended solids, and nitrogen loading of the influent wastewater that will be treated at the wastewater treatment facility (WWTF). The updated loading takes into account the impact of water conservation improvements and the nitrate content in the drinking water.

The wastewater loading established for the WWTF was presented in Table 2-6 of the Final Project Report dated March 7, 2001 and is summarized in Table A.

Table A – Project Report Wastewater Loading (a)

Parameter	Units	Average Day	Peak Day
Flow	mgd	1.3	1.6
BOD	mg/l	260	330
TSS (b)	mg/l	260	330
NH3-N	mg/l	30	40

(a) Note that the wastewater loading presented does not include the projected loading from septage. Septage loading was not included in the scope of this TM.

(b) As described in Section 7 – Project Description of the Project Report, the total suspended solids (TSS) loading amount was assumed to be the same as the biological oxygen demand (BOD).

The corresponding buildout population associated with the wastewater loading summarized in Table A is 18,428 people. The corresponding per capita wastewater loading from the Project Report is summarized in Table B.

Table B – Per Capita Wastewater Loading

Parameter	Average Day		Peak Day	
	lb/day	lb/cap/day	lb/day	lb/cap/day
BOD	2,800	0.15	3,600	0.19
TSS (a)	2,800	0.15	3,600	0.19
NH3-N	330	0.018	430	0.024

The nitrogen loading presented in the Project Report was based on ammonia (NH3) only. This TM will also update the nitrogen loading to include all other forms of nitrogen including organic nitrogen, nitrite, and nitrate. One common measurement of nitrogen is total Kjeldahl nitrogen (TKN) that represents the combination of organic nitrogen and ammonia nitrogen. Nitrite (NO2) nitrogen in wastewater is negligible and will not be further considered. Nitrate (NO3) nitrogen is also usually negligible in raw wastewater and typically neglected for wastewater loading. However, because of the high nitrate in the shallow groundwater aquifers of Los Osos, the nitrate content in the wastewater will be included in this evaluation.

Information Gathering

Seven Central Coast community treatment facilities were selected to obtain wastewater loading data. These communities shared two characteristics with Los Osos – geographic proximity and similar service populations. The community treatment facilities chosen and their associated service areas are listed as follows:

- Pismo Beach WWTP – Pismo Beach
- Morro Bay WWTP – Morro Bay, Cayucos
- Templeton WWTP – Templeton
- Paso Robles WWTP – Paso Robles, Templeton
- Cambria WWTP – Cambria
- Atascadero WWTP – Atascadero
- South San Luis Obispo WWTP – Oceano, Grover, Arroyo Grande, unincorporated areas

In addition to the seven facilities listed above, data from two other facilities was also obtained. The Monarch Grove/Sea Pines package plant that currently exists in Los Osos provides some valuable information about the wastewater characteristics of Los Osos residents and visitors in particular. Data from San Luis Obispo was alos obtained for reference, although its service population is larger and more urban than that of Los Osos.

The information gathered from the subject facilities included the following:

- Flow
- Influent biological oxygen demand (BOD)
- Influent total suspended solids (TSS)
- Any available influent nitrogen data - organic nitrogen, ammonia, TKN, nitrite, or nitrate
- Estimate of service population
- Communities served by WWTP
- Characterization of wastewater – domestic vs. commercial/industrial
- Acceptance of septage.

Most information was obtained on paper or electronically, and some information was obtained through telephone conversations with appropriate WWTP personnel and/or City Engineers. Flow, BOD, and TSS information was obtained from copies of monthly or annual reports submitted to the Central Coast Regional Water Quality Control Board (RWQCB). Influent nitrogen data was only available for the Cambria WWTP. Most facilities are not required to perform this type of testing on their influent. The San Luis Obispo WWTP periodically measures influent ammonia and provided an estimate of average values. More detailed information regarding WWTP contact information and the data received from all sources are included in the appendix to this TM.

Evaluation

Influent flow, BOD, TSS, nitrogen, and service population data obtained for this TM are summarized in Table C. All data obtained for this evaluation is attached to this TM for reference. Note that service population values are rough estimates by agency personnel.

A comparison of Table B and Table C shows that the assumed per capita BOD loading (0.15 lb/cap/day) for the Los Osos WWTF is at the low end of the range of values (0.15 lb/cap/day to 0.40 lb/cap/day) reported from the surrounding agencies. A comparison of Table B and Table C shows that the assumed per capita TSS loading (0.15 lb/cap/day) for the Los Osos WWTF is also at the low end of the range of values (0.16 lb/cap/day to 0.46 lb/cap/day) reported from the surrounding agencies. In addition, the reported values of TSS are consistently higher than the reported values of BOD.

The projected values for Los Osos would be expected to be on the low end of the range because Los Osos is predominately a residential community with minimal commercial, tourist, and industrial contributions of wastewater. The communities such as Pismo Beach that are at the high end of the range have significant commercial and tourist contributions. However, an increase in the projected values for per capita BOD and TSS loading would be prudent to be conservative and reflect the loading of nearby communities. The recommended increases in per capita BOD and TSS are shown in Table D with a comparison to the initial assumptions.

Table D – Recommended Per Capita Loading Increases

Parameter	Average Day		Peak Day	
	Initial	Revised	Initial	Revised
BOD (lb/cap/day)	0.15	0.20	0.19	0.25
TSS (lb/cap/day)	0.15	0.23	0.19	0.29
TKN (lb/cap/day)	NA	0.030	NA	0.038
TN (lb/cap/day)	NA	0.033	NA	0.042

The evaluation of nitrogen loading is difficult because the availability of nitrogen data is very limited. Only Cambria reported any significant data. However, TKN (combination of organic and ammonia nitrogen) is typically a function of the amount of BOD. The amount of TKN as a percentage of BOD ranges from 15 to 20 percent. For example, the Cambria average is 15 percent. The recommended per capita TKN loading values are based on a 15 percent factor as presented in Table D.

In addition to utilizing TKN values that represent both organic and ammonia nitrogen, some consideration of nitrate content should be provided. As previously discussed, nitrite content will be negligible. Although normally the nitrate content would also be negligible, because of the nitrate contamination of the upper aquifer groundwater, the raw wastewater in the initial years of operation of the new wastewater system may have a nitrate component.

The most conservative prediction of an incremental increase in total nitrogen due to nitrate content would be to assume a nitrate content of 5 mg/l as N. This would correspond to an average day and peak day increase in per capita nitrogen loading of 0.003 lb/cap/day and 0.004 lb/cap/day, respectively. The recommended total nitrogen (TN) loading values, the sum of TKN and nitrate, is presented in Table D.

Conclusion

The wastewater loading for the proposed Los Osos WWTF presented in the March 2001 Project Report appears to be low. An increase in the wastewater loading for BOD, TSS, and TN are recommended to be conservative and to insure adequate treatment performance. A summary of the recommended wastewater loading to serve as the basis of final design for the Los Osos Wastewater Project is presented in Table E.

Table E – Summary of Recommended Wastewater Loading

Parameter	Unit	Average Day	Peak Day
Flow	mgd	1.3	1.6
BOD	lb/cap/day	0.20	0.25
	lb/day	3,700	4,600
	mg/l	340	350
TSS	lb/cap/day	0.23	0.29
	lb/day	4,200	5,300
	mg/l	390	400
TN	lb/cap/day	0.033	0.042
	lb/day	610	770
	mg/l	56	58

Please contact Steve Hyland at (805) 528 – 9385 if you have any questions.

c. George Milanes – LOCSD
Liz Caldwell – LOCSD
Sorrel Marks – RWQCB
Rob Miller – JLWA
Dennis Gellerman - MWH
Kristin Field - MWH
Mallika Ramanathan - MWH
Scott Burke - MWH

Table 1: Influent Loading Data from Surrounding Community WWTP's

Influent Data:

Facility	Service Population	Flow			TSS				BOD			
		Average	Per Capita	#Data Pts.	Average	Average	Per Capita	#Data Pts.	Average	Average	Per Capita	#Data Pts.
(units)		gpd	gpcd		mg/L	lb/day	lb/cd		mg/L	lb/day	lb/cd	
Monarch Grove/Sea Pines	250	19127	77	>100								
Pismo Beach	8300	1056867	127	>100	428	3768	0.45	>100	378	3323	0.40	>100
Morro Bay/Cayucos	14000	1772500	127	12	333	4911	0.35	12	270	3977	0.28	12
Templeton	1993	155000	78	1								
Paso Robles	28000	2858417	102	12	362	8623	0.31	12	344	8185	0.29	12
Cambria	6200	750592	121	12	285	1780	0.29	12	250	1562	0.25	12
Atascadero	13000	1292500	99	12	277	2978	0.23	12	205	2201	0.17	4
South San Luis Obispo	45000	2723333	61	12	314	7110	0.16	12	295	6692	0.15	12
San Luis Obispo	50000	4250000	85	1	300	10616	0.21	1	300	10616	0.21	1

Facility	Service Population	Ammonia-N				TKN			
		Average	Average	Per Capita	#Data Pts.	Average	Average	Per Capita	#Data Pts.
(units)		mg/L	lb/day	lb/cd		mg/L	lb/day	lb/cd	
Monarch Grove/Sea Pines	250								
Pismo Beach	8300								
Morro Bay/Cayucos	14000								
Templeton	1992.857143								
Paso Robles	28000								
Cambria	6200	27	169	0.027	13	38	239	0.039	13
Atascadero	13000								
South San Luis Obispo	45000								
San Luis Obispo	50000	29	1020	0.020	1				

Table 1: Influent Loading Data from Surrounding Community WWTP's

Estimate of Total Nitrogen Based on TSS Measurements:

Facility	Service Population	Average Flow	Average TSS	Projected TKN	Projected Nitrogen Loading	Projected Per Capita Nitrogen Loading
(units)		gpd	mg/L	mg/L	lb/d	lb/cd
Monarch Grove/Sea Pines	250	19127				
Pismo Beach	8300	1056867	428	90	791	0.095
Morro Bay/Cayucos	14000	1772500	333	70	1031	0.074
Templeton	1992.857143	155000				
Paso Robles	28000	2858417	362	76	1811	0.065
Cambria	6200	750592	285	60	374	0.060
Atascadero	13000	1292500	277	58	625	0.048
South San Luis Obispo	45000	2723333	314	66	1493	0.033
San Luis Obispo	50000	4250000	300	63	2229	0.045

TKN/TSS Factor = 0.21

Estimate of Total Nitrogen Based on BOD Measurements:

Facility	Service Population	Average Flow	Average BOD	Projected TKN	Projected Nitrogen Loading	Projected Per Capita Nitrogen Loading
(units)		gpd	mg/L	mg/L	lb/d	lb/cd
Monarch Grove/Sea Pines	250	19127				
Pismo Beach	8300	1056867	378	79	698	0.084
Morro Bay/Cayucos	14000	1772500	270	57	835	0.060
Templeton	1992.857143	155000				
Paso Robles	28000	2858417	344	72	1719	0.061
Cambria	6200	750592	250	53	328	0.053
Atascadero	13000	1292500	205	43	462	0.036
South San Luis Obispo	45000	2723333	295	62	1405	0.031
San Luis Obispo	50000	4250000	300	63	2229	0.045

TKN/BOD Factor = 0.21

Appendix -
Monarch Grove/Sea Pines Data

2001 Flows:

	Flow (gpd)											
Day	January	February	March	April	May	June	July	August	September	October	November	December
1	20633	15833	15875	20534	15825	13287	52465	22560	12175	14940	14624	17730
2	18777	11723	12829	26109	23524	20601	9645	19373	21948	12273	17891	18343
3	18451	13616	14695	15235	12997	19543	10903	17588	25842	20716	16129	30878
4	17418	10942	11116	13008	14539	29381	14194	9158	22155	22581	18613	18749
5	15813	27298	21842	14753	18802	19529	20863	31360	15148	12161	22235	14139
6	15937	12405	18558	7157	18566	16051	18356	27692	19667	15926	16372	27819
7	12715	16684	14673	15269	32341	17884	6397	20011	13653	26408	19341	13700
8	21395	10534	12186	18805	17517	15792	24733	11184	11702	21443	14914	16161
9	13756	13035	7834	28710	17935	11570	26193	29192	27597	23360	29005	20041
10	12583	8350	15114	17781	18757	17402	17457	22038	23973	16860	12280	23070
11	15602	13444	16578	16230	11977	26263	18638	18920	12337	21533	21651	15963
12	10750	20698	28058	16267	12241	14627	18220	25214	24765	3666	23076	5141
13	13771	15536	18264	17749	16035	3197	11239	24741	16890	18721	31263	21419
14	14495	13612	17479	19548	33191	21437	23685	25443	15930	19446	20608	8392
15	23758	16190	25282	18269	16722	12161	19091	20100	15192	27876	16178	15809
16	18197	19367	22958	32606	17206	27890	20769	25228	16923	25745	14793	15790
17	17553	14221	15099	22162	17186	11973	19277	18416	21810	18090	10451	28706
18	17251	15438	33408	18971	9320	20363	19249	19247	18054	18214	40082	16299
19	18325	24478	12658	16432	19104	25273	19678	20799	23220	20652	15747	19427
20	18204	13443	13287	8807	15653	22054	21291	23896	17484	8090	20605	16396
21	16877	17456	19730	19225	37602	11262	7538	20205	19339	24702	21575	18041
22	19711	14113	18448	19612	13690	25037	26793	19103	21503	32231	16232	15208
23	18660	9730	8167	28684	19189	12049	24050	20894	21297	20334	30145	13665
24	12908	18284	26570	18261	25442	29844	19595	7885	21033	22329	22981	26380
25	14529	16764	10093	14808	26927	30122	20784	22736	14221	18591	19859	19886
26	15600	32546	26247	24272	14738	15134	18575	23773	23542	18295	32941	21047
27	9997	18700	14250	23884	28382	12716	19535	26990	17869	22831	48956	25185
28	21933	15404	5837	11806	27895	18162	9245	17624	19616	20143	19793	13733
29	24735		3109	23784	24131	10388	26909	18094	6882	20492	21675	28385
30	10343		16699	34018	22126	15383	26469	16011	36753	19360	10914	18910
31	13391		10398		14719		16037	17591		13880		17845
Monthly Avg.	**16583**	**16066**	**16366**	**19425**	**19815**	**18213**	**19609**	**20744**	**19284**	**19416**	**21364**	**18782**
Monthly Max.	24735	32546	33408	34018	37602	30122	52465	31360	36753	32231	48956	30878
Monthly Min.	9997	8350	3109	7157	9320	3197	6397	7885	6882	3666	10451	5141

Average of 2001-02 Monthly Averages: **19127** **gpd**

Source: Discharger Self-Monitoring Reports, RWQCB

Appendix -
Monarch Grove/Sea Pines Data

2002 Flows:

	Flow (gpd)											
Day	January	February	March	April	May	June	July	August	September	October	November	December
1		23018	16617	30524	20493			19735	25389			
2		19856	6126	27642	18850			19314	26519			
3		18589	28494	19660	14573			18701	18352			
4		14136	29163	21225	26928			24094	16496			
5		17870	23220	15584	19712			30173	17603			
6		19707	20536	27981	18912			21527	15565			
7		21505	18103	23926	19696			16428	10577			
8		18608	12709	22233	18874			20733	29598			
9		20809	28213	19567	19781			12000	20398			
10		16729	18035	18492	18518			25638	15827			
11		13228	23913	13712	4421			28989	19249			
12		18363	18800	24104	28516			25989	15097			
13		20885	19696	16950	24228			18189	18114			
14		20741	18036	21917	21199			17467	7861			
15		23580	20434	20134	15636			17245	26696			
16		17633	3737	19487	17479			16393	25312			
17		25044	26537	21430	13951			12520	16854			
18		16135	26154	18063	19805			22049	15897			
19		16134	18924	18389	24584			24910	21909			
20		9936	17059	18407	30705			17949	16189			
21		30288	20330	19560	18594			18220	23202			
22		24463	10216	35629	17202			17350	22752			
23		17103	19976	21130	19477			17688	14409			
24		18540	21137	18292	19580			22328	16094			
25		15416	22772	21262	18289			22473	26020			
26		17772	19678	14359	23493			28855	15399			
27		20431	18851	11446	26001			18559	15012			
28		26104	24084	18495	19618			18604	10556			
29		16892	15480	32724	20605			16708	17374			
30		18880	18170	19090	14113			16267	31503			
31		16512	17997		17166			17371				
Monthly Avg.		**19191**	**19458**	**21047**	**19710**			**20144**	**19061**			
Monthly Max.		30288	29163	35629	30705			30173	31503			
Monthly Min.		9936	3737	11446	4421			12000	7861			

Source: Discharger Self-Monitoring Reports, RWQCB

Appendix -
Morro Bay/Cayucos Data

Year 2000 Data:

Month	Flow (MGD)	Influent TSS (mg/L)	Influent BOD (mg/L)
January	1.664	434	318
February	2.28	330	228
March	1.835	274	262
April	1.796	356	300
May	1.692	390	321
June	1.797	455	295
July	1.964	283	248
August	1.904	259	232
September	1.683	273	207
October	1.578	253	214
November	1.603	332	290
December	1.474	354	319
Average	**1.773**	**333**	**270**

Historical Data:

Year	Flow (MGD)	Influent TSS (mg/L)	Influent BOD (mg/L)
1986	1.42	332	235
1987	1.51	274	257
1988	1.51	397	242
1989	1.46	321	259
1990	1.38	345	261
1991	1.28	280	236
1992	1.41	310	224
1993	1.54	339	222
1994	1.38	310	249
1995	1.55	270	208
1996	1.55	344	241
1997	1.64	283	231
1998	1.95	236	216
1999	1.68	386	287
2000	1.77	337	271
Average	**1.54**	**318**	**243**

Source - 2000 Annual Report, RWQCB

Appendix -
Morro Bay/Cayucos Data

Other Information:

These data represent measurements on the combined influent into the Morro Bay plant, coming from the City of Morro Bay and the City of Cayucos.

I&I can have a significant impact on treatment plant influent. The 2000 Annual Report to the RWQCB cites:

1) Peak flows of -	4.8 MGD from 5.5" rainfall	during Feb 2000
	3.3 MGD from 2.5" rainfall	during Feb 2000
	3.3 MGD from 1.7" rainfall	during Feb/Mar 2000
	2.7 MGD from 2.6" rainfall	during Apr 2000
2) Low influent BOD -	208 mg/L	during Feb 2000
	187 mg/L	during Feb/Mar 2000
3) Low influent TSS -	213 mg/L	during Feb/Mar 2000

Bruce Keogh, the plant superintendent, estimated an average 13% increase in flows due to I & I, with peaks up to 300%.

Service Population = 14000 (10k from Morro Bay and 4k from Cayucos)

Predominantly domestic sewage (not commercial)

No septage is accepted at the plant.

Bruce Keogh estimates that the water supply TDS numbers are similar to the plant's effluent numbers, ever since they switched to using state water about 4 years ago. When they were using well water before that, the TDS numbers were higher.
Some water softeners are still used by the service population, but much less since the switch from well water to state water.

Source - Bruce Keogh
Morro Bay WWTP Supervisor
(805) 772-6272

Appendix -
Templeton Data

No influent testing at Templeton. This facility sends flow to Paso Robles, where there is influent testing.

Flows:

	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02	Jul-02
Avg. (gpd)	30719	17192	21805		17761	10526	26827	26595	16979	22740	127552	146015
Max. (gpd)	127915	21019	98835		29484	46303	33742	34153	20852	28758	161255	171898

Average Value
155000
**WWTP upgrade took place in June 2002. Jay noted that average flow is now 155,000 gpd.

Service Population = 1993

Primarily residential sewage

I & I used to be a much larger problem than it currently is, according to Jay at the WWTP. Recent maintenance has been performed on the collection system, which has reduced the influence of I & I.

No septage is accepted at this WWTP.

Sources - Discharger Self-Monitoring Report, RWQCB
Templeton CSD - Jay
(805) 434-4907

Appendix -
Paso Robles/Templeton Data

2001 Influent Data:

Date	Avg. Flow MGD	Max. Flow MGD	Inf. TSS mg/L	Inf. BOD mg/L
Jan-01	2.832	4.8	394	387
Feb-01	2.9099	4.8	447	366
Mar-01	3.045	4.7	598	347
Apr-01	2.8074	4.6	338	405
May-01	2.7818	4.7	342	350
Jun-01	2.7597	4.4	304	350
Jul-01	2.8278	4.6	363	387
Aug-01	2.8672	4.5	263	311
Sep-01	2.8483	4.6	300	281
Oct-01	2.9047	4.5	317	323
Nov-01	2.8921	4.6	298	316
Dec-01	2.8251	4.4	384	304
Average	**2.8584**		**362**	**344**

Service Population = 28000

Mainly domestic sewage, <10% commercial (from tourism)

Not much I & I problems with sewer system, according to Ed Moldrem.

Accept no septage at the WWTP.

Sources - 2001 Annual Report, RWQCB
Ed Moldrem
Paso Robles WWTP
(805) 237-3865

Appendix -
Cambria Data

Influent Data:

Date	Avg. Flow MGD	Max. Flow MGD	TSS mg/L	BOD mg/L	Ammonia mg/L	TKN mg/L
Jan-00	0.6701	1.1243	375	230		
Feb-00	1.1736	2.063	254	170		
Mar-00	0.973	1.3122	258	120		
Apr-00	0.8257	1.2463	247	200		
May-00	0.6929	0.8767	209	170		
Jun-00	0.7109	0.7972	231	120		
Jul-00	0.7677	0.9737	261	220		
Aug-00	0.7275	0.8058	285	290		
Sep-00	0.6512	0.8313	365	500		
Oct-00	0.637	0.8609	331	350		
Nov-00	0.6152	0.8026	300	320		
Dec-00	0.5623	0.7928	301	310		
Sep-01					31	42
Oct-01					29	45
Nov-01					23	30
Dec-01					20	30
Jan-02					19	37
Feb-02					24	41
Mar-02					24	40
Apr-02					31	11
May-02					31	45
Jun-02					33	50
Jul-02					34	46
Aug-02					33	51
Sep-02					19	30
Average	**0.7506**	**1.0406**	**285**	**250**	**27**	**38**

Other Information:

Service Population = 6200

All domestic sewage

Plant does have I & I influence due to long collection system lines, acc. to Brian Bode.

No septage accepted at this plant.

This plant is a "complete nitrification" plant according to Brian Bode.

Sources - 2000 Annual Report, RWQCB
Electronic Data from and Conversation with:
Brian Bode
Cambria WWTP
(805) 927-6255

Appendix -
Atascadero Data

Influent Data:

Date	Flow MGD	TSS mg/L	BOD mg/L
Jul-01	1.26	246.8	
Aug-01	1.25	296.6	206
Sep-01	1.25	253.8	
Oct-01	1.23	272.8	
Nov-01	1.28	296	186
Dec-01	1.37	272.8	
Jan-02	1.38	284.2	
Feb-02	1.37	305.3	234
Mar-02	1.35	322.4	
Apr-02	1.31	234	
May-02	1.25	287	192
Jun-02	1.21	248.6	
Average	**1.29**	**276.7**	**204.5**

Other Information:

Service Population = 13000

Domestic Sewage

I & I does affect WWTP flows, according to Mark Markwort . Increases flows by about 30%.

They occasionally accept a very small amount of septage (<5%). Their contract with the hauler is that the hauler takes away the WWTP's solids and is allowed to discharge the liquid portion of its septage into the WWTP.

Sources - Discharger Self-Monitoring Report, RWQCB
Mark Markwort
City of Atascadero
(805) 461-7607

Appendix -
South San Luis Obispo WWTP Data

Influent Data:

	Flow - MGD			TSS - mg/L			BOD - mg/L		
Date	**Average**	**Maximum**	**Minimum**	**Average**	**Maximum**	**Minimum**	**Average**	**Maximum**	**Minimum**
Jan-01	3.04	3.43	2.8	383.7	406	348	281.8	325	203
Feb-01	3.03	3.58	2.72	378.8	430	328	378.8	430	328
Mar-01	2.92	5.08	2.44	264.8	442	108	236	335	136
Apr-01	2.73	3.04	2.58	305	364	260	284.3	305	258
May-01	2.62	2.39	2.39	293.8	366	250	273.3	296	241
Jun-01	2.49	2.81	2.13	292.4	349	260	301.7	343	277
Jul-01	2.75	2.92	2.43	300	336	252	286.2	311	267
Aug-01	2.7	2.92	2.34	286	314	236	308.4	343	281
Sep-01	2.68	3.04	2.32	312.1	466	238	305.8	339	269
Oct-01	2.71	2.98	2.53	284.6	374	216	295.5	373	273
Nov-01	2.66	3.1	2.41	329.4	376	272	291	334	221
Dec-01	2.35	2.82	1.96	332	400	230	298.8	313	272
Average	**2.72**			**313.6**			**295.1**		

Other Information:

Service Population = 45000

Communities served: Oceano
Grover
Arroyo Grande
unincorporated areas

Almost entirely domestic sewage.

Some I & I influence in the WWTP flows.

Do not accept septage at the WWTP.

Sources - 2001 Annual Summary, RWQCB
Jeff Appleton
City of Oceano
(805) 489-6666

Appendix -
San Luis Obispo Data

Service Population = 50000
Only about 40k at night, since many people who work there have commuted home.

Flow = 4.25 MGD (4 to 4.5MGD)

Have a "tremendous" I & I problem, according to Doug Marks, plant supervisor.
Peak flows can reach 22 MGD.

Flow is predominantly domestic type, with more commercial than Los Osos.

Facility accepts no septage.

Influent Data Average Estimates (Doug Marks):

TSS =	300 mg/L	
BOD =	300 mg/L	
Ammonia as NH3 =	35 mg/L	(30-40 mg/L)
Ammonia as N =	29 mg/L	

Source - Doug Marks
Plant Supervisor
San Luis Obispo WWTP
(805) 781-7240

Section 3

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	January 27, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Brian Chapman – V& A	**Job No.:**	1481166.063589
Subject:	Soil Corrosion Report		

Enclosed for your review and comment is the Soil Corrosion Report prepared by Villalobos & Associates for the Los Osos Wastewater Project. Please contact Steve Hyland at (805) 528 – 9385 if you have any comments or questions.

Distribution

John Bergen – MWH	Linda Tripp – MWH
Jack Osborn – MWH	Kevin Kai – MWH
Dennis Gellerman – MWH	Can Quach – MWH
Scott Burke – MWH	David Wilcoxson – MWH
Mallika Ramanathan - MWH	

Soils Corrosivity Investigation for the Los Osos Community Services District Wastewater Collection, Treatment, and Disposal Project

Prepared for: Steve Hyland, Montgomery Watson Harza

Prepared by: Brian Chapman, V&A Consulting Engineers
Wistaria Clark, V&A Consulting Engineers
Doug Hackley, V&A Consulting Engineers

Copies: File 02-090

Date: January 24, 2003

Introduction

V&A Consulting Engineers (V&A) was retained by Montgomery Watson Harza to perform a soil corrosion investigation of the future site of the Wastewater Treatment Facility (WWTF) as part of the Los Osos Community Services District Wastewater Collection, Treatment, and Disposal Project. The objective of the investigation was to perform field soil resistivity testing, review existing corrosion data, and perform chemical analysis of selected soil samples. These results were evaluated with respect to the possible levels of corrosion of reinforced concrete structures and buried steel, and a discussion was provided about the suitability of stainless steels in a wastewater treatment plant environment.

Chemical analysis was not performed as part of this survey. Corrosion data provided by Fugro West, Inc. included some chemical analysis data around the Los Osos community. Further chemical analysis of soil borings can be performed in the future if soil borings become available.

Recommendations for buried metallic structures, buried reinforced concrete structures, and stainless steel are at the end of this report. Based on chemical analysis and resistivity data, the soil appears to be negligibly corrosive to these structures.

TEST METHODS

In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process which is accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Field Determination of Soil Resistivity

Soil resistivity measurements were conducted at four locations at the proposed project site per ASTM G57 "*Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method.*" The Wenner Four-Electrode method involves the use of four metal electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 1. A soil resistance meter is used to generate an alternating current across the outer two electrodes, C1 and C2. The voltage drop is then measured across the inner two electrodes, P1 and P2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. Then soil resistivity is computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

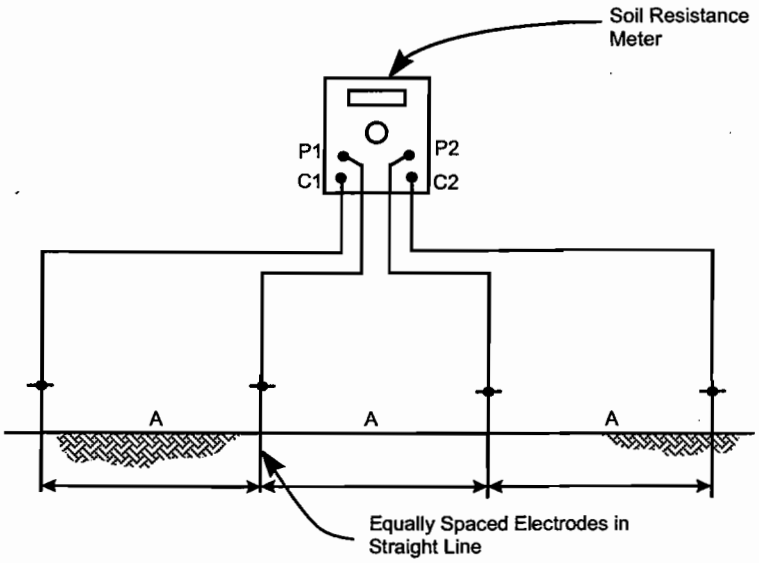


Figure 1 Soil Resistivity Measurement using the Wenner 4-Pin Method

The layer resistivity is a calculation using the measured data to estimate the resistivity for only that 5-foot layer. Soil resistivity was measured approximately every 1,000 feet along the proposed alignment. Consideration for adjusting the measurement location is necessary when foreign utilities are near enough to influence the measurement results. The soil resistivity measurements were conducted with several electrode spacings at 5, 10, 15 and 20 feet.

Chemical Analysis

To supplement the resistivity data obtained during field testing, corrosion test results from Fugro West, Inc. were analyzed. The test results include: minimum resistivity, pH, concentrations of water soluble chloride, and water soluble sulfate for ten locations near the project site and the community of Los Osos at varying depths.

TEST RESULTS

Data obtained during this investigation has been summarized in Tables 1, 2, and 3 for analysis and presentation.

Table 1 lists the results of the soil resistivity measurements conducted at the site. Table 2 summarizes the results of the field soil resistivity measurements. Table 3 lists a summary of data provided by Fugro West, Inc.

Table 1 Field Soil Resistivity Data

Site No.	Depth (feet)	Resistivity (ohm-cm)	Layer (feet)	Layer Resistivity (ohm-cm)
1	5	958,000	0-5	958,000
	10	785,000	5-10	665,000
	15	284,000	10-15	125,000
	20	613,000	15-20	249,000
2	5	1,150,000	0-5	1,150,000
	10	1,360,000	5-10	1,660,000
	15	1,150,000	10-15	877,000
	20	536,000	15-20	206,000
3	5	9,480,000	0-5	9,480,000
	10	8,230,000	5-10	7,280,000
	15	6,030,000	10-15	3,930,000
	20	2,300,000	15-20	804,000
4	5	2,300,000	0-5	2,300,000
	10	1,900,000	5-10	1,610,000
	15	1,210,000	10-15	699,000
	20	881,000	15-20	487,000

Table 2 Summary of Field Soil Resistivity Data

	At Depth (ohm-cm)					Layer (ohm-cm)		
Depth	Total	5'	10'	15'	20'	5-10'	10-15'	15-20'
Minimum	284,000	958,000	785,000	284,000	536,000	665,000	125,000	206,000
Average	2,450,000	3,470,000	3,070,000	2,170,000	1,080,000	2,810,000	1,410,000	431,000
Maximum	9,480,000	9,480,000	8,230,000	6,030,000	2,300,000	7,280,000	3,930,000	804,000

Table 3 Laboratory Soil Analysis Data[1]

Item No.	Boring No.	Approx. Depth (ft)	Soil Resistivity (ohm-cm)	Chemical Data		
				pH	Sulfate (ppm)	Chloride (ppm)
1	DH-103	11.0	11,979	6.98	18	7
2	DH-104	25.0	26,136	7.50	0.1	0.1
3	DH-101	2.0	3,393	6.33	19	9
4	DH-108	4.5	26,136	5.56	69	7
5	DH-109	10.0	11,979	6.89	18	9
6	DH-111	2.0	27,951	7.82	10	1.0
7	DH-112	9.0	9,801	5.50	14	19
8	DH-113	2.0	7,986	6.50	16	8
9	DH-115	2.0	3,230	5.71	46	347
10	DH-301	3.0	79,860	5.39	0.5	0.5

Interpretation of Soil Resistivity Data

Soil resistivity is inversely proportional to the soil's ability to conduct current (conductivity). Corrosion of a metal in soil is a function of current flow to and from a metal through the adjacent medium. Therefore, corrosion activity of metal in soil normally increases as soil resistivity decreases.

Field measured soil resistivity values give the average soil resistivity to a particular depth. Layer resistivity values are calculated using a mathematical formula to determine the approximate resistivity for soil at a particular depth range.

The laboratory determined minimum (or saturated) soil resistivity represents the resistivity in wet weather or high groundwater conditions. Soil resistivity values from laboratory results are typically minimum (or saturated) values, therefore it is assumed that Fugro's laboratory determined soil resistivity values are minimum (or saturated) values. Table 4 correlates resistivity values with corrosivity of the soil. The interpretation of corrosivity varies among corrosion engineers. However, this table is a generally accepted guide.

[1] Data from Fugro West, Inc.

Table 4 Soil Corrosivity [2]

Soil Resistivity (ohm-cm)	Degree of Corrosivity
0 - 500	Very High
500 - 1,000	High
1,000 - 2,000	Moderate
2,000 - 10,000	Mild
Above 10,000	Negligible

Based upon analysis of the average field soil resistivities, shown in Table 2, the soils at the 5, 10, 15, and 20-foot levels are negligibly corrosive. Soil resistivities shown in Table 3 indicate that the soils are negligibly to mildly corrosive in wet weather or high groundwater conditions.

Interpretation of Chemical Constituent Data

V&A has developed Tables 5, 6, and 7 to facilitate classification of the corrosivity of the soil environment based on the relative amounts of chemical constituents.

Water-soluble Chloride

Chloride ions found in soils tend to break down otherwise protective surface deposits, and can result in corrosion of buried metallic structures and reinforcing steel in concrete structures. Table 5 shows the effect of chloride ions on the corrosivity of the soil.

[2] Peabody, A. W. and Parker, M. E., "*Corrosion Basics, an Introduction*", Ed by Brasunas, A. deS., NACE International, p. 191 (1984)

Table 5 Effects of Chloride Ions on the Corrosivity of Soil[3].

Water-soluble Chloride Concentration (ppm)	Degree Of Corrosivity
Over 5,000	High
1,500 - 5,000	Moderate
500 - 1,500	Mild
100 - 500	Threshold
Below 100	Negligible

The water soluble chloride levels, shown in Table 3, ranged from 0.1 ppm to 347 ppm. This range is considered negligibly corrosive.

Acidity

Acidity, as indicated by the pH value, is another important factor of soil with respect to corrosivity. Lower pH (more acidic) will result in a greater degree of corrosivity with respect to buried metallic and concrete structures. When pH increases above 7.0 (the neutral value) the conditions become increasingly more alkaline. In alkaline environments, steel forms a protective layer on its surface. This is referred to as passivation. V&A developed Table 6, which correlates the effect of pH on the rate of corrosion for buried steel or concrete structures.

[3] Schiff, M. J., "What is a Corrosive Soil?", Proceedings from Western States Corrosion Seminar, California State Polytechnic State University, Pomona (1993); Romanoff, M., *"Underground Corrosion"*, NACE

Table 6 Effects of pH on the Corrosivity of Soil[4, 5]

pH	Degree Of Corrosivity
< 5.5	High
5.5 - 6.5	Moderate
6.5 - 7.5	Neutral
> 7.5	Negligible

The pH of the tested boring samples, shown in Table 3, ranged from 5.39 to 7.82. These levels are considered moderately corrosive to negligibly corrosive. Most of the samples had a pH above 5.5, but one sample was below 5.5. This indicates that there may be "hot spots" of low pH soils in the community. The samples were taken from the community surrounding the site; therefore it is possible the low pH values are not representative of the soil on the site. Further chemical analysis of soil borings at the WWTF site may be necessary to determine if high acidic conditions exist.

Water-soluble Sulfates

Soil with high levels of sulfates can chemically attack concrete structures. Table 7 correlates the effect of sulfates on the corrosivity of soil for concrete structures.

International, p. 11 (1957) ;V&A Consulting Engineers' Experience

[4] Romanoff, M., "*Underground Corrosion*", NACE International, p. 8 (1989)

[5] Uhlig H. H., "*Corrosion and Corrosion Control*", 2nd Edition, John Wiley & Sons Inc., pp.98-106 (1971); V&A's experience.

Table 7 Effects of Sulfate Ions on the Corrosivity of Soil [6]

Water-soluble Sulfate Concentration (ppm)	Degree Of Corrosivity
> 2,000	Severe
1,000 - 2,000	Moderate
< 1,000	Negligible

The water soluble sulfate levels, shown in Table 3, ranged from 0.1 ppm to 69 ppm. This range is considered negligibly corrosive.

RECOMMENDATIONS

Buried Metallic Structures

The soil at the WWTF appears to be non-corrosive to buried metallic structures. However, it is recommended that buried metallic piping systems, such as steel and ductile iron, be coated with a bonded dielectric or mortar coating. Due to some low pH levels in the surrounding community, V&A recommends additional sampling in the project area. Buried metallic piping should be electrically isolated from other metallic structures, such as reinforced concrete, or where a change in piping or coating material occurs.

The following coatings are recommended for buried applications:

- 100% Solids Polyurethane
- Fusion Bonded Epoxy
- Coal-tar Epoxy
- Tape Wrap conforming to Standard AWWA C209 (excluding use with ductile iron)

[6] V&A Consulting Engineers' Interpretation of Table 8.22.2, Bridge Design Specifications, California Department of Transportation (2000).

Buried Reinforced Concrete Structures

The soil at the WWTF appears to be negligibly corrosive to reinforced concrete structures. However, V&A recommends that buried reinforced concrete structures be constructed of durable concrete such as described in ACI Standards 201.2R and 222R.

V&A recommends the following:

- A minimum of 2 inches concrete cover over reinforcing steel.
- Salt-free sand and potable water should be used in the concrete mixture.

Stainless Steel

The WWTF pipelines will transport wastewater, creating the potential for hydrogen sulfide to develop. Hydrogen sulfide is corrosive to steel. For all non-structural applications V&A recommends that fiberglass components be used when available. Some manufacturers and suppliers of fiberglass equipment are: Plasti-Fab, Inc., A.O. Smith, Inc., FRP Supply Company, and Strongwell (www.strongwell.com).

For applications where fiberglass components are not available, or where fiberglass is not practicable, V&A recommends that stainless steel be utilized. Type 316L stainless steel has a higher resistance to pitting in wastewater treatment plant environments than type 316 or type 304. The cost of type 316L stainless steel is approximately 5% higher than type 316 stainless steel; however, the initial higher cost of 316L is offset by the potentially lower cost of maintenance and repair on type 316L stainless steel. Type 316L stainless steel is recommended for all immersed applications or where welding of the stainless steel is required. Type 316 stainless steel can be used for all non-immersed and non-welded applications, although it is V&A's experience that type 316L has better corrosion resistance in wastewater treatment plant environments.

The WWTF is located approximately ½ mile from the Pacific Ocean. Atmospheric corrosion from the marine atmosphere may cause corrosion to stainless steel. V&A's research has determined that in stainless steel exposed to the atmosphere more than 800 feet from the ocean,

surface pitting was insignificant after 26 years of exposure[7]. Type 316 stainless steel is recommended for architectural applications. When cost is a major factor, type 304 stainless steel can be used for architectural applications; however some surface corrosion may result. This is especially true if hydrogen sulfide gas is present.

[7]Baker, E. A. and Lee, T. S., "Long-Term Atmospheric Corrosion Behavior of Various Grades of Stainless Steel" from Dean, Sheldon W. and Lee, T. S. "Degradation of Metals in the Atmosphere"

Section 4

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	March 10, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Bill Thiessen - BBA	**Job No.:**	1481166.063594
Subject:	Acoustical Report		

Enclosed for your review and comment is the Acoustical Report entitled "Environmental Noise Assessment" prepared by Brown-Buntin Associates for the Los Osos Wastewater Project. The Acoustical Report presented herein was prepared to fulfill the requirements of Subtask 6.06 – Acoustical, under Task 6 – Support Services, in the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002.

This report will be used as the basis for the acoustical design of the standby power facilities associated with the collection system pump stations, the wastewater treatment facilities, and the harvest wellhouses.

Please contact Steve Hyland at (805) 528 – 9385 if you have any comments or questions.

Distribution

John Bergen – MWH	Linda Tripp – MWH
Jack Osborn – MWH	Kevin Kai – MWH
Dennis Gellerman – MWH	Can Quach – MWH
Scott Burke – MWH	David Wilcoxson – MWH
Mallika Ramanathan - MWH	Bill Thiessen – BBA
	Kyle Harris - RRM

APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of Anoise level reduction@ combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.

ENVIRONMENTAL NOISE ASSESSMENT

LOS OSOS WASTEWATER PROJECT
SAN LUIS OBISPO COUNTY, CALIFORNIA

PREPARED FOR

MONTGOMERY WATSON HARZA
130 TREAT BOULEVARD, SUITE 300
WALNUT CREEK, CALIFORNIA 94597-7966

PREPARED BY

BROWN-BUNTIN ASSOCIATES, INC.
VISALIA, CALIFORNIA

MARCH 5, 2003

1. INTRODUCTION

1A. Purpose

The purpose of this analysis is to prepare an environmental noise assessment for the proposed Los Osos Wastewater Project. The assessment reviews Federal, State, and local noise level standards and presents the results of existing noise environment measurements. The potential noise impacts of the project are also discussed.

Appendix A provides definitions of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported in this analysis are A-weighted sound pressure levels in decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighted sound levels, as they correlate well with public reaction to noise.

1B. Summary of Project Description

The project consists of a wastewater collection, treatment and disposal system to be located in the unincorporated community of Los Osos in San Luis Obispo County, California. Los Osos is located along the central coast of California south of the City of Morro Bay. The proposed project would replace existing individual septic systems with a community waste water collection, treatment and disposal system.

2. NOISE LEVEL STANDARDS

Appendix G (Environmental Checklist Form) of the CEQA Guidelines indicates that significant noise impacts occur when the project exposes people to noise levels in excess of standards established in local noise ordinances or general plan noise elements, or causes a substantial permanent or temporary increase in noise levels above levels existing without the project.

2A. Federal Noise Level Standards

Under the Occupational Safety and Health Act of 1970 (OSHA) (29 U.S.C. § 651 et seq.), the Department of Labor, Occupational Safety and Health Administration (OSHA) has adopted regulations (29 C.F.R. § 1910.95) designed to protect workers against the effects of occupational noise exposure. Table I lists permissible noise level exposure as a function of the amount of time during which the worker is exposed. The regulations further specify a hearing conservation program that involves monitoring the noise to which workers are exposed; assuring that workers are made aware of overexposure to noise; and periodically testing the workers' hearing to detect any degradation. There are no federal laws governing offsite (community) noise.

TABLE I OSHA WORKER NOISE EXPOSURE STANDARDS	
Duration of Noise (Hrs./day)	**A-Weighted Noise Level (dBA)**
8.0	90
6.0	92
4.0	95
3.0	97
2.0	100
1.5	102
1.0	105
0.5	110
0.25	115
Source: OSH Regulation	

2B. State and Local Noise Level Standards

The applicable standards for noise levels that apply to this project are those within the San Luis Obispo County Noise Element of the General Plan. For non-transportation noise sources (e.g., mechanical equipment), the Noise Element applies hourly noise levels performance standards at residential and other noise-sensitive uses. Noise-sensitive land uses include:

a. Residential uses listed in Table O, Framework for Planning of the Land Use Element, except temporary dwellings and residential accessory uses.
b. Schools-preschool to secondary, college and university; specialized education and training
c. Health care services (hospitals)
d. Nursing and personal care
e. Churches
f. Public assembly and entertainment
g. Libraries and museums
h. Hotels and motels
i. Bed and breakfast facilities
j. Outdoor sports and recreation
k. Offices

Table II summarizes the hourly County Noise Element standards. San Luis Obispo County has also adopted an ordinance that prohibits excessive noise levels at noise-sensitive receivers. The standards of the ordinance are the same as shown in Table II.

TABLE II

HOURLY NOISE LEVEL PERFORMANCE STANDARDS FOR NON-TRANSPORTATION NOISE SOURCES[1] SAN LUIS OBISPO COUNTY NOISE ELEMENT

	Day (7a-10p)	Night (10p-7a)[2]
Hourly, L_{eq}, dB	50	45
Maximum Level, dB	70	65
Maximum Level, dB Impulsive Noise	65	60

[1]As determined at the property line of receiving land uses.

[2] Applies only where the receiving land use operates or is occupied during nighttime hours.

2C. Substantial Noise Increases

CEQA does not define what constitutes a "substantial" increase in noise levels or advise when a substantial increase in noise levels becomes significant.

Federal agencies[1] have found that, in noisy environments where the noise exposure would normally be considered unacceptable, an increase of 1½ dBA may be a significant impact, whereas in quieter environments, such as suburban areas, an increase is usually not significant unless it is greater than 5 dBA[2]. It is therefore reasonable to assume that an increase of more than 10 dBA is clearly significant. An increase between 5 and 10 dBA should be considered adverse, but may be either significant or insignificant, depending on the particular circumstances of a case.

Factors to be considered in determining the significance of an adverse impact as defined above include:

1. the resulting noise level[3];
2. the duration and frequency of the noise;
3. the number of people affected;
4. the land use designation of the affected receptor sites;
5. public reactions or controversy as demonstrated at workshops or hearings, or by correspondence;
6. prior CEQA determinations by other agencies specific to the project.

[1]Federal Agency Review of Selected Airport Noise Analysis Issues, Federal Interagency Committee on Noise (FICON), August 1992.

[2]An increase of 1½ dBA in a noisy environment entails a greater increase in sound energy than a 5 dBA increase in a much quieter environment.

[3]For example, a noise level of 40 dBA would be considered quiet in many locations. A noise limit of 40 dBA would be consistent with the recommendations of the California Model Community Noise Control Ordinance for rural/suburban environments. If the project would create an increase in ambient noise no greater than 10 dBA at nearby sensitive receptors, and the resulting noise level would be 40 dBA or less, the project noise level would likely be insignificant.

3. EXISTING NOISE ENVIRONMENT

The existing noise environment near the proposed treatment plant and near pump stations and their standby power facilities was evaluated on February 26-27, 2003. Ambient noise levels at two locations near the treatment plant were measured continuously for 24 hours. Short-term measurements (15 minutes) were conducted at the five pump stations/standby power locations. The measurement locations are shown in Figure 1. Noise measurement equipment consisted of Larson-Davis model 820 sound level meters equipped with Bruel & Kjaer (B&K) Type 4176 ½ " microphones. The meters were calibrated before use with a B&K Type 4230 acoustical calibrator.

Land uses near the proposed treatment plant are a library and community center to the east, chamber of commerce office and residences to the south, and proposed residential developments to the west and north. All of these uses are considered to be noise-sensitive according to the County Noise Element. Residential uses are located near each of the pump station/standby power locations, except the East Paso location, which is adjacent to commercial uses.

Figures 2 and 3 show the hourly noise levels through a 24-hour period for the two long-term ambient noise monitoring locations near the proposed plant. Site LT-1 was located near the southwest corner of the County Library on Palisades Avenue and Site LT-2 was located in the backyard of the residence at 764 Woodland Drive.

At Site LT-1, the lowest noise levels occurred from 12:00 a.m. to 1:00 p.m. The hourly L_{eq} (energy average) was approximately 41 dBA, the hourly L_{50} (level exceed 50% of the time or median) was 36 dBA, and the L_{90} (level exceeded 90% of the time) was 33 dBA. During the hours of 2:00 a.m. and 3:00 a.m. there was a rain storm that increased background noise levels. By about 6:00 a.m., commute traffic and other human activity had begun which raised background noise levels.

At Site LT-2, a pattern similar to LT-1 is apparent, except hourly noise levels at LT-2 are more variable. This is probably due to a dog in the backyard that barked occasionally. The lowest hourly noise levels at LT-2 occurred from 1:00 a.m.-2:00 a.m. The hourly L_{eq}, L_{50}, and L_{90} were 39, 31 and 28 dBA, respectively.

Table III shows the results of the ambient measurements at the five pump station/standby power locations.

Figure 1
Ambient Noise Measurement Locations

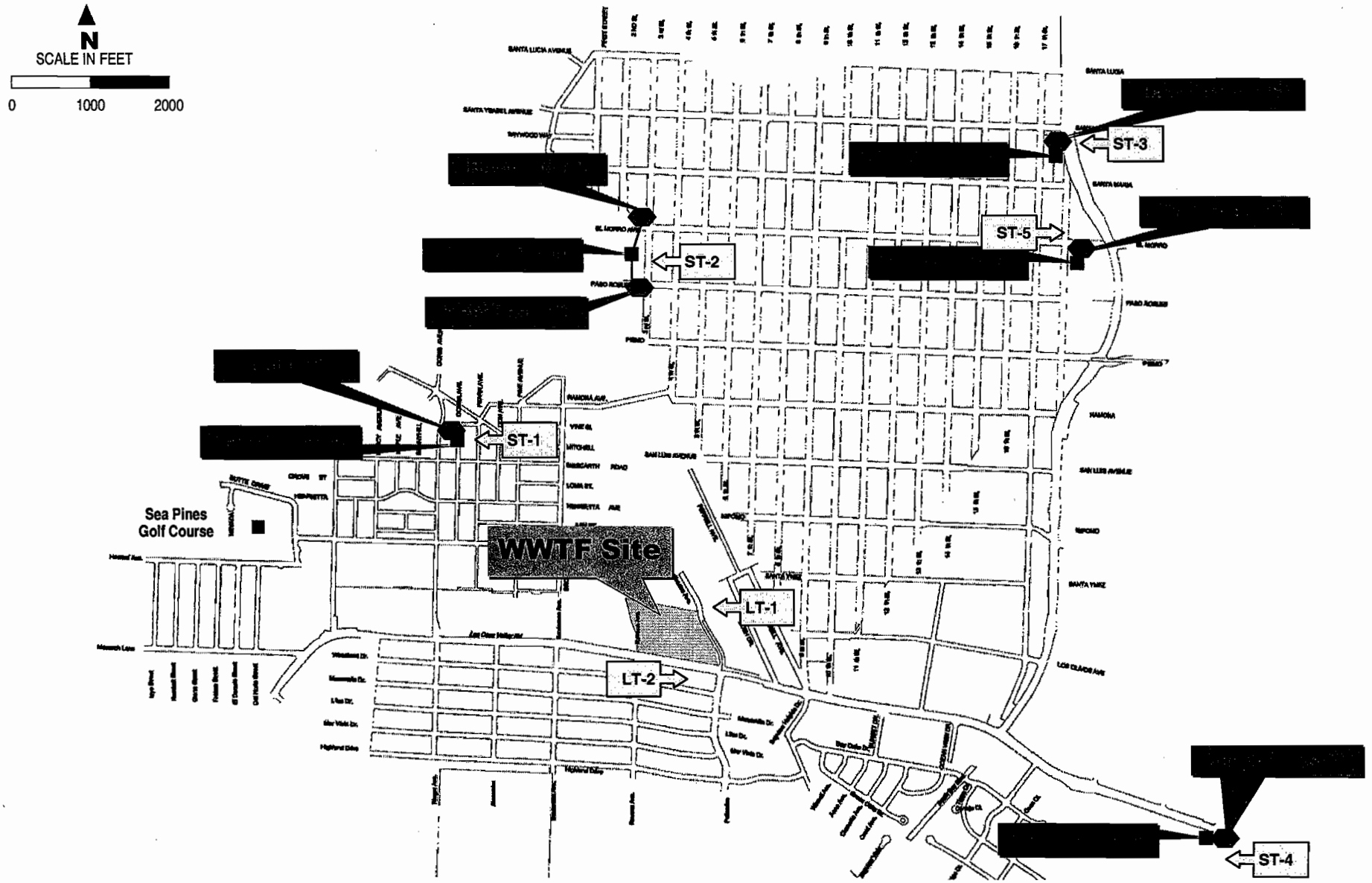


Figure 2
Ambient Noise Levels
Public Library, February 26-27, 2003

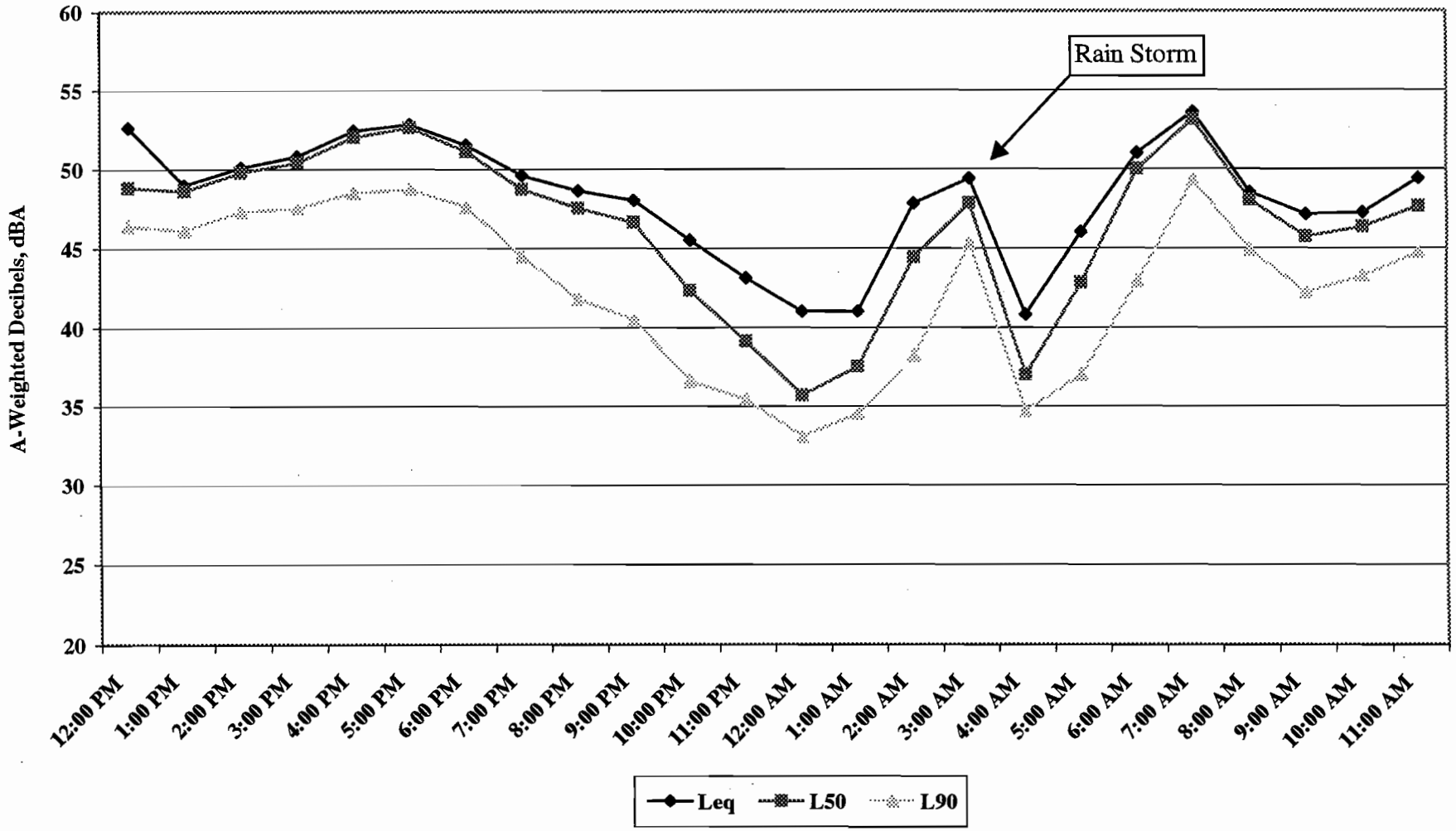


Figure 3
Ambient Noise Levels
764 Woodland Avenue, February 26-27, 2003

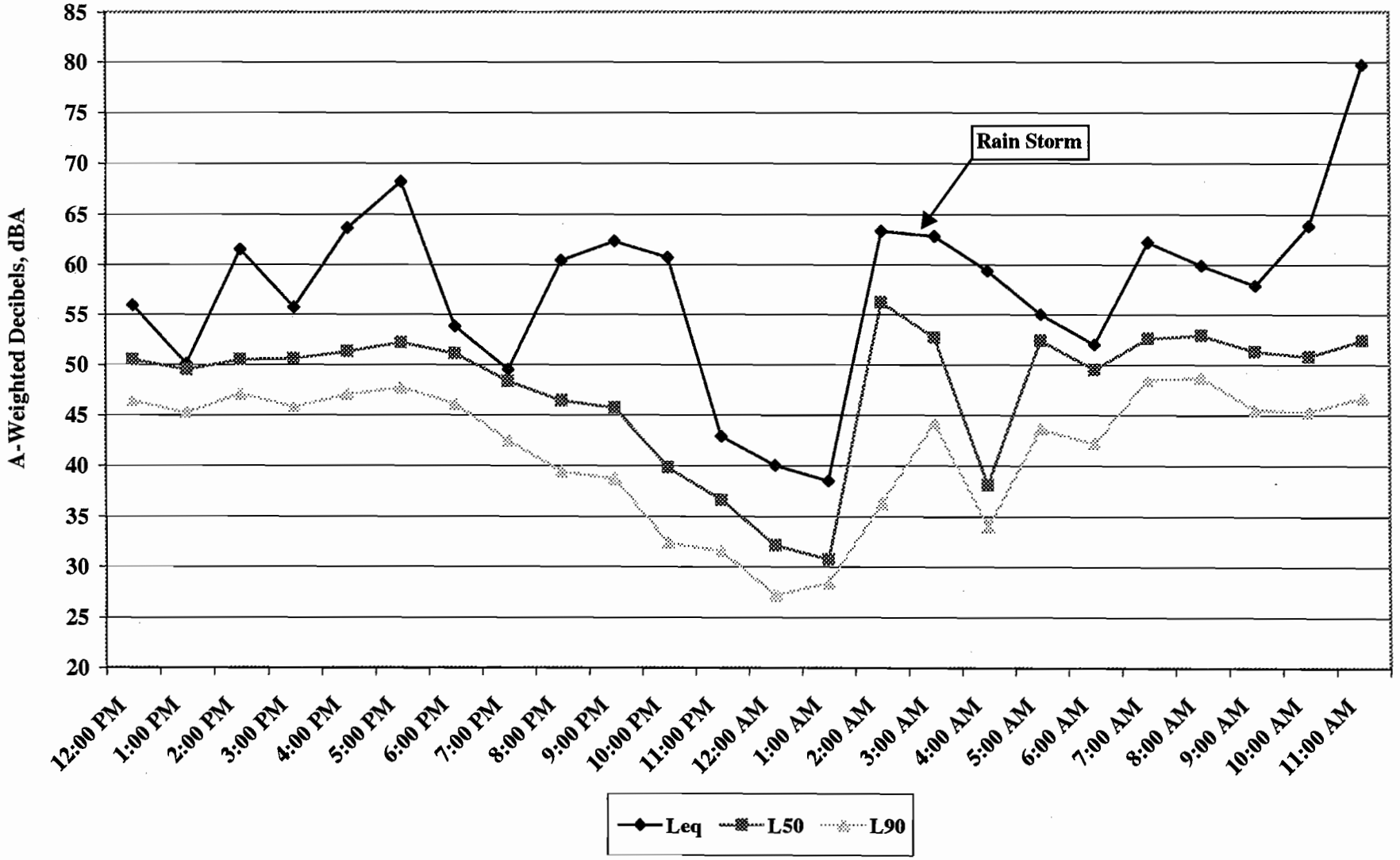


Table III shows that ambient noise levels near the pump stations/standby power facilities was generally 44-54 dBA in terms of the energy average (L_{eq}) and 39-50 dBA in terms of median noise level (L_{50}), and 36-46 dBA in terms of the L_{90}. These levels are typical of suburban settings in small communities with no dominant source of noise other than local traffic. We would expect nighttime noise levels to range from 35-45 dBA, L_{eq} at these locations when most human activity (e.g., traffic) had ceased.

TABLE III

AMBIENT NOISE LEVELS AT PUMP STATION/STANDBY POWER SITES

Site Name	Meas. No.	Date	Time	Noise Level, dBA			Comments
				L_{eq}	L_{50}	L_{90}	
Lupine	ST-1	2/26/03	1:30 p.m.	46	43	41	local traffic
Lupine	ST-1	2/27/03	10:25 a.m.	44	43	39	local traffic
West Paso/Baywood	ST-2	2/26/03	1:50 p.m.	54	44	42	local traffic
West Paso/Baywood	ST-2	2/2703	9:50 a.m.	51	39	36	local traffic
East Ysabel	ST-3	2/26/03	2:10 p.m.	54	53	49	traffic & wind
East Ysabel	ST-3	2/2703	9:10 a.m.	47	46	41	local traffic
Sunny Oaks	ST-4	2/26/03	2:30 p.m.	52	50	46	traffic & birds
Sunny Oaks	ST-4	2/2703	8:50 a.m.	51	50	46	traffic & birds
East Paso	ST-5	2/2703	9:30 a.m.	48	40	34	local traffic
East Paso	ST-5	2/2703	11:30 a.m.	50	46	40	local traffic, siren

4. PROJECT NOISE IMPACTS

4A. Construction Noise

During the construction phases of the project, noise from construction activities would dominate the noise environment in the immediate area. Activities involved in construction would generate noise levels, as indicated in Table IV ranging from 85 to 88 dBA at a distance of 50 feet. Construction activities would be temporary in nature, typically occurring during normal working hours. Construction noise impacts could be significant, if nighttime operations or use of unusually noisy equipment resulted in annoyance or sleep disruption for nearby residences.

During construction, traffic noise generated by approaching traffic would be reduced due to a reduction in speed required by working road crews. Conversely, traffic noise levels of vehicles leaving the construction area would be slightly higher than normal due to acceleration. The net effect of the accelerating and decelerating traffic upon noise would not be appreciable. The most important project-generated noise source would be truck traffic associated with transport of heavy materials and equipment. This noise increase would be of short duration and limited primarily to daytime hours.

TABLE IV

CONSTRUCTION EQUIPMENT NOISE

Type of Equipment	Maximum Level, dBA at 50 Ft.
Scrapers	88
Bulldozers	87
Heavy Trucks	88
Backhoe	85
Pneumatic Tools	85
Source: *Environmental Noise Pollution, Patrick R. Cunniff*, 1997.	

4B. Operational Noise

The project components can be described as the collection system, treatment plant, effluent disposal system, and water harvesting wells. As specific information about the components of the project are developed, noise level projections and determinations of significance will be made.

Collection System

The noise sources associated with the collection system include electric submersible pumps and standby power units. The submersible pumps will operate periodically depending on demand, more during the day than the night. The standby power units will be powered by diesel or gas engines and will be enclosed. If electrical power fails, they will turn on. They will be tested once a month for a few hours during the daytime hours.

Treatment Plant

The treatment facility will be enclosed, buried or screened. The sources of noise at the treatment plant will be pumps, motors and fans.

Effluent Disposal

There are no noise sources associated with this component that could produce significant noise impacts.

Water Harvesting

Submersible electric pumps will be used that will operate continuous for 12-20 hours per day.

APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of Anoise level reduction@ combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.

Section 5

MWH

MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	January 27, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Dennis Gellerman Jack Osborn	**Job No.:**	1481166.043579
Subject:	Area Classification		

Process areas are classified in accordance with the NFPA 820 Standard in order to provide a reasonable degree of fire and explosion protection for life, property, continuity of mission, and protection of the environment. The intent is to reduce or eliminate effects of fire or explosion by maintaining structural integrity, controlling the flame spread and smoke generation, preventing the release of toxic products of combustion, and maintaining serviceability and operation of the facility.

The specific objective of this technical memorandum is to establish coordinated design values for ventilation rates, electrical classifications, and corrosion classifications that meet the NFPA requirements and keep costs to a reasonable level. The final design team will utilize the criteria set in this memorandum to select HVAC equipment that will provide the minimum ventilation rates established. The final design documents will also reference the criteria set in this memorandum to establish the material and equipment requirements that can be specified in the contract documents. Material and equipment requirements will include the following:

- Electrical Motor Types
- Electrical Enclosure Ratings
- Ventilation Rates
- Gas Detection Requirements
- Electrical Conduit Materials

- Pipe Support Materials
- Anchor Bolt Materials

The attached table entitled "Facility Electrical/Corrosion/HVAC Classifications" was developed that identifies each project process area that will be isolated for ventilation and area classification purposes. When the air space volume for each discrete area is established, the appropriate air flow rates can be readily calculated based on the minimum air changes listed in the table.

The "Facility Electrical/Corrosion/HVAC Classifications" table will be used by process engineers, electrical engineers, and HVAC engineers to review and refine the design of the subject process areas. This table will be used throughout the design process and revised as the design evolves.

Distribution

John Bergen – MWH	Linda Tripp – MWH
Jack Osborn – MWH	Kevin Kai – MWH
Dennis Gellerman – MWH	Can Quach – MWH
Scott Burke – MWH	David Wilcoxson – MWH
Mallika Ramanathan - MWH	

FACILITY ELECTRICAL/CORROSION/HVAC CLASSIFICATIONS

AREA NUMBER & DESCRIPTION	NFPA 820 CODE TABLE REFERENCE	NFPA 820 CODE CLASSIFICATIONS	CLASSIFICATION FOR CORROSION	HVAC CRITERIA – MINIMUM AIR CHANGES PER HOUR
10 Site				
Influent Pump Station	2-2:16			
Wet Well		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Valve Vault		Class I, Div 2	Outdoor/Damp	N/A
Plant Drain Pump Station	2-2:16			
Wet Well		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Valve Vault		Class I, Div 2	Outdoor/Damp	N/A
12 KV Switchyard	N/A	Unclassified	Outdoor/Damp	N/A
20 Residuals Building				
Headworks				
Grinding/Screening Facility	3-2:1			
Above Cover		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Cover		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Grit Chamber	4-2:12			
Above Cover		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Cover		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Septage Receiving Area				
Above Cover		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Cover		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Mechanical Room		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Electrical/Control Room		Unclassified	General Purpose	< 12 Air Changes per Hour

FACILITY ELECTRICAL/CORROSION/HVAC CLASSIFICATIONS

AREA NUMBER & DESCRIPTION	NFPA 820 CODE TABLE REFERENCE	NFPA 820 CODE CLASSIFICATIONS	CLASSIFICATION FOR CORROSION	HVAC CRITERIA – MINIMUM AIR CHANGES PER HOUR
Solids				
General	4-2:12	Unclassified	Corrosive	> 12 Air Changes per Hour
Aerobic Digesters	3-2:9			
Above Deck		Unclassified	Outdoor/Damp	N/A
Below Deck		Unclassifiied	Corrosive	N/A
Digester Gallery		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Thickening/Dewatering	4-2:12			
Exhaust Hoods		Unclassified	Corrosive	> 12 Air Changes per Hour
Conveyor		Unclassified	Corrosive	> 12 Air Changes per Hour
Truck Loading		Unclassified	Corrosive	> 12 Air Changes per Hour
Polymer Area		Unclassified	Corrosive/Damp	< 12 Air Changes per Hour
40 Secondary Building				
Splitter Box	3-2:6			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Pre-Anoxic Area	3-2:6			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Aeration Basin/Oxidation Ditch	3-2:8			
Above Deck		Unclassified	Outdoor/Damp	< 12 Air Changes per Hour
Below Deck,		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Post-Anoxic Basin	3-2:6,8,16			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Re-Aeration Basin	3-2:8			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour

FACILITY ELECTRICAL/CORROSION/HVAC CLASSIFICATIONS

AREA NUMBER & DESCRIPTION	NFPA 820 CODE TABLE REFERENCE	NFPA 820 CODE CLASSIFICATIONS	CLASSIFICATION FOR CORROSION	HVAC CRITERIA – MINIMUM AIR CHANGES PER HOUR
Recycle Pump Area	3-2:8			
Pump Area		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Discharge Channel		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
RAS/WAS Pump Area		Unclassified	General Purpose	< 12 Air Changes per Hour
Secondary Splitter Box No. 1	3-2:8			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Aerated Scum Pit	4-2:4			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Methanol Storage and Pumps		Unclassified	Corrosive	N/A
Blower Room		Unclassified	General Purpose	< 12 Air Changes per Hour
Electrical Room		Unclassified	General Purpose	< 12 Air Changes per Hour
Engine Generator Room		Unclassified	General Purpose	< 12 Air Changes per Hour
50 Secondary Clarifiers				
Secondary Clarifier	3-2:14	Unclassified	Outdoor/Damp	N/A
Scum Pit	4-2:5			
Above Deck		Unclassified	Outdoor/Damp	N/A
Below Deck		Class I, Div 2	Corrosive	> 12 Air Changes per Hour
60 Tertiary Building				
Filter	3-2:20			
Above Deck		Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Below Deck		Unclassified	Corrosive	N/A
UV Disnfection	3-2:24	Unclassified	Corrosive	< 12 Air Changes per Hour

FACILITY ELECTRICAL/CORROSION/HVAC CLASSIFICATIONS

AREA NUMBER & DESCRIPTION	NFPA 820 CODE TABLE REFERENCE	NFPA 820 CODE CLASSIFICATIONS	CLASSIFICATION FOR CORROSION	HVAC CRITERIA – MINIMUM AIR CHANGES PER HOUR
Effluent Pump Station	3-2:19	Unclassified	Indoor/Damp	< 12 Air Changes per Hour
Electrical Room		Unclassified	General Purpose	N/A
Hypochlorite Storage and Pumps		Unclassified	Corrosive	< 12 Air Changes per Hour
Coagulant Storage and Pumps		Unclassified	Corrosive	< 12 Air Changes per Hour
80 Biofilter Area				
Odor Control System				
Within Fan/Duct	N/A	Class I, Div 2	Corrosive	> 12 Air Changes per Hour
Outside Vessel/Duct	N/A	Unclassified	Corrosive	N/A
90 Operations Building				
Operations Building	N/A	Unclassified	General Purpose	< 12 Air Changes per Hour
Pump Stations				
Baywood PS				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Valve Vault	2-2: 31a	Class 1, Group D, Division 2	Outdoor/Damp	Not Ventilated
West Paso PS				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Valve Vault	2-2: 31a	Class 1, Group D, Division 2	Outdoor/Damp	Not Ventilated
Baywood -Lupine				
Standby Power Building	2-2: 30	Unclassified	General Purpose	<12 Air Changes per hour
Lupine PS				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Valve Vault	2-2: 31a	Class 1, Group D, Division 2	Outdoor/Damp	Not Ventilated

FACILITY ELECTRICAL/CORROSION/HVAC CLASSIFICATIONS

AREA NUMBER & DESCRIPTION	NFPA 820 CODE TABLE REFERENCE	NFPA 820 CODE CLASSIFICATIONS	CLASSIFICATION FOR CORROSION	HVAC CRITERIA – MINIMUM AIR CHANGES PER HOUR
Standby Power Building	2-2: 30	Unclassified	General Purpose	<12 Air Changes per hour
Santa Ysabel PS				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Valve Vault	2-2: 31a	Class 1, Group D, Division 2	Outdoor/Damp	Not Ventilated
Standby Power Building	2-2: 30	Unclassified	General Purpose	<12 Air Changes per hour
East Paso PS				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Valve Vault	2-2: 31a	Class 1, Group D, Division 2	Outdoor/Damp	Not Ventilated
Standby Power Building	2-2: 30	Unclassified	General Purpose	<12 Air Changes per hour
Sunny Oaks PS				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Valve Vault	2-2: 31a	Class 1, Group D, Division 2	Outdoor/Damp	Not Ventilated
Standby Power Building	2-2: 30	Unclassified	General Purpose	<12 Air Changes per hour
Pocket Pump Stations				
Wet Well	2-2: 16a	Class 1, Group D, Division 2	Corrosive	Not Ventilated
Harvest Wells				
Skyline				
Well House	N/A	Unclassified	Corrosive	<12 Air Changes per hour
Rosina				
Well House	N/A	Unclassified	Corrosive	<12 Air Changes per hour
Loma				
Well House	N/A	Unclassified	Corrosive	<12 Air Changes per hour
Palisades				
Well House	N/A	Unclassified	Corrosive	<12 Air Changes per hour
El Morro				
Well House	N/A	Unclassified	Corrosive	<12 Air Changes per hour

FACILITY ELECTRICAL/CORROSION/HVAC CLASSIFICATIONS

AREA NUMBER & DESCRIPTION	NFPA 820 CODE TABLE REFERENCE	NFPA 820 CODE CLASSIFICATIONS	CLASSIFICATION FOR CORROSION	HVAC CRITERIA – MINIMUM AIR CHANGES PER HOUR
East Paso				
Well House	N/A	Unclassified	Corrosive	<12 Air Changes per hour
Effluent Disposal Sites				
Sea Pines Golf Resort				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Vista de Oro				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Monarch Grove School				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Pine				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Broderson Avenue				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Broderson				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Pismo				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Santa Maria / 18th Street				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
Los Osos Middle School				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
East Santa Ysabel				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment
South Bay				
RTU – Instrument Panel	N/A	Unclassified	Outdoor/damp	Ventilated for Equipment

Section 6

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	February 17, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Steve Hyland Jack Osborn	**Job No.:**	1481166.033579
Subject:	Energy Evaluation – Standby Power		

Introduction

The Energy Management Technical Memorandum (TM) presented herein was prepared to fulfill the requirements of Subtask 3.01 – General, under Task 3 – Pump Stations and Wells, in the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002. This TM discusses the energy evaluation for standby power to serve submersible pump stations and the wastewater treatment facility (WWTF). A companion TM that addresses the evaluation of solar energy at the WWTF will be prepared and transmitted in the near future.

Background

The wastewater system recommended in the Final Project Report for the Los Osos Wastewater Project dated March 7, 2001 prepared by MWH included standby power facilities for pump stations and the WWTF. The general locations and preliminary sizes for five standby power facilities to serve six submersible pump stations and one standby power facility to serve the WWTF are presented in Figure 1 – Standby Power Facilities.

The standby power facilities presented in the Final Project Report were based on diesel engine-generator sets. The conceptual appearance of the standby power facility in relation to its associated submersible pump station is shown in Figure 2 – Conceptual Appearance.

The objective of this TM is to evaluate alternative means of providing standby power. The two alternatives to diesel engine-generators that will be considered are natural gas engine-generators and natural gas microturbines. A technical work session to evaluate these alternatives was conducted on February 12, 2003. The meeting minutes of the technical work session are attached for reference. A summary of the results of the work session is presented below.

Evaluation

The comparison and evaluation of standby power alternatives examined the following parameters:

Equipment cost
Equipment size
Noise
Exercising
Useful life
Air emissions
Turndown
Efficiency
Fuel storage
Startup time
Longevity
Procurement
Electrical classification
Building size
Design intangibles

These parameters can be grouped into three categories that are deemed the most important to the District and the community. The three categories, the assignment of the above parameters to its appropriate category, and the relative weighting assigned to each category is presented as follows:

<u>Overall Cost (Weighting – 50)</u>

Equipment cost
Equipment size
Exercising
Efficiency
Fuel storage
Procurement
Electrical classification
Building size

<u>Reliability (Weighting – 30)</u>

Useful life
Turndown
Startup time

Longevity
Design intangibles

Aesthetics/Environment (Weighting – 20)
Noise
Air emissions

Conclusion

The overall cost category favors the diesel engine-generator. The equipment cost savings is estimated to be $240,000. Under the reliability category, the diesel engine-generator and natural gas engine-generator are favored over the microturbine. Although very promising, the microturbine technology is relatively new compared to the engine-generator technology. The microturbine is the preferred technology under the aesthetics/environment category because of lower noise and better air emissions. However, the weighting of the categories places a premium on overall cost and reliability. In these categories, the diesel engine-generator is preferred and is the recommended choice for standby power.

Please contact Steve Hyland at (805) 528 – 9385 if you have any questions.

Distribution

Fred Sisson – REC
Dennis Gellerman
Walt Hitch
Jack Osborn
Can Quach
Linda Tripp
David Wilcoxson

Figure 1 - Standby Power Facilities

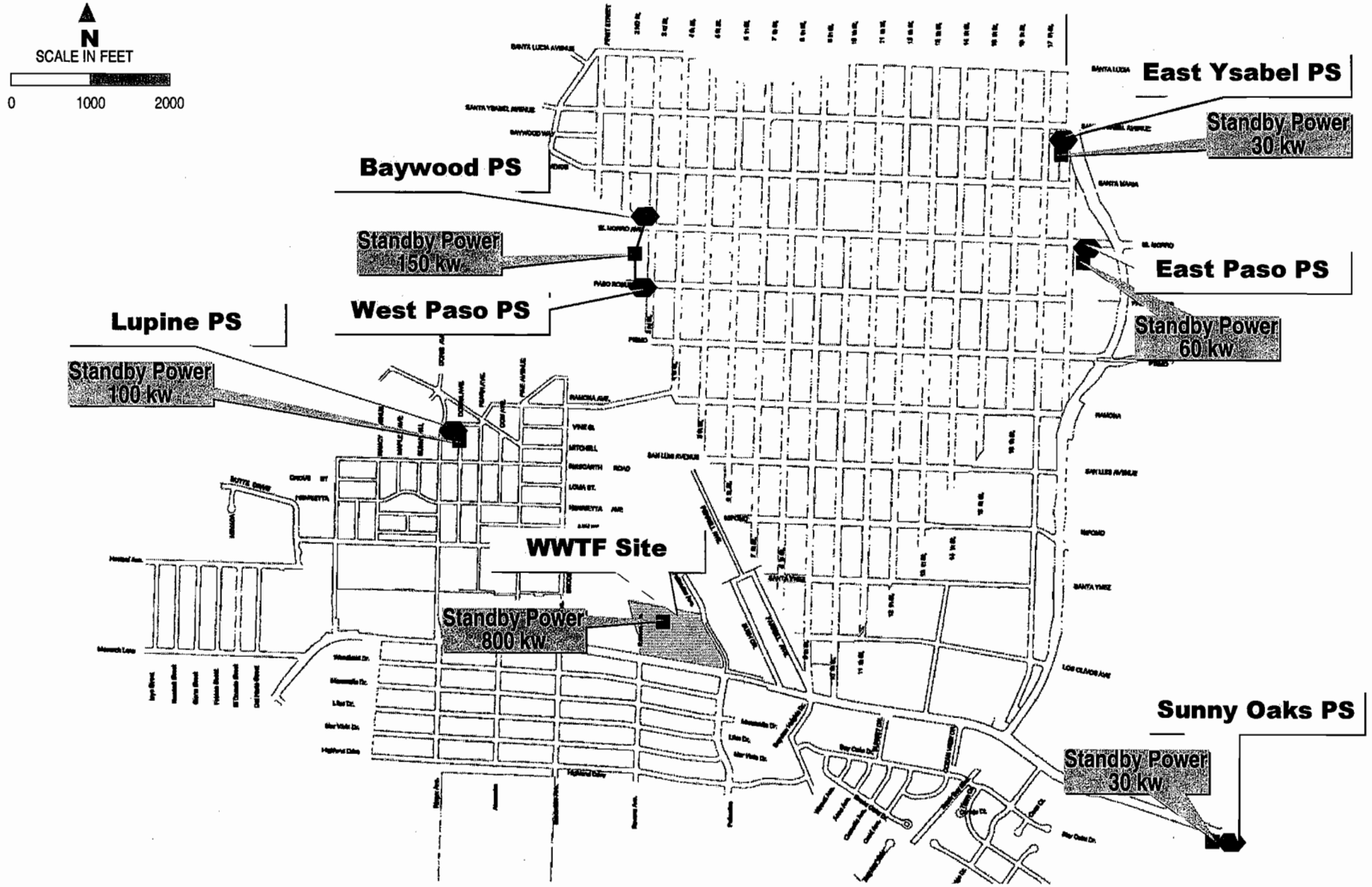
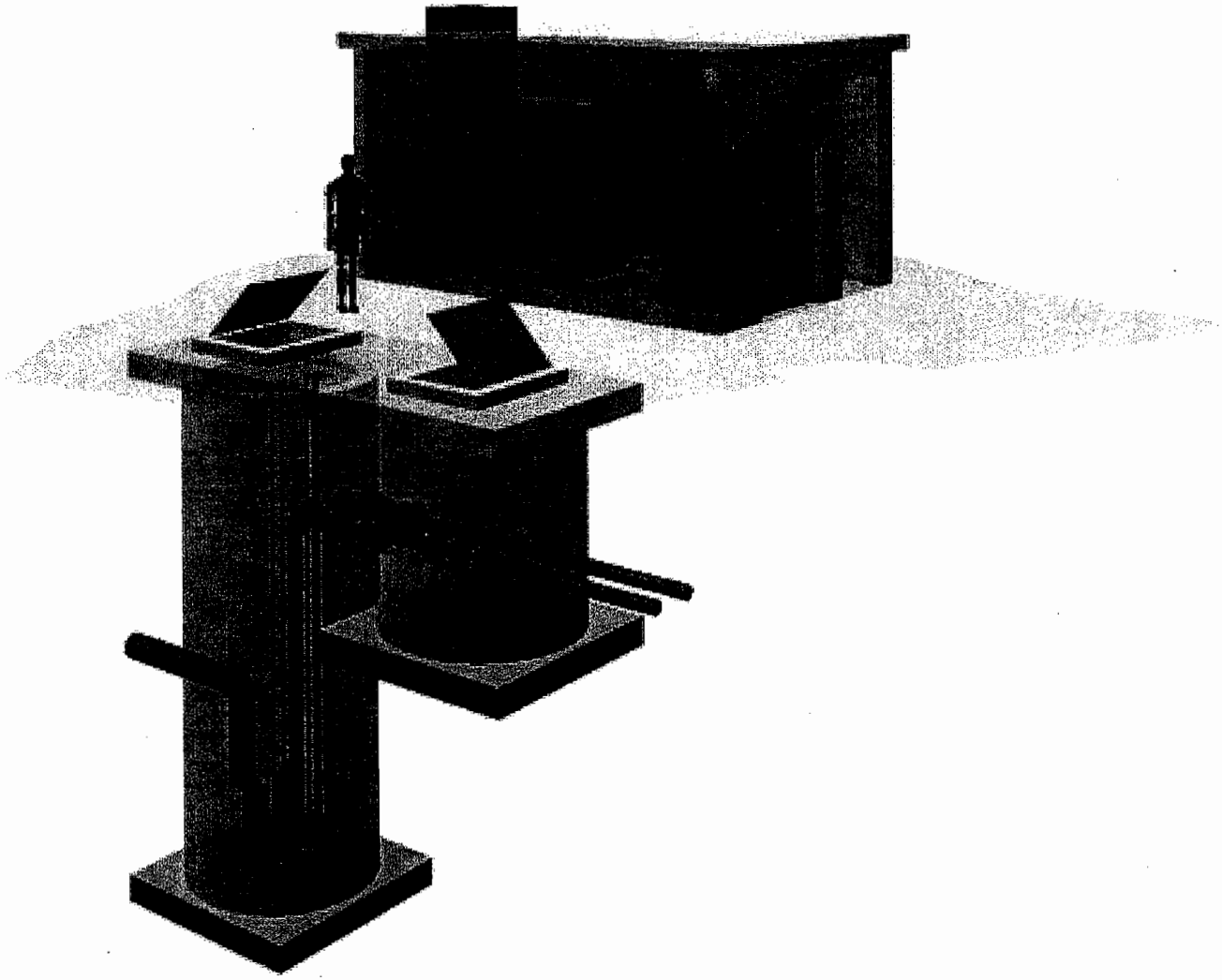


Figure 2 - Conceptual Appearance



LOS OSOS WASTEWATER PROJECT
TECHNICAL MEMORANDUM

To:	Steve Hyland MWH Project Manager	**Date:**	February 12, 2003
From:	Jack Osborn Pump Station / Wells PE	**Client:**	LOCSD
Subject:	Meeting Minutes Standby Power Evaluation	**Job No.:**	1481166.033579

Attending: Steve Hyland
Walt Hitch
Dennis Gellerman
Jack Osborn
Can Quach

1.0 Project Overview

The Los Osos Wastewater Project for the Los Osos Community Services District (LOCSD) will include five small buildings that would house the standby power equipment for the six submersible pump stations. A typical standby power building was to be 12 to 14 feet wide, 12 to 14 feet tall, and 20 to 24 feet long. The Facilities would be located in District owned parcels along the western and eastern boundaries of the town. Two of the Pump Stations (Baywood and West Paso) would share a common standby power facility to be located at the District's Third Street Well site.

The purpose of the work session was to consider the different types of standby power systems and recommend one for the project. The agenda for the meeting was to discuss the pros and cons of the three following alternatives:

a. A skid-mounted diesel engine-generator (DEG) with belly mounted diesel fuel tank.

b. A skid-mounted, natural gas (NGEG) powered, internal combustion engine-generator.

c. A natural gas powered Microturbine (MT) electrical generator.

For background and reference, copies of the various Pump Station electrical single-line diagrams were passed out, as well as copies of an illustration of a submersible pump station and its corresponding

standby power building. Preliminary sizes of the standby generator units (in KW) for each of the Pump Stations were listed as well as the Wastewater Treatment Facility.

2.0 Description

The diesel engine-generators and natural gas engine-generators require other equipment in order to work within the confines of the neighborhoods, where sensitivity to noise was an issue. The DEG requires a critical level exhaust muffler, intake louvers with acoustical silencers, and a sheet metal radiator exhaust duct with acoustical lining, in addition to its diesel fuel tank under the engine skid. The fuel tank size will be adequate for about 24 hours of run time.

The NGEG also required an acoustical silencer on the intake louvers, acoustical lining in the radiator exhaust ducting, and a critical level exhaust muffler. A natural gas supply is available to all of the Standby Power Facility sites through an existing network of underground piping by The Gas Company, (formerly Southern California Gas Company) the local natural gas utility. In order to make the standby power system completely stand alone and protected from gas line breaks and electrical power outages, a propane storage tank would need to be on the premises as a backup fuel supply.

The natural gas powered MT would be supplied by The Gas Company's natural gas network, and would also require a propane storage tank to insure unabated operation in the event of a gas line break. A critical grade exhaust silencer would also be part of the operating package. The MT units come in 30 KW and 60 KW sizes. The units can be combined in various configurations in order to fulfill the backup energy requirements for a particular Pump Station.

Cost

A tabulation of equipment costs per KW for each of the units is summarized as follows:

	DEG	NGEG	MT
Equipment Cost per KW	800 ($/KW)	900 –1000 ($/KW)	1000 ($/KW)

3.0 Skid Size

A comparison of overall skid size shows that all three are similar in size for the units that are 60 kw or less. The engine-generators require 3 to 4 feet of clearance on each side of the skid for maintenance and repair access. A monorail would be provided for routine maintenance.

The 60 KW MT requires a similar 3-feet space in front of its side panels for maintenance access. The 30 KW units can be placed side to side, since the turbine units slide out from the end for repair and maintenance. However, this feature may be discontinued in future models. A hydraulic pallet jack can be used to remove the MT units and an engine hoist can be used to lift out the turbine itself, the heaviest component.

A summary of 60 kw unit sizes is presented as follows:

	DEG	NGEG	MT
Overall Skid Size (60 KW)	3' W x 8.3'L x 6'H	3' W x 8.3'L x 6'H	2.5'W x 6.5'L x 7'H

4.0 Noise

Equipment noise is a sensitive issue in the neighborhoods where the Pump Stations are located. Each DEG, NGEG, or MT will be required to use a critical–level muffler on its exhaust pipe. The engine unit will have a more traditional truck-like sound, whereas the MT will have a higher pitched, higher frequency sound.

A summary of the decibel rating for the units is presented as follows:

	DEG	NGEG	MT
DBA @ 3 feet	110	105	75 @3 feet

5.0 Exercising

The recommended frequency of exercising is similar for each type of standby power device. Each unit would be expected to be operated 2 to 4 hours each month to insure that it will be operable when an electrical power outage occurs.

6.0 Overhaul – Service Life

The MT unit is expected to have four times the service life of an engine-generator before major overhaul is required. An air bearing limits the MT shaft wear during operation. Most of the MT shaft wear occurs during startups and shutdowns, when the air bearing is no longer able to provide protection to the shaft bearing area.

The anticipated service life before major overhaul of the units is summarized as follows:

	DEG	NGEG	MT
Useful Life	10,000 hrs 1800 rpm	10,000 hrs 1800 rpm	40,000 hrs 90,000 rpm Air Bearing

7.0 Emissions

Local air quality requirements limit the use of diesel engine-generators in a standby power application to 200 hours per year for maintenance and cycling. Emergency use is exempt from this limitation. No yearly use limits exist for NGEG or MT standby power units

	DEG	NGEG	MT
Emissions	200 hr yearly use limit For Standby Operation only	No yearly limit	No Limits for Prime or Standby

8.0 Turndown

MT allows for much higher turn down ratios on equipment loads, which implies that the unit will function satisfactory at minimum loads as well as higher load levels.

	DEG	NGEG	MT
Turn-Down	2.5 to 1	3 to 1	10 to 1

9.0 Efficiency

A comparison of energy use per hour for 60 kw units shows that the diesel engine-generator has the highest energy efficiency as shown in the table below..

	DEG	NGEG	MT
Energy Efficiency (60KW)	640,000 BTUH	920,000 BTUH	760,000 BTUH

10.0 Fuel Storage

The typical fuel storage requirement is to have enough fuel on hand to last 24 hours. The local gas utility generally has a good record of providing supply for the area. For the NGEG and MT to be entirely self sufficient, separate liquid propane tanks (LPG) would need to be on the premises as backup fuel source. Current Code restrictions require that electrical gear must be placed in a separate room with a 1-hour fire-rated door barrier between the propane consuming equipment.

A comparison of the fuel storage requirements for 60 kw units is shown in the following table:

	DEG	NGEG	MT
24-hourFuel Supply	110 Gal #2 Diesel	300 Gal Propane	250 Gal Propane

11.0 Startup Time

Startup times for the MT, while several times longer than those of the DGEG and the NGEG, are not an issue for the safe operation of the Pump Station pumps and controls.

	DEG	NGEG	MT
Startup Time	15-30 secs	15-30 secs	2 minutes

12.0 Longevity of Technology

Internal combustion engines as the motive force for backup generators have a long history of use and reliability. Parts availability, maintenance and repair companies and personnel are both plentiful and experienced. The MT, as a commercial power source, is a recent break through. Very few companies produce the equipment and availability of repair parts and experienced Maintenance Shops are not wide spread.

	DEG	NGEG	MT
Longevity of Technology	50 years	50 years	3 to 5 years

13.0 Procurement

Standby-engine generators are supplied and supported by several companies in the area. MT units have relatively few suppliers. The procurement of engine-generators by competitive bidding is suitable. However, due to the limited supply and support for MT technology, sole source procurement may be required to insure acceptable pricing.

	DEG	NGEG	MT
Competitive Bid	Competitive Bid	Competitive Bid	Sole Source?

14.0 NEC Classification

The use of natural gas and/or propane as a fuel source may trigger stringent National Electrical Code (NEC) requirements for the electrical equipment used. The electrical equipment housed in the same room with natural gas or propane storage would be rated for Class I, Div 1 or explosion-proof. The installation of electrical equipment in a separate room would be preferable to using explosion-proof electrical gear. However, the location of electrical gear in a separate room is less convenient and more expensive.

15.0 Building Size

The size of the building to house the standby power equipment will vary depending upon the overall rating of the standby power facility. The range of building sizes for various sizes of standby power capacity is summarized in the following table:

	DEG	NGEG	MT
60 KW	22' x 14'	22' x 14'	16' x 14'
150 KW	24' x 14'	24' x 14'	24' x 14'
200 KW	26' x 14'	26' x 14'	30' x 14'

16.0 Design Intangilbles

Experience in designing a MT standby power system is not wide spread. This increases the risk of the design and the ease at which the system is constructed.

	DEG	NGEG	MT
Design Experience	High	High	Low
Design Risk	Low	Low	High
Implementation of design	Low	Low	High

17.0 Summary

The comparison of standby power alternatives was made on the basis of three major categories – Cost, reliability, and aesthetics/environment as indicated in the table below. The relative importance or weight of each category was allocated as indicated in the table below. The diesel engine-generator represented the lowest overall cost with high reliability but the lowest aesthetics/environment rating

because of air emissions. The natural gas engine-generator was rated to be more expensive than the diesel engine-generator, has equivalent reliability, and was better from an aesthetic/environment standpoint because natural gas is clean burning. The microturbine was the most expensive, reliability was ranked lower because of the lack of long-term history, and was ranked highest for aesthetics/environment because of clean burning and quieter operation.

	DEG	NGEG	MT
Overall Cost (50 Weighting)	Lowest	Middle	Highest
Reliability (30 Weighting)	High	High	Lower (a)
Aesthetics/Environment (20 Weighting)	Lowest	Middle	Highest

(a) The performance of MTs to date has been excellent. However, performance to date has been based on a relatively short period of time compared to engine-generators (5 years vs. 50 years or longer). Therefore, the reliability is considered lower at this time.

The installation of conventional diesel engine-generators is recommended because the weighting of overall cost and reliability offsets the aesthetics/environment category weakness. The total installed capacity of standby power will be approximately 1200 kw. At a unit cost differential of roughly $200/kw, this translates to a capital cost difference of $240,000. This cost difference coupled with its proven track record and reliability, favors the conventional diesel engine-generators.

Section 7

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT
TREATMENT PROCESS ANALYSIS
DESIGN CRITERIA

3/20/2003

PARAMATER	AMOUNT	UNITS	CALCULATION
FLOW			
Average Daily	1.3	mgd	
Peak Daily	1.6	mgd	
INFLUENT LOAD			
Population Served	18428		
Avg Daily BOD	340	mg/l	
Avg Daily BOD Load	3686	lbs/d	
Per Capita BOD	0.20	lbs/c/d	
Peak Daily BOD	350	mg/l	
Peak Daily BOD Load	3795	lbs/d	
Per Capita BOD	0.21	lbs/c/d	
Avg DailyTSS	390	mg/l	
Avg Daily TSS Load	4228	lbs/d	
Peak Daily TSS	400	mg/l	
Peak Daily TSS Load	5338	lbs/d	
Avg Daily TKN	56	mg/l	
Avg Daily TKNLoad	607	lbs/d	
Peak Daily TKN	58	mg/l	
Peak Daily TKN Load	774	lbs/d	
SEPTAGE			
Septage BOD	5000	mg/l	
Avg Daily Flow	250	gpd	
Peak Daily Flow	3000	gpd	
Avg Septage BOD Load	10	lbs/d	
Peak Septage BOD Load	125	lbs/d	
Septage TSS	15000	mg/l	
Avg Septage TSS Load	31	lbs/d	
Peak Septage TSS Load	375	lbs/d	
Avg Daily TKN	500	mg/i	
Peak Daily TKN	650	mg/l	
Avg Septage TKN Load	1	lbs/d	
Peak SeptageTKN Load	16	lbs/d	
Recycle Flows			
Grit Overflow	50	gpm	
Filter Backwash	80	gpm	
Thickening-GBT	100	gpm	
Dewatering-Belt Filter Press	50	gpm	
Dewatering-Belt Filter Press TKN	150	mg/l	
Dewatering-Belt Filter Press TKN	30	lb/d	Recycle Nitrogen from digestion
TOTAL LOAD			
Avg BOD Load	3697	lbs/d	
Peak BOD Load	3920	lbs/d	
Avg TSS Load	4260	lbs/d	
Peak TSS Load	5713	lbs/d	
Avg TKN Load	638	lbs/d	
Peak TKN Load	820	lbs/d	
Influent Pump Station			
Flow Capacity	1	mgd	Influent Sewer @ 0.4 mgd plus 0.6 mgd recycle/septage
Pump Type	Submersible		
Number of Pumps	3		2 duty , one standby
Pump Drive	VFD		
Influent Grinding/Screening			
Flow Capapcity	4	mgd	
Grinder	Channel Type		
Screen Type	Auger/seive type		
Screen Opening	0.25	inch	
Screenings loading	11	CF/MG	
Screenings Quantity	0.53	cy/d	
Influent Metering			
Flow Capacity	4	mgd	
Meter Type	Magnetic Flow		
Grit Removal			
Flow Capacity	3	mgd	
Type	Mechanical Vortex		
Number of units	1		No redundant unit
Residence Time	25	sec	
Diameter	8	ft	
Grit Pumping	Centrifugal		
Grit Classifier	Screw Conveyor		
Grit loading	24.6	cf/mgal	MOP
Grit Quanity	1.2	cy/day	

Nitrification/ Denitrification Basins						
Basin Depth		15	ft			
Pre Anoxic Detention Time		0.22	days			
Pre Anoxic Volume		0.28	MG			
In Basin Anoxic Detention Time		0.45	days			
In Basin Anoxic Volume		0.59	MG			
Aerobic Detention Time		1.00	days			
Aerobic Volume		1.3	MG			
Total Detention Time		1.67	days			
Total Volume		2.17	MG			
MLVSS		2500	mg/l			
Solids Inventory		45353	lbs VSS			
F/M		0.08				
MCRT		12.27	days			
Denitrification Rate		0.01	lbs TKN/lbs VSS/day			
Anoxic Zone Mixing						
Mixer Type		Submersible				
Number of mixers		6	each	one per anaoxic chamber		
Mixed Liquor Recycle						
Rcyle Pump Type		Horizontal Centrifugal				
Recycle Rate		100 -400	%			
Number of Recyle Pumps		3		1 duty for each train, one standby		
Pump Drive		VFD				
AERATION						
Average Oxygen Demand		6633	lbs/d	1lbO/lbBOD+4.6lbO/lbNH3		
Peak Oxygen Demand		7693	lbs/d	1lbO/lbBOD+4.6lbO/lbNH3		
Aeration Type		Surface				
Number of Aerators		2	ea	two duty		
Field Oxygen Transfer efficiency		1.8	lbsO2/hp-hr			
Aerator Horsepower (ea)		89	hp			
AERATOR Drives		VFD				
RAS/WAS Pumping						
Recycle Rate		0.75	%			
RAS Flow		0.975	mgd			
RAS Pump Number		3	each	2 duty 1 standby		
RAS Pump Flow		338	gpm			
RAS Pump HP		5	HP			
SECONDARY CLARIFIERS						
Avg flow		1.6	mgd			
Recycle Flow(Assume 75 %)		1.2	mgd			
Total Flow		2.8	mgd			
Overflow Rate		500	gal/ft2/d			
Number of Clarifiers		2				
Surface Area		2800	SF			
Clarifier Diameter		60	ft			
Sidewater Depth		14	ft			
Solids Loading Rate		8.34	lbs/d/sf			
FILTERS						
Type		Continuous Backwash, moving bed				
Flow		2.5	mgd	2 mgd PDF plus Utility water @ 0.5 mgd		
Number		8	ea	12 ft Diamter by 22 ft high, SS Tank		
Design Limiitation Loading Rate		5	gpm/sf	with one unit out of service for Title 22		
Cell surface Area		50	sf			
Total Filter Area		350		Assumes 1 out of service		
Actual Loading Rate		4.96		2 mgd with one unit out of service		
Auxillary Equipment- Airlift Blower		21@25	scfm-psi			
Cooagulant		Alum/Polymer				
Cooagulant Dose		10	mg/l			
Coagulant Use- Daily		209	lbs/day	Q*Dose*8.34		
Coagulant Use		42	gpd	Assumes 5 lbsAlum/gal		
Coagulant Storage		584	gallons	Assumes 14 days storage		
Coagulant Tank		1000	Gallons			
Backwash Rate		10	gpm/filter			
Back Wash flow		80	gpm			
DISINFECTION						
Type		LP/HO UV				
Flow		2	mgd	1.6mgd PDF plus Utility water @ 0.4 mgd		
Number of Channels		2				
Number Of bank		6	ea	One redundant bank/channel		
UV Dose		100	mws/cm2			
Effluent Transmittance		0.55	%			
Lamp Life Factor		0.5				
Number of Duty Lamps /Channel		112				
Number of Duty lamps /bank		56	7x8 Array			
Total Number of Lamps		336	lamps			
Channel Effluent Weir Headloss		0.2	ft			
Channel Effluent Weir Flow		1.3	mgd			
Channel Effluent Weir Length		6.8	ft			
Effluent Pump Station						

Flow		2.5	mgd	2 mgd PDF plus Utility water @ 0.5 mgd		
Pressure zones		2		Broderson, UW and RW seperated from infiltration fields		
Broderson/UW Zone Flow		1.2	mgd	0.8 +0.4 UW		
Broderson/UW Zone Pressure		300	ft			
Broderson/UW Zone Pump		833	gpm			
Broderson/UW Zone Pump		3		2duty, 1 standby		
Broderson/UW Zone Pump		416	gpm			
Broderson/UW Zone Pump		42	hp			
Infiltration Field Zone Flow		1.3	mgd			
Infiltration Field Zone Pressure		120	ft			
Infiltration Field Zone Pump		902	gpm			
Infiltration Fields Zone Pump		3				
Infiltration Fields Zone Pump		451	gpm			
Infiltration Fields Zone Pump		18	hp			
Clear Well		107712	gallons	20'x12'x60'		
Pump Type		Vertical Turbine with VFD				
HypoChlorination						
HypoChlorine Dose		10	mg/l			
HypoChlorine Use- Daily		108	lbs/day	Q*Dose*8.34		
HypoChlorine Use		108	gpd	Assumes 1 lbs CL/gal		
Hypochloine Storage		1518	gallons	Assumes 14 days storage		
SOLIDS PROCESSING						
Solids Yield		1	lbsTSS/lbs BOD			
Solids Production	SP	3697	lbs/d			
RAS/WAS MLSS		7500	mg/l			
WAS Flow		59100	gpd	WAS Q = solids Prod/WAS MLSSx 8.34		
Gravity Belt Thickeners						
Number of Units		2		Assume no standby, operate longer with a unit out of service.		
GBT Operation		6	hrs/d	Days per week		
GBT Flow		164	gpm/unit			
GBT Width		1.0	m			
GBT Hydraulic Loading		164	gpm/m			
GBT Number		2	ea	One Duty		
Thickened Sludge		2.5	%			
Thickened Sludge Flow		17730	gpd	Solids Prod*(100lbw/TS%lbs)*1 gal/8.34lbw		
Aerobic Digestion						
Hydraulic Residence Time		25	Days			
Total Volume		443250	Gallons			
Number of Cells		4				
Volume per Cell		110813	Gallons			
Cell Dimensions		823	square ft	Assumes 18 ft depth		
Arearation type		Coarse Bubble				
Solids Inventory		92418	lbs	SP* HRT		
MLVSS		0.80				
VS to digestor		2957	lbsvs/day	Solids Prduction x %VS		
VS Reduction		0.40				
VS Reduction		1183	lbsVS/day			
Solids Out fo Digester		2514	lbs/day			
Solids Flow Out of Digester		12056	gpd	Assume 2.5% Solids		
Oxygen Requiement		3	lbs02/1000 lbs MLSSS/hr			
Oxygen Requiement		332	lbs02/hr			
Air Flow		1662	lbsair/hr			
Air Flow		28	lbsair/min			
Transfer efficiency		0.08				
Air Supply		346.3	lbsair/min			
Air Supply		4502	acfm			
Number of Blowers		3	each	2 duty, one standby		
Blower Capacity		2251	acfm			
Blower Pressure		15	psi			
Blower Size		99	hp			
Blower Type		Multistage Centrifugal				
Solids Dewatering						
Digester Flow		12056	gpd			
Dewatering Time		6	hr/day			
Dewatering Days		5	days/wk			
Dewatering Flow		46.9	gpm			
Number of BFP		2				
Sludge Cake		7.5	wet tons/day	assumes 16% cake		
ODOR CONTROL						
Type		Biofiolter				
Headworks Area		10000	cfm			
Solids Thickening/Dewatering		10000	cfm			
Solids Stabalization		5000	cfm			
Septage Area		5000	cfm			
Aeration Basin		10000	cfm			
Biofilter Loading Rate		3	cfm/ft2			
Biofilter Area		13333	ft2			

LOS OSOS COMMUNITY SERVICES DISTRICT
PROCESS SIZING AND MASS BALANCE
Revised - 2/3/2003

Plant Los Osos		Average Day	Peak Day	PWWF
Nominal Plant Capacity (ADWF)	mgd	1.30		
Plant Influent Flow and Characteristics (ADWF)				
Inf BOD	mg/L	340		
Inf TSS	mg/L	390		
Inf TKN	mg/L	51		
Inf NH_3-N	mg/L	34		
Inf NO_3-N	mg/L	5		
Inf Total P	mg/L	6		
Inf Alkalinity (as $CaCO_3$)	mg/L	250		
Plant Influent Flow and Load (Avg.)				
Avg. Flow	mgd	1.30		
Avg. BOD Load	lb/day	3,686		
Avg. TSS Load	lb/day	4,228		
Avg. TKN Load	lb/day	553		
Avg. NH_3-N Load	lb/day	369		
Avg. NO_3-N Load	lb/day	54		
Avg. P Load	lb/day	65		
Avg./Peak Day Factors				
Peak Day Flow Factor	--	1.23		
PWWF Factor	--	1.54		
Peak Day BOD Factor	--	1.25		
Peak Day TSS Factor	--	1.26		
Peak Day TKN Factor	--	1.27		
Peak Day NH_3-N Factor		1.27		
Avg. NO_3-N Load		1.27		
Peak Day P Factor	--	1.25		
Design Plant Influent Flow and Load		**Avg.**	**Peak Day**	**PWWF**
Volatile Solids	%	80%	80%	--
Degradable Influent VSS	%	70%	70%	--
mg BOD/mg Degradable VSS	mg/mg	0.95	0.95	--
Suspended BOD	lb/day	2,249	2,836	--
Soluble BOD	lb/day	1,437	1,772	--
Soluble BOD	mg/l	133	133	--
Soluble Non-Degradable Organic N	mg/l	1.00	1.00	--
Nitrogen in TSS	lb/day	183	234	--
Estimated Nitrogen Content of VSS	%	5.42%	5.48%	--
Soluble P	%	80%	80%	--
Flow	mgd	1.30	1.60	2.00
BOD	lb/day	3,686	4,608	--
TSS	lb/day	4,228	5,331	--
VSS	lb/day	3,383	4,265	--
Non-Degradable VSS	lb/day	1,015	1,280	--
Non-Volatile SS	lb/day	846	1,066	--
TKN	lb/day	553	704	--
NH_3-N	lb/day	369	469	--
NO_3-N	lb/day	54	69	--
Total P	lb/day	65	81	--
Septage Added to Influent				
Septage Flow	gpd	250	5000	
Septage BOD	mg/l	5,000	5,000	
Septage TSS	mg/l	15,000	15,000	
Septage TKN	mg/l	500	650	
Septage NH_3-N	mg/l	150	200	
Septage NO_3-N Load	mg/l	0	0	
Septage P	mg/l	25	30	
Volatile Solids	%	67%	67%	

Plant Los Osos		Average Day	Peak Day	PWWF
Degradable VSS	%	50%	50%	
mg BOD/mg Degradable VSS	mg/mg	0.95	0.95	

Septage Flow	mgd	0.00025	0.00500	
Septage BOD	lb/day	10	201	
Septage TSS	lb/day	31	628	
Septage VSS	lb/day	21	419	
Non-Degradable VSS	lb/day	10	210	
Non-Volatile SS	lb/day	10	209	
Septage TKN	lb/day	1.04	21	
Septage NH_3-N	lb/day	0.80	16.04	
Septage NO_3-N	lb/day	0.00	0.00	
Septage P	lb/day	0.05	1.25	

Total Plant Recycle Flow and Load to Influent

Recycle Flow	%	24.6%	25.7%	30.1%
Recycle BOD	%	3.9%	5.0%	--
Recycle TSS	%	6.4%	8.0%	--
Recycle VSS	%	5.8%	8.5%	--
Recycle Non-Degradable VSS	%	10.9%	15.7%	--
Recycle NVSS	%	8.9%	19.5%	--
Recycle TKN	%	3.0%	7.6%	--
Recycle NH_3-N	%	0.4%	1.8%	--
Recycle NO_3-N	%	27.4%	11.0%	--
Recycle P	%	17.5%	12.8%	--

Recycle Flow	mgd	0.32	0.41	0.60
Recycle BOD	lb/day	22	23	--
Recycle TSS	lb/day	27	40	--
Recycle VSS	lb/day	95	132	--
Recycle Non-Degradable VSS	lb/day	71	201	--
Recycle Non-Volatile SS	lb/day	25	208	--
Recycle TKN	lb/day	17	53	--
Recycle NH_3-N	lb/day	2	9	--
Recycle NO_3-N	lb/day	1	6	--
Recycle P	lb/day	1	8	--

Combined Influent Flows, Loads, and Characteristics

Flow	mgd	1.62	2.02	2.60
BOD	lb/day	3,839	5,048	--
TSS	lb/day	4,530	6,384	--
VSS	lb/day	3,599	5,047	--
Non-Degradable VSS	lb/day	1,136	1,690	--
Non-Volatile SS	lb/day	931	1,480	--
TKN	lb/day	571	784	--
NH3-N	lb/day	370	486	--
NO3-N	lb/day	69	77	--
Total P	lb/day	76	93	--
BOD	mg/L	284	300	--
TSS	mg/L	335	380	--
VSS	mg/L	266	300	--
Non-Degradable VSS	mg/L	84	101	--
Non-Volatile SS	mg/L	69	88	--
TKN	mg/L	42	47	--
NH3-N	mg/L	27	29	--
NO3-N	mg/L	5	5	--
Total P	mg/L	6	6	--

Denitrification and Aeration Basins

Wastewater Flow to Denitrification/Aeration Basins

Flow	mgd	1.62	2.02	2.60
BOD	lb/day	3,839	5,048	--
TSS	lb/day	4,530	6,384	--
VSS	lb/day	3,599	5,047	--
Non-Degradable VSS	lb/day	1,136	1,690	--
Non-Volatile SS	lb/day	931	1,480	--
TKN	lb/day	571	784	--
NH3-N	lb/day	370	486	--
NO3-N	lb/day	69	77	--

Plant Los Osos		Average Day	Peak Day	PWWF
Total P	lb/day	76	93	--

Aerobic MCRT Required for Nitrification

Temperature	deg C	17	17	--
Max Nitrifier Growth Rate @ 15 deg C	1/day	0.45	0.45	--
Max Nitrifier Growth Rate @ Temp	1/day	0.55	0.55	--
Design Effluent Ammonia	mg/l	0.50	0.50	--
Basin DO	mg/l	2.00	2.00	--
Kn (nitrogen constant)	mg/l	0.50	0.50	--
Ko (oxygen constant)	mg/l	1.00	1.00	--
Nitrifier Growth Rate @ Operating Conditions	1/day	0.18	0.18	--
Nitrifier Decay Rate @ 20 deg C	1/day	0.050	0.050	--
Nitrifier Decay Rate @ Temp	1/day	0.044	0.044	--
Minimum Aerobic MCRT	days	7.24	7.24	--
Safety Factor	--	1.50	1.50	--
Minimum Required Aerobic MCRT	days	10.87	10.87	--
Target Aerobic MCRT	days			--

Heterotrophic Biological Solids Production

Cell Yield	mg VSS/mg BOD	0.65	0.65	--
Decay Coefficient @ 15 deg C	1/day	0.06	0.06	--
Temperature Coefficient	--	1.04	1.04	--
Decay Rate @ Temp	--	0.0649	0.0649	--
Cell Yield @ Temp and Target MCRT	mg VSS/mg BOD	0.33	0.39	--
Net Cell Yield	lb VSS/day	1,264	1,990	--
Cell Non-Degradable VSS Fraction	--	0.20	0.20	--
Cell Non Degradable VSS	lb/day	253	398	--
Cell Non-Volatile Solids Fraction	--	0.10	0.10	--
Cell Non-Volatile Solids	lb/day	126	199	--
Cell Nitrogen Fraction	mg N/mg VSS	0.09	0.09	--
Cell Phosphorus Fraction (use 0.03 w/o Bio-P, 0.07 w/Bio-P)	mg P/mg VSS	0.03	0.03	--
Cell Nitrogen	lb/day	114	179	--
Cell Phosphorus	lb/day	38	60	--

Autotrophic Biological Solids Production

Cell Yield	mg VSS/mg NH3-N	0.15	0.15	--
Decay Coefficient @ 20 deg C	1/day	0.05	0.05	--
Temperature Coefficient	--	1.04	1.04	--
Decay Rate @ Temp	--	0.0444	0.0444	--
Cell Yield @ Temp and Target MCRT	mg VSS/mg NH3-N	0.09	0.10	--
Net Cell Yield	lb VSS/day	74	135	--
Cell Non-Degradable VSS Fraction	--	0.20	0.20	--
Cell Non Degradable VSS	lb/day	15	27	--
Cell Non-Volatile Solids Fraction	--	0.10	0.10	--
Cell Non-Volatile Solids	lb/day	7	14	--
Cell Nitrogen Fraction	mg N/mg VSS	0.09	0.09	--
Cell Phosphorus Fraction	mg P/mg VSS	0.03	0.03	--
Cell Nitrogen	lb/day	7	12	--
Cell Phosphorus	lb/day	2	4	--

Total Secondary Sludge Production

Total Sludge Produced	lb/day	3,539	5,508	--
VSS Produced	lb/day	2,474	3,815	--
Non-Degradable VSS Produced	lb/day	1,403	2,115	--
NVSS Produced	lb/day	1,065	1,693	--
TKN in Sludge	lb/day	196	307	--
Total P in Sludge	lb/day	40	64	--
% Volatile Solids	%	70%	69%	--
Apparent Yield	mg TSS/mg BOD	0.92	1.09	--

Nitrification

Nitrification Rate	mg NH3-N/mg VSS-day	2.03	1.76	--
Nitrifier Fraction (Fn)	mg/mg MLVSS	0.03	0.04	--
Design MLSS	mg/l	3,500	3,500	--
Ammonia Oxidation Rate	mg NH3-N/l-hr	6.15	6.29	--
Safety Factor	--	1.50	1.50	--
TKN Oxidized in Nitrification	lb/day	358	457	--
TKN Oxidized in Nitrification	mg/l	26	27	--
Minimum Required Aeration Time for TKN Oxidation	hr	6.35	6.37	--

Plant Los Osos		Average Day	Peak Day	PWWF
Minimum Required Volume for TKN Oxidation	MG	0.43	0.53	--
Minimum Volume for TKN Oxidation Provided	MG	**0.60**	**0.60**	--
Basin Sizing (Aerobic Volume + Internal Anoxic)				
Flow	mgd	1.62	2.02	--
BOD Load	lb/day	3,839	5,048	--
Design MLSS	mg/l	3,500	3,500	--
MLVSS	%	70%	69%	--
MCRT Required	days	15.00	10.00	--
Required System Solids for MCRT	lb	53,078	55,076	--
Required Basin Volume	MG	1.82	1.89	--
Detention Time for MCRT	hr	26.94	22.46	--
Required Detention Time	hr	26.94	22.46	--
Limiting Design Volume Requirement	--	MCRT	MCRT	--
F/M	lb BOD/lb MLVSS-day	0.10	0.13	--
Number of Basins	--	**2**	**2**	--
Volume of Basins (each)	MG	0.91	0.94	--
Basin Width	ft	**25**	**25**	--
SWD	ft	**15**	**15**	--
Basin Length Required	ft	324	336	--
Basin Length Provided	ft	**336**	336	--
Basin Volume Provided (each)	MG	0.94	0.94	--
Total Basin Volume Provided	MG	1.88	1.88	--
Denitrification (Provide Multiple Denitrification Stages - 2-3 minimum)				
BCOD/BOD Ratio	--	**1.65**	**1.65**	--
Influent BCOD	mg/L	469	495	--
TKN Oxidised to NO_3-N	mg/L	26	27	--
Influent and Recycle NO_3-N	mg/L	5	5	--
Total NO_3-N	mg/L	32	32	--
Available BCOD Denitrification Capability	mg/L	55	58	--
Desired Effluent NO3-N	mg/l	**4**	**4**	--
Adequate Denitrification Capability?	--	YES	YES	--
Denitrification Required	mg/l	22	23	--
Denitrification Required	%	85%	85%	--
Internal Recirculation Required for Maximum Denitrification	% of Flow	562%	580%	--
Internal Recirculation Provided	% of Flow	**400%**	**400%**	--
Recirculation Pump Capacity Required	mgd	6.48	8.06	--
Denitrification Rate @ 20 deg C	mg NO3-N/g MLVSS-hr	**4.00**	**4.00**	--
Temperature Coefficient	--	**1.06**	**1.06**	--
Initial Denitrification Rate @ Temp	mg NO3-N/g MLVSS-hr	3.36	3.36	--
Minimum Anoxic Detention Required for Denitrification	hr	2.74	2.85	--
Denitrification Safety Factor	--	**1.20**	**1.20**	--
Required Anoxic Detention Time	hr	3.29	3.42	--
Anoxic Fraction	%	11%	13%	--
Required Basin Volume	MG	0.22	0.29	--
Number of Basins	--	**2**	**2**	--
Volume of Basins (each)	MG	0.11	0.14	--
Basin Depth	ft	**15.5**	**15.5**	--
Basin Length/Width Required	ft	30.93	35.19	--
Basin Width Provided	ft	**35**	35.00	--
Basin Length Provided	ft	**35**	35.00	--
Total Anoxic Basin Volume Provided	MG	0.28	0.28	--
Total System				
Total Basin Volume Provided	MG	2.17	2.17	--
Total Detention Time at Actual Flow	hr	30.2	25.9	--
Total Detention Time Based on Design Influent Flow	hr	40.0	32.6	--
Maximum Anoxic Volume Allowed	%	**40%**	**40%**	--
Maximum Anoxic Volume Allowed	MG	0.87	0.87	--
Minimum Aerobic Volume for Nitrification	MG	0.60	0.60	--
Controlling Parameter	--	Anoxic	Anoxic	--
Total Anoxic Volume Provided	MG	0.87	0.87	--
Pre-Anoxic Volume Provided	MG	0.28	0.28	--
In-Basin Anoxic Volume Provided	MG	0.58	0.59	--
Aerobic Basin Volume Provided	MG	1.30	1.30	--
Overall F/M	lb BOD/lb MLVSS-day	0.09	0.11	--
Overall MCRT (includes anoxic basins)	days	16.83	11.52	--
Total System Solids	lb MLVSS	41,632	43,954	--
Alkalinity				

Plant Los Osos		Average Day	Peak Day	PWWF
Alkalinity Consumed by Nitrification	mg/L	188	193	--
Alkalinity Returned by Denitrification	mg/L	81	83	--
Total Loss of Alkalinity	mg/L	107	110	--
Minimum Residual Alkalinity Desired	mg/L	80	80	--
Alkalinity Addition Required (as $CaCO_3$)	mg/L	0	0	--
Caustic Required (as 100% NaOH)	T/day	0.00	0.00	--
Effluent Alkalinity	mg/l	143	140	--
Aeration Requirements				
Oxygen Required for BOD	mg O_2/mg BOD	1.20	1.20	--
Oxygen Required for Nitrification	mg O_2/mg NO_3-N	4.60	4.60	--
Oxygen Returned from Denitrification	mg O_2/mg NO_3-N	2.85	2.85	--
Total Oxygen Required	lb/day	5,387	7,049	--
Average Oxygen Uptake Rate	mg O_2/l-hr	15	19	--
Peaking Factor	--	1.25	1.25	--
Peak Oxygen Demand	lb/day	6,734	8,811	--
Field Oxygen Transfer Efficiency	lb O_2/hp-hr	1.80	1.80	--
Average hp Required	hp	125	163	--
Peak hp Required	hp	156	204	--
Number of Aerators	--	2	2	--
Minimum Aerator Size	hp	78	102	--
Secondary Clarifiers				
Capacity Required				
Flow	mgd	1.62	2.02	2.60
Allowable Solids Load	lb/sqft/day	16.00	20.00	25.00
MLSS	mg/L	3,500	3,500	3,500
SVI (Stirred)	ml/g	125	125	125
Settled Volume	ml	437.5	437.5	437.5
Required RAS Rate (% Q)	%	78%	78%	78%
RAS Flow	mgd	1.26	1.57	2.02
RAS Concentration	mg/L	8,000	8,000	8,000
Clarifier Area Required for Flow and Solids Load	sqft	5,255	5,231	5,399
Minimum Clarifier Area Required	sqft	5,399	5,399	5,399
Number of Clarifiers	--	2	2	2
SWD	ft	15	15	15
Minimum Diameter Required	ft	59	59	59
Diameter Provided	ft	60	60	60
Circular Clarifier Area Provided	sqft	5,655	5,655	5,655
Circular Overflow Rate at Flow	gpd/sqft	287	357	460
Secondary Effluent BOD	mg/L	10	15	--
Secondary Effluent TSS	mg/L	10	15	--
WAS				
Total Sludge Produced	lb/day	3,539	5,508	--
Sludge Lost in Secondary Effluent	lb/day	131	242	--
Sludge to Belt Presses	lb/day	3,587	5,543	--
WAS Concentration	mg/L	8,000	8,000	--
WAS Flow	mgd	0.05	0.08	0.08
WAS to Belt Presses				
Flow	mgd	0.05	0.08	--
BOD	lb/day	1,031	1,625	--
TSS	lb/day	3,587	5,543	--
VSS	lb/day	2,508	3,839	--
Non-Degradable VSS	lb/day	1,423	2,129	--
Non-Volatile SS	lb/day	1,079	1,704	--
TKN	lb/day	199	309	--
NH3-N	lb/day	0.22	0.35	--
NO3-N	lb/day	1.79	2.77	--
Total P	lb/day	41	64	--
Secondary Effluent Flow to Tertiary Filters				
Flow	mgd	1.57	1.93	2.52
BOD	lb/day	131	242	--
TSS	lb/day	131	242	--
VSS	lb/day	91	168	--

Plant: Los Osos		Average Day	Peak Day	PWWF
Non-Degradable VSS	lb/day	52	93	--
Non-Volatile SS	lb/day	39	74	--
TKN	lb/day	29	36	--
NH3-N	lb/day	7	8	--
NO3-N	lb/day	52	64	--
Total P	lb/day	36	29	--
BOD	mg/L	10	15	
TSS	mg/L	10	15	
VSS	mg/L	7	10	
Non-Degradable VSS	mg/L	4	6	
Non-Volatile SS	mg/L	3	5	
TKN	mg/L	2	2	
NH3-N	mg/L	1	1	
NO3-N	mg/L	4	4	
Total P	mg/L	3	2	
Chemical Addition (Alum)				
Alum Added (as $Al2(SO4)_3$)	mg/L	**10.00**	**10.00**	--
mg $CaCO_3$/mg Al	mg/mg	**5.56**	**5.56**	--
Alkalinity Consumed (as $CaCO_3$)	mg/L	8.78	8.78	--
Chemical Sludge Produced	mg/L	2.85	2.85	--
Total Chemical Sludge	lb/day	37	46	--
Aluminum Dose (as Al)	mg/l	1.58	1.58	--
Al/P Molar Ratio	mole Al/mole P	0.66	1.01	--
P Removal	%	**20%**	**20%**	--
Total Solids Load to Filters	lb/day	168	288	--
Non-Volatile Solids Load	lb/day	77	120	--
Volatile Solids Load	lb/day	91	168	--
Non-Degradable Volatile Solids Load	lb/day	52	93	--
Filtration				
Maximum Allowable Filter Loading (1 unit out)	gpm/sqft	5	5	5
Total Number of Filters	--	2	2	2
Number of Operating Filters	--	1	1	1
Filters in Backwash	--	1	1	1
Filter Area Required for Flow (each)	sqft	218	268	350
Minimum Required Filter Area (each)	sqft	350	350	350
Proposed Length	ft	**37.5**	37.5	37.5
Proposed Width	ft	**9.5**	9.5	9.5
Proposed Filter Size (each)	sqft	356	356	356
Average Filter Loading (all units)	gpm/sqft	1.53	1.88	2.45
Maximum Filter Loading (1 unit out)	gpm/sqft	3.05	3.77	4.91
Backwash Rate	gpm/sqft	**12.0**	12.0	12.0
Backwash Time	min	15	15	15
Backwash Pump Size Required	gpm	4,275	4,275	4,275
Backwash Pump Size Provided	gpm	4,500	4,500	4,500
Backwash Volume per Backwash Cycle	gal	67,500	67,500	67,500
Filter Run Time Between Backwash	hr	**24**	**18**	**12**
Backwashes per Day per Filter	--	1.00	1.33	2.00
Total Backwash Volume	mgd	0.14	0.18	0.27
Backwash Percent of Filter Flow	%	9%	9%	11%
Backwash Percent of Influent Flow	%	10%	11%	13%
Filter Effluent BOD	mg/l	**4.00**	**6.00**	
Filter Effluent TSS	mg/l	**4.00**	**6.00**	
Filter Backwash Return				
Recycle Flow	mgd	0.14	0.18	0.27
Recycle BOD	lb/day	6	9	
Recycle TSS	lb/day	6	9	
Recycle VSS	lb/day	6	9	
Recycle Non-Degradable VSS	lb/day	4	6	
Recycle Non-Volatile SS	lb/day	3	5	
Recycle TKN	lb/day	2	3	
Recycle NH3-N	lb/day	1	1	
Recycle NO3-N	lb/day	3	4	
Recycle P	lb/day	2	3	
Final Effluent Flow				
Flow	mgd	1.30	1.61	--
BOD	lb/day	43	81	--

Plant Los Osos		Average Day	Peak Day	PWWF
TSS	lb/day	43	81	--
VSS	lb/day	24	47	--
Non-Degradable VSS	lb/day	13	26	--
Non-Volatile SS	lb/day	20	34	--
TKN	lb/day	24	30	--
NH3-N	lb/day	5	7	--
NO3-N	lb/day	43	54	--
Total P	lb/day	29	23	--
BOD	mg/L	4.00	6.00	--
TSS	mg/L	4.00	6.00	--
VSS	mg/L	2.18	3.49	--
Non-Degradable VSS	mg/L	1.23	1.94	--
Non-Volatile SS	mg/L	1.82	2.51	--
TKN	mg/L	2.24	2.24	--
NH3-N	mg/L	0.50	0.50	--
NO3-N	mg/L	4.00	4.00	--
Total Nitrogen	mg/L	6.74	6.74	--
Total P	mg/L	2.64	1.72	--

Utility Water Return Flow

Recycle Flow	mgd	0.10	0.15	0.20
Recycle BOD	lb/day	3	5	7
Recycle TSS	lb/day	3	5	7
Recycle VSS	lb/day	2	3	4
Recycle Non-Degradable VSS	lb/day	1	2	2
Recycle Non-Volatile SS	lb/day	2	3	4
Recycle TKN	lb/day	2	3	4
Recycle NH3-N	lb/day	0	1	1
Recycle NO3-N	lb/day	3	4	5
Recycle P	lb/day	2	3	4

Belt Press Dewatering of WAS

Belt Presses

Belt Press Loading Capacity	gpm/meter	100	100	--
Belt Width	meter	1	1	--
Sludge Feed Concentration	mg/l	8,000	8,000	--
Solids Capture	%	95%	95%	--
Sludge to Belt Presses	lb/day	3,587	5,543	--
WAS Sludge Flow (Avg)	mgd	0.06	0.09	--
WAS Sludge Flow (Avg)	gpm	39.30	60.73	--
Number of Units Provided	--	2	2	--
Hours of Press Operation/wk (all units in service)	hrs	33.0	51.0	--
Hours of Press Operation/wk (1 unit out of service)	hrs	66.0	102.0	--
Washwater Flow Required per Press	gpm	50	50	--
Recycled Washwater Flow	mgd	0.03	0.04	--
Cake Solids	%	17%	17%	--
Cake Produced (wet)	tons/day	10	15	--
Cake Bulk Density	lb/cf	45	45	--
Wet Cake Produced	cy/day	16	25	--

Belt Press Return Flow

Recycle Flow	mgd	0.03	0.04	0.05
Recycle BOD	lb/day	2	3	4
Recycle TSS	lb/day	2	3	4
Recycle VSS	lb/day	1	2	2
Recycle Non-Degradable VSS	lb/day	1	1	1
Recycle Non-Volatile SS	lb/day	1	2	2
Recycle TKN	lb/day	1	2	2
Recycle NH3-N	lb/day	0	0	1
Recycle NO3-N	lb/day	2	3	3
Recycle P	lb/day	1	2	2

Total Recycle to Headworks

Recycle Flow	mgd	0.13	0.19	0.25
Recycle BOD	lb/day	12	18	24
Recycle TSS	lb/day	12	18	24
Recycle VSS	lb/day	8	12	16
Recycle Non-Degradable VSS	lb/day	4	6	8
Recycle Non-Volatile SS	lb/day	6	9	12

Plant Los Osos		Average Day	Peak Day	PWWF
Recycle TKN	lb/day	47	53	
Recycle NH_3-N	lb/day	12	1	
Recycle NO_3-N	lb/day	5	8	
Recycle P	lb/day		10	

Recycle Percent (of Design Influent)

Recycle Flow	%	24.6%	25.7%	30.1%
Recycle BOD	%	3.9%	5.0%	--
Recycle TSS	%	6.4%	8.0%	--
Recycle VSS	%	5.8%	8.5%	--
Recycle Non-Degradable VSS	%	10.9%	15.7%	--
Recycle NVSS	%	8.9%	19.5%	--
Recycle TKN	%	3.0%	7.6%	--
Recycle NH_3-N	%	0.4%	1.8%	--
Recycle NO_3-N	%	27.4%	11.0%	--
Recycle P	%	17.5%	12.8%	--

Section 8

MWH
MONTGOMERY WATSON HARZA

Los Osos WWTP									
Equipment list									
	Area	**Equip**	**Equip**						
	Number	**Type**	**Number**	**Capacity**	**HP**	**Control**	**Vendors**		
Site	10								
Influent PumpStation	11								
Influent Pump No1		P	124		5	VFD	Submersible		
Influent Pump No2		P	125		5	VFD	Submersible		
Influent Pump No 3		P	126		5	VFD	Submersible		
Plant Drainage Pump Station	12								
Plant Drainage Pump #1		P	121		5	VFD	Submersible		
Check Valve		CV	121						
Valve		V	121						
Plant Drainage Pump#2		P	122		5	VFD	Submersible		
Check Valve		CV	122						
Valve		V	122						
Plant Drainage Pump#3		P	123		5	VFD	Submersible		
Check Valve		CV	123						
Valve		V	123						
Headworks	20								
Septage Recieiving	21								
Septage Screen		SC	211						
Septage Tank		T	212	4000 gal					
Grinding and Screening	22								
Grinder#1		GR	221		5				
Screen#1		SC	221		2				
Grinder#2		GR	222		5				
Screen#2		SC	222		2				
Grit Removal	23								
Grit Seperation Tank		T	230						
Vortex Drive		M	230		5				
Grit Pump#1		P	231		15	Constant Speed	Horizontal, Centrifugal		
Grit Pump #2		P	232		15	Constant Speed	Horizontal, Centrifugal		
Grit Classifer		T	233		5				
General Ventilation	25								
Supply Fan #1 Septage Receiving		SF	251		5	VFD			
Supply Fan #2 Headworks, Grit Loading		SF	252		7	VFD			
Exhaust Fan #1 Septage Receiving		EF	255		10	VFD			
Exhaust Fan #2 Headworks		EF	256		10	VFD			

Aeration Basins	40								
Splitter Box	40								
Gate #1		G	401						
Gate #2		G	402						
PreAnoxic Basins	41								
PreAnoxic Basin Mixer#11		M	411		5				
PreAnoxic Basin Mixer#12		M	412		5				
PreAnoxic Basin Mixer#13		M	413		5				
PreAnoxic Basin Mixer#21		M	414		5				
PreAnoxic Basin Mixer#22		M	415		5				
PreAnoxic Basin Mixer#23		M	416		5				
Aeration Basins	42								
Basin #1Inlet Gate		G	420						
Anoxic Zone Mixer			422		5				
Anoxic Zone Mixer			423		5				
Basin#1Aerator		A	424		100	VFD	Surface with submerged Turbine		
Basin #1Outlet Gate		G	425						
Basin #2Inlet Gate	43	G	430						
Anoxic Zone Mixer		M	431		5				
Anoxic Zone Mixer		M	432		5				
Basin#2 Aerator		M	433		100	VFD	Surface with submerged Turbine		
Basin #2 Outlet Gate		G	435						
Recycle pumping	44								
Recycle Pump #1		P	441	2000 gpm	15	VFD	Horizontal Centrifugal		
Recycle Pump#2		P	442	2000 gpm	15	VFD	Horizontal Centrifugal		
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Channel #1, bank#2			652		17 KW				
Channel #1, bank#3			653		17 KW				
Channel #2, bank#1			654		17 KW				
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Hypo Metering Pump #1		P	721		1				
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Effluent Pump Station	75								
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Broderson Pump #1		P	752		50	VFD			
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BFP#1		M	331	I meter	5	VFD			
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GBT Feed Pump #1		P	435	150 gpm	10	VFD	Progressive Cavity		
GBT Feed Pump #2		P	436	150 gpm	10	VFD	Progressive Cavity		
BFP Feed Pump #1		P	437	50 gpm	5	VFD	Progressive Cavity		
BFP Feed Pump #2		P	438	50 gpm	5	VFD	Progressive Cavity		
TWAS Pump #1		P	439	20 gpm	5	VFD	Progressive Cavity		
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Scum Pump#1	35	P	351		5		Submersible		
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Polymer Mixer		M	378		1				
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Section 9

MWH
MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	February 6, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	Kyle Harris - RRM	**Job No.:**	1481166.043585
Subject:	Architectural Code Study		

Enclosed for your review and comment is the draft Architectural Code Study prepared by the RRM Design Group for the Los Osos Wastewater Project. The Architectural Code Study presented herein was prepared to fulfill the requirements of Subtask 4.05 – Architectural, under Task 4 – Wastewater Treatment Facility, in the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002.

The final Architectural Code Study will be submitted with the 30 Percent Design Submittal. Please contact Steve Hyland at (805) 528 – 9385 if you have any comments or questions.

Distribution

Kyle Harris - RRM
Dennis Gellerman – MWH
Scott Burke – MWH
Mallika Ramanathan - MWH

RRM DESIGN GROUP

Creating Environments People Enjoy

Los Osos Waste Water Treatment Facility

Preliminary Code Analysis

Prepared by RRM Design Group
January 31, 2003

Operations Building:

Governing Code:	1998 CBC
Occupancy:	B2
Construction Type:	V-N
Zoning:	Public Facility
Building Area:	2,500 square feet
Building Height:	1 story
Off-set distances:	
Front:	> 20'-0"
Right:	> 20'-0"
Left:	< 20'-0"
Back:	> 20'-0"
Allowable Area Increase:	75% based on off-set distances
Base Allowable Area:	8,000 square feet
Total Allowable Area:	14,000 sq. ft. (28,000 w/ fire sprinklers)
Allowable Height:	2 stories
Fire Sprinklers:	Required by local ordinance.
Summary:	2,500 sq. ft. < 14,000 sq. ft. therefore, building is allowed.
Remarks:	The Laboratory will be separated from the adjacent rooms by 1-hour fire resistive construction. Two means of egress will be provided from the Lab, one directly to the outside.

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Residuals Building:

Governing Code:	1998 CBC
Occupancy:	F2
Construction Type:	II-N
Zoning:	Public Facility
Building Area:	8,400 square feet (1st floor) 4,800 square feet (2nd floor)
Building Height:	2 story
Off-set distances:	
Front:	> 20'-0"
Right:	> 20'-0"
Left:	< 20'-0"
Back:	> 20'-0"
Allowable Area Increase:	75% based on off-set distances
Base Allowable Area:	18,000 square feet each floor
Total Allowable Area:	31,500 sq. ft. each floor
Allowable Height:	2 stories
Fire Sprinklers:	No
Summary:	13,200 sq. ft. < 31,500 sq. ft. therefore, building is allowed

Remarks:

Secondary Treatment Building:

Governing Code:	1998 CBC
Occupancy:	F2
Construction Type:	II-N
Zoning:	Public Facility
Building Area:	3,000 square feet (1st floor) 4,600 square feet (2nd floor)
Building Height:	2 story
Off-set distances:	
Front:	> 20'-0"
Right:	> 20'-0"
Left:	> 20'-0"
Back:	> 20'-0"
Allowable Area Increase:	100% based on off-set distances
Base Allowable Area:	18,000 square feet each floor
Total Allowable Area:	36,000 sq. ft. each floor
Allowable Height:	2 stories
Fire Sprinklers:	No

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Summary:	7,600 sq. ft. < 36,000 sq. ft. therefore, building is allowed
Remarks:	

Tertiary Treatment Building:

Governing Code:	1998 CBC
Occupancy:	F2
Construction Type:	II-N
Zoning:	Public Facility
Building Area:	3,300 square feet (1st floor)
Building Height:	1 story
Off-set distances:	
Front:	> 20'-0"
Right:	> 20'-0"
Left:	> 20'-0"
Back:	> 20'-0"
Allowable Area Increase:	100 % based on off-set distances
Base Allowable Area:	18,000 square feet each floor
Total Allowable Area:	36,000 sq. ft. each floor
Allowable Height:	2 stories
Fire Sprinklers:	No
Summary:	3,300 sq. ft. < 18,000 sq. ft. therefore, building is allowed
Remarks:	

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Section 10

MWH

MONTGOMERY WATSON HARZA

LOS OSOS WASTEWATER PROJECT

TECHNICAL MEMORANDUM

To:	Bruce Buel LOCSD General Manger	**Date:**	January 27, 2003
From:	Steve Hyland MWH Project Manager	**Client:**	LOCSD
Prepared by:	David Wilcoxson	**Job No.:**	1481166.033579 1481166.043579 1481166.053579
Subject:	SCADA Architecture		

Introduction

This technical memorandum describes the Supervisory Control and Data Acquisition System (SCADA) architecture for the Los Osos Wastewater Collection, Treatment, and Disposal System (Project). The description will detail the components needed to monitor and control the Project and to communicate with additional Los Osos Community Services District (District) facilities.

Wastewater Project

All of the Project facilities are located in a relatively small geographic area so the SCADA system will be designed to use a combination of radio telemetry and fiber optic cable as the communication methods between and within each facility.

Project Communication Philosophy

The Wastewater Treatment Facility (WWTF) will be the primary location used to control and monitor the Project. Additional capability to perform certain or all control and monitoring tasks will be provided at the District's Main Office and the District's Water Operations Center. Details of the additional capability will be determined during the design process.

To provide a secure, reliable, and efficient operation, it is recommended as a minimum each primary control location will communicate via fiber optic cable, using Fast Ethernet. The fiber optic cable route will follow the disposal main that will be constructed as part of the Project. During the design a cost analysis will be done to determine if an extension of the fiber optic

cable will be made to serve other key sites along the disposal main. The remaining sites will use radio transceivers to communicate to a master radio located at the WWTF. Refer to the attached Project SCADA Architecture block diagram.

Wastewater Treatment Facility SCADA Components

A main control room for the Project will be provided in the Operations Building at the WWTF. In the control room will be a minimum of two desktop operator workstations with 21-inch monitors that will be used to control and monitor both the Project and other possible District facilities. The workstations will continuously log process and historical data to a separate data/historian server. The server will be provided with a 17-inch monitor and will also be located at the WWTF Operations Building. The server will configured to be Redundant Array of Independent Disks (RAID) level 5. This will ensure that the data is stored and protected through fault tolerant, redundant drives. The server will have a read/read-write CD-ROM that will enable the District to periodically schedule backups of the stored data. Recommended operator workstation and server manufacturers are Dell, Hewlett-Packard and IBM.

A report/alarm printer will be provided in the control room along with any other equipment, such as walkie-talkie radios and video surveillance that will be used to operate and monitor the Project. The operator workstations will use Fast Ethernet (100-Base T) to communicate to an ethernet switch also located at the WWTF Operations Building. The switch will connect all equipment that use ethernet as a communication method. The switch will also connect to the WWTF Programmable Logic Controllers (PLC's), the data/historian server, the bridge or router used to communicate with other District facilities and any other workstation in the WWTF.

All of the PLC's, the master radio, the data/historian server, and the bridge device will be powered by an Uninterruptible Power Supply (UPS). The UPS will ensure that power is not interrupted during a power outage. The UPS will be sized to provide potential standby power to the components mentioned, if the facility generator does not come on line for a minimum of two hours. Recommended UPS manufacturers are American Power Corporation (APC), Best, and Liebert Corporation.

The operator workstations will be loaded with SCADA operating software that will communicate with all other process control equipment using non-propriety "Open" protocols as defined by international standard ISO/IEC 7498-1:1994 "Information Technology – Open Systems Interconnection". This standard defines a model that is used in some form by all network protocols today.

The actual SCADA workstation software packages that will be specified for this project will be propriety, although they will be compatible in the features and capabilities. As discussed earlier the workstations will communicate with other equipment through an ethernet switch. The switch will allow both 10-Base T equipment (typically PLC's) and other 100-Base T equipment such as servers, printers and other computers to communicate with the operator workstations. Recommended SCADA operating software packages are USDATA Corporation "FactoryLink", Invensys Plc "Wonderware", National Instruments "Lookout" and GE Fanuc Automation, Intellution Division "iFix". Each package can provide the functionality, backup support and training that will be required to maintain the package.

Graphics developed for the operator workstations will be full color animated depictions of the process. The graphics will be arranged in a logical order. When the workstations first come online the LOCSD logo will be displayed on the screen. Then the main graphic, an overview of the WWTF will be displayed, from this graphic all other process graphics will be available through target icons shown in an outlined form. When "picked" the icon will display the relative process area selected.

Standard features of each graphic will be the ability to go to relevant alarm and trend graphics for equipment shown on the graphic and to go to the next piece of equipment in the process or back to the main graphic. Graphical historical and real-time trends with colored pens will be provided for the analog inputs monitored by the SCADA System. Standard operating colors, per NFPA 79: Electrical Standard for Electrical Machinery, for all of the graphics and Local Control Panels, to be consistent, will be as follows:

a) On/Running/Energized	Green
b) Off/Stopped/De-energized	Red
c) Caution conditions	Amber
d) Abnormal/Alarm condition	Red (flashing)

The operator will also be able to produce various regulatory agency mandated and custom reports for the WWTF. The report formats will be developed during the construction phase of the project.

The WWTF will use PLC's for control and monitoring of the wastewater treatment process. The main PLC will be located in an enclosure in the Operations Building to ensure a clean, maintained environment. It is recommended that the PLC be a "Hot-Standby" PLC, as it will provide the bulk of the control and interlock capability for the WWTF. Hot-Standby PLC's consist of a main processor with a fail-over backup processor that will come online and immediately take over control of the facility following any failure of the main processor, without any loss of control.

It is recommended that the main PLC use a combination of propriety Remote Input / Output (I/O) cards and non-propriety DeviceNet networks located throughout the facility for control and monitoring in areas that are not controlled by equipment vendor provided PLC's. Remote I/O expands the main PLC's I/O cards into remote racks located in areas of the facility without distributing and fragmenting the main program that resides in the main PLC.

DeviceNet is typically used on applications that extensively use discrete (On/Off) I/O. DeviceNet provides a simple, highly reliable and prioritized communication network between intelligent devices, such as motor starters and protection relays. It will be used to control of all of the electrical equipment that is typically a mass of mostly discrete I/O signals. One of the primary advantages of using DeviceNet is that all of the signals that typically are hardwired between the I/O cards and the MCC's will now use a network cable, which will cut down dramatically on the labor and cost associated with multiple wire pulls. As stated above it is extremely reliable and is easily troubleshot through diagnostic tools provided by the equipment vendor. The combination will ensure that the PLC's network components will be compatible and will allow for easy expansion in the future.

Continuous electrical monitoring of switchgear and power feeder parameters such as kW, kWh, and power factor (pF) will be provided at the operator workstations. The parameters will be communicated via network connection or hardwired depending upon the electrical equipment selected.

The recommended communication cable throughout the WWTF is a fiber optic cable. It has several advantages over traditional copper cable including that it is less prone to interference, it has a much greater data throughput and is typically run in a separate protected conduit. The recommended cables between the main PLC and the associated remote I/O racks, between the vendor PLC's and the ethernet switch and between the ethernet switch and the remote operator workstations are 62.5/125-micron core/clad, FT-4 flame rated, tight buffered, fiber optic cables. The cables will all be multi-mode with at least 12 fibers per cable within the facility.

Consideration will be given to supply a 24 fiber, single-mode cable backbone between the WWTF, District Office, and Water Operations Center. Multi-mode cable is typically used for small distances (less than 1 mile) and within industrial plants due to the relative ease of termination and inexpensive light sources that are required for each cable. Single mode cable is typically used for longer distances but is also used for larger data concentrated applications. The single-mode cable in comparison is much harder to terminate due to its smaller size. The Project specifications will state that each cable and fiber will require labeling and each fiber will be terminated with ST type connectors into a patch panel at each location where equipment is required to be connected to the cable.

The recommended communication cable within the WWTF Operations Building to link the operator workstations and the ethernet switch and any other ethernet cabling for computers used throughout the building will be category 5 ethernet cable.

The main facility PLC will communicate with the vendor provided PLC's through the ethernet switch so that the PLC and the operator workstations can provide both setpoints and interlocks and also monitor the vendor processes. This will also allow the vendor flexibility on the PLC provided. However due to future maintenance requirements, including limiting spare equipment costs and ease of expansion, the specifications will state that the contractor shall be responsible to coordinate with all equipment vendors so that the PLC's provided shall be made by the same manufacturer. Recommended PLC manufacturers would be Allen Bradley, Schneider Automation (Modicon) or General Electric. Small volume regional manufacturers would not be recommended due to limited and unreliable maintenance and support capability. This will ensure that the contractor responsible for the complete systems integration will not encounter delays associated with trying to integrate incompatible network systems.

Several remote operator workstations and or local operator interfaces will be provided in the WWTF. The specific locations for each workstation or interface will be determined when the actual layout of the facility is better defined. Initial indications are for operator workstations to be placed at the following locations:

a) Residuals Building

b) Secondary Building

c) Tertiary Building

The operator workstations will perform the same functionality as the main control room workstations. The local operator interfaces will be included as part of the vendor packaged equipment and will provide direct control of the respective piece of equipment.

Remote alarm monitoring will be provided by a software package that will be configured to call designated facility personnel when a specified alarm is present at the any facility in the Wastewater Project or potentially any water services project. The software package will work seamlessly with the SCADA operating software on an individual I/O point basis. The software can be configured in many different forms such as calling only "On-call" operators depending upon the day and time. It can call many different devices such as cell phones and message pagers. The software can also allow for return commands such as a change or a disablement of alarm setpoints. The detail of the software package configuration will be further defined during the final design. A recommended "alarm-dialing" software package is ScadAlarm. This package has been used successfully on many recent MWH projects.

Wastewater Collection and Disposal Systems SCADA Components

As stated earlier, the wastewater collection system will use radio telemetry to communicate with the WWTF where access to the fiber optic cable is not practical due to cost considerations. The Submersible Pump Stations at Baywood, West Paso, Lupine, Scenic, East Paso, and Sunny Oaks and the numerous "pocket" pump stations will each have with a small PLC, a radio, and directional antenna.

The WWTF will have an omni-directional antenna that will receive all of the remote radio signals. This will enable the PLC at the WWTF to connect directly with the PLC's at the pump stations. The radios will use a technique called unlicensed "Frequency Hopping Spread Spectrum". The advantages of this technique include the following:

a) Excellent economic alternative to traditional hard-wired and licensed radio solutions,

b) Provides potential for long distance operations,

c) Designed to operate in harsh conditions,

d) Scalable for growth and unlimited coverage using repeater links,

e) Good for interference avoidance and rejection,

f) Offers excellent noise immunity.

The radios will operate in the 902-928Mhz-frequency range and because they use spread spectrum technology are not subject to license per part 15.247 of the FCC regulations. Each remote pump station radio will be located in the Remote Terminal Unit (RTU) that will also contain the facility PLC. As the two devices are located in the same enclosure the radio and PLC will connect via direct RS-232 connection. The radio will then use a 0.5-inch foam heliax cable to connect to a yagi directional antenna that will be mounted either on a pole or side of the building to provide the best signal strength back to the main antenna at the WWTF. A radio survey will be carried out to ensure that the radio signal strength is sufficient for reliable communications. If necessary a repeater site will be included, possibly at the 16th Street water storage facility that will allow the radios, especially in the northern part of the Project, to effectively communicate.

One other feature of a comprehensive radio system that will be considered is centralized monitoring using one the operator workstations for diagnostics and overall health of entire radio system at the WWTF. Recommended radio manufacturers are Microwave Data Systems (MDS) and Aironet. MDS radios have been successfully used on many of the last MWH projects.

Communication With Other District Facilities

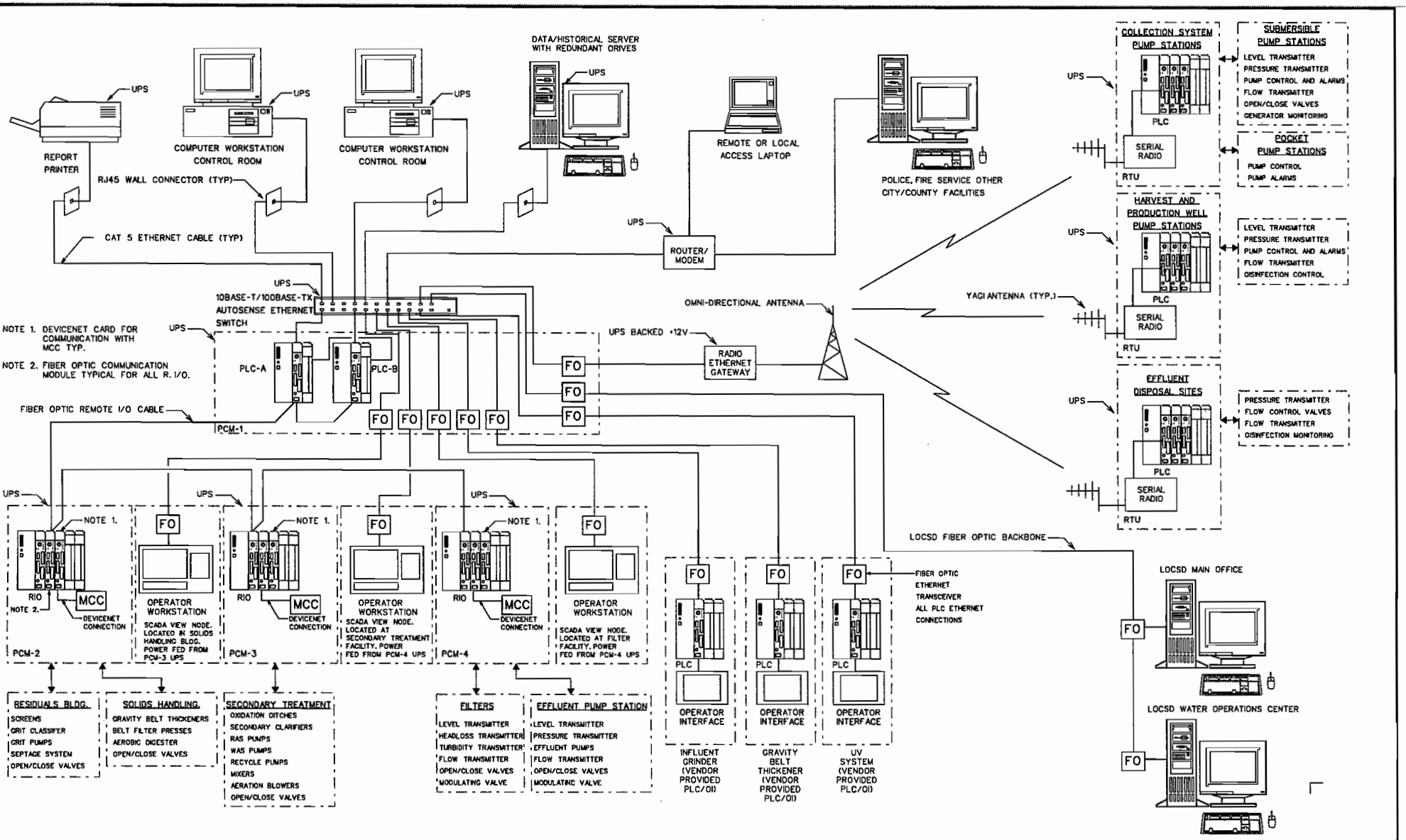
The WWTF ethernet switch will also communicate with a bridge or router with built-in firewall security that will allow for any District location other than the District office and Water Operations Center to communicate with the WWTF. The bridge will be configured to allow multiple different methods of communication to access and receive information from the WWTF. These could include Plain Old Telephone (POT), Integrated Digital Services Network (ISDN), and T1 leased lines, all of which can be supplied by the Telephone Company. Several facilities and services have been identified as potential candidates for direct communication. These would include incorporating the Districts water services that currently have an existing propriety Tesco AutoCon Control System. Potential water services facilities that could be monitored include the Palisades, 3rd Street, 8th Street, 10th Street, and South Bay Boulevard well sources especially for sodium hypochlorite control, the 8th Street treatment facility for iron content, and the 10th Street and 16th Street water storage facilities. Another District facility that has been identified for potential monitoring is the weather station at 8th Street and El Moro. This would also be of benefit to the WWTF.

Other agencies outside of the District could also be included in the communication capabilities such as the police department for security and the fire department for fire and hazard warnings.

The bridge could also provide a future communication link for inline water quality measurements that would include pH, temperature, and TDS. The final configuration of the bridge will include spare capacity that will allow future equipment, facilities and privileged personnel access to the main control system. Obviously security concerns will be taken into serious consideration when allowing access to users outside of the facility. All network components that allow remote access will be provided with firewalls, multiple password protection and Intrusion detection systems built-in. Recommended ethernet switch and bridge manufacturers are Cisco, Allied Telesyn, and Alcatel.

Distribution

John Bergen – MWH	Linda Tripp – MWH
Jack Osborn – MWH	Kevin Kai – MWH
Dennis Gellerman – MWH	Can Quach – MWH
Scott Burke – MWH	David Wilcoxson – MWH
Mallika Ramanathan - MWH	



CONTROL SYSTEM BLOCK DIAGRAM

REV	DATE	BY	DESCRIPTION

SCALE

WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0, ½, 1)

DESIGNED:
DRAWN:
CHECKED:

SUBMITTED BY

LICENSE NO. DATE

LICENSE NO. DATE

LOS OSOS COMMUNITY SERVICES DISTRICT

MWH Walnut Creek, California

SUBCONSULTANT'S LOGO

WASTEWATER TREATMENT FACILITY

SCADA BLOCK DIAGRAM

SHEET GI-3

200 OF 200

Job No. 83/6081

Plot Date: 27-JAN-2003

Section 11

MWH
MONTGOMERY WATSON HARZA

Los Osos Wastewater Project

CAD Drafting Guidelines

December 2, 2002

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Preface

The CAD Drafting Guidelines presented herein are intended to provide guidance and information for the preparation of contract drawings for the Los Osos Wastewater Project. The design consultants must exercise professional judgement in the application of the CAD Drafting Guidelines to meet Project objectives. The Guidelines are not intended to be strictly prescriptive requirements that are universally applied in all situations. Furthermore, the Guidelines are not intended to preclude the use of alternative or supplemental approaches. Changes to the Guidelines will be expected to meet Project goals and requirements.

Any proposed additions, revisions, and/or deletions to the Guidelines must be submitted to Les Wong - MWH. Proposed changes will be reviewed and evaluated in conjunction with the design consultant input. All changes are subject to review and acceptance by the Los Osos Community Services District (LOCSD). The Guidelines will be periodically updated and reissued as changes and additions are adopted.

This document was prepared to fulfill the requirements of Subtask 1.06 – CAD Drafting Guidelines in the Agreement for Final Design of Wastewater Project between the Los Osos Community Services District and MWH Americas, Inc. dated October 2, 2002. The document was prepared by Rodger Sasaki - MWH and Les Wong – MWH and reviewed by Steve Hyland – MWH. Please contact Les Wong at (805) 528 – 9385 or Rodger Sasaki at (925) 274 – 2273 if you have any questions about the technical

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Section 1

CAD Drafting Guidelines for the Los Osos Wastewater Project

December 2, 2002

Introduction

The purpose of this document is to ensure that the drawings produced during design and the electronic files delivered upon completion of the project meet the requirements of the Los Osos Community Services District (LOCSD). Terminology herein refers to AutoCAD.

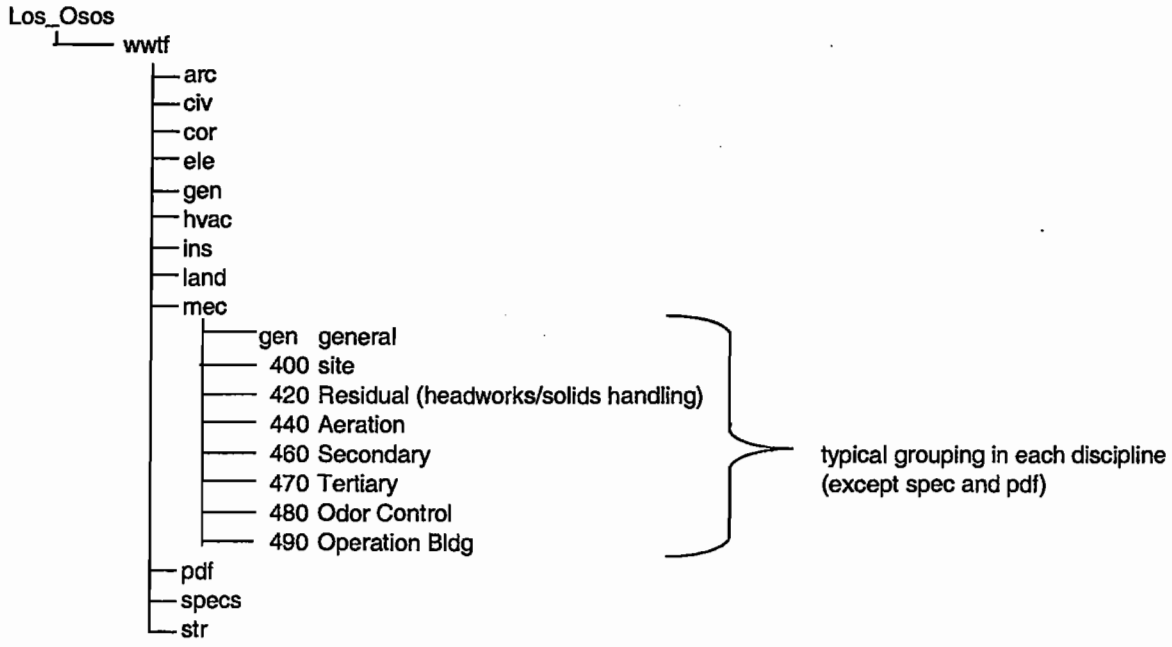
Drawing platform

Design files will be generated using AutoCAD or using MicroStation with translation to AutoCAD, and delivered in AutoCAD 2000 compatibility.

Job Specific Standards

Directory Structure

Directory structure shall be consistent for all consultants. Conformance will reduce file transfers and xref update problems. The project shall be created with a top level project directory as shown below

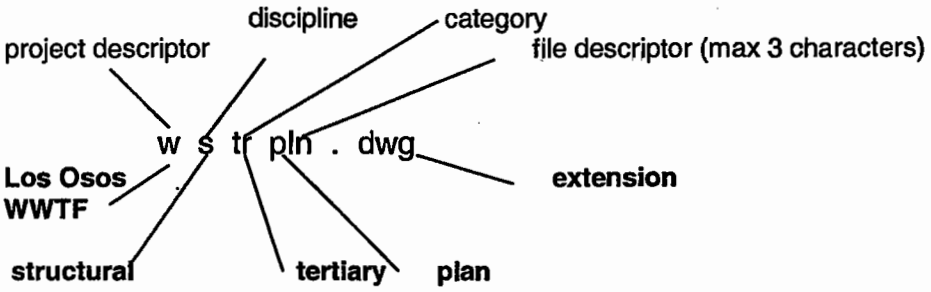


File Naming Conventions

Model Files

Names for master/model files shall include PROJECT DESCRIPTOR, DISCIPLINE, DRAWING FILE DESCRIPTOR, and EXTENSION.

ie.... A structural base model file for the Aeration Basin Plan will be named.....



Filenames shall try to conform to 8.3 filenames with no dashes. Below is a listing of disciplines, areas, and file descriptors.

	DISCIPLINE
a	architectural
c	civil
d	demo
e	electrical
g	general
h	hvac
i	instrumentation
l	landscaping
m	mechanical
pp	plan and profile
s	structural

	CATEGORY
ar	Aeration
oc	Odor Control
op	Operations Building
rs	Residual
sc	Secondary
st	Site
tr	Tertiary

	FILE DESCRIPTOR
bs	base map or site plan
cn	conduit plan
ele	elevation of new facilities
ep	existing yard piping
ex	existing
fac	facilities plan
flr	floor plan
grd	grading and drainage plan
hc	horizontal control and paving
ltp	lighting plan
md	general model file
pln	plan
pro	profile
pw	power plan
rfp	roof plan
sec	section
yp	yard piping

Areas and File Descriptors not indicated can be inserted and used. Length and acronym descriptions are to be consistent with labels as shown.

Paper Space / Sheet Files / Composition Files

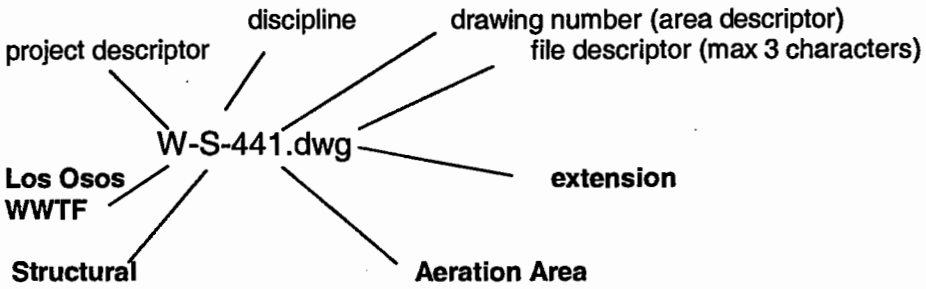
Paper Space / Sheet Files/ Composition Files shall be named to be indicative of the drawing number. There should be one file for every drawing in the drawing list.

These file names shall be reflected in the title block on the left hand border. The name in the border shall include the full path name of the location of the file.

Filenames shall not exceed the 8.3 character standard.

Names for Sheet Files shall include PROJECT DESCRIPTOR, DISCIPLINE, DRAWING NUMBER and EXTENSION. Note that for the sheet files the drawing number is both a incremental tag and a area designation.

ie.... The first structural sheet file for the Aeration Basin will be named.....



Below is a listing of Discipline abbreviations

	DISCIPLINE
a	architectural
c	civil
d	demo
e	electrical
g	general
h	hvac
i	instrumentation
l	landscaping
m	mechanical
pp	plan and profile
s	structural

And a listing of Drawing Number/Areas for Treatment Facilities, Collection, Effluent Disposal, and Pump Station by number

For General Drawings, inclusive of all disciplines, treatment facilities and pipelines

100 - Collection System
200 - Pump Station
300 - Effluent Distribution
400 - Wastewater Treatment Facility

For Wastewater Treatment Facility Unit Process:

400-419 - Site
420-439 - Residual
440-459 - Aeration
460-469 - Secondary
470-479 - Tertiary
480-489 - Odor Control
490-499 - Operations Building

Layer names

Layer naming conventions shall meet 1997 AIA CAD Layering Guidelines. See Section 3 for additional information.

Standard Cells/Blocks

Standard blocks are to be placed in the design files at 1:1 ratio. Do not stretch or modify the scale of blocks or cells non-proportionally. Creation of blocks shall conform to AutoCAD standards and layering rules. Block files shall be delivered with design files in subdirectory (directory named blocks) of each project discipline.

Borders

Border drawing file " ls_bdr.dwg" shall be xref'd to paper space. Every border shall have the file path, date, and time printed on the left of the border edge.

Borders are not to be scaled in the sheet file to maintain a paper space zoom factor 1:1.

Insert block "ls_data.dwg" and "ls_rev.dwg" for title block information in your paper space file. The separation of these two files is made to facilitate global changes to the border.

Line Weight

Map the pen number/color of the elements to the following for line weight plotting. (Additional MicroStation Lineweight shown for reference only, MicroStation users will plot by color also)

Pen table for half size plots (11x17)				
AutoCAD pen no.	**Color***	**Mm**	**in**	**Equivalent MicroStation lineweight**
1	red	0.15	0.005	1
2	yellow	0.175	0.007	2
3	green	0.25	0.010	3
4	cyan	0.3	0.012	4
5	blue	0.35	0.014	5
6	magenta	0.4	0.016	6
7	white	0.075	0.003	0
8	dk. grey	0.075	0.003	0
9	dk. red	0.075	0.003	0
10	orange	0.075	0.003	0
11	salmon	0.15	0.005	1
12	lt blue	0.175	0.007	2
13	violet	0.25	0.010	3
14	rose	0.3	0.012	4
15	grey (screen)	0.15	0.010	3

Pen table for full size plots (22x34)				
AutoCAD pen no.	**Color***	**mm**	**in**	**Equivalent MicroStation lineweight**
1	red	0.30	0.010	1
2	yellow	0.35	0.014	2
3	green	0.50	0.020	3
4	cyan	0.60	0.024	4
5	blue	0.70	0.028	5
6	magenta	0.80	0.031	6
7	white	0.15	0.005	0
8	dk. grey	0.15	0.005	0
9	dk. red	0.15	0.005	0
10	orange	0.15	0.005	0
11	salmon	0.30	0.010	1
12	lt blue	0.35	0.014	2
13	violet	0.50	0.020	3
14	rose	0.60	0.024	4
15	grey (screen)	0.30	0.014	2

Colors 10 thru 14 are not default AutoCAD colors. These pen and colors are used to facilitate additional available colors and lineweights for both AutoCAD and MicroStation.

Note: plotting weights may be proportionally modified due to plotter configuration. These weights are consistent with plotting halfsize on a HP laser jet 8000N and fullsize on a Xerox 8830.

Drafting Conventions

The following section of drafting standard conventions are to be followed to ensure consistency between consultants. The presentation of the plotted drawing's color, weight, style, font, text size and dimensioning styles should look the same. Standard drafting practices are to be evident.

The project border file will include outside of the plot limits related callouts and symbols to copy or match for consistency.

Text

Text shall be font ROMANS, width factor of 1, and an oblique angle of 0. Text size shall not be smaller than 0.125" (except existing information, when appropriate, may have a minimum text size 0.10".) Text shall be 0.125". See "common symbology" in the border for main title, section, and general text sizes.

Color

Color will be determined "bylayer" in the layer control menu. Subsequently many layers will need to be created to control line weight.

Standard Callouts

Project Specific Detail Callouts

Project specific detail callouts shall be shown using detail callout circles. Use the partially deleted detail callout circle when the drawing number text exceeds the detail circle boundaries. Details are to be label with numbers. A sample of the size is included in the border.

Standard Detail Callouts

Standard detail callouts shall be shown as MWH's octagon. A sample of the size of the octagon is included in the border. New, added or modified standard details are to be labeled with the discipline letter and consecutive number.

Section Callouts

Section callouts shall be shown using section callout circles. Section callout and arrows are to be shown using standard drafting practices for orientation and placement. Sections are to be label with letters. A sample of the size and section arrows is included in the border.

Pipe Callouts

Pipe callouts are shown as rectangles. A sample of the pipe callout is included in the border. Pipe callouts include size, fluid type and possibly the optional pipe material type. The fluid type is per the pipe material table.

Equipment Callouts

Equipment callouts are shown as a modified oval. A sample of the equipment callout is shown in the border. Equipment callouts for major equipment and piping appurtenances 6" and larger are to labeled and included in the equipment lists.

Leader Lines

Leader lines shall be straight with vertices at the note's beginning or end, see below for an example. Curved leader lines shall not be used. Place notes and leader lines so no lines cross.

Arrowheads

Arrowheads are to be placed as filled, with a length to height ratio of 1:5. Leader lines and dimensions shall have the same size arrowheads.

Symbols and Abbreviations

Symbols and abbreviations shall follow MWH standards. The project symbols for details and section boxes, matchlines, north arrows and other typical elements are shown outside of the border.

Pipe Depiction

Pipes equal to or greater than 24 inches in diameter shall be shown double line when the scale is less than or equal to 1"=20'.
Pipes less than 24 inches in diameter shall be shown single line.

Line Style

Line styles shall be limited to the default line style as delivered by AutoCAD. Line styles can be different on a given layer.

Screening Methods

Screening on this project will be controlled through plotting. The color of the element or text will be plotted screened by selecting the appropriate color. Color 15 has been reserved for screening.

Model Files / Composition Files

Other consultants will continually update model files. The file names and location of graphics shall be consistent so file composition integrity remains.

Symbols and Abbreviations

Symbols and abbreviations shall follow MWH standards.

Model Space / Paper Space

Drawings shall be created and assembled using model and paperspace. Graphic elements shall be drawn full size in a drawing file and reference to a sheet file as an xref using paperspace to display area of concern. Paperspace viewports are to be put on unique layers. Name of layer to be indicative of viewport. Borders are to be placed at 1:1 with the view ports to be scaled. Plotting will be from a paperspace viewport at 1:1

Patterning

Patterning shall use standard AutoCAD patterns. No user-defined patterns shall be used.

Xref Filing

Drawings shall be xref in modelspace to be plotted in paperspace. Xref's are not bound to the drawings. Xref's will be constantly updated by the consultants.

Plotting

AutoCAD plotting files (PCP, PC2 and other) shall be used to control element plotting based on element color. Submitted hard copy plots will accompany delivered PDF files. PDF files shall be created for plotting to 11 x 17 paper.

Delivery of Files

Intermediate and final delivery of electronic files are to be made on CD-ROM's in AutoCAD. Files delivered shall include a description of all files submitted:

Section 2

Drawing Numbering Convention

Drawing numbering shall follow this format:

X-YY-ZZZ

Examples: D-GC-204 Area D – General Civil – Pump Station, Drawing No. 204
W-M-465 WWTF – Mechanical – Secondary Process Drawing No. 465

Where X is the Prefix tied to the Bid Packages:

A –Area A (includes collection system, pump stations/wells and effluent disposal)
B –Area B (includes collection system, pump stations/wells and effluent disposal)
C –Area C (includes collection system, pump stations/wells and effluent disposal)
D –Area D (includes collection system, pump stations/wells and effluent disposal))
W – Wastewater Treatment Facility

Where YY is the Discipline Description:

G - General
GC - General Civil
C - Civil
PP - Plan and Profile
GL - General Landscape
L - Landscape
GA - General Architectural
A - Architectural
GS - General Structural
S - Structural
GM- General Mechanical
M - Mechanical
GH - General HVAC
H - HVAC
GE - General Electrical
E - Electrical
GI - General Instrumentation and Control
I - Instrumentation and Control

Where ZZZ is the Drawing Number based on the following categories:

For all Area Drawings:

100-199 Collection System
200-299 Pump Station/Wells
300-399 Effluent Distribution

For Wastewater Treatment Facility Drawings:

General - G, GC, GL, GA, GS, GM, GH, GE, and GI Drawings:

400-499 General

Unit Processes – C, L, A, S, M, H, E, and I Drawings:

400-419 Site
420-439 Residual
440-459 Aeration
460-469 Secondary
470-479 Tertiary
480-489 Odor Control
490-499 Operations Building

Sample Drawing list for all components of Area D as follows (other areas are typical of Area D) Not all numbers will be used.

For the Collection System – Area D

D-G-100	THRU	D-G-...	General Drawings
D-GC-100	THRU	D-GC-...	Civil Standard Details*
D-PP-100	THRU	D-PP-...	Plan and Profile Drawings

* First six (6) drawings reserved for standard details that are common to all areas. These sheets will be included in all areas (identical except for drawing number)

For the Pump Station and Wells – Area D

D-G-200	THRU	D-G-...	General Drawings
D-GC-200	THRU	D-GC-...	General Civil Drawings
D-C-200	THRU	D-C-...	Civil Drawings, Site Plans, Sections and Details
D-GL-200	THRU	D-GL-...	General Landscaping Drawings
D-L-200	THRU	D-L-...	Landscaping Drawings, Plans, Details
D-GA-200	THRU	D-GA-...	General Architectural Drawings
D-A-200	THRU	D-A-...	Architectural Drawings, Plans, Elevations
D-GS-200	THRU	D-GS-...	General Structural Drawings
D-S-200	THRU	D-S-...	Structural Drawings, Plans and Sections
D-GM-200	THRU	D-GM-...	General Mechanical Drawings
D-M-200	THRU	D-M-...	Mechanical Drawings, Plans and Sections
D-GH-200	THRU	D-GH-...	General HVAC Drawings
D-H-200	THRU	D-H-...	HVAC Drawings, Plans and Sections, Tables
D-GE-200	THRU	D-GE-...	General Electrical Drawings
D-E-200	THRU	D-E-...	Electrical Drawings, Plans, Schematics
D-GI-200	THRU	D-GI-...	General Instrumentation Drawings
D-I-200	THRU	D-I-...	Instrumentation Drawings, Schematics

For the Effluent Distribution – Area D

D-G-300	THRU	D-G-...	General Drawings
D-GC-300	THRU	D-GC-...	General Civil Drawings
D-C-300	THRU	D-C-...	Civil Drawings, Site Plans, Sections and Details
D-GL-300	THRU	D-GL-...	General Landscaping Drawings
D-L-300	THRU	D-L-...	Landscaping Drawings, Plans, Details
D-GE-300	THRU	D-GE-...	General Electrical Drawings
D-E-300	THRU	D-E-...	Electrical Drawings, Plans, Schematics
D-GI-300	THRU	D-GI-...	General Instrumentation Drawings
D-I-300	THRU	D-I-...	Instrumentation Drawings, Schematics

Section 3

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Layer Names

The CAD Layer Guidelines are organized as a hierarchy. This arrangement accommodates expansion and addition of user-defined extensions to the layer list. Layer names are alphanumeric and use abbreviations that are easy to remember and are logical in their descriptions. This approach is particularly important when the CAD files are used by many multiple consultants. The Layer strategy will follow typical CAD layering standards per the "AIA CAD Layer Guidelines" (see Section 4)

The following section details the methodology behind the layer naming conventions and their general use.

```
Field 1 Discipline Code
|  Field 2 Major Group
|  |    Field 3 Minor Group
|  |    |
X-XXXX-XXXX
```

Field 1 or the Discipline Code, is the same as the codes used for the filenames

	DISCIPLINE
a	architectural
c	civil
d	demo
e	electrical
g	general
h	hvac
i	instrumentation
l	landscaping
m	mechanical
p	plan and profile
s	structural

Field 2, or the Major Group is a description describing a group. The major group system uses names like wall, door, pump, pipe, equp, and text. This field may be a 3 or 4 character description. This field is the most looked at field. The descriptions used here typically are what makes layering useful. The engineer will need to be creative and consistent in how these names are assigned. A listing here would go on and on. Some examples of Major Group descriptions are:

Ablt	Anchor Bolt	Irrg	Irrigation
Accs	Access	Jois	Joists
Area	Area	Ltng	Lightning Protection
Beam	Beam	Mach	Machine Shop
Bldg	Building	Plan	Plans
Code	Code	Plnt	Plant
Cols	Columns	Powr	Power
Comm	Communications	Proc	Process
Cont	Controls	Rcov	Recover
Detl	Detail	Refg	Refrigeration
Domw	Domestic Water	Risr	Risers
Dust	Dust	Road	Road
Elev	Elevation	Roof	Roof
Elht	Electric Heat	Site	Site
Exhs	Exhaust	Slab	Slabs
Fire	Fire	Soun	Sound
Fixt	Fixture	Spcl	Special
Flor	Floor	Sprn	Sprinklers
Fndn	Foundation	Stan	Standpipe Systems
Fuel	Fuel	Stem	Steam
Furn	Furniture	Strm	Storm
Glaz	Glass	Test	Test
Grid	Grids	Topo	Topography
Grnd	Grounding		

Besides a name describing a layer this Field 1 or Major Group can also include the word "ANNO" for annotation.
Annotation can be placed in both paper and model space (Model files/Titleblock files). Dimensions, symbols, and keynotes would typically be placed in model space. Legends, schedules, borders, and title blocks would typically be placed in paper space. The same layer names would be used in both cases Types of annotation are as follows:

* represents Discipline Code

*-Anno-Dims	Dimensions
*-Anno-Keyn	Keynotes
*-Anno-Legn	Legends And Schedules
*-Anno-Note	Notes
*-Anno-Nplt	Construction Lines, Non-Plotting Information
*-Anno-Redl	Redline
*-Anno-Revs	Revisions
*-Anno-Symb	Symbols
*-Anno-Text	Text
*-Anno-Ttlb	Border And Title Block

The use of a 4th (fourth) group (not shown) is optional. This group is used to describe layers like, demo (demolition), exst (existing), and futr (future). This group can be at the discretion of the consultant.

Section 4

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Section 12

MWH

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LOS OSOS WASTEWATER RPOJECT
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