City of San José

San José/Santa Clara Water Pollution Control Plant Master Plan

TASK NO. 5
PROJECT MEMORANDUM NO. 11
FUTURE SUPPORT FACILITIES

FINAL DRAFT
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CITY OF SAN JOSÉ

SAN JOSÉ/SANTA CLARA WATER POLLUTION CONTROL PLANT MASTER PLAN

TASK NO. 5
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GLOSSARY OF ACRONYMS AND TERMS

AB	Assembly Bill
AC	Acre
ACH	Air Changes per Hour
AD	Air Drying
ADAF	Average Day Annual Flow (Average daily flow or loading for an annual period)
ADC	Alternative Daily Cover
ADMMF	Average Day Maximum Month Flow (Peak month for each year)
ADMML	Average Day Maximum Month Load
ADWF	Average Dry Weather Flow (Average of daily influent flow occurring between May - October)
ADWIF	Average Dry Weather Influent Flow (Average of five consecutive weekday flows occurring between June - October)
ADWL	Average Dry Weather Load
AES	Advanced Energy Storage
ANSI	American National Standards Institute
ARWTF	Advanced Recycled Water Treatment Facility
BAAQMD	Bay Area Air Quality Management District
BAB2E	Bay Area Biosolids to Energy
BACWA	Bay Area Clean Water Association
BAF	Biological Aerated Filter
BC	Brown and Caldwell
BCDC	Bay Conservation and Development Commission
BNR	Biological Nutrient Removal
BNR1	Formerly Secondary Facilities
BNR2	Formerly Nitrification Facilities
BOD	Biochemical Oxygen Demand
BTUs	British Thermal Units
CAG	Community Advisory Group

CAL OSHA	California Occupational Safety and Health Administration
CAMBI	Vendor name for a pre-processing technology
CARB	California Air Resources Board
CCB	Chlorine Contact Basin
CEC	California Energy Commission
CECs	Contaminants of Emerging Concern
CEPT	Chemically Enhanced Primary Treatment
CEQA	California Environmental Quality Act
CFM	Cubic feet per minute
CH_4	Methane
CH_3SH	Methyl mercaptan
CIP	Capital Improvement Program
City	City of San José
CL	Covered Lagoons
CO	Catalytic Oxidation
CO_2	Carbon Dioxide
CO_2E	Carbon Dioxide Emissions
CSI	California Solar Incentive
DAFT	Dissolved Air Flotation Thickener
DO	Dissolved Oxygen
DG	Digester Gas
DPH	Department of Public Health
D/T	Dilutions to threshold
EBOS	Emergency Basin Overflow Structure
EDCs	Endocrine Disrupting Compounds
EEC	Environmental Engineering and Contracting, Inc.
e.g.	For example
EIR	Environmental Impact Report
ELAC	Engineering, Legal, and Administrative Costs

EPA	United States Environmental Protection Agency
EQ	Equalization
ESB	Environmental Services Building
ESD	Environmental Services Department
etc	etcetera
Fe_2O_3	Ferric Oxide
Fe_2S_3	Ferric Sulfide
FIPS	Filter Influent Pump Station
FOG	Fats, Oils, and Grease
fps	foot per second
FRP	Fiberglass Reinforced Plastic
FWS	Food Waste Separation
GC/SCD	Gas Chromatograph/Sulfur Chemiluminescence Detector
GHG	Greenhouse Gas Emissions
gpd/ft^2	Gallons per Day per Square Foot
GWP	Global Warming Potential
H_2S	Hydrogen Sulfide
H_2SO_4	Sulfuric Acid
HOCl	Hypochlorous Acid
HP	Harvest Power
HRT	Hydraulic Residence Time
HVAC	Heating Ventilation and Air Conditioning
HW	Headworks
IMLR	Internal Mixed Liquor Return
IWA	International Water Association
ISCST3	Industrial Source Complex Short-Term 3
ITC	Investment Tax Credit
JEPA	Joint Exercise of Power Authority
L	Liter

LFG	Landfill Gas
LHV	Lower Heating Valve
MAD	Mesophilic Anaerobic Digestion
MBR	Membrane Bioreactor
MD	Mechanical Dewatering
MG	Million Gallons
mgd	Million Gallons per Day
mg/L	Milligrams per Liter
MLE	Modified Ludzack - Ettinger
MLSS	Mixed Liquor Suspended Solids
MM	Million
MOP	Manual of Practice
MSW	Municipal Solid Waste
MW	Mega Watt
NAS	Nitrifying Activated Sludge
NBB	Nitrification Blower Building
NFPA	National Fire Protection Association
NG	Natural Gas
NH_3	Ammonia
N_2O	Nitrous Oxide
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
ORP	Oxidation-Reduction Potential
OUR	Oxygen Uptake Rate
PE	Primary Effluent
PG&E	Pacific Gas and Electric
PEPS	Primary Effluent Pump Station
PHWWF	Peak Hour Wet Weather Flow (Peak hour flow resulting from a rainfall event)
PM	Project Memorandum

PMP	Plant Master Plan
PPA	Power Purchase Agreement
ppbv	Parts per billion by volume
PPCD	Pounds per capita per day
ppmv	Parts per million by volume
PPP	Public Private Partnerships
PS	Primary Sludge
PV	Photovoltaic
QA/QC	Quality Assurance/Quality Control
RAS	Return Activated Sludge
RO	Reverse Osmosis
ROAP	Regional Odor Assessment Program
RPS	Renewable Portfolio Standard
RSM	Residual Solids Management
RSPS	Raw Sewage Pump Station
SBB	Secondary Blower Building
SBR	Sequencing Batch Reactor
SBWR	South Bay Water Recycling
SC	Santa Clara
SCAQMD	South Coast Air Quality Management District
SCR	Selective Catalytic Reduction
SJ	San Jose
sf	Square Feet
SGIP	Self-Generation Incentive Program
SOM	Skidmore, Owings, and Merrill
SOTE	Standard Oxygen Transfer Efficiency
SRT	Solids Residence Time
SS	Suspended Solids
SSPS	Settled Sewage Pump Station

SVI	Sludge Volume Index
TAD	Thermophilic Anaerobic Digestion
TAG	Technical Advisory Group
TBL	Triple Bottom Line
TM	Technical Memorandum
TN	Total Nitrogen (organic & inorganic forms which are ammonia, nitrates, nitrite)
TSS	Total Suspended Solids
TWAS	Thickened Waste Activated Sludge
UV	Ultraviolet
VFDs	Variable Frequency Drives
VOC	Volatile Organic Compound
VSL	Volatile Solids Loading
WAS	Waste Activated Sludge
WEF	Water Environment Federation
WPCP	Water Pollution Control Plant
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION/SUMMARY

1.1 Introduction

The purpose of this project memorandum (PM) is to identify strategic considerations for the necessary support facility improvements for the San José/Santa Clara Water Pollution Control Plant (WPCP) based on the proposed process improvements recommended by the Plant Master Plan (PMP). For the purpose of the evaluation presented in this PM, the support facilities improvements have been defined into two major categories: (1) the support buildings, which include administration and engineering offices, operations, environmental support services, maintenance facilities, workshops, warehouses, and storage facilities, and (2) the support systems, which include an analysis of non-City vehicle traffic patterns into and around the plant, the major influent pipelines that convey raw sewage to the WPCP, site requirements for stormwater handling, and the electrical power distribution system which supplies the process facilities.

1.2 Summary

Proposed upgrades to the various site support facilities can be summarized as follows:

- The new access road, which is currently planned to be upgraded to provide truck access for delivery of fats, oils and grease (FOG) to the digesters, would also serve as the main access point for receiving warehouse deliveries as well as for septic tank haulers.
- Consideration should be given to constructing a new central receiving warehouse and laydown area along this new access road.
- Consideration should be given to consolidating the administration and engineering offices at the Environmental Services Building (ESB) location. This would require that a new public access point be provided at this location. The existing Administration Building could be modified to provide for a consolidated training and/or public education facility.
- As treatment facilities are decommissioned and demolished, e.g. Headworks No. 1 and West Primaries, these sites could be utilized for additional warehousing and storage facilities.
- Influent conveyance piping to the plant would be consolidated and routed through the emergency basin overflow structure (EBOS).

- Stormwater facilities would be modified and expanded to accommodate the future site considerations associated with upgrades to the process treatment facilities.
- The plant's electrical distribution system would be expanded to accommodate future solids handling facilities to the north of the WPCP, as well as for possible future secondary treatment facilities to the east.

The recommendations provided in this TM are at a planning level only, and should be evaluated further in a detailed Support Facilities Plan.

2.0 BACKGROUND

The PMP has identified the modifications to the liquids, biosolids, energy, and odor treatment facilities through the year 2040 (see PMs 5.1, 5.2, 5.3 and 5.5). These proposed changes to the process facilities will necessitate a review of the various major support functions for the WPCP.

The WPCP currently houses a total staff of 298, who provide administrative, engineering, operations and maintenance functions and work out of a varied combination of support buildings scattered throughout the plant site. In addition there are 100 support staff that are located in an off-site location. The on-site support buildings are varied in age and certain facilities will need to be either refurbished or replaced over the 30-year PMP. In addition, questions have been raised as to the efficiency of the current "decentralized" distribution of staff. At the same time, there is the opportunity to improve traffic flow into and out of the plant, as well as within the plant itself. This would involve improving the efficiency of flow of staff between the administration, engineering, and control centers, and the various treatment facilities (including improving safety for bicycle traffic and pedestrians).

The modifications to the process facilities within the WPCP would also impact other support systems as well, such as medium voltage electrical distribution and storm water collection. In addition, the current influent conveyance piping system has evolved to the point where it is worthwhile to consider a plan to simplify the headworks feed piping system to reduce operational and maintenance complexity.

This PM provides an assessment of potential support facility improvements in an attempt to address long-range planning considerations from a master planning level. The assumptions with regards to future growth and space allocations for maintenance and operational spaces were based on the fact that the existing facilities would be retained as long as possible and repaired and rehabilitated as needed. A more detailed analysis of each building, including a comprehensive condition assessment, should be incorporated into this decision. Space required for growth would be added as necessary. However there are some fundamental support services considerations that need to be addressed in more detail. These include:

1. Centralization of maintenance support functions to free up critical process and traffic flow areas.
2. Consolidation of both warehouse and maintenance satellite spaces.
3. Consolidation of all operations to a centralized location.
4. Storage space needs for the equipment required for the proposed future processes.

In addition, it was assumed that any staff functions that are currently off-site (i.e., accounting), would remain off-site. All of these issues will need to be examined further along with a more detailed analysis of the staffing requirements for the future operational, maintenance and support staff needs. This requires that a site specific detailed Facilities Plan be conducted.

3.0 SUPPORT BUILDINGS

3.1 Existing Facilities

The existing support buildings have been divided into two main categories:

- Category 1: Management, administration, operations, engineering support, laboratory facilities, and training facilities.
- Category 2: Warehouse, laydown areas, storage spaces, maintenance facilities (mechanical, HVAC and electrical), and workshops.

The existing support buildings located at the treatment plant are shown in Figure 1. A summary of the current floor areas of the major support buildings is summarized in Table 1, with the details provided in Appendix A.

Table 1 Summary of Major Support Buildings Floor Area
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Floor Area (sf)
Administration, Operations, Engineering, and Training	135,500±
Maintenance	46,000±
Storage/Warehouse	68,800±
Laboratory	27,500±
Total	**277,800±**

Management and administrative functions, as well as the plant operation control center, are located in the Administration Building. Engineering and laboratory functions are located in the Environmental Services Building (ESB). Training and classroom facilities are distributed within three buildings to the north of the primary clarifiers. Additional operations control centers are located at the individual unit process areas.

Figure 1
EXISTING SUPPORT BUILDINGS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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The central receiving warehouse and laydown area are located south of the ESB, with other storage spaces dispersed throughout the plant. Maintenance and workshop facilities are distributed along Center and C Streets.

3.2 Major Considerations

The following major considerations frame the issues to be resolved with the support buildings:

Considerations

- Administration and engineering staff are dispersed between the Administration Building and the ESB.
- Training facilities are remote from the administration and engineering functions, and distributed over several buildings.
- Operations and maintenance functions are dispersed across the plant site.
- There are no central lunchroom facilities available to accommodate all staff.
- The central receiving warehouse and laydown area is remote from the various other function-specific warehouses.
- The central receiving warehouse does not provide covered protection against inclement weather during off-loading.
- The current electrical equipment storage facilities are inadequate both in terms of available area and suitable protection from the elements.

Based on these considerations, several planning questions would need to be resolved:

- How much additional administrative, office, storage, and warehousing space will be needed at the WPCP?
- Should administration and engineering staff be housed in one facility?
- If administration and engineering functions are combined, is it correct to assume that the expanded complex would be located adjacent to the recently remodeled ESB?
- Are there other functions that should be decentralized, e.g., operations, maintenance, training, etc, to facilitate better communication between functions and allow shared use of facilities, such as workshops?

3.3 Centralized vs. Decentralized Staff Distribution

The WPCP can generally be described as a decentralized facility, with more than one building or location for each support staff function. As future support facilities are planned,

one of the main decisions that would need to be made is whether certain support functions should remain decentralized, or whether there would be sufficient benefit to being more centralized.

This decision is not unique to the WPCP, since many large wastewater treatment agencies also have facilities that have expanded over decades through a series of plant modifications. While each agency has a preferred approach to managing their support functions, there is a benefit to understanding their approach.

To that end, a number of large agencies were approached for information, specifically pertaining to their support buildings. While surveys were sent to eight facilities, only four had responded at the time of preparing this PM. It should be noted that some of these large industries surveyed only treat to secondary quality and do not have tertiary filtration facilities like the WPCP.

Further details on the surveys, and a summary of the feedback, is presented in Appendix B. The actual surveys received from these agencies are contained in Appendix C.

Regarding the centralized or decentralized nature of the different categories of support buildings of these agencies, the majority responses are shown in Table 2. The corresponding information for the WPCP is also presented in Table 2. The survey shows that these particular agencies are moving to a centralized approach for their support services functions

Table 2 Summary of Large Agency Survey – Centralized vs Decentralized
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Majority of Agencies Surveyed	WPCP
Operations	C	D
Administration	C	D
Maintenance	C	D
Engineering	C	D
Storage/Warehouse	C	D
Laboratory	C	C
Training	C	D
Laydown areas	D	C

Notes:
C – More than half responded with Centralized
D – More than half responded with Decentralized

3.4 Space Allocations

The survey also solicited the large agencies for their space allocations to different support functions. While further details regarding the survey are presented in Appendices B and C, Table 3 shows a summary of the square foot space per staff member (sf/staff) for the administration, operations, engineering, and training functions.

Table 3 Summary of Large Agency Survey – Space Allocation
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Average of Agencies Surveyed	WPCP[1]
Administration, Operations, Engineering, and Training	989 sf/staff	898 sf/staff[2]
Maintenance	299 sf/mgd	368 sf/mgd[3]
Storage/Warehouse	183 sf/mgd	550 sf/mgd[3]
Laboratory	166 sf/mgd	220 sf/mgd[3]

Notes:
(1) See Table 1 for floor area per support function.
(2) Based on 298 WPCP employees currently, of which 151 employees are in the Administration, Operations, Engineering, and Training support functions.
(3) Based on a 2010 ADAF of 125 mgd.

The table also shows the square foot per million gallons per day (sf/mgd) of treated average day annual flow (ADAF) for the maintenance, storage/warehouse, and laboratory functions. The comparable information for the WPCP is also shown in the table.

Due to the especially wide variability in responses for laydown areas, these results are not presented.

Based on this comparison, the WPCP square foot (sf) space per staff member for the administration, operations, engineering, and training functions is approximately 9 percent less than the average of the agencies surveyed. The WPCP square foot per million gallons per day of treated ADAF for the maintenance, storage/warehouse, and laboratory functions were all higher than the average of the agencies surveyed. This is consistent with the fact that the WPCP is a tertiary facility, which will require more area for support functions.

These calculations are intended only to provide a general indication of how WPCP space allocation compares to that of other large agencies. While the results may suggest that the WPCP generally has more sf/mgd within some support functions, this may be a consequence of the decentralized nature of the plant, possibly requiring duplication of certain facilities and/or the more advanced tertiary treatment process requiring additional support function needs.

4.0 STAFFING REQUIREMENTS

The WPCP currently employs a staff of 298[1] on the plant site, which translates to a staffing ratio of 2.4 plant employees per mgd of treated ADAF. The average of the larger agencies (Fresno, LACSD, Denver Metro, and OCSD) was 2.3 employees per mgd of treated ADAF.

In "A National Survey of Municipal Wastewater Management Financing and Trends" issued by the National Association of Clean Water Agencies (NACWA), the 2007 median for staffing is 3.3 employees per mgd of treated ADAF. This is based on a survey of 95 agencies, with a wide range of treatment capacities and capabilities. While the WPCP staffing ratio of 2.4 is lower than the 2007 median reported in the NACWA report, it is similar to the 2.3 average of the four larger agencies surveyed. Again, it shall be noted that none of the other large agencies operate a tertiary treatment process, which would account for the slightly higher staffing ratio.

For this report, a preliminary operations and maintenance staff analysis was performed. Based on this analysis, along with assumptions of staff needs in the administration, laboratory and training functions, a future staff population of 321 employees was estimated. Details of the preliminary staffing study are presented in Appendices B and E. A more detailed staffing study would be required once the final 30-year CIP is established and selection of new and upgraded unit processes are more defined.

5.0 PLANNING LEVEL COST ESTIMATE

Planning level cost estimates were prepared for support buildings through 2040, based on the staff and ADAF projections. It was assumed that the current WPCP space allocation for the different support functions would remain the same (Table 3). Appendix D shows the details of the cost development for the different support functions.

Administration, Operations, Engineering, and Training

Currently, 151 of the total 298 WPCP employees constitute this support function, and is assumed to increase by 14 to 165 (See Table B-3). This results in an increase in area for this function of 12,700 sf. Based on an additional 31,600 sf for relocation of the Administration Building and an estimated unit project cost of $380/sf, the project cost for this function would be approximately $17.0 million. This assumes that a new Administration Building would be built and the existing Administration Building would be re-purposed for other support functions.

[1] WPCP, October 5, 2010

Maintenance

Currently, the existing area for this support function is 46,000 sf. At a 2040 ADAF flow of 172 mgd, the estimated total required area is 63,300 sf. This is an increase in area of 17,300 sf. Based on an estimated unit project cost of $270/sf, the project cost for the increased area for this function would be approximately $4.7 million.

Storage/Warehouse

Currently, the existing area for this support function is 68,700 sf. At a 2040 ADAF flow of 172 mgd, the estimated total required area is 94,600 sf. This is an increase in area of 25,900 sf. Based on an estimated unit project cost of $230/sf, relocation of existing warehouse and storage spaces (21,000 sf) and providing additional increased area for this function, the project cost for this function would be approximately $10.8 million.

Laboratory

Currently, the existing area for this support function is 27,500 sf. At a 2040 ADAF flow of 172 mgd, the estimated total required area is 37,840 sf. This is an increase in area of 10,340 sf. Based on an estimated unit project cost of $480/sf, the project cost for the increased area for this function would be approximately $5.0 million.

Summary of Support Areas Cost Estimate

From these estimates, the planning level project cost for the increased support function floor areas through 2040, would be approximately $37.5 million.

In addition, the existing floor areas will require repair and rehabilitation. Although the Condition Assessment Report[2] indicated that there were several support facilities that were in need of repair, only projects related to electrical sub-stations and about $1 million for miscellaneous support facilities were recommended in the CIP list of recommended projects. For planning purposes therefore, it is assumed that approximately 50% of the existing floor area would need to be remodeled over the 30-year planning period (approximately 140,000 square feet). Using a remodeling cost of $250 per square foot, this would equate to an additional $35 million in support facilities upgrades. Therefore, the total planning level cost estimate for support buildings through 2040 would be $72.5 million.

It should be noted that any support buildings that are to be placed outside the existing berm will either require a separate berm or be raised above the flood elevations. This would be addressed in the detailed Facilities Plan discussed earlier.

[2] City of San José, Infrastructure Condition Assessment Report, CH2M Hill, May 2007.

6.0 TRAFFIC ACCESS AND ROUTING

This section addresses the non-City vehicle traffic issues into and out of the plant, as well as traffic routing through the plant. Three traffic flow scenarios are presented: (1) continuing with the current traffic patterns; (2) utilizing the existing and currently planned traffic patterns, and (3) an alternative traffic pattern.

6.1 Current Layout

Figure 2 shows the current non-City vehicle traffic access into and out of the WPCP, as well as traffic routing through the plant. There are three main entry points for non-City vehicle traffic into the plant:

1. Visitors and Professional Services: Traffic passes by the ESB along Zanker Road, continues along Los Esteros Road, and is received at the existing Administration Building. Where applicable, traffic accesses the plant at the traffic gate adjacent to the existing Administration Building, and is routed along Main Street, Center Street, and 1st Street to the ESB.
2. Deliveries: Trucks making deliveries to the plant enters along G Street for delivery to the central warehouse. Staff then distributes parts and consumables from the central warehouse to various other storage facilities across the plant site.
3. Septage Hauling: Septage hauling trucks enter at Main Street, travel south to Center Street, and west to discharge their load at the headworks.

6.2 Major Considerations

The following major considerations frame the issues to be resolved with traffic flow patterns:

Considerations

- There is no clear “gateway entrance” to the WPCP for visitors and professional services.
- Visitors and professionals to the ESB have to be routed through the plant.
- There are no safe overnight parking facilities for delivery trucks arriving after hours.
- Septage hauling trucks have to be routed through the plant to the discharge location at the headworks.

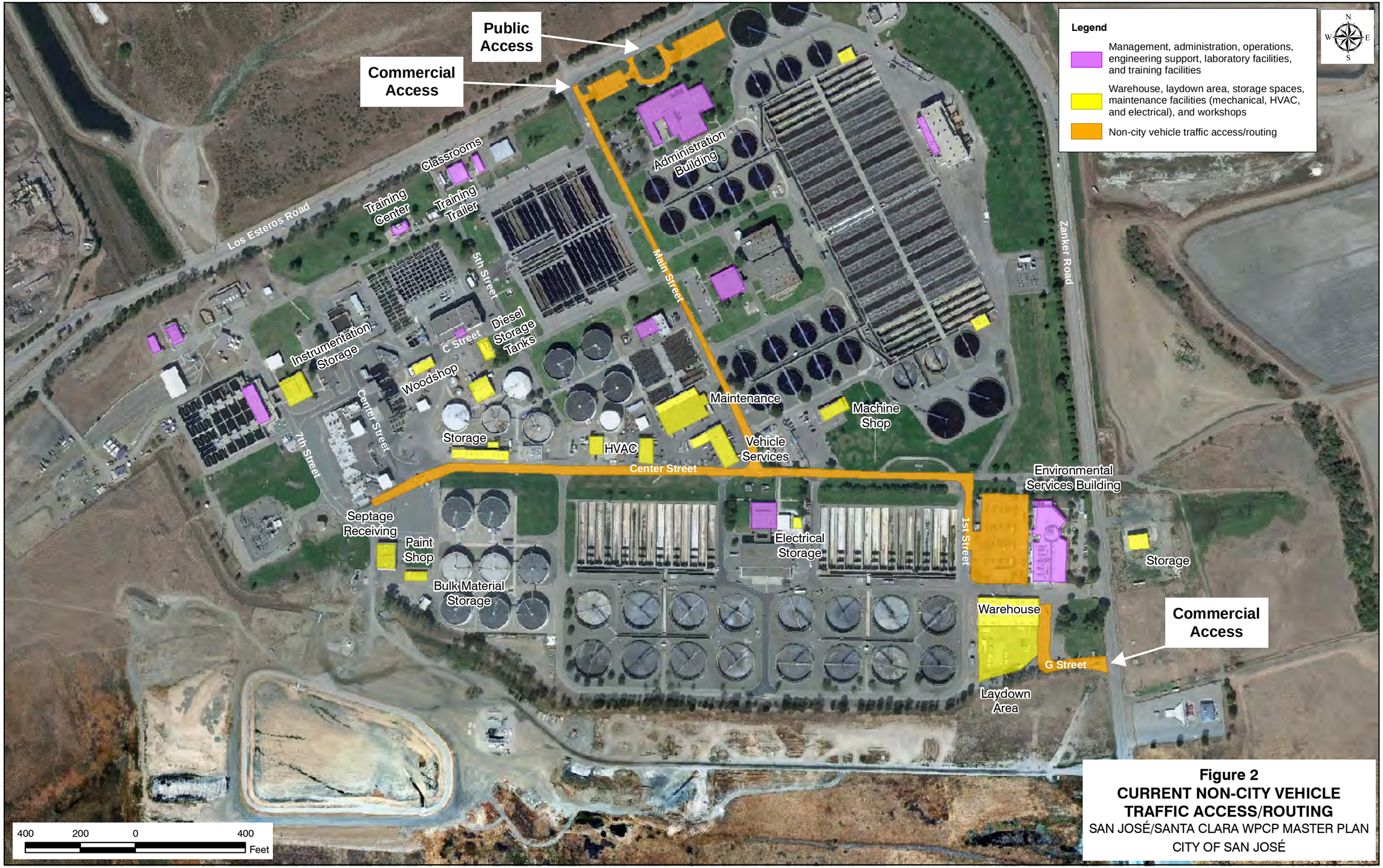

Figure 2
CURRENT NON-CITY VEHICLE TRAFFIC ACCESS/ROUTING
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Based on these considerations, several planning questions would need to be resolved:

- How can a more obvious “gateway entrance” to the plant be established, especially for first-time visitors?
- How can outside traffic through the plant be minimized?
- Can the deliveries and septage hauling functions be accommodated at a single point of entry?

6.3 Current and Planned Layout

From the alternatives assessment performed as part of the PMP, a new access road is being planned to receive FOG hauling trucks. The new road would direct traffic to the FOG receiving facility directly south of Digester Nos. 12, 13, and 14. This new access road is shown on Figure 3. While this is a necessary improvement for the new FOG receiving approach at the plant, it would likely require the addition of a new security gate.

Other than the new access road, the scenario presented in Figure 3 reflects the status quo in terms of support building and traffic flow layout. In addition, areas slated for decommissioning and demolition, i.e. Headworks No. 1, the West Primaries, and the classrooms and training trailer, are shown as “greened-out” areas on the figure. These areas could potentially be considered for expansions to the support buildings.

6.4 Alternative Layout Scenario

Figure 4 presents a scenario that attempts to address some of the major questions regarding traffic flow. It expands the functionality of the FOG access road 1) to also serve as the new deliveries access point, and 2) to provide a new septage hauling route to the headworks without directing these haulers through the main plant. This new route, dubbed Pilot Alley, would also form the access road to a number of energy-related pilot projects, i.e. a municipal solid waste (MSW) processing facility, and a 1 MW solar installation.

A key feature of this scenario would be the construction of a new central warehouse facility with laydown area. The new facility could be designed to allow covered off-loading, providing the necessary protection against inclement weather. In addition, enough space would be available to provide off-road overnight parking facilities for the arrival of after hour delivery trucks.

By moving the central warehouse, the space liberated next to the ESB could be available for centralizing the management, administration, engineering, laboratory, and potentially the central plant control functions. It could also be designed to include a more central lunchroom/break area, promoting more frequent interaction between the different plant staff disciplines.

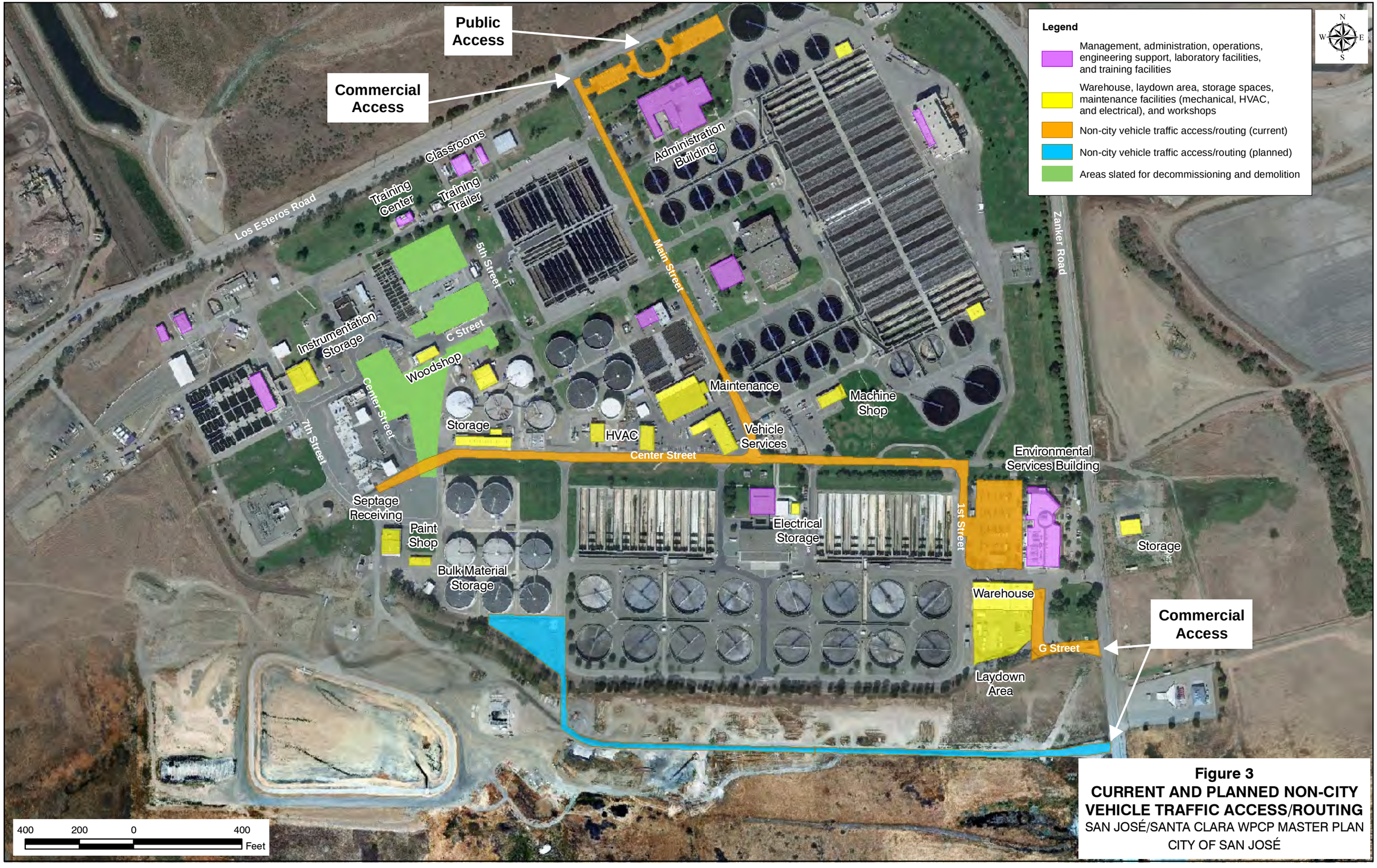

Figure 3
CURRENT AND PLANNED NON-CITY VEHICLE TRAFFIC ACCESS/ROUTING
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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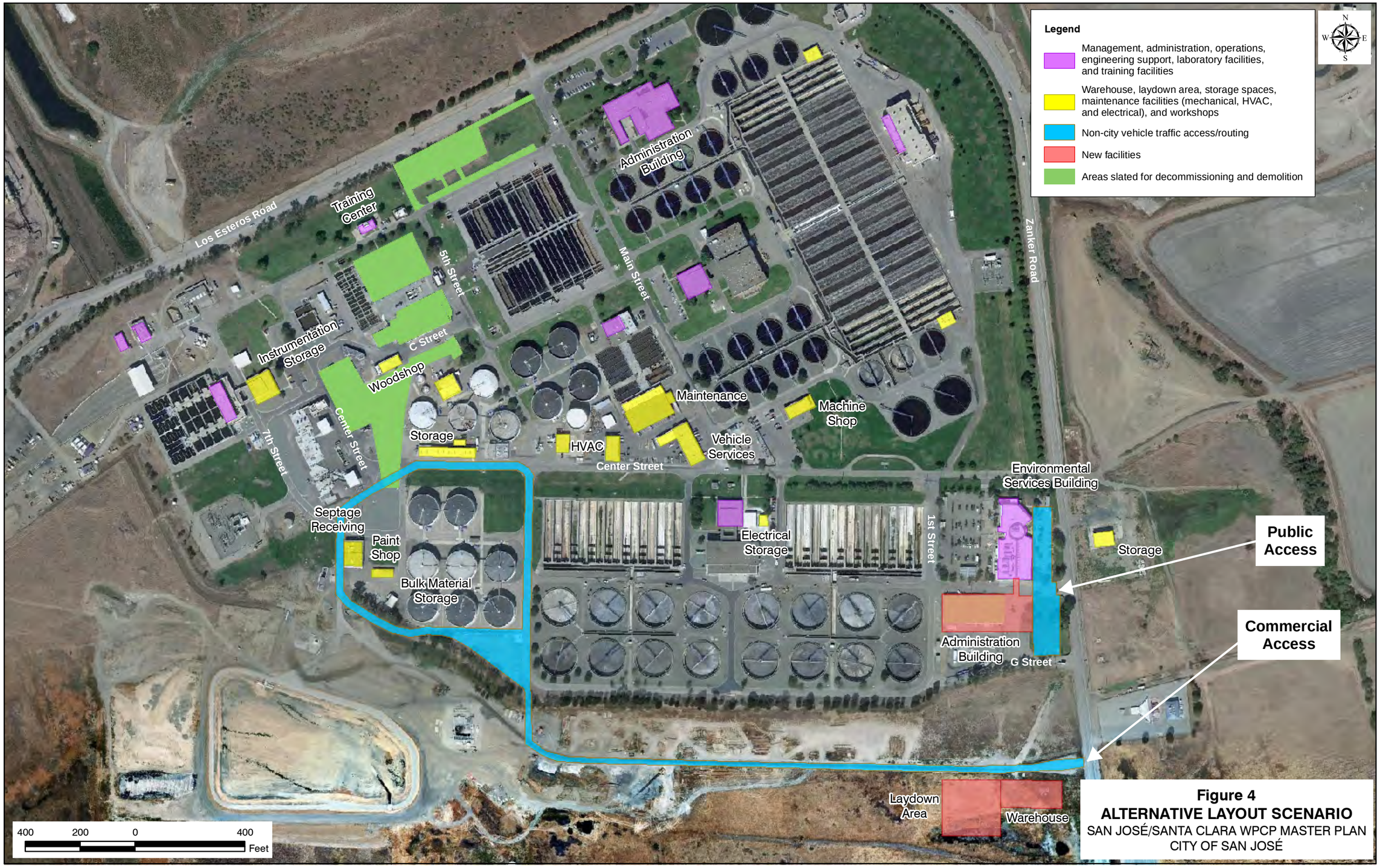

Figure 4
ALTERNATIVE LAYOUT SCENARIO
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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This new, centralized complex would also serve as the primary receiving point for visitors to the plant. It would be one of the first features of the plant presented to approaching traffic, naturally creating the “gateway entrance” which is currently lacking.

The training facilities could move into the vacated and remodeled Administration Building, which could also be adapted into a public education center.

The greened-out areas represent the space vacated by the decommissioned Headworks No. 1 and West Primaries. The existing training facilities would be available for use as potential storage and workshop space expansion, as needed. The maintenance, workshops, and unit process-specific operations functions status quo would be preserved.

7.0 INFLUENT AND INTER-PROCESS PIPELINES

This section reviews the current major raw influent pipelines to the plant, and the feasibility of transitioning to tunnel or covered trench pipeline corridors.

7.1 Existing Pipelines

Figure 5 shows the configuration of the existing major raw influent pipelines to Headworks No. 1 and Headworks No. 2, and the supernatant recycle flow from the solids handling lagoons. This is a simplified representation, since a number of additional, smaller pipelines have not been shown for clarity.

It is clearly a complex layout, a result of numerous add-on projects over the years. This has resulted in a convoluted flow path into Headworks No. 2 for influent flows entering the plant from the eastern tributaries. These flows, predominantly wastewater from Milpitas, have to be routed south to EBOS where they mix with San José flows entering through three 84-inch interceptor mains, before flowing north to Headworks 2. As a consequence, one of the operational problems the plant has experienced is excessive solids deposition in the pipelines to EBOS during low flows.

Wastewater is routed through the treatment process in a maze of inter-connection pipelines and tunnels. The general flow pattern is toward the east after passing through the headworks and then westward again, with the treated effluent being discharged to the slough north of the plant. This complex flow path is achieved by using a series of pipelines that are buried side by side in the available corridors between the various concrete structures. Over the years of plant expansion, the installation of new pipelines has become increasingly difficult due to the limited space availability. In addition, getting access to inspect and repair or replace existing pipelines has become increasingly difficult.

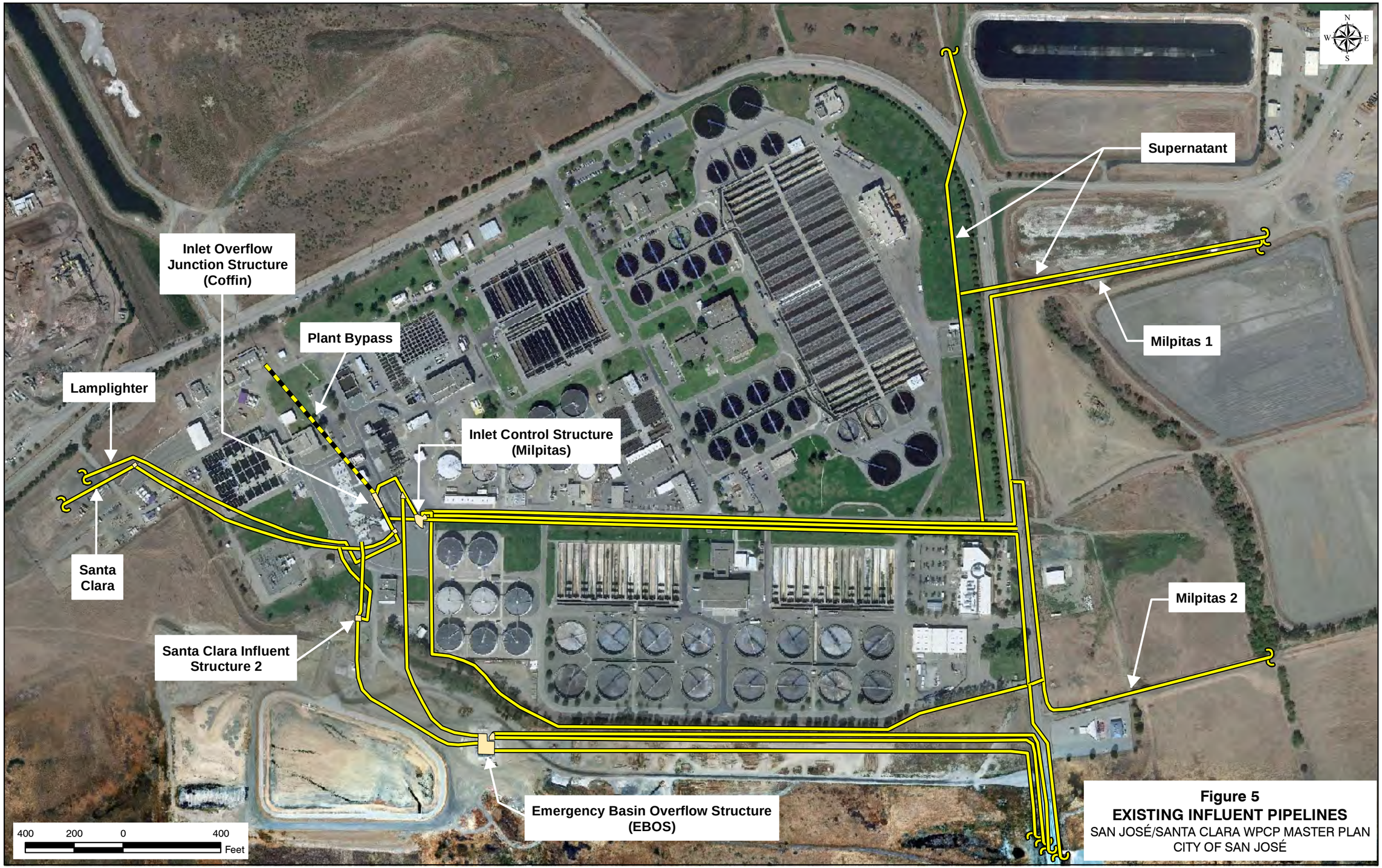

Figure 5
EXISTING INFLUENT PIPELINES
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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7.2 Major Considerations

The following major considerations frame the issues to be resolved with influent and inter-process pipelines:

Considerations

- The major influent pipelines have a very complicated layout.
- Excessive solids deposition occurs in the pipeline conveying Milpitas flows to EBOS during low flow periods.
- Inter-process pipelines constitute a maze of pipelines throughout the plant. There is very limited space available between these existing pipelines and structures for new pipelines.
- Pipelines are buried, for the most part, making it very difficult to conduct condition inspections, and maintenance.

Based on these considerations, several planning questions would need to be resolved:

- How can the influent pipelines configuration be modified to direct all/most of the raw influent flow to the plant through EBOS, and mitigate solids deposition?
- Would it be possible to install inter-process pipelines in tunnels or covered trenches to improve accessibility for maintenance inspections and repairs?

7.3 Simplified Inlet Configuration

Figure 6 shows a simplified inlet configuration under which most raw influent flows would be routed through EBOS, and on to Headworks No. 2. The major features of this improved configuration are the following:

- A new 96-inch pipeline between Zanker Road and EBOS
- New connections between the 84-inch pipelines along Zanker Road and the pipelines flowing west toward EBOS (three existing 84-inch, one new 96-inch pipeline)
- New Milpitas 1 and 2 connections to these pipelines
- A 120-inch pipeline (or combination of one smaller and larger diameter pipelines) from EBOS to Headworks No. 2
- The existing 84-inch pipeline from EBOS to Headworks No. 1 will be dedicated to plant bypass flows through the influent overflow junction structure (coffin structure) to the discharge slough

In addition, MSW processing and potentially other wastewater generating facilities are earmarked for development north of Los Esteros Road. Also, the inactive lagoons area would be the designated site for the City's gradual transition to a more mechanized solids

processing approach. A new interceptor main is shown on Figure 6 along Los Esteros Road to Headworks No. 2 for wastewater flows from these areas.

Once the City transitions out of the current lagoon and drying bed operation, this freed-up land could be used for development toward the northeast boundary of the plant.

Wastewater from all these conveyance facilities would have to be intercepted and routed to the headworks facilities, and then probably combined with pumped Milpitas flows.

7.4 Inter-Process Pipeline Corridors

Currently, most of the buried piping and other utilities in the San José/Santa Clara WPCP are buried in trenches. There is no easy way to access the piping/utilities without excavation around a desired location. This arrangement makes it expensive to replace/repair existing valves, fittings, joints and other piping appurtenances, and check for leaks etc. In addition, construction of new piping becomes difficult as the piping layout gets congested. Covered trench-type utility corridors (utili-dors) could be utilized to house existing piping to allow access and easier maintenance. These utili-dors are typically much smaller than full-size tunnels (i.e. 8-0” high x 10’-0” wide). These have pipe rack supports on walls, and often have clear area for walkway accessibility. Removable traffic-rated covers are provided for maintenance access.

To evaluate the feasibility of placing pipes in corridors, certain criteria were used to plan a preliminary utili-dor layout. The utili-dors are planned to house existing pipes that are smaller than 24 inches in diameter; have pressure service (not gravity flow); and should not be earmarked for modifications through scheduled CIP projects.

Additionally, the criteria for laying the preliminary utili-dor layout for this evaluation is that these should run along major piping routes (to allow housing maximum number of process services), should connect to existing utility tunnels and structures in order to use these structures, should not conflict with current and future buildings, and should minimize conflict with existing utilities/pipes at the plant (for ease of construction). Allowance for future pipe runs was also considered in the evaluation. Based on these criteria, it was found that running the utili-dors along the interior streets at the WPCP would allow them to serve the majority of piping and connect to the majority of structures. See attached Figure 7 for a preliminary utili-dor layout. This preliminary alignment has been laid out so that it does not conflict with electrical duct banks shown in Figure 11.

Some of the major pipes that may possibly conflict with the utili-dor layouts have been identified in Table 4.

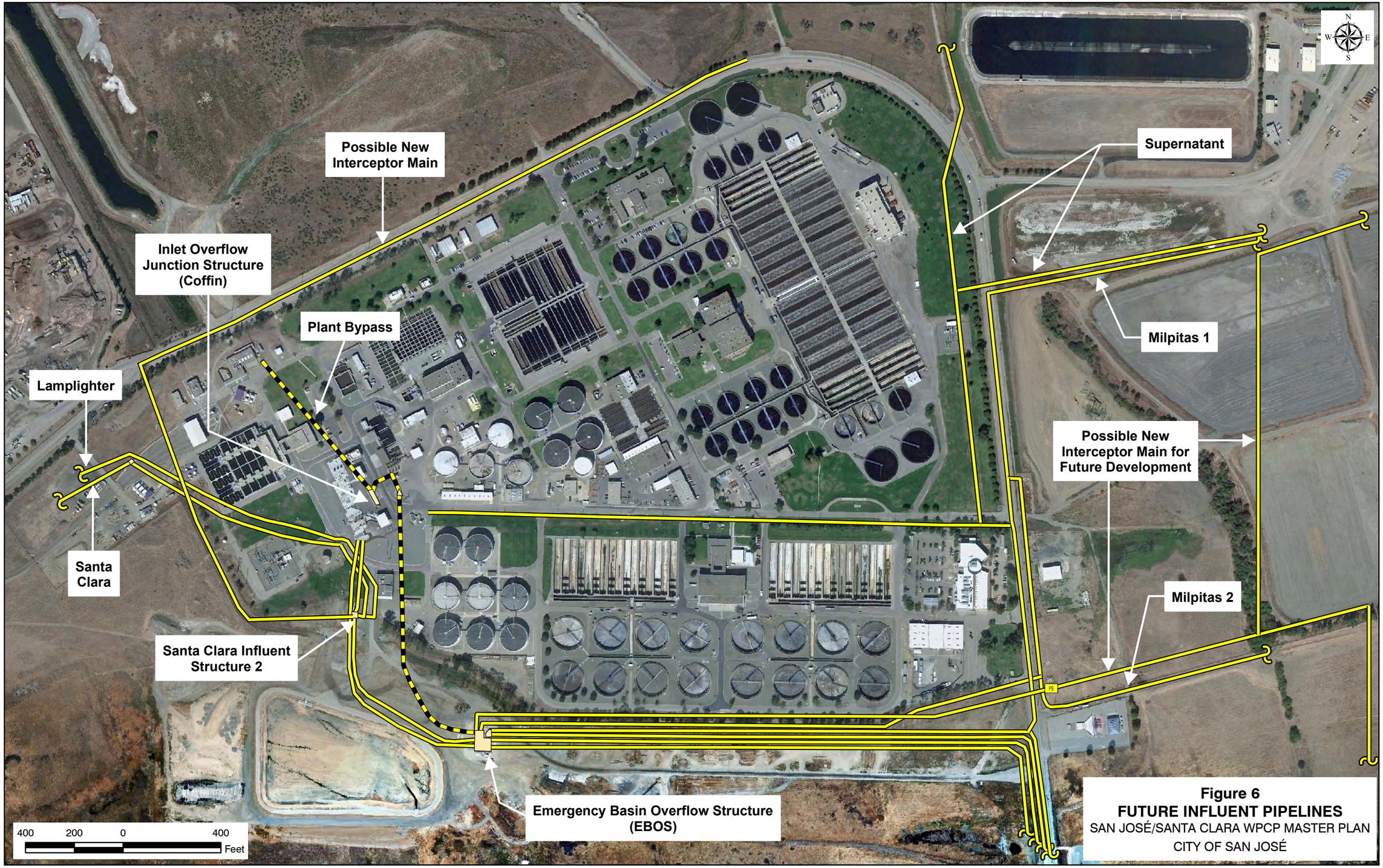

Figure 6
FUTURE INFLUENT PIPELINES
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Friday, April 15, 2011

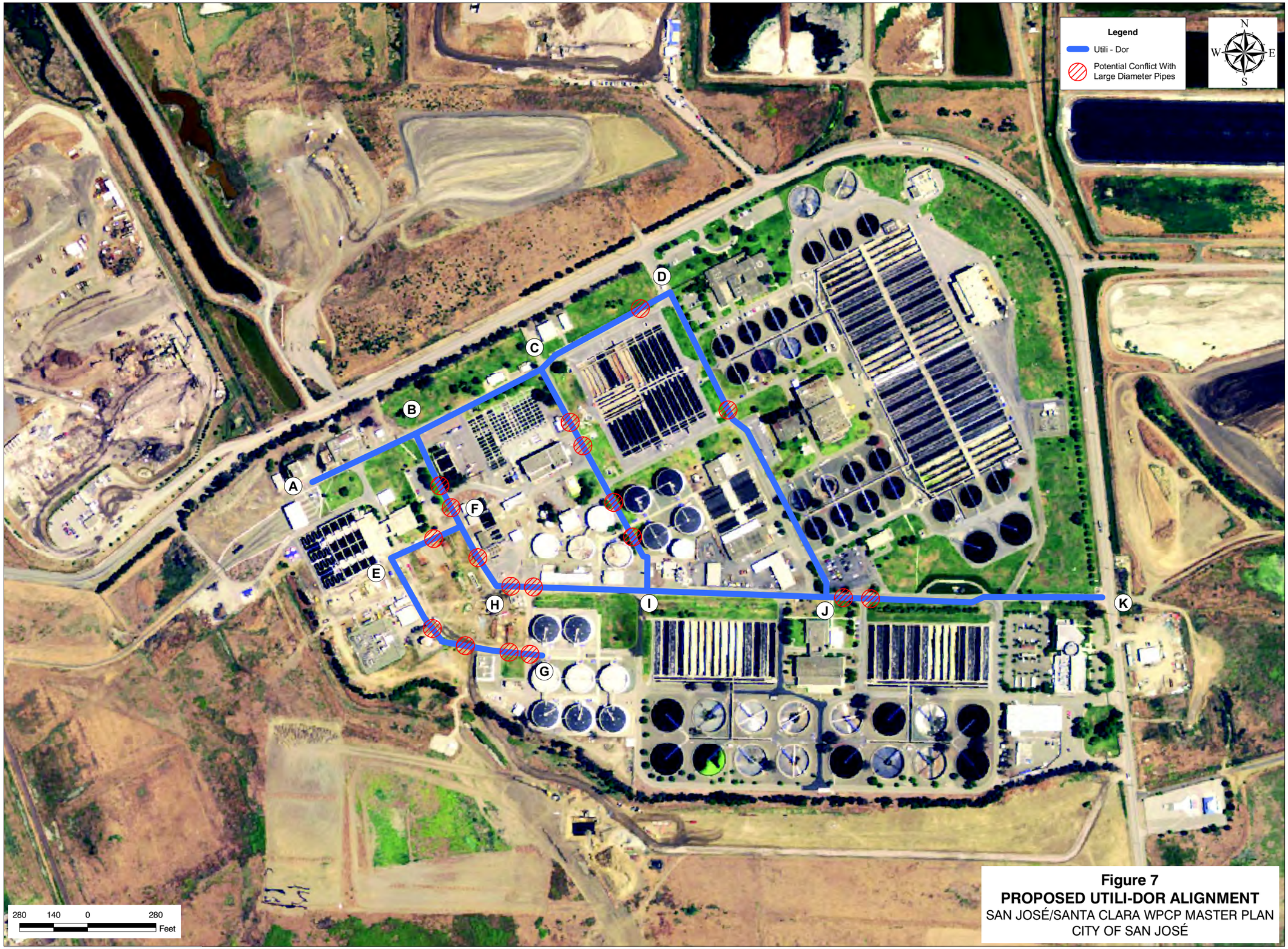

Figure 7
PROPOSED UTILI-DOR ALIGNMENT
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Friday, May 6, 2011

Table 4 Summary of Utili-dor Layout
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Segment	Pipes In Potential Conflict With Utili-dor Segment(1)	Pipes Potentially Enclosed Within Utili-dor Segment(1)
Point A to C (along A St. to junction of A St. and 5th St)	10" Alviso Force main, 12" WTR4, 6" SD, 30" TBW, 6" SS, 4" WTR2, 2 ½" WTR1, 8" RW, 8" WTR4	12" WTR4, 4" WTR2, 4" WTR1, 4" WTR2, 2 ½" WTR1, 4" WTR2, 4" CS
Point C to D (along A St., from 5th St junction to Main St. junction)	18"SD, 6" WTR2, 84" PE, 3" WTR1	6" WTR2, 2" WTR2, 12" PSM, 12" WTR4, 4" CS, 4" WTR2
Point B to H (along Center St.)	4" WTR2, 4" WTR1, ¾" ALUM, 1 ½" WTR2, 48" WBW, ¾" LPA, 8" SD, 12" D, 8" D, 6" D, 78" RS, 54" RS	8" D, 12" D, 8" CS, 10" PD, 12" SD, 6" PD, 18" SD, 6" WTR2, 6" WTR1
Point C to I (along 5th St. to junction of 5th St and Center St.)	78" PE, 3" WTR2, 8" RW, 1 ½" RW, 5" WTR1, 4" D, 102" RS, 66" RS, 8" SD, 18" SD, 24" EDS, 12" EDS, 3" RW, 24" DG, 21" SD, 18" SD, 6" D, 6" RW, 8" WTR2	5" WTR1, 12" PSM, 8" WTR4, 8" RW, 10" BS, 8" PSM, 10" BS, 3" RW, 1 ½" RW
Point D to J (along Main St., from A St to Center St.)	4" WTR2, 8" SS, 24" WTR3, 6" WTR1, 6" WTR2, 8" SSM, 4" LCH, 12" SD, 1 ½" HWS, 18" SD, 8" NG, 6" WTR1, 8" WTR2, 10" WTR4, 8" WTR4	8" WTR4, 4" CS, 12" SSM, 8" SSM, 4" WTR2, 12" SSM, 12" SSM, 3" WTR1, 3" WTR3, 6" WTR2, 6" WTR2, 1 ½" WTR1, 1 ½" WTR1, 1 ½" WTR1, 8" WNAS
Point H to K (along Center St. from Center St. to Zanker Road)	84" RS, 12" SD, 6" WTR2, 54" RS, 24" D, 8" WT4, 6" RW, 6" SD, 8" D, 6" TES, 4" SS, 8" WTR4, 2" NG, 3" SD	8" WTR4, 6" WTR1, 6" RW, 8" WTR2, 8" WTR4, 6" WTR1
Point F to G (along C St. and 7th St, from Center St. to Remote Digester Tunnels)	10" PD, 8" CS, 18" SD, 4" WTR2, 8" WTR1, 6" RW, 4" D, 48" Santa Clara Force main, 12" SD, 120" RS, 2" WTR1, 15" SD, 10" SD, 36" Milpitas New Force main	3" LPA, 6" RW, 6" WTR4, 8" WTR4, 10" Alviso Force main, 8" WTR1, 6" PD

Note:

(1) Pipes that could be identified using the data provided by the City are listed here, and not all pipes are included in this table.

Based on the proposed layout in Figure 7, many potential issues have been identified with the proposed utili-dor installations. There are multiple conflicts with existing pipes that have been identified, and would have to be verified against installed pipeline elevations. Multiple shutdowns would be required for re-routing of piping both within utili-dors and around utili-dors (for services not being housed in these facilities). Temporary bypass arrangements would also have to be implemented during the shutdown of multiple process piping. Furthermore, the construction of utili-dors would involve excavation at multiple locations and also have a significant impact on roads during construction (as the utili-dors follow road alignment). This construction would have to be performed in stages to avoid disruption of plant operations. Traffic would also have to be re-routed temporarily. Another aspect to consider when re-routing pressure piping through utili-dors would be the additional hydraulic head created due to addition of pipe lengths and fittings. Existing pumps may have to be modified to accommodate this additional head.

In addition to considering utili-dors for current piping, the PMP identified a number of areas to be set aside for future processes, as shown in Figure 8. These future processes include the solids handling, future treatment, advanced water treatment facility (AWTF), and a solids handling and energy pilot area. As these new process areas are developed, there would be a need to establish inter-process pipeline corridors, which may offer the opportunity to utilize additional tunnels or covered trenches. As the sizes of these future processes are more clearly defined, a more detailed evaluation should be performed to determine the feasibility of buried versus tunnel/trench installations.

Because of the anticipated disruption to the existing operations, along with the substantial cost impacts, it is recommended that a more detailed cost-benefit analysis be performed before any major utili-dor system is implemented.

8.0 STORMWATER HANDLING

8.1 Existing Facilities

Presently, storm drainage is provided for the developed portions of the plant site, and the access roads between the sludge drying beds. There are a number of destinations for stormwater runoff:

- Headworks No. 1, from where it is pumped into the treatment system.
- Dedicated pump stations, pumping either to other sections of the collection system, the headworks, a stormwater retention lagoon north of the plant, the primary effluent equalization basin, or to the discharge slough.

The stormwater runoff catchment areas are shown on Figure 9, along with the associated pump station dedicated to that area (where applicable), and the final discharge location for the collected runoff.

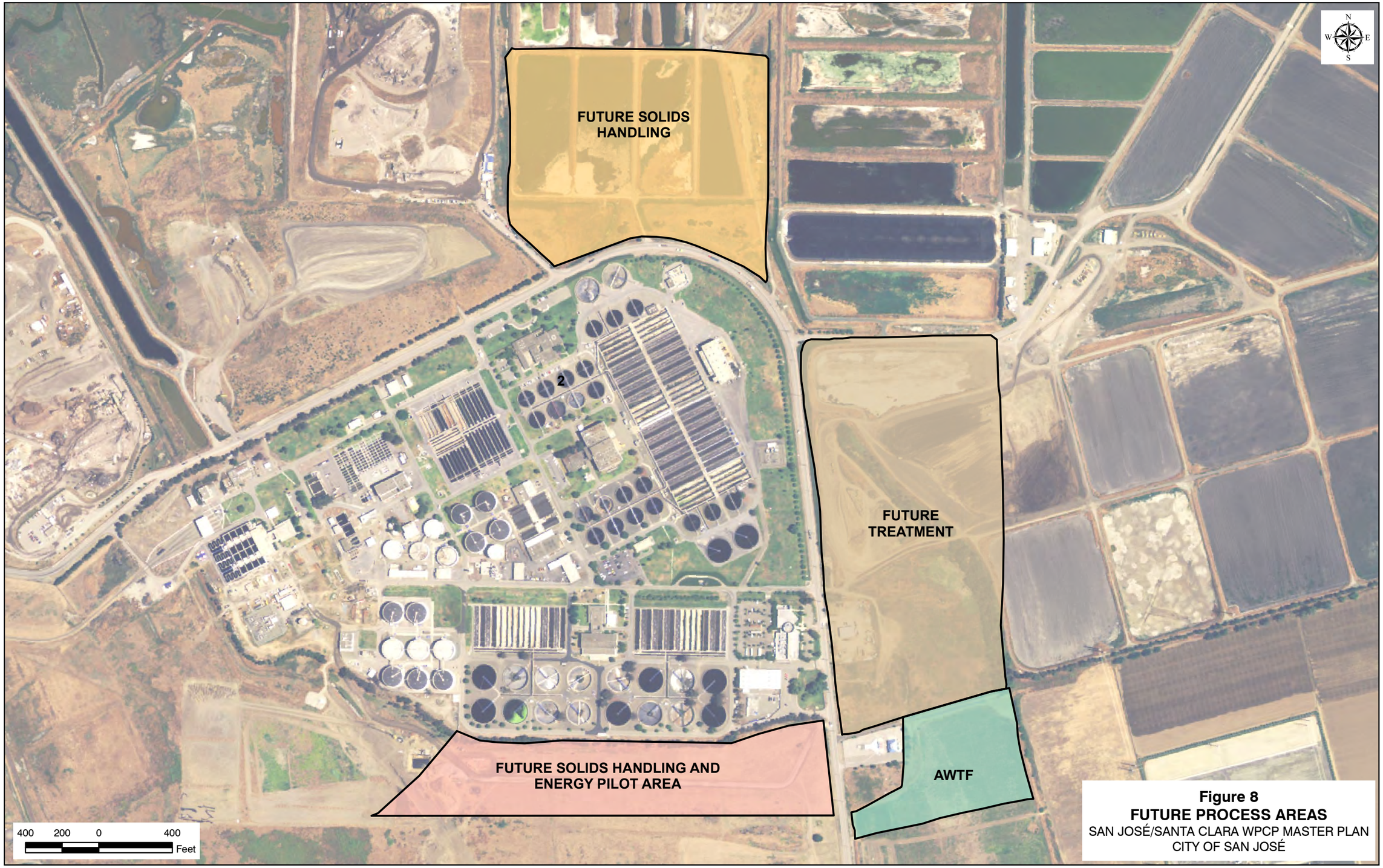

Figure 8
FUTURE PROCESS AREAS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Monday, September 20, 2010

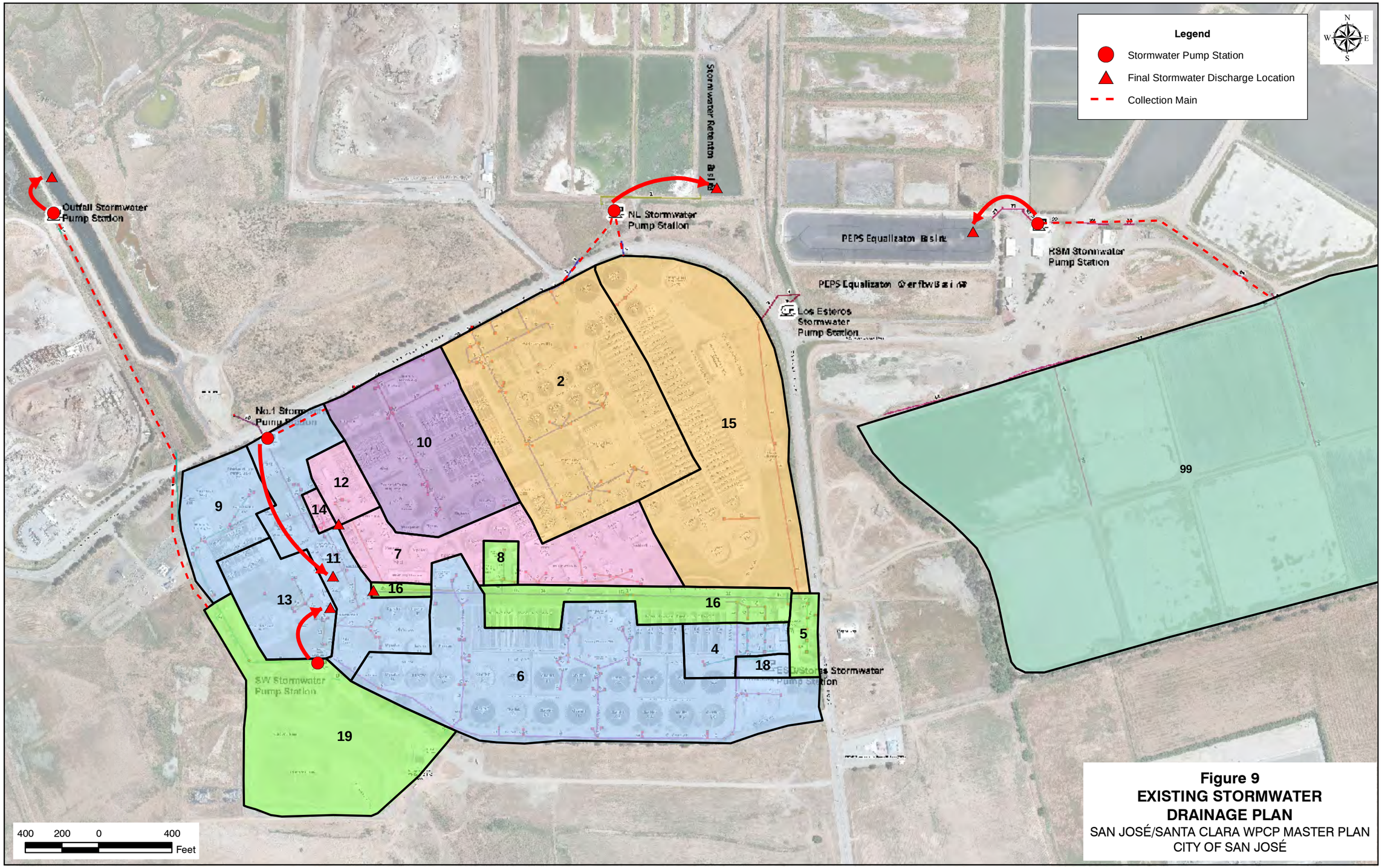

Figure 9
EXISTING STORMWATER DRAINAGE PLAN
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Friday, September 8, 2010

8.2 Major Considerations

The following major considerations frame the issues to be resolved with stormwater handling:

Considerations

- Future treatment areas have been identified in the PMP, which will need to be incorporated into the stormwater handling plan.

8.3 Future Facilities

The future processes identified in the PMP would need to be incorporated into the stormwater handling plan. A schematic of the future stormwater handling plan is presented in Figure 10, and comprises the following:

- Stormwater from the new AWTF facilities would be discharged to a new pump station on the plant site, which would then be pumped to the EBOS.
- The future solids handling and energy pilot area would be connected to the infrastructure of the area to the north.
- Runoff from the future treatment area would be routed to the existing residual solids management (RSM) stormwater pump station via a new collection main.
- Runoff from the future solids handling area would be collected at the existing stormwater pump station currently located in that area. The discharge location would be modified to discharge to the primary effluent equalization basin.
- Two new stormwater pump stations would be added to intercept stormwater that is currently discharged to Headworks No. 1. These new pump stations would discharge into the raw sewage flow distribution structure (California Structure).

9.0 PLANT ELECTRICAL DISTRIBUTION SYSTEM

The PMP has identified a combination of plant modifications and improvements to the various treatment processes to accommodate future flows and loads, and meet specific plant objectives. This section describes a planning level estimate of the associated year 2040 power demands and their likely impacts on the WPCP's power distribution system.

The 2010 and anticipated 2040 power requirements for each WPCP treatment process are presented in Table 5, along with the incremental increases over the 30-year period. The detailed energy evaluation presented in PM 5.3 was performed around these anticipated

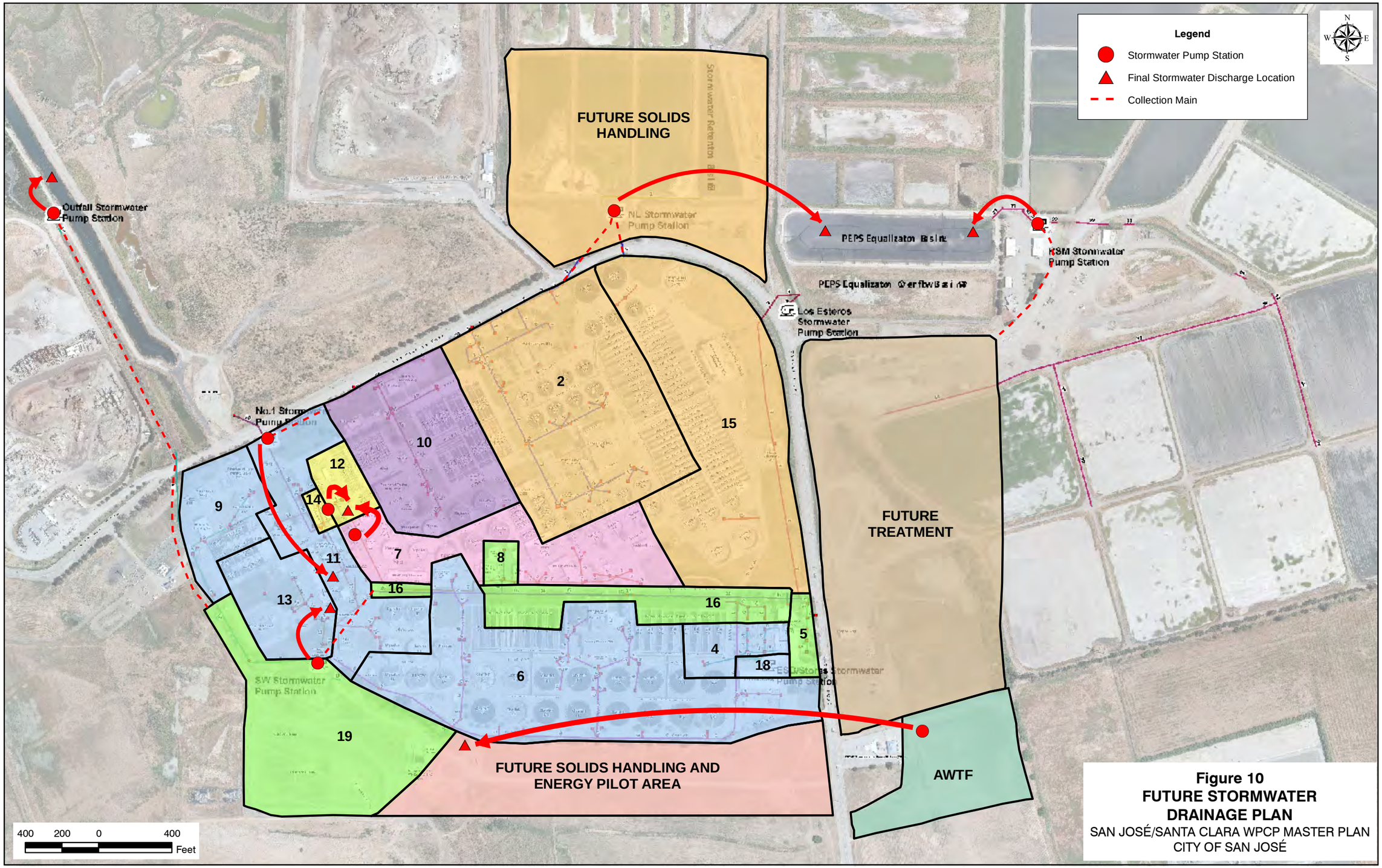

Figure 10
FUTURE STORMWATER DRAINAGE PLAN
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Friday, September 9, 2010

2040 power requirements, with the exception of the 2040 solids handling power demand. In that report, belt drying was assumed for 20 percent of the dewatered solids stream, while Table 5 includes the power demand associated with thermal oxidation (incineration, gasification, etc.) of the full dewatered solids stream. Thermal oxidation has a slightly higher power demand than sludge drying, which is an important consideration for the electrical distribution system. However, the energy evaluation in PM 5.3 was based on the more likely belt drying scenario.

Table 5 Summary of Planning Level Electrical Demands
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Treatment Process	2010 Demand (MW)	2040 Demand (MW)	Increase (MW)
Headworks	0.3	0.4	0.1
Primary Treatment	0.1	0.1	–
Secondary Treatment	3.4(1)	8.7(2)	5.3(3)
Filters	0.8	1.0	0.2
Disinfection(4)	0.02	0.4	0.4
Reuse Pump Station(5)	1.0	3.6	2.6
Solids Handling(6)	1.0	2.6	1.6
Miscellaneous (10%)	1.0	1.7	0.7
Total	**7.6**	**18.5**	**10.9**

Notes:
(1) Does not include the equivalent 3.1 MW aeration air provided to BNR1 by the engine-driven blowers in the SBB, which also contribute toward meeting the plant heat demand. Typically, electrical blowers are often used to partially or fully meet the plant aeration demand.
(2) A new aeration pipeline connecting the various aeration headers will enable the engine-driven blowers in the SBB to provide aeration air to BNR2 as well. However, the engines will likely not be able to meet future air emissions regulations, and will have to be decommissioned at some point. Therefore, it is assumed by 2040, all aeration air (BNR1 and BNR2) would be produced by the electrical blowers.
(3) The increase is only 2.2 MW if the 3.1 MW aeration air in 2010 is provided fully by the electrical blowers.
(4) Includes transitioning 34 mgd to ozone disinfection by 2040. This serves as a "placeholder" power demand due to the uncertainty of future disinfection/advanced oxidation requirements.
(5) Includes reuse (WPCP and ARWTF combined) increasing from 15 mgd to 55 mgd by 2040.
(6) Includes co-thickening, a fats-oils-grease (FOG) station, full sludge dewatering, and thermal oxidation of the dewatered solids stream by 2040.

The relative allocation of these power increases across the entire WPCP site is shown on Figure 11.

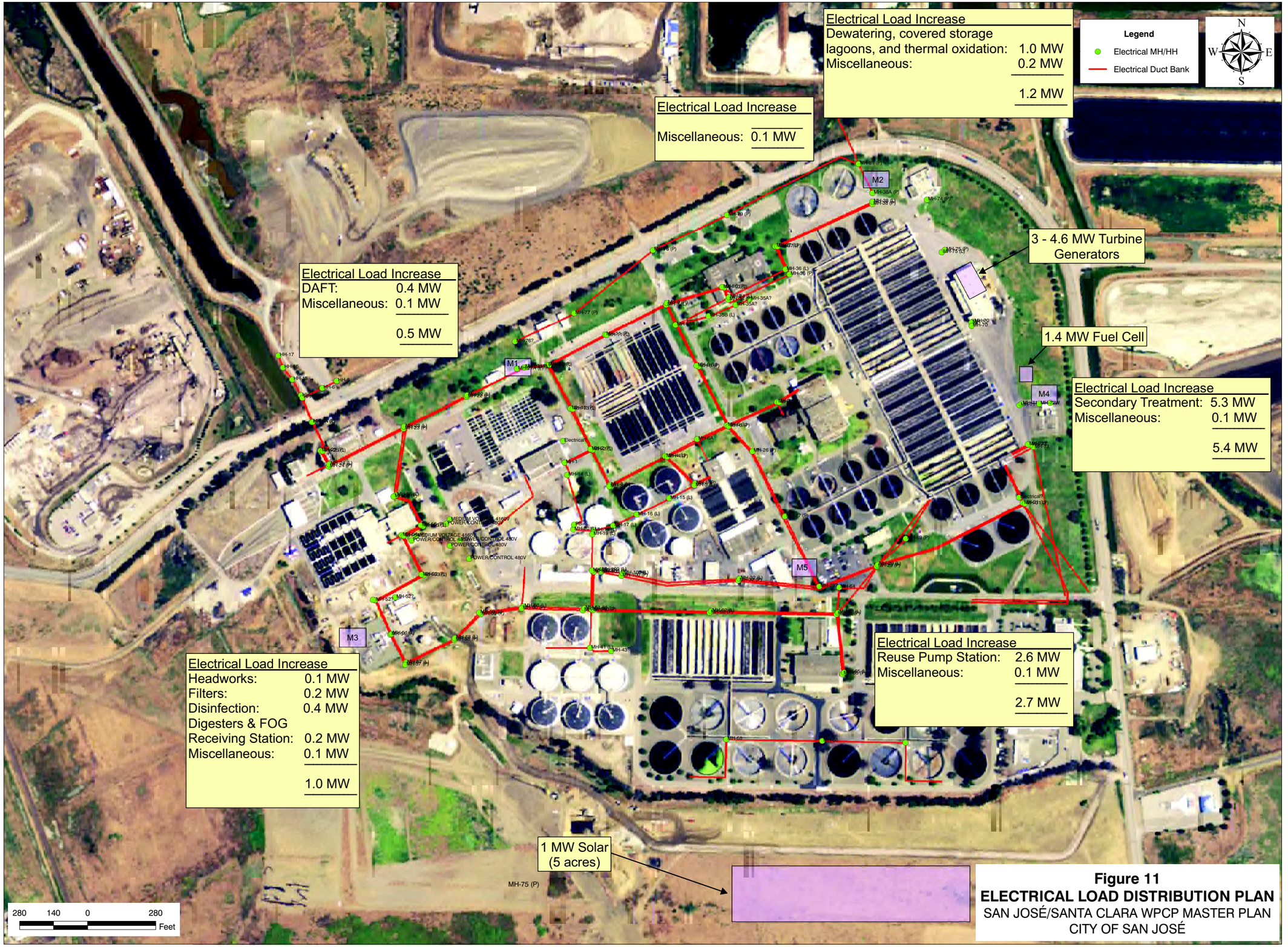

Figure 11
ELECTRICAL LOAD DISTRIBUTION PLAN
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Monday, August 22, 2011

The plant is currently in the process of a major electrical distribution system upgrade, including the improvements necessary to convert the existing 4.16 kilovolt (kV) electrical distribution system into a ring bus system[3]. The power increases are grouped and shown on the figure relative to the nearest switchgears (M1 through M5).

The power increases associated with future solids processing in the inactive lagoons area, have been shown separately since they will likely require a dedicated switchgear due to their location. Future analyses would be required to determine whether the new switchgear should be connected to the ring bus system, or be fed from the 22-kV line drop line currently supplying power to the RSM area.

[3] Electrical System Improvement Study Project, YEI Engineers, Inc., October 2004.

APPENDIX A – EXISTING SUPPORT FACILITIES

APPENDIX A – EXISTING SUPPORT FACILITIES

The following is a summary of the major support buildings floor areas at the WPCP.

Table A-1 Summary of Administration, Operations, Engineering and Training Square Footage
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function		Area (square ft)
Administration		
Administration Building	**Sub-Total**	**31,600**
Operations		
Disinfection Building		3,750
Chlorine Office Building		3,000
Filter Service Wing Building		6,400
Secondary Blower Building Service Wing		6,725
Sludge Control & Gas Compressor Building		8,500
P&E Building (Mezzanine)		5,060
Grit Building		1,744
Nitrification Service Building		6,400
Blower/Generation Building (Mezzanine)		12,600
Digestion Control Building		4,932
CIP/OIT Trailer a.k.a. Trailer A		3,600
RSM Operations Building		2,178
SBWR TPS		3,000
	Sub-Total	**67,889**
Engineering		
Environmental Services Building	**Sub-Total**	**32,500**
Training		
Training Center		2,016
Training Trailer a.k.a. Trailer B		1,440
	Sub-Total	**3,456**
	TOTAL	**135,500±**

Table A-2 Summary of Maintenance Square Footage
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Area (square ft)
Maintenance	
Wood Shop	3,500
Machine Shop/ Tube Cleaning Building	2,772
Maintenance Building	15,400
Vehicle Repair	7,100
AC Shop	3,200
Paint Building	6,700
Electric Cart Building (Electric Shop)	2,236
Electric Cart Building (Instrumentation)	2,236
RSM Lube/Oil Building (canopy area only)	1,500
RSM Wash Down Building (canopy area only)	1,540
TOTAL	**46,000±**

Table A-3 Summary of Storage/Warehouse Square Footage
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Area (square ft)
Storage/Warehouse	
Warehouse	21,000
South Aeration Building	1,890
Nitrification	544
Filtration	240
Cart Barn	200
Paint Shop	280
Tempco	5,832
West Primary (outside)	480
New Blower Building	2,100
Secondary Blower Building	1,300
Old Grits Building	3,820
Sludge Control	770
P&E	860
Maintenance	22,375
Butler Building	5,828
Electrical Shop Barn	1,200
TOTAL	**68,800±**

Note:
(1) Laydown area is an additional 40,000 square feet.

APPENDIX B – LARGE AGENCY SURVEY RESULTS

APPENDIX B – LARGE AGENCY SURVEY RESULTS

The following is a summary of the results of the large agency survey, which was sent out to eight wastewater treatment agencies with large treatment capacities. These agencies are:

1. City of Fresno, Regional Wastewater Reclamation Facility.
2. Los Angeles County Sanitation District (LACSD), Carson Joint Water Pollution Control Plant.
3. Denver Metro Wastewater Reclamation District, Robert W. Hite Treatment Facility.
4. East Bay Municipal Utility District (EBMUD), WWTP.
5. Orange County Sanitation District (OCSD), Fountain Valley WWTP.
6. Orange County Sanitation District (OCSD), Huntington Beach WWTP.
7. King County, West Point Treatment Plant.
8. King County, South Treatment Plant.

Responses have been received from the City of Fresno, LACSD, Denver Metro, King County (West Point Treatment Plant) and OCSD (both Fountain Valley and Huntington Beach WWTPs). EBMUD declined to complete the survey.

The survey was focused on obtaining information from the agencies in the areas of centralization versus decentralization of facilities, staffing, and square footage of existing support facilities.

Centralization vs. Decentralization

Table B-1 summarizes the centralized versus decentralized portion of the survey of the five agencies that responded.

Staffing Requirements

Based on the survey responses, it was also possible to compare the staffing of different support functions at large agencies. Table B-2 summarizes the staffing per mgd of treated average day annual flow (ADAF) for the support facilities. The values ranged from 0.70 to 2.98 employees per mgd of treated ADAF for the agencies surveyed, with an average of 2.04. However, one of the agencies was significantly lower than the other four, and was disregarded. The average of the four larger agencies was 2.3 employees per mgd of treated ADAF.

The National Association of Clean Water Agencies' (NACWA) "A National Survey of Municipal Wastewater Management Financing and Trends" indicates that the 2007 median for staffing is 3.3 employees per mgd of treated ADAF. This was based on a survey of

Table B-1 Summary of Large Agency Survey – Centralized vs. Decentralized
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Fresno RWRF	LACSD	Denver Metro	King County	OCSD	Majority of Survey Results
Operations	D	D	C	C	C	**C**
Administration	C	C	C	C	C	**C**
Maintenance	D	D	C	C	C	**C**
Engineering	C	C	C	C	D	**C**
Storage/Warehouse	C	C	C	C	C	**C**
Laboratory	C	C	C	C	C	**C**
Training	C	D	C	C	D	**C**
Laydown areas	C	D	D	C	D	**D**

Notes:
C – Centralized.
D – Decentralized.
C/D – Two respondents centralized, two respondents decentralized.

Table B-2 Summary of Large Agency Survey Staffing
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Fresno RWRF (staff/ mgd)	LACSD (staff/ mgd)	Denver Metro (staff/ mgd)	King County (staff/ mgd)	OCSD (staff/ mgd)	Average (staff/ mgd)
Operations	0.51	0.33	0.22	0.28	0.47	**0.36**
Administration	0.22	0.05	1.04	0.08	0.52	**0.38**
Maintenance	0.81	0.63	0.74	0.16	0.70	**0.61**
Engineering	0.12	0.04	0.27	0.10	0.85	**0.27**
Storage/Warehouse	0.04	0.01	0.04	0.02	0.13	**0.05**
Laboratory	0.16	0.16	0.44	0.04	0.20	**0.20**
Training	0.03	0.00	0.01	0.02	0.00	**0.01**
Other	0.19	0.04	0.21	0.0	0.00	**0.15**
Total	**2.09**	**1.27**	**2.98**	**0.70**	**2.86**	**2.04**

95 agencies. The staffing ratio for the WPCP is 2.4 employees per mgd of treated ADAF. This value, although lower than the median from the NACWA report, falls within the range of value of the other agencies surveyed.

However, for the purposes of estimating future staff needs, the current ratio of 2.4 employees per mgd of treated ADAF was not used. Instead a preliminary analysis was conducted based on process improvement needs. This analysis provides an estimate of additional staffing required for support operation and maintenance of upgraded facilities. Appendix E is a memorandum that shows the preliminary estimate for operations and maintenance staff needs. Based on the testing requirements for new and upgraded facilities, it is assumed for the purpose of this study that 2 additional laboratory staff personnel are required. In addition, based on feedback from plant staff, 5 additional engineering staff and additional training staff is assumed in the future. Table B-3 below shows a summary of the additional staff needs.

Table B-3 Summary of Additional Staff Needs
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Functions	**Additional Staff Required**
Operations	6(1)
Maintenance	7(1)
Laboratory	2(2)
Engineering	5(3)
Training	1(4)
Administration	2(4)
TOTAL	**23**

Notes:
(1) From Appendix E.
(2) Based on the anticipated increase in testing requirements for new and upgraded facilities.
(3) Based on City staff feedback.
(4) Based on anticipated requirements for new and upgraded facilities.

Therefore the staff projection for build-out is 321 employees. A more detailed staffing study would be required once the final 30-year CIP is established and selection of new and upgraded unit processes are more defined.

Space Allocation

Based on the survey responses, it was also possible to compare the square footage allocation per staff employee to different support functions at large wastewater treatment agencies. Although spaces that are used for offices are directly related to the number of employees, spaces related to warehousing, maintenance and laboratory functions are more

typically related to treatment capacity. Therefore, only spaces related to administration, operations, engineering, and training are evaluated on a space per staff employee basis.

The survey showed a wide variability in reported space allocation for these different functions. This is likely attributed to differences in how these spaces are defined from one agency to another. For example, in some cases, engineering functions are included in the space allocation for administration. Therefore, these functions were combined for space allocation determination.

Table B-4 shows a summary of the space per employee for the combined functions of operations, administration, engineering, and training based on information in the survey responses.

Table B-4 Summary of Large Agency Survey Space Allotment per Staff Employee
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Combined Support Functions	Fresno RWRF (sf/staff)	LACSD (sf/staff)	Denver Metro (sf/staff)	King County (sf/staff)	OCSD (sf/staff)	Average (sf/staff)
Operations/ Administration/ Engineering/ Training	1,144	583	687	1,650	880	**989**

Spaces related to maintenance, storage/warehousing and laboratory are evaluated on a space per treated flow basis. Table B-5 summarizes the space per mgd of treated ADAF for the surveyed facilities. From the responses received, there was a wide range in this value, which likely reflects differences in approaches from one agency to another. For example, laboratory space for the LACSD and King County plants was much lower than for the Fresno RWRF and Denver Metro. This could be because of the number of laboratory services that are outsourced, requiring a smaller in-house laboratory.

Table B-5 Summary of Large Agency Survey Space Allotment per Treated Annual Average Flow
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Support Function	Fresno RWRF (sf/mgd)	LACSD (sf/mgd)	Denver Metro (sf/mgd)	King County (sf/mgd)	OCSD (sf/mgd)	Average (sf/mgd)
Maintenance	182	287	510	96	421	**299**
Storage/Warehouse	203	45	250	40	378	**183**
Laboratory	147	58	433	16	176	**166**
Laydown areas	1,250	2,553	9,680	56	N/A	**1,794**

Certain functions such as laydown areas are very site specific and can vary drastically from one location to another depending on the agency philosophy of ordering and storage. Laydown area space should therefore be evaluated on a site-specific needs basis.

APPENDIX C – LARGE AGENCY SURVEY RESPONSES

APPENDIX C – LARGE AGENCY SURVEY RESPONSES

1. City of Fresno, Regional Wastewater Reclamation Facility
5. Los Angeles County Sanitation District (LACSD), Carson Joint Water Pollution Control Plant
6. Denver Metro Wastewater Reclamation District, Robert W. Hite Treatment Facility
7. King County, West Point Treatment Plant
8. Orange County Sanitation District (OCSD), Fountain Valley and Huntington Beach WWTP.

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Support Facilities Survey Questionnaire

1. Name of Plant : Regional Wastewater Reclamation Facility
2. Plant Location: 5607 W. Jensen Avenue, Fresno, CA 93706
3. Treated Annual Daily Average Flow , (mgd): 68 MGD
4. Design Annual Daily Average Flow , (mgd): 80 MGD
5. Current site location size, (acres) 2000 ACRES
6. Plans for future site expansion,(acres) NOT AT THIS TIME
7. List any support functions that are located off the treatment plant site:
   NORTH FRESNO SATTELITE PLANT

8. Please indicate your current support facilities information in the table below:

	No. of personnel	**Total existing square footage[3] (+/- 100 ft²)**	**Total number of buildings**	**Current Staff Distribution**	
				Centralized (C) or De-centralized (D)[1]	**Future Changes[3]**
Operations	35	2600	1	☑ C ☑ D	No
Administration[2]	15	12000	1	☑ C ☐ D	No
Maintenance	55	12400	2	☑ C ☑ D	No
Engineering	8	1360	1	☑ C ☐ D	No
Storage/Warehouse	3	13800	2	☑ C ☐ D	No
Laboratory	11	10000	2	☑ C ☐ D	No
Training	2	200	1	☑ C ☐ D	No
Lay down Areas		85000		☑ C ☐ D	No
Other, please specify: Environmental Control	13	1900	1	☑ C ☑ D	No

Notes:

(1) Applies to daily assignments.

(2) Includes offices, lockers, and lunch areas.

(3) If yes, provide any additional information in the space below or use additional pages if necessary.

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Support Facilities Survey Questionnaire

1. Name of Plant: Joint Water Pollution Control Plant

2. Plant Location: Carson, CA

3. Treated Annual Daily Average Flow, (mgd): 300 – pure oxygen secondary with ocean discharge

4. Design Annual Daily Average Flow, (mgd): 400

5. Current site location size, (acres) 294

6. Plans for future site expansion, (acres) NONE

7. List any support functions that are located off the treatment plant site:
   The Districts' main administrative office is NOT at the treatment plant.

8. Please indicate your current support facilities information in the table below:

	No. of personnel	Total existing square footage[3] (+/- 100 ft^2)	Total number of buildings	Current Staff Distribution	
				Centralized (C) or De-centralized (D)[1]	Future Changes[3]
Operations	98	7,100	3	D	No
Administration[2]	16	14,300	1	C	No
Maintenance	190	86,200	5	D	No
Engineering	12	*	*	C	No
Storage/Warehouse	3	13,600	1	C	No
Laboratory **	48	17,500	1	C	No
Training	***	1,380	2	D	No
Lay down Areas		766,000	N/A	D	No
Other, please specify: Buffer Area	N/A	2,395,500	N/A		No

Notes:

(1) Applies to daily assignments.

(2) Includes offices, lockers, and lunch areas.

(3) If yes, provide any additional information in the space below or use additional pages if necessary.

* Note: Engineers are in plant administrative building.

** Laboratory does analyses for more than just treatment plant.

*** Training done by plant engineering staff with assistance from staff at Districts' main administrative office.

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Support Facilities Survey Questionnaire

1. Name of Plant :Robert W. Hite Treatment Facility – Metro Wastewater Reclamation District
2. Location:6450 York St. Denver, CO 80229-7499
3. Treated Annual Daily Average Flow , (mgd): ~135 MGD
4. Design Annual Daily Average Flow , (mgd): 220 MGD
5. Current site location size, (acres) 140 acres. The campus is split by a river. The actual processing area is 100 acres, with Admin on the other 40 across the river.
6. Plans for future site expansion,(acres) None – but the site isn't built out yet. Roughly 20% is open.
7. List any support functions that are located off the treatment plant site:
   None. Facility is self-contained. As stated above, the administrative functions (Engineering, Records, etc) are on the 40 acre portion. All O&M, biosolids transport, warehouse/purchasing and lab services are on the 100 acre side.

8. Please indicate your current support facilities information in the table below:

	No. of personnel	**Total existing square footage[3] (+/- 100 ft²)**	**Total number of buildings**	**Current Staff Distribution**	
				Centralized (C) or De-centralized (D)[1]	**Future Changes[3]**
Operations	30	X	1	C	No
Administration[2]*	140	X	1	C	No
Maintenance	100**	X	2***	C	No
Engineering	36	X	1	C	No
Storage/Warehouse	6	X	1	C	No
Laboratory	60****	X	1	C	No
Training	2	X	1	C	No
Lay down Areas		30 acres	Contractor trailers	n/a	
Other, please specify: Resource Recovery and Reuse (RR&R) – biosolids handling and application *****	28	X **X = see site map**	1		

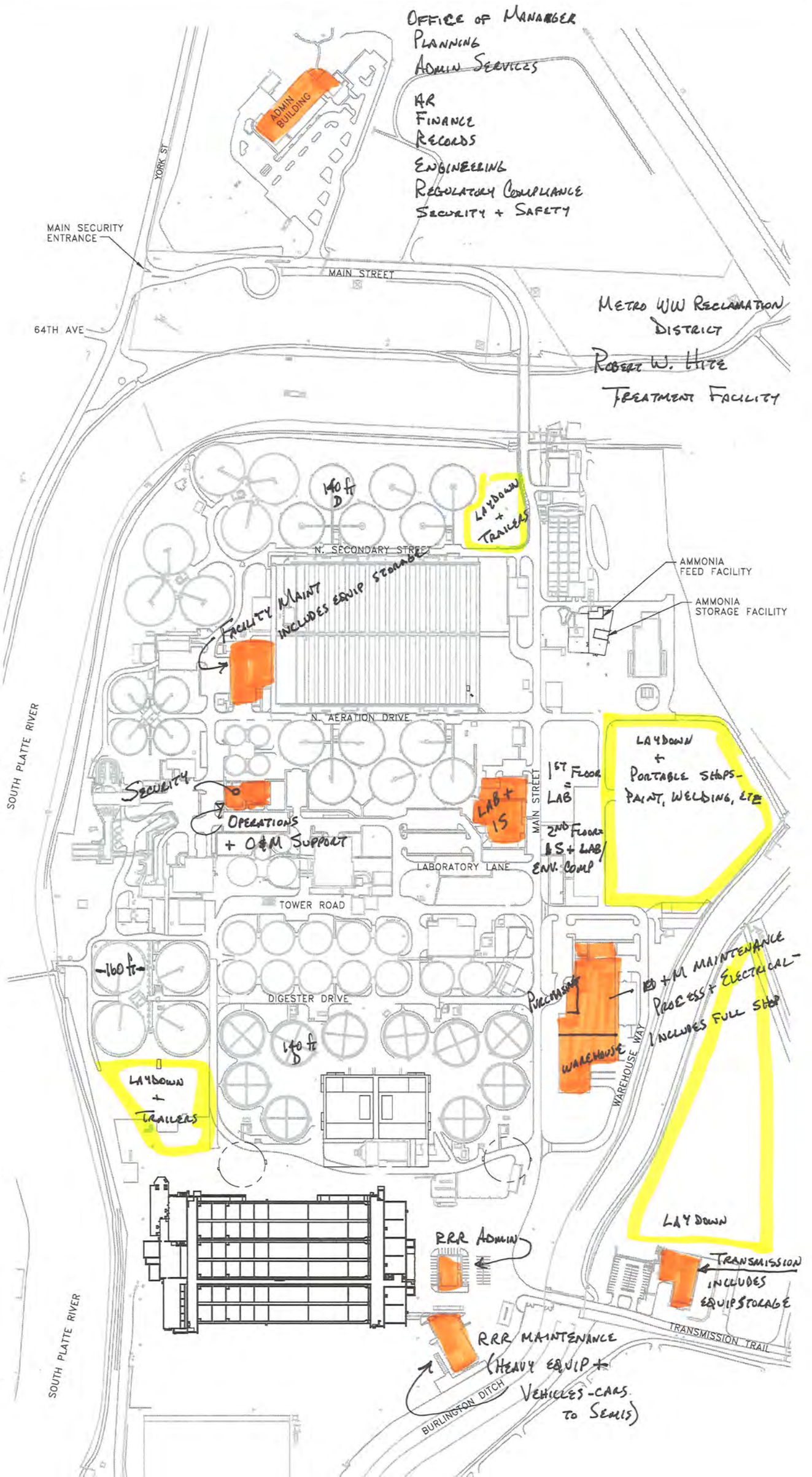
*=Admin services, Purchasing, Info Services, Planning, HR, Office of the Manager, Environmental Services (including pre-treatment

**= Process mechanics and supervisors = 20; Electrical Instrument Techs and supervisors = 14; Facility Laborers and supervisors = 25. Collections operators, maintenance and supervisors = 25; Biosolids field operators = 10. O&M support = 8.
** = Plant maintenance (process, facility, and electrical) is sited in one building along with the Purchasing/Warehouse. RRR performs all vehicle maintenance – from cars through heavy equipment.
**** Laboratory includes Environmental Services, Governmental Affairs, Pre-Treatment, Regulatory Compliance
*****= RRR mechanics and supervisors = 20;Support personnel (for Biosolids program) = 8

The O&M department consists of Treatment (nee Operations), Maintenance (facility, process and electrical), Transmission (Collections) and an O&M Support group (8 engineers and 2 admin assts).

Notes:
(1) Applies to daily assignments.
(2) Includes offices, lockers, and lunch areas.
(3) If yes, provide any additional information in the space below or use additional pages if necessary.

The District is planning an additional 24 MGD facility about 20 miles north of the existing. They are in the process of deciding how to administer, man and operate that facility. Carollo is the owner's rep on for Metro's Northern Treatment Plant.


OFFICE OF MANAGER
PLANNING
ADMIN SERVICES
HR
FINANCE
RECORDS
ENGINEERING
REGULATORY COMPLIANCE
SECURITY + SAFETY
ADMIN BUILDING
YORK ST
MAIN SECURITY ENTRANCE
MAIN STREET
64TH AVE
METRO WW RECLAMATION DISTRICT
ROBERT W. HITE TREATMENT FACILITY
140 ft D
LAYDOWN + TRAILERS
N. SECONDARY STREET
AMMONIA FEED FACILITY
AMMONIA STORAGE FACILITY
FACILITY MAINT INCLUDES EQUIP STORAGE
N. AERATION DRIVE
SOUTH PLATTE RIVER
SECURITY
OPERATIONS + O&M SUPPORT
LAB + IS
1ST FLOOR = LAB
2ND FLOOR = IS + LAB/ ENV. COMP
MAIN STREET
LABORATORY LANE
LAYDOWN + PORTABLE SHOPS- PAINT, WELDING, ETC
TOWER ROAD
160 ft
DIGESTER DRIVE
140 ft D
PUMPHOUSE
WAREHOUSE
WAREHOUSE WAY
E&M MAINTENANCE PROCESS + ELECTRICAL - INCLUDES FULL SHOP
LAYDOWN + TRAILERS
LAY DOWN
RRR ADMIN
TRANSMISSION INCLUDES EQUIP STORAGE
TRANSMISSION TRAIL
RRR MAINTENANCE (HEAVY EQUIP + VEHICLES - CARS TO SEMIS)
BURLINGTON DITCH
SOUTH PLATTE RIVER

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Support Facilities Survey Questionnaire

1. Name of Plant : West Point Treatment Plant
2. Plant Location: Seattle WA
3. Treated Annual Daily Average Flow , (mgd): 125 ; ~~330~~
4. Design Annual Daily Average Flow , (mgd): 133 ; 330 SECONDARY
5. Current site location size, (acres) 32
6. Plans for future site expansion,(acres) NO
7. List any support functions that are located off the treatment plant site:
   NONE
8. Please indicate your current support facilities information in the table below:

	No. of personnel	Total existing square footage[3] (+/- 100 ft²)	Total number of buildings	Current Staff Distribution	
				Centralized (C) or De-centralized (D)[1]	Future Changes[3]
Operations	35	~14,000		☑ C ☐ D	Yes/No
Administration[2]	10	~5,000		☑ C ☐ D	Yes/No
Maintenance	20	~12,000		☑ C ☐ D	Yes/No
Engineering	12	~5,000		☑ C ☐ D	Yes/No
Storage/Warehouse	3	5,000		☑ C ☐ D	Yes/No
Laboratory	5	2000		☑ C ☐ D	Yes/No
Training	3	1000		☑ C ☐ D	Yes/No
Lay down Areas		~7,000		☑ C ☐ D	Yes/No
Other, please specify:			2 Buildings total. 1 ~ 10,000 SF 1 ~ 40,000 SF	☑ C ☐ D	Yes/No

Notes:

(1) Applies to daily assignments.

(2) Includes offices, lockers, and lunch areas.

(3) If yes, provide any additional information in the space below or use additional pages if necessary.

NEW ADMINISTRATION Building 2011 ~ 5000 SF

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Support Facilities Survey Questionnaire

1. Name of Plant : Orange County Sanitation District
2. Plant Location: Plant 1: Fountain Valley, Plant 2: Huntington Beach
3. Treated Annual Daily Average Flow , (mgd): 207 Total Plant 1 & Plant 2
4. Design Annual Daily Average Flow , (mgd): 372 Total Plant 1 & Plant 2
5. Current site location size, (acres) Plant 1: 109.9 ac, Plant 2: 109.6 ac
6. Plans for future site expansion,(acres) N/A
7. List any support functions that are located off the treatment plant site:
   N/A

8. Please indicate your current support facilities information in the table below:

	No. of personnel	**Total existing square footage[3] (+/- 100 ft²)**	**Total number of buildings**	**Current Staff Distribution**	
				Centralized (C) or De-centralized (D)[1]	**Future Changes[3]**
Operations	97	22,482	2	☒ C ☐ D	Yes/No
Administration[2]	107	44,231	1	☒ C ☐ D	Yes/No
Maintenance	145	87,242	5	☒ C ☐ D	Yes/No
Engineering	175	41,170	10	☐ C ☒ D	Yes/No
Storage/Warehouse	27	78,330	4	☒ C ☐ D	Yes/No
Laboratory	41	36,360	1	☒ C ☐ D	Yes/No
Training		5,664	1	☐ C ☒ D	Yes/No
Lay down Areas		See Comments		☐ C ☒ D	Yes/No
Other, please specify: Human Resources Safety		 5,329 2,314	 1 1	☒ C ☐ D	Yes/No

Notes:

(1) Applies to daily assignments.z

(2) Includes offices, lockers, and lunch areas.

(3) If yes, provide any additional information in the space below or use additional pages if necessary.

Lay down areas: OCSD has multiple projects in construction, unable to determine exact lay down square footage at this time.

Maintenance: New centralized facilities for Collection Facilities O&M are being planned at Plant 1 for completion in 2011/2013? Facilities modifications for maintenance staff at Plant 2 will be done.

APPENDIX D – COST ESTIMATE FOR INCREASE IN SUPPORT FACILITIES AREA

APPENDIX D – COST ESTIMATE FOR INCREASE IN SUPPORT FACILITIES AREA

Table D-1 Cost Estimate for Increase in Support Facilities Area
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Description	Units	Current	Future
1	**Admin, Operations, Engineering, Training**			
	Admin, Ops, Eng, and Training Staff[1]	staff	151	165
	Space Allotment[2]	sf/staff	898	898
	Admin, Ops, Eng, Training Area	sf	135,500	148,200
	Increase in Area Required	sf		12,700
	Existing Admin Building (replace/relocate)	sf		31,600
	TOTAL AREA	sf		44,300
	Cost per sf[3]			$ 380
	TOTAL PROJECT COST			**$ 16,834,000**
2	**Maintenance**			
	Maintenance Area	sf	46,000	63,296
	ADAF	mgd	125	172
	Space Allotment[2]	sf/mgd	368	368
	Increase in Area Required			17,296
	Cost per sf[3]			$ 269
	TOTAL PROJECT COST			**$ 4,653,000**
3	**Storage/Warehouse**			
	Storage/Warehouse Area	sf	68,719	94,557
	ADAF	mgd	125	172
	Space Allotment[2]	sf/mgd	550	550
	Increase in Area Required			25,838
	Existing Warehouse (replace/relocate)	sf		21,000
	TOTAL AREA	sf		46,838
	Cost per sf[3]			$ 231
	TOTAL PROJECT COST			**$ 10,820,000**
4	**Laboratory**			
	Laboratory Area	sf	27,500	37,840
	ADAF	mgd	125	172
	Space Allotment[2]	sf/mgd	220	220
	Increase in Area Required			10,340
	Cost per sf[4]			$ 480
	TOTAL PROJECT COST			**$ 4,963,000**
	Total Cost for Future Support Facilities Area			**$ 37,270,000**

Notes:
(1) Future staffing is based on increases as follows: Admin = 2; Ops = 6; Engineering = 5; Training =1. See Table B-3.
(2) See Table 3.
(3) See Table D-3.
(4) See Table D-2.

Table D-2 RS Means - Data
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Office[2]	Research Laboratory
Direct Unit Cost[1]	$ 155/ft^2	$ 198/ft^2
Square Foot Modifier[1]	0.9	1.1
ENR-CCI	1.171	1.171
Construction Estimating Contingency	15%	15%
Contingency	25%	25%
Engineering, Legal Administration and Construction Management	30%	30%
Project Unit Cost	$ 305/ft^2	$ 480/ft^2

Notes:
(1) From 2011 R.S. Means Catalogue.
(2) For comparison/check only. Not used in determining project costs.

Table D-3 Summary of Building Costs from Reference Projects
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Facility	Location	Description of Building	Size of Building (ft^2)	Engineer's Estimate ($)	Actual SOV ($)	Unit Cost ($/$ft^2$)	Year of Costs	Comments
1	Central County Water Reclamation Facility	Sarasota, FL	Administration Building	4,500		$ 579,700	$ 129	2011	Single story, slab on grade. Reinforced CMU wall. Metal joist and deck with single-ply membrane roof.
2	City of Austin's Water Plant 4	Austin, TX	Administration/ Control Building	8,600		$ 3,863,000	$ 449		LEED Silver building with some extra features like low flow plumbing fixtures, water-source heating and cooling, and rainwater storage tanks for landscape irrigation.
3	Jennings Road WWTP	Modesto, CA	Administration/ Operations	6,400	$ 2,932,343		$ 458	2011	Single story building. 8-inch CMU walls.
4	Jennings Road WWTP	Modesto, CA	Maintenance	3,500	$ 1,045,547		$ 299	2012	Single story building. 8-inch CMU walls.
5	Pleasant Grove WWTP	Roseville, CA	Administration/ Maintenance	8,415		$ 2,900,297	$ 345	2000	Single story building.
6	Perris Water Treatment Plant	Riverside, CA	Control Building: Control and Electrical Room	2,896		$ 851,268	$ 294	2002	Single story building. No interior offices, lab space, bathrooms.
7	San Jacinto Plant 2 Expansion	San Jacinto, CA	Operations and Maintenance	11,330		$ 1,841,000	$ 162	2010	

Table D-3 Summary of Building Costs from Reference Projects
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Facility	Location	Description of Building	Size of Building (ft^2)	Engineer's Estimate ($)	Actual SOV ($)	Unit Cost ($/$ft^2$)	Year of Costs	Comments
8	Moapa Valley Water Resource Center	Moapa Valley, NV	Operations Building	1,400		$ 1,282,000	$ 916	2009	It houses an electrical room, storage room, and a lab/office with shower, restroom, and mechanical room.
						Average	$ 381		
			Control Building Average				$ 294		
			Operations Building Average				$ 456		
			Maintenance Building Average				$ 269		
			Combined Administration/Operations Building Average				$ 380		
			Storage				$ 231		

APPENDIX E –FACILITY OPERATIONS AND MAINTENANCE STAFFING INTEROFFICE MEMORANDUM

San Jose/Santa Clara Water Pollution Control Plant

Facility Operations and Maintenance - Staffing

To: Allan Briggs, P.E.

From: Steve Walker, Senior Operations Specialist

Date: June 7, 2011 Project No.: 7897A.00

Subject SJSCWPCP Facility Operations and Maintenance - Staffing

Introduction

The purpose of this memorandum is to estimate the additional staffing requirements required to support operation and maintenance of upgraded and additional facilities at the San Jose/Santa Clara Water Pollution Control Plant. These include odor control facilities, FOG receiving, dissolved air flotation, mechanical solids dewatering, drying and greenhouse facilities, upgraded digesters, new cogeneration engines and a fuel cell, more complicated secondary treatment, and UV disinfection.

Assumptions

This estimate addresses the staffing levels to adequately perform work that results from upgraded and additional facilities only. It does not address adequacy of current staffing levels for the existing plant.

The plant is currently for staffed for the following hours:

- Operators work an 8-hour shift, 24/7coverage with full staffing on each shift.
- Maintenance (Mechanical, Electrical, and Facilities) - work an 8-hour shift M-F.
- Maintenance (Mechanical and Electrical) – skeleton crew during off shifts and on weekends.

Typical operations personnel responsibilities include:

- Inspect process equipment. Operators conduct rounds that require them to evaluate equipment and components used in each unit process area. This typically entails using a log sheet or PDA to record observations such as run time, pressures, temperatures, and the like.
- Conduct process optimization. Operators make adjustments based on observation, testing and analysis, and following directives to optimize unit process performance.
- Samples the unit processes. The operators take samples to verify and optimize unit process performance and comply with permit criteria.
- Perform typical process control analyses on the unit processes. Operators conduct some lab analyses to establish unit process performance, populate databases for permit compliance.

- Perform minor maintenance. Operators complete housekeeping tasks such as scum removal or general cleanup and minor equipment maintenance.

Typical maintenance personnel responsibilities include:

- Mechanical: Conduct major and minor repair and replacement of equipment and piping. Complete preventative maintenance tasks as scheduled.
- Electrical: Conduct major and minor repair and replacement of electrical equipment and systems such as motors and controls. Conduct calibration and replacement of instrumentation and analyzers. Maintain process control system. Complete preventative maintenance tasks as scheduled.
- Facilities: Conduct major and minor activities such as building maintenance, process structure cleaning, painting, grounds and housekeeping. Complete preventative maintenance tasks as scheduled.

Liquid Stream

The liquid stream unit processes are upgraded with:

- Odor control on the headworks and primaries.
    - For plant operators: The system requires a minimum of once per shift inspection. A general assessment of equipment, chemical feed systems, and working pressures should occur.
    - For maintenance personnel: Preventative maintenance tasks and time as suggested by the manufacturers and suppliers. Corrective maintenance should be minimal on the new equipment. Facilities maintenance will be required to maintain these new facilities as required to meet the desired service life.
    - Chemical shipments will have to be handled.

- More complicated secondary process control.
    - For plant operators: Process inspection time will remain comparable, but data assessment and optimization time may increase. Process sampling and analysis may increase depending on in situ samplers and analyzers and volume of readings and values desired. Minor maintenance should be comparable to the existing workload.
    - For maintenance personnel: Mechanical maintenance tasks and time required should be comparable to the current workload. Electrical maintenance preventative maintenance tasks and time are tied to the amount and complexity of in situ analyzers and control systems. Corrective maintenance should be comparable to the existing workload.
    - Lab analyses will be required to substantiate process optimization efforts.

- Disinfection by UV.
    - For plant operators: The system requires a minimum of once per shift inspection due to its impact on permit compliance. Time to complete an evaluation of the equipment and record operating data will be comparable to the previous disinfection method.
    - For maintenance personnel: Mechanical and electrical maintenance tasks will be comparable to or less than the previous system, depending on effluent clarity and subsequent impact on bulb maintenance. Facilities maintenance will be required to maintain these new facilities as required to meet the desired service life.

Solids Stream

The solids stream unit processes are upgraded with:

- Dissolved Air Flotation thickening with support equipment, including odor control.
    - For plant operators: The thickeners will require attention periodically throughout a shift to inspect, operate and optimize. The polymer makedown system will require attention. Minor maintenance will include keeping the polymer system working.
    - For maintenance personnel: Preventative mechanical and electrical maintenance tasks and time should follow the manufacturer's recommendations. Corrective maintenance should be minimal on the new equipment, but the instrumentation and controls will require consistent attention to maintain operability required for process optimization. Facilities maintenance will be required to maintain these new facilities as required to meet the desired service life. The polymer system will require attention to minimize safety related issues typical to these chemicals.
    - Chemical shipments will have to be received.
    - Lab analyses will be required to substantiate process optimization efforts.

- FOG receiving station.
    - For plant operators: The offloading and transfer equipment may require a visual inspection at least once per shift. Operator assistance may be periodically required to assist the haulers. FOG shipments may require sampling, depending on pretreatment policies. It is probable that staff (operators or facilities maintenance) will have to clean the rock traps, screens, and catch basins/drains periodically.
    - For maintenance personnel: Preventative maintenance tasks and time should follow the manufacturer's recommendations. Corrective maintenance may be fairly high due to the variability in FOG shipments. Facilities maintenance will be required to maintain these new facilities as required to meet the desired service life.
    - Lab analyses may be required to crosscheck hauler manifests.

- New cogeneration engines and a fuel cell with support equipment.
    - For plant operators: The fuel cell, engines and support equipment will require visual inspection at least once per shift.
    - For maintenance personnel: Cogeneration engines that fire on digester gas require a high level of maintenance to provide consistent performance. Diligent electrical maintenance is required to ensure these systems are operating and can disconnect safely. Preventative maintenance tasks and time for both the mechanical and electrical components should follow the manufacturer's recommendations. Corrective maintenance should be minimal on the new equipment. A focused oil analysis program is recommended. The lubricant vendor can typically supply or recommend the service. Facilities maintenance will be required to maintain these new facilities as required to meet the desired service life.
    - Air permit compliance must be confirmed through lab analyses.

- New mechanical dewatering, drying and greenhouse facilities, including odor control.

- For plant operators: Process optimization may require significant attention. The dryness of dewatered biosolids impacts disposal costs. Entrained solids in the centrate can impact liquid stream processes and permit compliance. Staff will have to handle the chemical shipments. The polymer makedown system will require attention. Minor maintenance will consist of cleanup and washdown and keeping the polymer system working.
- For maintenance personnel: Preventative mechanical and electrical maintenance tasks and time should follow the manufacturer's recommendations. Corrective maintenance should be minimal on the new equipment, but the instrumentation and controls will require consistent attention to maintain operability required for process optimization. Facilities maintenance will be required to maintain these new facilities as required to meet the desired service life. The polymer system will require attention to minimize safety related issues typical to these chemicals. Greenhouse duties will likely be handled by facilities staff.
- Chemical shipments will have to be received.
- Lab analyses will likely increase as required to substantiate both process optimization efforts and permit compliance.

Table 1 suggests minimum time requirements – shown as a portion of an 8-hour shift - to complete daily operation of the new or upgraded equipment. Previous experience, typical work structuring, or the desired level of service may result in an adjustment of these estimates. Fractions indicate that a portion of a shift would be dedicated to that process area. The existing work load is not accounted for.

Table 1 Minimum Time Requirements for						
Unit Process	**Process Change**	**Additional Operators per shift**	**Total number of Operations staff**	**Additional Maintenance staff by craft – Mechanical, Electrical Instrumentation and Facilities**		
				M	**E**	**F**
Headworks	New odor control	1/ 4	3/ 4	1/ 8	1/ 4	1/ 3
Primaries	New odor control	1/ 4	3/ 4	1/ 8	1/ 4	1/ 3
FOG	New receiving station	1/ 8	3/ 8	1/ 4	1/ 8	1/ 3
DAF	New process	1/ 4	3/ 4	1/ 2	1/ 4	1/ 3
Solids Handling	New mechanical dewatering, drying and greenhouse facilities	1/ 2	1.5	1	1/ 4	1/ 3
Digesters	Upgraded units	1/ 8	3/ 8	0	1/ 8	0
Power Generation	New engines and Fuel Cell	1/ 8	3/ 8	1	1/ 4	1/ 3
Secondary	More complicated process control to meet more stringent limits	1/ 4	3/ 4	0	1/ 4	0
Blower Complex	No change	0	0	0	0	0
Filters	No change	0	0	0	0	0
UV	New process	1/ 8	3/ 8	0	1/ 4	0
Recycle water	No change	0	0	0	0	0
Operations Sub-Total		**2**	**6**			
Maintenance Sub-total				**3**	**2**	**2**
TOTAL Operations and Maintenance staff increase						**13**

Discussion

The table reflects an 8-hour per day work load. Some of the tasks may take less than indicated to complete. The actual completion time will vary by the diligence of the staff, items that divert attention, and other time demands.

Recommendations

1. Increase operations staff by six.
2. Increase mechanical maintenance staff by three.
3. Increase electrical maintenance staff by two.
4. Increase buildings and grounds staff by two.
5. Additional lab techs may also be required. New or upgraded processes should be measured to determine performance and optimization success. More stringent requirements and increased expectations to reduce budget constraints require more comprehensive process analyses.

Other Considerations

It is a good practice to ensure there is enough operations and maintenance personnel to adequately address issues that can arise during start-up and optimization of new processes and equipment, plus complete the existing workload. Training during start-up will require additional hours. Staff will be developing familiarity with the processes, equipment and maintenance frequencies. The workforce can be resized through attrition over time.

It is recommended that all work efforts be examined periodically. Items to evaluate include:

- Does the work still have value?
- Is the frequency adequate?
- Is the work redundant?
- Can procedures can be streamlined or modified to best use the available resources?
- Is the desired level of service being delivered?