FINAL REPORT

Asset Management Program Audit

San Francisco Public Utilities Commission Operation and Maintenance Programs

PREPARED FOR

Bay Area Water Supply & Conservation Agency

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WEST YOST ASSOCIATES

Asset Management Program Audit

San Francisco Public Utilities Commission
Operation and Maintenance Programs

Prepared for

Bay Area Water Supply & Conservation Agency

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List of Acronyms and Abbreviations

AMP	Asset Management Plans
BAWSCA	Bay Area Water Supply & Conservation Agency
CalWARN	California Water/Wastewater Agency Response Network
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
CM	Corrective Maintenance
CMMS	Computerized Maintenance Management Systems
COF	Consequence of Failure
DSOD	California Department of Water Resources Division of Safety of Dams
EPA	Environmental Protection Agency
GIS	Geographical Information Systems
HHWP	Hetch Hetchy Water and Power
IIMM	Institute of Public Works Engineering Australasia
IPWEA	International Infrastructure Management Manual
IT	Information Technology
KPI	Key Performance Indicators
LOF	Likelihood of Failure
LOS	Level of Service
O&M	Operation and Maintenance
PCCP	Pre-stressed Concrete Cylinder Pipe
PdM	Predictive Maintenance
PM	Preventative Maintenance
R&R	Renewal and Replacement
RRA	Risk Resiliency Assessment
RUL	Remaining Useful Life
SFPUC	San Francisco Public Utilities Commission
SOP	Standard Operating Procedure
West Yost	West Yost Associates
WSIP	Water System Improvement Program
WST	Water Supply and Treatment

1.0 EXECUTIVE SUMMARY

The Bay Area Water Supply & Conservation Agency (BAWSCA) retained West Yost Associates (West Yost) to evaluate and audit the processes, systems, and tools used to support asset management efforts at the San Francisco Public Utilities Commission (SFPUC) for two of its divisions. The divisions are the Hetch Hetchy Water and Power (HHWP) Division, responsible for operating the Hetch Hetchy Regional Water System east of Tesla; and the Water Supply and Treatment (WST) Division, responsible for operating the Hetch Hetchy Regional Water System at Tesla and west of Tesla. This report documents West Yost's audit criteria, assessment scoring methodology, data reviewed, staff interviews, and evaluation performed to form an opinion regarding the current state of the SFPUC asset management program.

This final report incorporates comments received from SFPUC on the Draft Report dated March 2020. Comments and West Yost response to comments are included in Appendix A.

1.1 Audit

The Environmental Protection Agency (EPA) addresses asset management with five simple questions.

- What is the current state of my assets?
- What is my required level of service?
- Which assets are critical to sustained performance?
- What are my best Operation and Maintenance (O&M) and Capital Improvement Plan (CIP) investment strategies?
- What is my long-term funding strategy?

These five questions yield several key elements of asset management that must be applied over the lifecycle of an asset. These include:

- Asset Registry
- Asset Risk: Criticality and Condition
- Service Level
- Maintenance Planning
- Life Cycle Cost Analysis
- Replacement Planning
- Business Processes
- Data Systems and Software Tools
- Staffing Plan

For this asset management audit, West Yost grouped these elements into 10 primary criteria. Table ES-1 presents a summary of the criteria.

Table ES-1. Criteria Summary

Criterion	Description
Asset Registry	A hierarchical asset registry supports asset location and the rolling up of performance such as cost, work, etc. and has a structured classification domain that includes defining attributes. It is the cornerstone of an asset management program and addresses the first of EPA's five questions which is to know your assets. This criterion evaluates the state of the asset register and its support of asset management objectives.
IT Capabilities to Support Asset Management	Information systems are an essential tool set in asset management programs. This criterion evaluates support systems for asset management software tools.
Risk Procedures	Risk in utility asset management considers the likelihood an asset may not perform at its intended service level, causing an adverse impact to the utility and the consequence of the asset failing. Risk must be addressed as part of a maintenance and asset renewal program. This criterion evaluates the use of risk policies to support decision-making.
Operation and Maintenance	O&M is a process of providing inspection and service to an asset to achieve its prescribed useful life and must be optimized so as to not over- or under-manage the asset. This criterion evaluates the use of business processes, data collection, and maintenance practices to support asset management.
Condition Assessment and Remaining Useful Life	Understanding where an asset is in its life cycle is essential to understanding when to apply renewal efforts. This criterion evaluates the monitoring of asset remaining useful life in decision-making.
Replacement Planning	Replacement planning addresses the last of the EPA's asset management questions and includes strategies for setting aside the needed funding for asset renewal. This criterion evaluates if processes are in place for long-term funding of asset refurbishment and replacement.
Service Level	One of the considerations in utility asset management is the acceptance that not all assets serve the same mission nor have the same criticality and, as such, must be managed to perform at a desired level of service. This criterion evaluates the practice of using required service level to optimize decision-making.
Connection to Other Plans	Utilities operate based on plans and visions adopted by their governing board and other senior management. These plans must be coordinated and consistently applied. This criterion assesses the level to which asset management activities are influenced by relevant agency plans.
Supply Chain	Supply chain for a utility is the management of the materials consumed for its day-to-day and year-to-year operation. Many efficiencies may be gained or lost due to improper materials management practices. This criterion evaluates supply chain practices to support asset management and improves work efficiencies.
Staffing to Support Asset Management	An asset management program relies on many roles and disciplines to implement the measures describes above. This criterion evaluates staffing levels to support asset management.

Each of the criteria were evaluated on a five-level capability maturity model (shown in Table ES-2 below), similar to that used by the Institute of Public Works Engineering Australasia (IPWEA) which produces the International Infrastructure Management Manual (IIMM). The five-level model used in this audit represents a more practical interpretation for the water industry.

Table ES-2. Capability Maturity Model

Level	Description
Initial[c]	Processes are disorganized, even chaotic. Success is likely to depend on individual efforts and is not considered to be repeatable, because processes would not be sufficiently defined and documented to allow them to be replicated.
Repeatable[a]	Basic project management techniques are established, and successes could be repeated, because the requisite processes would have been made established, defined, and documented.
Defined[d]	An organization has developed its own standard process through greater attention to documentation, standardization, and integration.
Managed[b]	An organization monitors and controls its own processes through data collection and analysis.
Optimized[e]	Processes are constantly being improved through monitoring feedback from current processes and introducing innovative processes to better serve the organization's particular needs.

(a) Basic project management techniques are established, and successes could be repeated because the requisite processes would have been made established, defined, and documented.
(b) An organization monitors and controls its own processes through data collection and analysis.
(c) Processes are disorganized, even chaotic. Success is likely to depend on individual efforts, and is not considered to be repeatable, because processes would not be sufficiently defined and documented to allow them to be replicated.
(d) An organization has developed its own standard process through greater attention to documentation, standardization, and integration.
(e) Processes are constantly being improved through monitoring feedback from current processes and introducing innovative processes to better serve the organization's particular needs.

1.2 Scope of Review

To support our analysis, West Yost requested and received a variety of information from each Division. The information received and reviewed is outlined in Section 4 of this report.

West Yost also met with staff in both the HHWP and WST Divisions of the SFPUC in January 2020 to discuss each of the 10 evaluation criteria. The discussion related specifically to each division's individual asset management practices. Both divisions utilize Maximo by IBM for a Computerized Maintenance Management System (CMMS).

West Yost met collectively with Margaret Hannaford, Scott Riley, and Cheryl Sperry of the HHWP Division on January 22, 2020 to review a series of questions that support the evaluation criteria and discuss the HHWP asset management program.

West Yost then met collectively with Angela Cheung, Edward Forner, and Annie Li of the WST Division on January 24, 2020 to review the same set of questions. Detailed information pertaining to the staff interviews is located in Section 5 of this report.

1.3 Conclusions and Recommendations

1.3.1 Conclusions

Based on a review of data and documents provided by WST and HHWP, West Yost finds that SFPUC embraces the basic principles of asset management within its WST and HHWP Divisions. Guiding policy and direction exists at the management level but WST and HHWP are at different levels of implementation and, in some areas, are not consistent in their implementation of certain principles listed below.

- Management direction for asset management is strong and is captured in the 2018 State of the Regional Water Supply Report and the 2020 Strategic Plan. Specific objectives included in both documents include:
  - Establishing quantifiable operational and capital Level of Service (LOS) goals by enterprise.
  - Formalizing the asset management approach across SFPUC.
  - Establishing a uniform investment prioritization process linked to asset management priorities across SFPUC.
  - Ensuring SFPUC can mitigate, respond to, and recover from threats and disasters.

The summary assessment based on the capability maturity model is presented in Table ES-3.

Table ES-3. Summary Assessment

Criterion	HHWP	WST	Conclusions
Asset Registry	Repeatable[(a)]	Repeatable	Asset registries are reportedly nearly complete but there is no process in place to regularly update the registries and staffing levels do not support routine asset reviews.
IT Capabilities to Support Asset Management	Managed[(b)]		IT tools and systems are current and provide proper support to asset management technology tools.
Risk Procedures	Initial[(C)]	Initial	Risk policies exist, yet both HHWP and WST report little to no risk assessments being performed. HHWP is embarking on a strong implementation of asset management programs including preparation of a risk assessment protocol and a series of asset management plans. The use of Maximo could be extended to capture risk and asset performance data for improved, data-centered decision-making.
Operation and Maintenance	Repeatable	Repeatable	Maintenance practices are developed, and maintenance is being performed.
Condition Assessment and Remaining Useful Life	Repeatable	Initial	Institutional knowledge is relied on significantly. Staff reports that a more data-centric structure is desired and would benefit planning and O&M. Remaining useful life is not measured, making it difficult to forecast replacement and rehabilitation needs beyond just a few years.
Replacement Planning	Repeatable	Repeatable	Replacement planning is performed during biennial project planning and budgeting but does not incorporate a structured platform of risk in the decision-making. Although collaboration exists between Divisions, decisions appear to be made based on institutional knowledge.
Service Level	Repeatable	Initial	A structured service level objective is not in place. Without a service level objective, certain assets or facilities may be over- or under-maintained.
Connection to Other Plans	Initial	Repeatable	There is some development of strategies at HHWP to develop asset management protocols in conformance to the 2018 State of the Regional Water System Report.
Supply Chain	Defined[(d)]	Defined	Supply Chain management is prescribed, and methods exist.
Staffing to Support Asset Management	Defined	Defined	Staffing functions to support asset management are defined.

(a) Basic project management techniques are established, and successes could be repeated because the requisite processes would have been made established, defined, and documented.
(b) An organization monitors and controls its own processes through data collection and analysis.
(c) Processes are disorganized, even chaotic. Success is likely to depend on individual efforts, and is not considered to be repeatable, because processes would not be sufficiently defined and documented to allow them to be replicated.
(d) Defined = An organization has developed its own standard process through greater attention to documentation, standardization, and integration.
(e) Optimized = Processes are constantly being improved through monitoring feedback from current processes and introducing innovative processes to better serve the organization's particular needs.

1.3.2 Recommendations

West Yost has developed recommendations for enhancements to the SFPUC Asset Management Program. This Phase 1 audit represents a qualitative evaluation of the principles and practices at SFPUC. It was based on a review of an assembly of documents provided by SFPUC and staff interviews and identified preliminary areas that could be improved to yield efficiencies that will result in long term life-cycle cost reductions. Many of these recommendations are currently being implemented by HHWP in its efforts to address risk and will take time to complete. West Yost did not assess staffing levels, so that element is excluded from our recommendations. Recommendations to improve the asset management program at SFPUC are presented below.

1.3.2.1 Enhancements to SFPUC's Current Asset Management Planning

- Develop a uniform approach to risk assessment including consequence of failure and likelihood of failure definition, risk definition, and risk thresholds and develop a policy for application across the entire utility. This can be achieved by completing the development of the risk framework and risk assessment tool for HHWP and including WST.
- WST join in the ISO-55001 Gap Analysis and asset management planning that HHWP is conducting.

1.3.2.2 Near Term, Within One to Three Years

- Combine all work and asset management standards for application to HHWP and WST uniformly. Abolish standards and procedures specific to one Division.
- Develop a policy and process to review the asset registry in Maximo for accuracy. Maximo should have current, existing assets properly classified and documented with appropriate attributes. It is recommended SFPUC perform a review and update of its asset registry at approximately five-year intervals.
- It is recommended SFPUC look for opportunities to align its asset hierarchy, classification and attributes for both HHWP and WST. Formalizing the asset management approach uniformly across the utility was mentioned in the Fiscal 2020 Strategic Plan Asset Management Objectives. Further a unified approach provides: 1) greater overall collaboration between staff when both systems use the same configuration. , 2) consistent classifications and attributes allow for shared data and metrics such as profiling equipment failure, equipment standards sharing of inventory stores, and 3) a unified standard can be more efficient to develop and maintain than separate standards for the same segment of the system.
- Review and update current asset definition policy. Policy should consider not only asset value but asset criticality and maintenance requirements. While SFPUC manages LOTO through its existing regulatory and safety policies, SFPUC should consider also including LOTO in the asset definition policy.
- Develop a uniform policy and business processes for work management, asset creation and modification, and work prioritization. This uniform policy should be developed as a utility standard for application to HHWP and WST collectively.

1.3.2.3 Long Term, Within Three to Five Years

- Evaluate asset criticality at least every 5 years, after a major CIP or when a significant modification to a system is implemented.
- Maintain a risk register in Maximo noting the total risk score and the criticality and condition score. This can be addressed simply using the asset hierarchy with criticality evaluated at the process or subprocess level with child assets inheriting the criticality. Condition can then be evaluated for assets with higher criticality.
- Configure Maximo for automated workflow processes for work and maintenance where minimum data collection points are required and where process efficiencies may be increased.
- Develop a policy and method for estimating remaining useful life.
- Develop a replacement planning program to forecast asset renewal needs and costs. Link this forecast to the establishment of utility rates. Use this forecast to inform CIP planning efforts.
- Implement the Fiscal 2020 Strategic Plan Asset Management Objectives to develop LOS criteria and goals and connect maintenance planning with LOS requirements by asset. LOS goals can be inherited from higher process or subprocess levels in the asset hierarchy to reduce the analysis required.
- Implement the Fiscal 2020 Strategic Plan Asset Management Objectives to develop a uniform investment process linked to asset management priorities across the utility.
- Implement the Fiscal 2020 Strategic Plan Asset Management Objectives to formalize the asset management approach across the utility uniformly.
- Develop a formal warehouse management plan to be applied to both HHWP and WST. The plan should renew business processes and policies for inventory counts and reconciliation, establish procedures for maintaining critical spare parts that can be shared between HHWP and WST.
- Evaluate spare parts lists and begin stocking spare parts in the warehouse for asset maintenance work.
- Eliminate the practice of undocumented storerooms with “invisible” inventory that is not valued or carried in the finance ledger.

1.3.2.4 BAWSCA Phase 2 Audit Recommendations

- Evaluate SFPUC’s use of Maximo as a work and asset management tool. This includes evaluating Maximo’s asset registry, maintenance management, supply chain, workflow, and other modules.
- Participate in the HHWP effort to complete the ISO-55000 gap analysis and establish asset management plans, risk management policies, and the risk management tool. This will allow BAWSCA to follow the development of the program versus waiting for a post-implementation review and will keep BAWSCA informed of progress towards completion of the gap analysis and SFPUC asset management principles and policies.

2.0 BACKGROUND

The San Francisco Public Utilities Commission (SFPUC) provides retail drinking water and wastewater services to the City of San Francisco, wholesale water to three Bay Area counties, green hydroelectric & solar power to Hetch Hetchy electricity customers, and power to the residents & businesses of San Francisco through the CleanPowerSF program. SFPUC's mission is to provide customers with high quality, efficient and reliable water, power, and sewer services in a manner that is inclusive of environmental and community interests, and that sustains the resources entrusted to its care. The SFPUC manages the Hetch Hetchy Regional Water System, which includes the infrastructure that delivers the water supply to the 26 Bay Area Water Supply and Conservation Agency (BAWSCA) member agencies.

BAWSCA Member Agencies

- Alameda County Water District
- California Water Service
- City of Brisbane
- City of Burlingame
- City of Daly City
- City of East Palo Alto
- City of Hayward
- City of Menlo Park
- City of Millbrae
- City of Milpitas
- City of Mountain View
- City of Palo Alto
- City of Redwood City
- City of San Bruno
- City of San Bruno
- City of San Jose
- City of Sunnyvale
- Coastside County Water District
- Estero Municipal Improvement District
- Guadalupe Valley Municipal Improvement District
- Mid-Peninsula Water District
- North Coast County Water District
- Purissima Hills Water District
- Stanford University
- Town of Hillsborough
- Westborough County Water District

The SFPUC is relied upon to manage its infrastructure assets for sustainable performance. Asset Management can be defined as the balancing of costs, risks, opportunities, and level of service (LOS) to achieve the optimum performance value of a utility's infrastructure. This involves the collection and maintenance of asset related data to make data-driven decisions. It also involves multi-divisional and multi-agency team collaboration and transparency of the decision-making efforts and the programs that support them to promote confidence and partnership within SFPUC and the broad BAWSCA stakeholder base.

BAWSCA retained West Yost Associates (West Yost) to evaluate and audit processes, systems, and tools used to support asset management efforts at SFPUC for its Hetch Hetchy Water and Power (HHWP) Division, responsible for operating the Hetch Hetchy Regional Water System east of Tesla; and the Water Supply and Treatment (WST) Division, responsible for operating the Hetch Hetchy Regional Water System at Tesla and west of Tesla.

This report documents West Yost's audit criteria, assessment scoring methodology, data reviewed, staff interviews, and evaluations performed to form an opinion regarding the current state of the SFPUC asset management program.

3.0 ASSET MANAGEMENT OVERVIEW

Asset Management in the utility industry is a process that optimizes the expenditures made over the life cycle of an asset. It is a combination of strategic direction, the establishment of service level requirements, a process to manage an asset to not exceed the prescribed service level of the asset, and the management of data or information to support these elements. This includes an assessment of risk and capital planning for renewal and replacement as well as an investment strategy to support it. The Environmental Protection Agency (EPA) captures this in the document *Asset Management for Water and Wastewater Utilities* (https://www.epa.gov/sustainable-water-infrastructure/asset-management-water-and-wastewater-utilities). In it, EPA identifies the five elements of asset management with 5 questions:

- What is the Current State of my assets?
- What is my required level of service?
- Which assets are critical to sustained performance?
- What are my best operation and maintenance (O&M) and Capital Improvement Plan (CIP) investment strategies?
- What is my long-term funding strategy?

The five questions above represent six key practical elements of asset management that must be applied over the lifecycle of an asset. This includes establishment of an asset inventory and the attributes that describe the assets, characterizing assets for risk including asset criticality and condition, determining the appropriate service level the asset is required to operate at, maintaining the asset, and tracking the assets' performance and costs and planning for asset renewal and replacement. The six key practical elements of asset management are:

- Asset Registry
- Asset Risk: Criticality and Condition
- Service Level
- Maintenance Planning
- Life Cycle Cost Analysis
- Replacement Planning

This is in addition to the three key support elements of asset management that provide the systems and procedures that enable a successful asset management initiative:

- Business Processes
- Data Systems and Software Tools
- Staffing Plan

3.1 Audit Criteria

West Yost grouped these elements into 10 primary criteria for the evaluation of SFPUC asset management practices. The primary criteria are described below.

Evaluation Criteria

- Asset Registry
- IT Capabilities to Support Asset Management
- Risk Procedures
- Operation and Maintenance
- Condition Assessment and Remaining Useful Life
- Replacement Planning
- Service Level
- Connection to Other Plans
- Supply Chain
- Staffing to Support Asset Management

3.1.1 Asset Registry

The asset registry is the cornerstone of an asset management program. It addresses the first of EPA's five questions which is to know your assets. A robust asset registry is typically contained in a database that is structured in a hierarchy that supports asset location and the rolling up of performance (such as cost, work, etc.) and has a structured classification domain that includes defining attributes. Policies and business processes should exist to define what constitutes an asset and for regular review and updating of the asset registry.

3.1.2 IT Capabilities to Support Asset Management

Information systems are an essential tool set in asset management programs. Computerized Maintenance Management Systems (CMMS) and Geographic Information Systems (GIS) provide registries for assets and can be integrated to share data. Most CMMS' also include maintenance planning and scheduling, work management functionality, advanced data collection related to asset performance, asset profiling for condition and criticality and reporting abilities to extract data. GIS systems incorporate spatial relationships to other features such as environmental and land use features. Information Technology (IT) systems must be managed to remain up to date and compatible with host systems including hardware and software.

3.1.3 Risk Procedures

Risk in utility asset management considers the likelihood an asset may cause an impact to the utility. It is measured in terms of the likelihood of an asset failure that will trigger an event coupled with the consequence of that event to certain utility values. The consequence of asset failure (COF) is a relation to how critical that asset is to the utility. The likelihood of failure (LOF) relates to asset condition. Factors influencing consequence of failure include Environmental, Financial, Safety, Operational and Capacity impacts. There are many subfactors such as asset redundancy that are considered in the analysis.

Managing risk requires a risk policy that defines the elements of risk to the utility (COF and LOF), risk objectives that define the level of tolerable risk, and action levels to mitigate risk as it increases. The CMMS or other registry is used to maintain a Risk Register of assets or other level in the asset hierarchy.

3.1.4 Operation and Maintenance

O&M is a process of providing inspection and service to an asset to achieve its prescribed useful life. It includes the scheduling of work activities so that they are completed within a prescribed time frame and interval, plan to complete prescribed work tasks, the collection of asset data such

as inspections notes and the logging of performance data to efficiently optimize O&M work activities. Business Processes provide a prescribed workflow for activities and are standardized to assure O&M activities are performed with an intended outcome. Policies are typically established to assure processes are followed.

3.1.5 Condition Assessment and Remaining Useful Life

Understanding where an asset is on its life cycle curve is essential to understand when to apply renewal efforts. An understanding of asset condition and its corresponding remaining useful life (RUL) is a significant part of the assessment of risk described earlier. Assessing asset condition includes formal assessment criteria and metrics against which to gauge. Policies and business processes should be established and followed to assure condition ratings are consistently monitored.

3.1.6 Replacement Planning

Replacement planning addresses the last of EPA's asset management questions and includes strategies for setting aside the needed funding for asset renewal. It includes forecasting the expenditures required for asset renewal and the funding required to satisfy the renewal needs and policies governing the funding sources and expenditures from those sources.

3.1.7 Service Level

One of the considerations in utility asset management is the acceptance that not all assets serve the same mission nor have the same criticality. One asset may be providing a service that is not as critical to the utility as another and as such it may not warrant the same O&M and renewal efforts as another more critical asset. To this end, the application of service levels to certain assets is important such that an asset is not overly maintained or renewed too soon. This requires policies for definition of service level metrics important to the utility and service level goals applied to assets or other hierarchical positions.

3.1.8 Connection to Other Plans

Utilities operate based on plans and visions adopted by their governing board and other senior management. This includes the development of master plans and other planning instruments that guide the operation and management of the utility. Asset management is a key element of these planning instruments and should be integrated into their application.

3.1.9 Supply Chain

Supply chain for a utility is the management of the materials consumed for its day-to-day and year-to-year operation. This involves the purchasing process and the warehouse management of stored materials. As applied to asset management, this also includes the availability of important materials that are critical to the operation of a utility's infrastructure.

3.1.10 Staffing to Support Asset Management

An asset management program relies on many roles and disciplines to implement the measures described above. Individuals, groups, and committees are needed to establish policies and business processes and to monitor the systems and the data collected.

Table 1 presents the primary criteria, sub criteria, and the metrics used for purposes of this study.

Table 1. Evaluation Criteria

Criterion	Sub Criteria	Criterion Metric
Asset Registry	Business Processes for Asset Creation and Modification	Business Processes, including standard operation procedures, are developed and followed such that asset registry is maintained at highest level of accuracy.
	Asset Registry	Asset Registry is complete and represents an appropriate cross-section of assets.
	Asset Registry Hierarchy	Asset Hierarchy is well defined and provides sufficient detail to assess cost, risk, and work at multiple levels.
	Asset Classification Domain	Asset Classification structure is sufficiently detailed to define assets individually by type without significant generalization.
	Asset Attribute Domain	Asset attributes are detailed by classification to provide enough asset data and knowledge.
	Asset Definition	A definition of an asset, for the purposes of asset management planning, exists and is used to develop the asset registry.
	Policy for updating asset registry	A policy is in place that provides for the review of the asset registry and updating on a regular basis.
IT Capabilities to Support Asset Management	List of software tools such as Maximo, GIS, InfoAsset, etc. including version	Software list in place.
	Data Flow Diagram	A data flow diagram is in place that documents integrations between asset management software tools.
	Modules for software tools	Appropriate modules available and in use.
	Discovery Tools	Discovery Tools are in use for hardware and software.
	Mobile connectivity Platform	Mobile computing is in use on a reliable network system.
	IT Staffing dedicated to Asset Management Systems	Sufficient staff positions are authorized and filled that are dedicated to management of Asset Management hardware and software management. Vendors are contracted for support as needed.
	Infrastructure replacement and refresh policy	A policy is in place for the replacement of aging IT infrastructure including hardware and software dedicated to asset management.
	IT budget for asset management hardware and software support.	Sufficient budget is allocated for IT hardware, software, and staff.
	LAN/WAN Platforms (diagram/map)	Local and Wide Area Network plans are developed that document network configuration.
	Patch Management Plan	A Patch Management Plan is in place and is followed to keep software products current to achieve optimum performance.
	Security Plan - Public/Private access, Firewall	A Security Plan is in place that provides security against cyber threats.
Risk Procedures	Risk Policy	A Risk Policy is in place that interprets Criticality and Condition to develop Risk Ratings for assets as well as defines thresholds for action based on Risk.
	Business Process for Criticality Assessment	A structured process is in place to evaluate system and asset criticality.

Table 1. Evaluation Criteria

Criterion	Sub Criteria	Criterion Metric
	Description of Risk management tools currently in use	Risk assessment tools exist and are used to evaluate criticality and condition of assets and systems.
	Risk Register	A Risk Register is in place for all systems and assets.
	Criticality criteria and definitions	Criticality criteria and definitions are in place.
Operation and Maintenance	Maintenance Management	Preventative maintenance activity is performed as required by the manufacturer or the specific asset performance.
	Maintenance Management	Predictive maintenance activity is performed as required by the manufacturer or the specific asset.
	Maintenance Management	Business Processes exist for work and maintenance management.
	Maintenance Management	Asset performance data are collected and available for analysis.
	Work Management	Work is performed efficiently based on asset and work prioritization.
	Work Management	Work Management data are collected and available for analysis
Condition Assessment and Remaining Useful Life	Business Process for Condition Assessment	A structured process is in place to evaluate system and asset condition.
	Condition criteria and definitions	Condition criteria and definitions are in place.
	RUL	Policy, procedures, and criteria for estimating RUL of assets are in place and RUL assessments are performed in accordance with the policy.
	Policy for updating RUL	A policy is in place that provides for the review of estimated RUL of assets on a regular basis.
	Condition Assessment Register	Asset condition is monitored in the asset registry.
Replacement Planning	Rehabilitation and Replacement Planning	Infrastructure rehabilitation and replacement planning methodology is in place and planning is conducted in accordance with the methodology.
	Rehabilitation and Replacement Funding	A funding plan is in place and maintained for infrastructure rehabilitation and replacement.
	Rehabilitation and Replacement Expenditure Policy	A policy for the expenditure of rehabilitation and replacement is in place and funds are allocated in accordance with the plan.
Service Level	Service Level definitions for asset management	Service Level goals are defined and applied to each asset as appropriate.
Connection to Other Plans	Capital Improvement Plan	Asset Management plan elements and principles are an integral part of other planning documents where asset renewal, funding, and replacement are considered.
Supply Chain	Business Process and Policy for Supply Chain	Business Processes and Policies for Supply Chain are in place and followed.
	Item Master Export	Item Master is developed and applied to assets in the asset registry.
	Warehouse Management	Warehouses (virtual or physical) exist with inventory managed in logical rows, shelves, bins, etc.
	Warehouse Management	Supply chain processes are connected to the Work Order.
	Warehouse Management	Parts are reserved against work orders.

Table 1. Evaluation Criteria		
Criterion	Sub Criteria	Criterion Metric
	Warehouse Management	Physical and Cycle Counts are performed at regular intervals.
Staffing to Support Asset Management	Staff matrix and job description	Staff matrices and job descriptions dedicated to support work and asset management exist.

3.2 Assessment Scoring Methodology

Each of the criteria were evaluated on a five-level capability maturity model (shown in Table 2 below), similar to that used by the Institute of Public Works Engineering Australasia (IPWEA) which produces the International Infrastructure Management Manual (IIMM). The five-level model used in this audit represents a more practical interpretation for the water industry

Table 2. Capability Maturity Model	
Level	Description
Initial	Processes are disorganized, even chaotic. Success is likely to depend on individual efforts and is not considered to be repeatable, because processes would not be sufficiently defined and documented to allow them to be replicated.
Repeatable	Basic project management techniques are established, and successes could be repeated, because the requisite processes would have been made established, defined, and documented.
Defined	An organization has developed its own standard process through greater attention to documentation, standardization, and integration.
Managed	An organization monitors and controls its own processes through data collection and analysis.
Optimized	Processes are constantly being improved through monitoring feedback from current processes and introducing innovative processes to better serve the organization's particular needs.

4.0 DATA REVIEWED

West Yost prepared an information request and submitted it to BAWSCA which was forwarded to SFPUC. The information requested related to policy, procedures, and discrete data related to assets. A listing of the data requested is presented below.

- Asset Registry
  - Business Processes for Asset Creation
  - Asset Registry export
  - Asset Registry hierarchy
  - Asset Classification Domain
  - Asset Attribute Domain
  - Asset Definition
  - Policy for updating asset registry
- IT Capabilities to Support Asset Management
  - List of software tools such as Maximo, GIS, InfoAsset, etc. including version
  - Integration map of software tools
  - Modules for software tools listed above
  - Discovery Tools in use for hardware and software
  - Mobile connectivity Platform
  - Staff count and title dedicated to management of Asset Management hardware and software management
  - Infrastructure replacement and refresh policy
  - IT budget for asset management hardware and software support.
  - Contracted Vendors
  - LAN/WAN Platforms (diagram/map)
  - Patch Management Plan
  - Security Plan – Public/Private access, Firewall
- Risk Procedures
  - Risk Policy
  - Business Process for Criticality Assessment
  - Description of Risk management tools currently in use
  - Risk Register export
  - Criticality criteria and definitions
- Operation and Maintenance
  - Business processes for all work management efforts
  - Maintenance Policy

- Condition Assessment and RUL Business Process for Condition Assessment
  - Condition assessment criteria and definitions for all asset classes
  - Policy, procedures, and criteria for estimating RUL of assets
  - Condition Assessment Register export
- Replacement Planning
  - Describe infrastructure rehabilitation and replacement planning methodologies currently in place
  - Most recent infrastructure replacement and rehabilitation planning forecast
  - Summary of funding sources for rehabilitation and replacement of aging infrastructure. Please include current fund balances.
  - Policy for expenditure of funds reserved for rehabilitation and replacement of aging infrastructure
- Service Level
  - Service Level definitions for asset management
- Connection to Other Plans
  - Capital Improvement Plan
  - Strategic Plan
  - Master Plan
  - Other documents connected to asset management efforts
- Supply Chain
  - Business Process for Supply Chain
  - Item Master Export
  - Supply Chain Policies
- Staffing to Support Asset Management
  - Staff matrix and job description for work and asset management

SFPUC provided the following documents. Depending on the scope and content of the documents, West Yost either reviewed or noted their existence as a resource to SFPUC.

- WST Asset List, Undated
- DSOD Inspection of Dam No. 10-21 dated February 4, 2019
- Internal Inspection of Crystal Springs Bypass Pipeline, SFPUC, San Francisco, Simpson Gumperz & Heger, August 16, 2018
- Maintenance Engineering Asset Condition Assessment Annual Summary Report, Water Supply and Treatment Division, September 15, 2009
- Maintenance Engineering Asset Condition Assessment Quarterly Report, First Quarter 2011, April 22, 2011

- Maintenance Engineering Asset Condition Assessment Quarterly Report, Third Quarter 2010, December 30, 2010
- Maintenance Engineering Asset Condition Assessment Quarterly Report, Fourth Quarter 2010, January 27, 2011
- PowerPoint Presentation on Work Scheduling, Undated
- City and County of San Francisco, Office of the Controller, Accounting Policies and Procedures, July 1, 2016
- Spreadsheet titled HH Inventory Valuation Report for Storeroom(s) HH-MAIN, Undated
- Asset Management Services, Roles and Responsibility Matrix, Undated
- ISO 55001 Gap Analysis, Hetch Hetchy Water and Power Statement of Work, Genesis Solutions, April 2019
- MAX SOP – 1056 Rotating Assets, Undated
- Asset List Guiding Document Dated September 9, 2019
- HHWP Asset List dated September 9, 2019
- HHWP Asset Hierarchy
- Maximo Classification Structure Guiding Document Dated September 9, 2019
- Maximo Classification Domain Dated September 9, 2019
- Maximo Asset Attribute Guiding Document Dated September 9, 2019
- Maximo Asset Attribute Domain Dated September 9, 2019
- State Of The Regional Water System, 2018
- Hetch Hetchy Water, Short and Long Term Risk Based Capital Planning Phase 1 Definition, Scope of Work, Black & Veatch, December 22, 2017
- Hetch Hetchy Water, Short and Long Term Risk Based Capital Planning Phase 2A, Scope of Work, Black & Veatch, February 5, 2018
- Hetch Hetchy Water, Short and Long Term Risk Based Capital Planning Phase 2B, Scope of Work, Black & Veatch, August 17, 2017
- Draft Technical Memorandum Capital Planning Study Proposed Asset Valuation Approach, Hetch Hetchy Water and Power, Black and Veatch, September 3, 2019
- Hetch Hetchy Water and Power Assets Master Plan, Black and Veatch, December 22, 2009
- Job Request Form Flowchart, dated January 10, 2019
- Job Initiation Form
- Job Initiation Form Approval Process
- Project On Hold Process, December 14, 2018

- HHWP Maintenance Engineering Policy for Project Closeout, May 1, 2019
- HHWP Project Closeout Memorandum Template, Undated
- Closeout Workflow Flow Chart, April 19, 2019
- Workflow/Status Relationships, Undated
- Services Requests in Maximo presentation, May 17, 2017
- Presentation on Work Scheduling, Undated
- Pre-Loaded Material in a Work Order Presentation, September 19, 2018
- Dam Safety Program Report, AECOM WRE, April 2014
- Work Order Approval Standard Operating Procedure, December 15, 2010\
- Supervisor Approval of Work Orders Standard Operating Procedure, February 22, 2011
- Planner Work Order Preview Standard Operating Procedure, June 24, 2019
- Supervisor Work Order Completion Standard Operating Procedure, February 22, 2011
- Bucket (Backlog) Management Standard Operating Procedure, February 22, 2011
- Work Log Standard Operating Procedure, November 1, 2014
- Planner Review Standard Operating Procedure, November 1, 2014
- HSIP Work Order Initiation Standard Operating Procedure, February 22, 2011
- Creating A New HSIP Work Order Standard Operating Procedure, February 22, 2011
- Reliability Reporting Method, Undated
- Priority Codes Standard Operating Procedure, July 25, 2014
- Backlog Management Spreadsheet (Bucket), Undated
- List of Condition Assessment Reports since 2007
- Criticality Assessment Template, Undated
- Spreadsheet of Project Expenditures Based on General Ledger, Undated
- City and County of San Francisco, Fixed Asset Definitions and Guidelines, October 2013
- 2020 San Francisco Public Utilities Strategic Plan, dated August 2016
- Materials Management Process Schematic, Undated
- Materials Management Process, Undated
- Hetch Hetchy Inventory Valuation Report for Storerooms, Undated
- Maintenance Engineering Staff Roles, Undated
- Asset Management Services Roles and Responsibilities, Undated

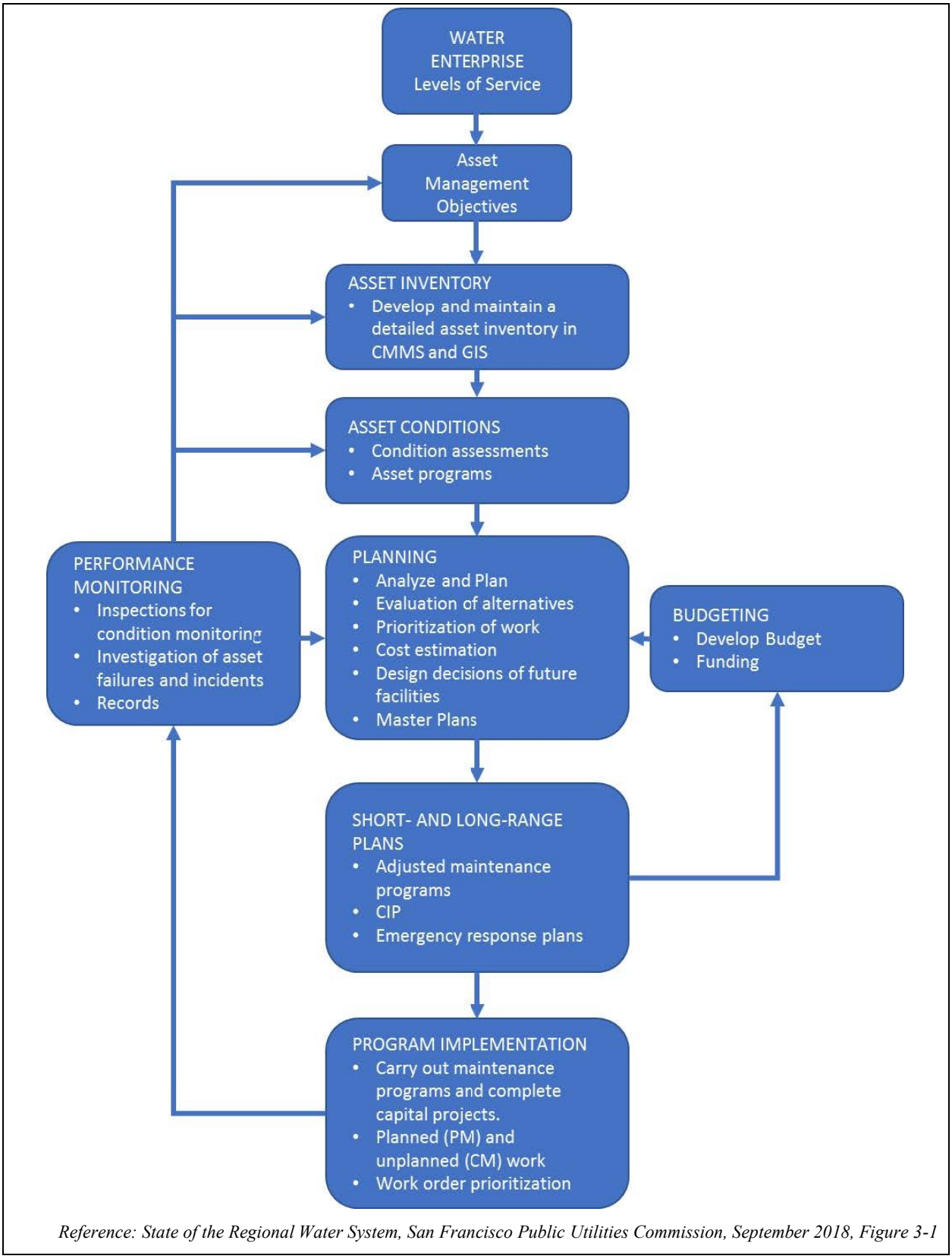
- SFPUC 2018 – 2019 Performance Plan and Appraisal Report Human Resources
- HHWP Asset Management Services Competency Model, Dated May 12, 2017
- HHWP Competency Model Validation Report, Asset Management Services, Dated May 1, 2017
- HHWP Materials Management Staff Matrix, Undated
- HHWP Communication and Coordination Process, Undated
- HHWP Service Request to Work Order Through Close-Out Role Flow, Undated
- Warehouse Commodity Code Item Master, November 15, 2016
- WST Warehouse Policies and Procedures, July 1, 2014
- WST Purchasing and Accounts Payable Policy and Procedures, April 30, 2018
- WST CMMS Business Practices Policy and Procedure, October 5, 2011

The September 2018 SFPUC report titled "State of the Regional Water System" is highlighted for its mention of asset management objectives for SFPUC. The report is published in September of every even-numbered year in accordance with contractual requirements in the July 2009 Water Supply Agreement between the SFPUC and its wholesale water customers (Section 3.10B of the agreement). It includes a discussion of notable events related to the water system as well as a summary of SFPUC's asset management and maintenance activities and capital improvement program. Section 3 of the report is included as Appendix B.

In the report SFPUC states it:

> "*is striving towards integration of the following functions that collectively create an asset management program:*
> - *Define LOS: Establish, publish, and regularly review LOS and related performance objectives.*
> - *Document Asset Inventory and Condition: Perform periodic condition assessment of assets and determine actual performance as related to the LOS.*
> - *Plan/Analyze: Perform planning tasks that help identify performance shortcomings and, where needed, modify maintenance practices and/or generate capital project scopes that eliminate the performance gaps and prioritize work.*
> - *Develop Budget: Review cost estimates of new or modified work, compare to the existing budget, and prepare revised budgets for decision makers' review. In parallel, SFPUC Finance staff help prioritize and structure the budget (including the CIP) by providing financing options and limitations.*
> - *Implement/Operate: Carry out maintenance programs, as adjusted, and complete any capital projects.*
> - *Obtain/Apply Feedback: Record available data for use in informing planning and budgeting."*

The diagram presented on Figure 1 applies to both the HHWP and the WST divisions and illustrates how SFPUC intends these functions to work together.



Reference: State of the Regional Water System, San Francisco Public Utilities Commission, September 2018, Figure 3-1

Figure 1. Asset Management Program Intended Processes

SFPUC's asset management objectives are intended to guide capital and maintenance planning and connect daily activities with broader ratepayer expectations. The bullet list below is a summary of the objectives and is included in Table 3-1 of SFPUC's State of the Regional Water System published in September 2018, which notes SFPUC's current status assessment for both the HHWP and the WST Divisions. This document is included in Appendix B.

- Develop and maintain detailed asset inventory
- Regularly complete asset condition assessments
- Use a CMMS to centralize all asset data
- Perform preventative maintenance (PM) and predictive maintenance (PdM) activities and reduce corrective maintenance (CM) activities and unplanned outages where cost effective
- Prioritize PM work to increase system reliability
- Evaluate maintenance programs to conform to industry standards
- Track costs for facilities, assets, and maintenance programs to identify life-cycle costs
- Update the CIP considering asset condition, RUL, failure analysis, replacement costs, maintenance efforts, level of service, and forecasted capital and renewal and replacement (R&R) needs
- Implement failure analysis to identify root cause and implement appropriate mitigation
- Plan facility maintenance to minimize risk to customer service
- Maintain an emergency response plan
- Design future facilities informed by asset management program data.

Together these constitute the SFPUC plan for asset management.

5.0 STAFF INTERVIEWS

West Yost met with staff in both the HHWP and WST Divisions of the SFPUC in January 2020 to discuss each of the 10 evaluation criteria discussed in Section 2. The discussion related specifically to each division individually. Both divisions utilize Maximo by IBM for a CMMS. Maximo is a CMMS with advanced functionality that supports asset management objectives. Staff were presented a series of questions prior to the meetings in preparation for the discussions. The questions are presented in Appendix C. A discussion of the meetings with staff follows.

5.1 HHWP

West Yost met collectively with Margaret Hannaford, Scott Riley, and Cheryl Sperry of the HHWP Division on January 22, 2020 to review the questions presented in Appendix C and discuss the HHWP asset management program. Prior to the meeting, HHWP had prepared written responses to the questions to make discussions more informative. The HHWP response is presented in Appendix D. Appendix E presents detailed notes from the meeting. A summary of the meeting discussion presented by topics covered is provided below.

5.1.1 HHWP Asset Management Overview

HHWP has responsibilities in power generation as well as water production and manages a broad variety of asset types. This encompasses assets in service at dams, pipelines, roads, bridges, powerhouses, and electric substations. Staff interviewed indicated many of the assets are beyond their useful life and are awaiting capital funding. Two years ago, HHWP adopted a more rigorous approach to asset management to ensure efficient implementation of maintenance and capital programs and ensure those programs maintain LOS goals. Staff reports that much of their work is still in progress and includes the following:

- Development of Asset Management Plans (AMPs) for each Asset Category
  - 4 out of 14 total AMPs will be completed in fiscal year 2020
- Assessment and Prioritization of risk assessment tools
  - Replacement based on condition, consequence of failure, and probability of failure
  - Strategy for capital improvement, data collection, and planning processes
- Optimization of Asset Management Program (ISO 55001 standard)
  - Gap Analysis of current asset management programs to the ISO 55001 asset management standard

5.1.2 Asset Registry

There is no formal asset creation process other than for specific asset types that may be repurposed at different locations in the system (known as rotating assets). HHWP has a specific Standard Operating Procedure (SOP). Notwithstanding that, the asset registry is periodically reviewed for updates as staff resources are available. When creating new or modifying old assets there is no quality assurance and quality control process in place to confirm the registry. Capital improvement projects identify new assets, but they are not quickly included in the registry. With limited staff, there is no formal walkdown of assets to confirm the asset registry aligns with assets in the field.

Staff reports the asset registry is 90 to 95 percent complete, with greater than 17,300 assets registered. Assets are defined for inclusion in Maximo by value greater than $5,000 and if they are a managed maintenance item. Over 9,000 assets are classified with most having descriptive attributes. Horizontal assets have fewer completed attributes than vertical assets. Horizontal assets are identified by pipeline versus a more discrete segment. Staff wants to break this down to a finer segment (node to node). Maximo Linear is a module in Maximo designed for long linear asset types such as rail, roadways, and pipelines and allows flexibility in delineating pipelines. Maximo Linear is not used at HHWP.

A formal asset hierarchy is currently under development and the current structure is mixed and difficult to navigate and roll up. Staff is developing a more refined hierarchy by Area/Place/ Facility/Asset Assembly/Asset which will afford greater flexibility in navigating the registry and reporting. Maximo Systems are in use and allow greater flexibility in organizing assets. The current asset hierarchy is presented in Appendix F. The asset classification attribute domain is presented in Appendix G.

Asset Classifications are managed by each SFPUC Division independently with HHWP following a separate domain than WST. Both classifications and subclassifications are used, giving greater granularity in defining assets. Staff acknowledged that a classification standard between Divisions is needed and desired.

5.1.3 Risk Procedures

HHWP is working on a risk-based capital planning tool. The framework will include LOF and COF, set thresholds and goals/objectives. It is planned to be a Monte Carlo type simulation model that will allow for scenario simulations and mitigation strategies.

Risk data does not reside in Maximo. The risk-based capital planning tool (above) will house all risk data and risk scores will be managed in Maximo allowing easy use for decision-making.

5.1.4 Operation and Maintenance

The HHWP PM program is based on manufacturers' recommendations. The PM program is managed following several SOPs as noted below. These SOPs provide the formal business processes for moving a work order through its life cycle.

- SOP, California Environmental Quality Act (CEQA) Review of Work Orders
- SOP, Preventative Maintenance Request: New or Modification
- Work Order Workflow
- SOP Work Order Approval
- SOP Supervisor Work Order Approval
- SOP Planner Preview of Work Orders
- SOP Work Order Completion
- SOP Bucket Management

- SOP Work Log
- SOP Planner Review
- SOP HSIP Work Order Hierarchy
- SOP Creating an HSIP Work Order
- SOP Priority Codes

Work order planning and scheduling is performed by a group dedicated to this function from 13 different shops. Work is managed and scheduled weekly. A third-party scheduling program is used for work planning and a 16-day look ahead is reported for work management. Backlog management is performed using a Microsoft Excel spreadsheet. Maximo service requests are used for all work requests which are then converted to a work order if further work activities are to be performed. Work order planning includes job plan development and includes labor and materials estimates in Maximo.

Work prioritization follows standard policy MAXSOP-1002. Work status is tracked using the following status categories:

- Waiting Approval
- SAPPR (Supervisor Approved)
- Planner Approved
- Queued (4 to 12 weeks out)
- Approved (up to 4 weeks completion)
- In Progress

Schedule compliance is monitored, and work orders are evaluated for effectiveness and availability by maintenance planners. Effectiveness reflects the accuracy of the planned work to identify if modifications should be made to planned expectations and availability reflects the actual work order performance with respect to meeting planned goals for schedule and resources. This allows maintenance planners to adjust estimates and schedules as needed for future similar work orders.

HHWP has a Predictive Maintenance (PdM) program for transformers, breakers, generator bearings, and the oil pressure sets.

5.1.5 Condition Assessment and Remaining Useful Life

Condition assessment is performed by category groups that include Fixed Assets, Linear Assets, and Dams, each of which are summarized below.

- **Fixed Assets** at facilities are inspected every 1 to 10 years based on desired LOS. Initial inspections are part of routine maintenance activities and as assets move through their life cycle, greater inspections are planned with more detailed data collected. The level of inspection in subsequent inspections is dictated by earlier inspection data. Younger assets and critical assets are assessed as part of routine maintenance.

- **Linear Asset** inspection frequency is governed by pipeline conditions, ability to isolate the asset, operations concerns, and anticipated condition.
- **Dams** are inspected and monitored with regulatory oversight and staff feels the inspection program is appropriately conservative relative to other asset groups and given the high liability associated with these assets. Regular inspection and monitoring, reporting, maintenance, repairs, and planning studies are completed in coordination with California Department of Water Resources Division of Safety of Dams (DSOD).

The condition assessment program is not developed to include standards for condition rating. There is no policy or guidance for determining RUL although staff has used age and Iowa Curves to approximate this. Both new standards and policies are expected to be included in the asset management plans currently under development.

5.1.6 Replacement Planning

Capital projects are developed on a 10-year rolling plan basis with updates every 2 years. Planning is performed based on institutional knowledge of system requirements for renewal. The risk policy being developed with the creation of the asset management plans will help guide capital project renewal and replacement planning; thus, relying less on staff's institutional knowledge to support decision making.

Internal accounting policies prevent mixing funds and expenditures across water and power but do not prevent R&R funds from being expended on non-R&R needs. As such there is no control policy to prevent dedicated R&R funds from being expended on CIP or maintenance needs.

5.1.7 Service Level

Like replacement planning, the pending asset management plans will develop LOS criteria and goals. Maximo will store LOS goals. The use of goals is expected to support replacement planning decision making efforts.

5.1.8 Connection to Other Plans

HHWP did not provide a response to this section. Discussions during the staff interview confirmed progress towards implementing the objectives of the 2018 State of the Regional Water System Report.

5.1.9 Supply Chain

Purchase Requests and Purchase Orders are managed in Maximo. A dedicated Chart of Accounts governs budgeting. An Item Master is maintained in Maximo and reorder points are established. Staff runs reorder reports to identify restocking needs.

HHWP maintains a warehouse at the Moccasin site and inventory is stored using a defined Row/Bin/Shelf/Rack system. Although there are no other formal warehouses established and no virtual warehouses, informal overflow storerooms space exists. Staff reports that additional space is needed.

Receiving in warehouse management is a process of taking possession of purchased materials, logging the materials into inventory and noting on the Purchase Order that the contracted requirements have been satisfied. Materials are received directly in Maximo where inventory balances are then modified and are issued only to work orders. Returns are processed at the warehouse for restocking and entered back into Maximo. Barcoding of storeroom bins, shelves, etc., is not used.

Warehouses stock primarily consumables with over 2,300 active inventory items. Approximately 75 critical spare items are linked in the Item Master to assets and stocked. Fuel is managed using a system by EJ Ward and data is manually loaded into Maximo.

Material Reservations is a process during the work order planning task to identify materials needed for the work and "reserving" those materials from the warehouse to assure their availability. Kitting is a process of assembling reserved materials for a work order and providing the assembled materials to the work order staff as a package. Together, Material Reservation and Kitting increase efficiency in work performance allowing work order staff to move quickly to the task at hand. Material Reservations are seldom used for work orders and Kitting is not performed. Staff is beginning to consider parts availability versus ordering specifically for the work order during planning.

Inventory controls include annual physical counts by HHWP staff and an external audit every other year. Cycle counts are performed weekly with monthly balance reports. All counts are blind, meaning the person performing the counting does not know the desired quantity and enters the count into Maximo not knowing if it matches that on record.

5.1.10 Staff Plan

HHWP Asset Management Services include the following positions,

- 0931 Asset Management Services Manager (1)
- 7262 Asset Planner (2)
- 7263 Planning and Scheduling Manager (1)
- 7262 Maintenance Planner (4)
- 7219 Maintenance Scheduler (2)

Materials Management/Warehouse Operations include the following positions:

- 1944 Materials Coordinator (1)
- 1942 Assistant Materials Coordinator (2)
- 1931 Senior Parts Storekeeper (3)

Staffing needs are comprehensively evaluated each two-year budget cycle.

5.2 WST

West Yost met collectively with Angela Cheung, Edward Forner, and Annie Li of the WST Division on January 24, 2020 to review the questions presented in Appendix C and discuss the WST Division asset management program. Appendix H presents detailed notes from the meeting. A summary of the meeting discussion presented by topics covered is provided below.

5.2.1 Asset Registry

Maximo is used as the registry for managed assets. The initial Maximo registry was established in 1999 when Maximo was first brought online and was loosely imported from a previous database. At that time, staff performed data scrubbing, although data standards did not exist. The Maintenance Planning Group adds and modifies assets and is the registry owner with sole permission to add or modify assets and attributes. Maintenance Planning works with Maintenance Engineering and capital project teams to import new assets and equipment data sheets that come from capital projects into Maximo.

Maintenance Planning is currently working closely with the System Operations group to field verify asset inventory at select facilities and make updates and corrections to the asset registry at these facilities as necessary with the goal of going through all WST treatment facilities in the next couple of years. This process includes creating and standardizing PM records, and developing and standardizing job plans for similar assets. WST expects to add 3,000 to 4,000 assets that were part of WSIP to the asset registry as a result of this effort. Fixed assets make up the majority of the assets in Maximo for WST assets.

Quality control is typically implemented during asset creation and is not performed as regularly when the registry is updated with new data. No formal program exists to update the asset registry and assets are evaluated for completeness as staff resources are available. Updates are also made when field staff report errors.

Capital projects are the primary source for identifying new assets. An equipment list (Equipment Data Sheet) is prepared during the project implementation. The information is provided to Maintenance Planners who import the new assets and their attributes into Maximo as part of start-up. Staff reports that approximately 10 percent of the Equipment Data Sheets are reviewed for quality control. Staff wants to incorporate more asset identification and loading during the design process.

The asset registry is about 80 to 85 percent complete and includes approximately 13,000 assets. Approximately 3,000 to 4,000 assets are not registered. The asset registry is being updated to create additional classifications and attributes and staff is focusing on populating more attributes. The asset registry hierarchy currently follows a Location/Process/Equipment structure. A policy from 2010 governing classifications and hierarchy is presented in Appendix I. Staff reports this policy is followed most of the time but is outdated in meeting current asset management practices. WST management retained a consultant to work with Maintenance Planning, Maintenance Engineering and System Operations to update existing policy including development of an expanded hierarchy structure, capturing additional attributes, and improving the equipment data sheets with a focus on new assets and attributes being readily importable into Maximo to avoid delays in the assets getting into Maximo following the completion of capital projects. The updated policy is expected to be completed in summer of 2020.

Staff follows the WST CMMS Business Practices Policy (2011) that includes procedures for the following:

- Work order initiation
- Supervisor responsibilities
- Work order backlog tracking
- Work order closeout
- Key Performance Indicators (KPI) and monthly reporting
- Work order authority and role-based permissions
- Work order review and approval
- Condition assessment
- Purchasing

This policy is being updated. It is included in Appendix J.

A 2008 Policy defines assets as greater than $5,000 value for Finance purposes. In practice, however, there are assets valued lower in the registry due to asset criticality, maintenance needs, run-to-fail assets, and regulatory requirements. Lock-Out Tag-Out assets are not considered. Staff is updating asset definition standard which will include the elimination of run-to-fail assets in Maximo.

5.2.2 Risk Procedures

WST does not follow a formal risk policy or risk rating of assets. Work order priority follows a 9-level scale and is based on work type and institutional knowledge of the asset. Staff does formal planning of work using collaboration and institutional knowledge.

Criticality is evaluated at the Facility/Process level during the bi-annual budgeting process. This consists of an informal rating of project priority following a 1-2-3 priority scale (1 = Safety/Regulatory, 2 = Operationally required, 3 = Desirable).

Some assets are flagged as critical in Maximo but not based on a formal assessment.

5.2.3 Operation and Maintenance

PM and PdM programs generally follow manufacturer specifications and institutional knowledge of the asset. PMs are run-time and calendar based as well as regulatory based. Regulatory related PMs are given high priority. SCADA is not integrated with Maximo, so run-time and other asset-related data are manually loaded into Maximo. Maintenance Planners create and manage PMs in Maximo.

The CMMS Business Practices Policy does the following:

- Uses a 9-level priority hierarchy
- Classifies work type (Corrective, Preventative, Administrative, Operations and Project)
- Identifies role-based responsibilities

- Documents backlog management
- Establishes work order status tracking standards

A copy of the CMMS Business Practices Policy is included as Appendix J. Work is manually planned and scheduled, and backlog is managed by maintenance supervisors. Maximo workflow is not used.

Reporting is used to identify follow-on or corrective work and modify maintenance plans. Asset performance data is used for life cycle management and not maintenance management. Instead, maintenance field staff use institutional knowledge for decision-making. Staff would like a more data-centric approach to maintenance related decision-making. Currently, PdM work orders are only prepared for Vibration Analysis. Labor and materials data are logged or captured against a work order or asset, but not tool data.

5.2.4 Condition Assessment and Remaining Useful Life

Condition assessment is performed by category group: Linear Assets and Vertical Assets. Each are summarized below.

5.2.4.1 Linear Assets

Linear Assets are assessed according to the following schedule:

- Tunnels – 20 years,
- Steel pipe – 20 years,
- Pre-stressed Concrete Cylinder Pipe (PCCP) – 10 years

Over the past 10 years, assessments have occurred less frequently due to the implementation of the Water System Improvement Program (WSIP) which has consumed staff resources and also replaced many assets. Now that the WSIP is nearly completed, the asset inspection program has resumed.

Inspections typically consist of electromagnetic analysis, visual inspection, and sounding. Acoustic listening technologies also are used for leak detection. Staff has developed its own electromagnetic condition assessment solution for pipelines and performs many of the pipe lining and structural repairs in-house with staff. The Sunol Facility has plate rolling equipment for repairing PCCP. Contractors are also available and perform lining and other repairs as needed.

Staff report that WST has good emergency preparedness measures in place with a lot of pipe stockpiled in and around the service area.

5.2.4.2 Vertical Assets

Vertical Assets were last inspected in 2009 although periodic, informal assessments are ongoing. Stationary engineers, house plumbers, electricians and electronic maintenance technicians perform routine PMs and as part of that work perform informal condition assessments. As noted earlier, WSIP renewed a considerable amount of infrastructure.

Asset condition is not noted in the asset registry in Maximo but is documented in separate reports or memoranda. Staff recognizes they are not where they want to be on condition assessment and want a more robust methodology. The asset management policy update will include a more analytical procedure to analyze and report asset condition to plan for asset replacement and refurbishment.

5.2.5 Replacement Planning

R&R funding is maintained by facility (Harry Tracy Water Treatment Plant, Sunol Water Treatment Plant, Field Facilities). Staff uses a collaborative methodology for determining replacement needs based on institutional knowledge. Risk and level of service goals are considered. As needs are identified, rates are adjusted, and the R&R fund is maintained. The finance division determines whether and how much cost for R&R can be included in rates and the amount of debt financing.

5.2.6 Service Level

Service level goals are currently not developed or used.

5.2.7 Connection to Other Plans

The Fiscal 2020 Strategic Plan has a goal to provide reliable service and value to customers. Several asset management related objectives were identified. These are identified in Table 3 with a description of WST's implementation as provided from WST staff.

Table 3. Asset Management Objectives and WST Response

Fiscal 2020 Strategic Plan Asset Management Objectives	WST Response
Establish quantifiable operational and capital LOS goals by enterprise.	Quantifiable Operational and Capital LOS goals by enterprise is a Commission-level objective. WST has not defined LOS goals separately.
Formalize our asset management approach across SFPUC.	There is no formalized approach to asset management other than to use Maximo. There is a culture of collaboration which does support asset management.
Establish a uniform investment prioritization process linked to asset management priorities across SFPUC.	Prioritization is done during the CIP process but does not utilize uniform prioritization guidelines.
Ensure SFPUC can mitigate, respond to, and recover from threats from disasters.	Risk and Resiliency Assessment (RRA) has been completed. WST has emergency response procedures and plans in place, and two emergency interties with neighboring water agencies. Emergency Mutual aid is in place through participation in the California Water/Wastewater Agency Response Network (CalWARN).

5.2.8 Supply Chain

Purchase Requests and Purchase Orders are managed in Maximo. The Purchase Request is initiated in Maximo and approved in the finance system (Oracle PeopleSoft). Warehouse management is in Maximo. Warehouses stock primarily consumable, and not asset-related, materials. Spare parts are stored at individual facilities outside of warehouse and inventory control

management. Inventory of spare parts is managed by individual work crews in System Operations and the trades on both sides of the bay. Tools are managed in Maximo and issued to work crews.

Materials are received at the central warehouse in Millbrae and are directly entered into Maximo. Materials sent out of the warehouse are issued to staff only through work orders. Returns are processed at the warehouse and restocked back into Maximo. Material reservations are not used for work orders and kitting is not performed. Staff practices for stocking spare parts vary between the different work crews and trades.

Inventory controls include annual physical counts by non-WST, City of San Francisco staff and losses are noted in finance shrinkage codes. Cycle counts are not performed.

5.2.9 Staff Plan

WST Asset Management Services comprises of engineering, maintenance, and operations.

5.2.9.1 Asset and Materials Management

- Maintenance Planning Manager (1)
- Asset Planners (3)
- Senior Parts Storekeeper (1)
- Storekeeper (3)

5.2.9.2 Engineering

- Two mechanical engineers and one electrical engineer support troubleshooting.
- Dam Management/Right-of-Way Management/USA and GIS.

5.2.9.3 Maintenance

Maintenance Staff are all certified operators.

- One Maintenance Manager, Three Maintenance Planners
- No Warehouse Management staff
- Electricians and Technicians.

5.2.9.4 Operations

- Stationary Engineers

5.3 Information Technology Response

West Yost did not meet with the IT Division of SFPUC but submitted a list of questions that the IT Division provided a written response to West Yost. Due to security concerns, not all questions could be provided a response; however, West Yost does not feel this limits the effectiveness of the assessment. The IT Division response is provided in Table 4.

Table 4. IT Division Response to Questions

Question	IT Division Response
List of software tools such as Maximo, GIS, InfoAsset, etc. including version	Maximo Asset Management version 7.6.0.9, Interloc Informer v5.6.3 and Prometheus DataSplice v5.2 products are used for mobile access to Maximo. PUC Enterprise GIS - ArcGIS Platform 10.6.1, with ArcGIS Mobile Survey123v13.3 and Collector v18
Integration map of software tools	Maximo is integrated bidirectionally with the ***PUC's Billing system** to receive work orders and send back work order updates, and the ***SF City Financial system** to send up purchase reqs and receive posted POs. Maximo also interfaces bidirectionally with the SF 311 Customer Service system. **Both *311** for the customer call **and *Maximo** for the call response are the systems of record in that interface. The same is true with the PUC Time Entry system bidirectional integration, ***Maximo** provides the work orders for which time is posted against in the ***Time Entry system** and the posted time is sent back to Maximo for asset and maintenance cost analysis. The PUC BI system reads information from the ***Maximo** database for enterprise reporting for asset information and maintenance work. Maximo receives data inbound from the ***PUC SCADA Historian system** to generate work orders based on operating parameters and inbound from the ***PUC Fleet Mgmt and Fuel system** to generate work orders based on mileage and maintain inventory of fuel stock for inventory valuation, replenishment ordering and receiving. Maximo also receives asset data from another ***SF City department's GIS system** contracted by PUC to maintain GIS asset data for a non-Water PUC division. ***Maximo** also has a small integration with another ***SF City department's CMMS system** to submit work requests and receive updates on work submitted. The PUC Enterprise GIS system reads information from ***Maximo, *PUC Billing system and *Sharepoint system** to include on various map services.
Modules for software tools listed above	Add-On Maximo modules: Maximo Transportation7.6.2.4, Maximo Spatial 7.6.0.3 and Maximo Linear 7.6.0.2 are installed. Maximo Scheduler 7.6.7 will be installed in the near future. A project to evaluate a new Maximo GIS integration product will begin later this year. We have 2 -3rd party products installed: CiM Visual Planner work scheduling product and MaxGrip strEAM+, an RCM product. AspenTech's Mtell product is used to send SCADA historian data to Maximo. PUC Enterprise GIS Add-On Modules: Spatial analysis, network analysis, geocoding services, 3D analysis, ETL.
Discovery Tools in use for hardware and software	Would need to pass by IT Security Manager before providing this.
Mobile connectivity Platform	Mobile access via Panasonic Toughbook Windows PCs, Lenovo Thinkpads, Apple iPads, iPhones.
Staff count and title dedicated to management of Asset Management hardware and software management	1.5 FTE - Principal IS Engineer, 2 FTE - Senior IS Engineers, 1 FTE- Senior Business Analyst, 1 FTE - Senior Programmer/Analyst.
***BOLD FACE** – Indicates system of record	

6.0 CONCLUSIONS AND RECOMMENDATIONS

Please see West Yost conclusions and recommendation listed below.

6.1 Conclusions

Table 5 summarizes West Yost's conclusions regarding the state of Asset Management activities for the HHWP and WST Divisions of the SFPUC. The conclusions drawn are our professional opinion based upon review of data submitted and the interviews conducted with select agency staff members. Conclusions are provided for each Division by the criteria developed for this analysis and scored based on the capability maturity model described in Section 3.

6.2 Recommendations

West Yost has developed recommendations for enhancements to SFPUC Asset Management Program. This Phase 1 audit represents a qualitative evaluation of the asset management principles and practices at SFPUC. It was based on a review of an assembly of documents provided by SFPUC and staff interviews and identified preliminary areas that could be improved to yield efficiencies that will result in long term life-cycle cost reductions. Many of these recommendations are currently being implemented by HHWP and WST in its efforts to address risk and will take time to complete. West Yost did not provide an analysis of staffing levels; therefore, the category of Staffing to Support Asset Management is not included in Table 6. Recommendations to improve the asset management program at SFPUC are included in Table 6.

Table 5. Evaluation Conclusions Summary

Criteria	Sub criteria	Description	HHWP	WST
Asset Registry	Business Processes for Asset Creation and Modification	Business Processes are developed and followed such that asset registry is maintained at highest level of accuracy.	Asset Registry is not regularly updated, and quality control of the asset registry is not performed at a high level. **Initial Level**	Asset Registry is not regularly updated, and quality control of the asset registry is not performed at a high level. **Initial Level**
	Asset Registry	Asset Registry is complete and represents an appropriate cross-section of assets.	Asset Registry is 90 to 95% complete. This represents a good completion level. **Repeatable Level**	Asset Registry is 80 to 85% complete. This represents a good completion level. **Repeatable Level**
	Asset Registry Hierarchy	Asset Hierarchy is well defined and provides sufficient detail to assess cost, risk and work at multiple levels.	Asset Hierarchy is well defined. Staff are currently modifying the asset hierarchy. **Repeatable Level**	Asset Hierarchy is well defined. Staff are currently modifying the asset hierarchy. **Repeatable Level**
	Asset Classification Domain	Asset Classification structure is sufficiently detailed to define assets individually by type without significant generalization.	Asset classification domain is well defined. **Defined Level**	Asset classification domain is well defined. **Defined Level**
	Asset Attribute Domain	Asset attributes are detailed by classification to provide sufficient asset data and knowledge	Asset classification attribute domain is well defined **Defined Level**	Asset classification attribute domain is well defined **Defined Level**
	Asset Definition	A definition of an asset, for the purposes of asset management planning, exists and is used to develop the asset registry	Assets are defined primarily based on value and do not include other parameters. **Initial Level**	Assets are defined primarily based on value and do not include other parameters. **Initial Level**
	Policy for updating asset registry	A policy is in place that provides for the review of the asset registry and updating on a regular basis	Policy does not exist for the review and updating of the asset registry. **Initial Level**	Policy does not exist for the review and updating of the asset registry. **Initial Level**
IT Capabilities to Support AM	List of software tools such as Maximo, GIS, InfoAsset, etc. including version		The version of Maximo (7.6.09) is approximately 3 years behind on their update versions but still within the primary 7.6 version. Remote access and GIS software are current and an industry standard. IT Staff are in the process of integrating Maximo with GIS. **Managed Level**	
	Data Flow Diagram	A data flow diagram is in place that documents integrations between asset management software tools.	Maximo is the main interface source and is linked to the necessary systems to automate maintenance and reporting. The SCADA historian is integrated with Maximo to support time-based work order generation. HHWP and WST staff reported that this integration did not exist, however, their understanding of the configuration may be limited. **Managed Level**	
	Modules for software tools		Many Maximo modules are installed and available for use including Transportation, Spatial (GIS), and Linear (pipeline and roads). Other third-party products are in place. **Managed Level**	
	Discovery Tools	Discovery Tools are in use for hardware and software	Discovery tools are in place. **Managed Level**	
	Mobile connectivity Platform	Mobile computing is in use on a reliable network system.	Mobile computing tools and systems are in place. **Managed Level**	
	IT Staffing dedicated to Asset Management Systems	Sufficient staff positions are authorized and filled that are dedicated to management of Asset Management hardware and	4.5 full time equivalents (FTE) are staffed including business analysts and engineers. **Managed Level**	

Table 5. Evaluation Conclusions Summary

Criteria	Sub criteria	Description	HHWP	WST
		software management. Vendors are contracted for support as needed.		
	Infrastructure replacement and refresh policy	A policy is in place for the replacement of aging IT infrastructure including hardware and software dedicated to asset management.	Replacement policy is industry standard. **Managed Level**	
	IT budget for asset management hardware and software support.	Sufficient budget is allocated for IT hardware, software and staff	$300,000 per year budgeted for software service will support periodic software upgrades and minor hardware upgrades. **Defined Level**	
	LAN/WAN Platforms (diagram/map)	Local and Wide Area Network plans are developed that document network configuration.	LAN/WAN mapping exists. **Managed Level**	
	Patch Management Plan	A Patch Management Plan is in place and is followed to keep software products current to achieve optimum performance.	The patch management plan is an industry standard. **Managed Level**	
	Security Plan - Public/Private access, Firewall	A Security Plan is in place that provides security against cyber threats.	Security policies exist. **Managed Level**	
Risk Procedures	Risk Policy	A Risk Policy is in place that interprets Criticality and Condition to develop Risk Ratings for assets as well as defines thresholds for action based on Risk.	A risk policy does not currently exist. A risk policy is currently being developed for HHWP. **Initial Level**	A risk policy does not currently exist. **Initial Level**
	Business Process for Criticality Assessment	A structured process is in place to evaluate system and asset criticality.	A risk policy does not currently exist. A risk policy is currently being developed for HHWP. **Initial Level**	A risk policy does not currently exist. **Initial Level**
	Description of Risk management tools currently in use	Risk assessment tools exist and are used to evaluate criticality and condition of assets and systems.	A risk assessment tool does not currently exist. A risk assessment tool is currently being developed for HHWP. **Initial Level**	A risk assessment tool does not currently exist. **Initial Level**
	Risk Register	A Risk Register is in place for all systems and assets.	A formal risk register does not exist. **Initial Level**	A formal risk register does not exist. **Initial Level**
	Criticality criteria and definitions	Criticality criteria and definitions are in place.	Criticality is not defined. **Initial Level**	Criticality is not defined. **Initial Level**
Operation and Maintenance	Maintenance Management	Preventative maintenance activity is performed as required by the manufacturer or the specific asset performance.	Preventative maintenance is performed as required by the manufacturer. **Repeatable Level**	Preventative maintenance is performed as required by the manufacturer. **Repeatable Level**
	Maintenance Management	Predictive maintenance activity is performed as required by the manufacturer or the specific asset.	Predictive maintenance is not currently performed. **Initial Level**	Predictive maintenance consisting of vibration monitoring is performed. **Repeatable Level**
	Maintenance Management	Business Processes exist for work and maintenance management	Business processes exist for work and maintenance management.	Business processes exist for work and maintenance management.

Table 5. Evaluation Conclusions Summary

Criteria	Sub criteria	Description	HHWP	WST
			Repeatable Level	**Repeatable Level**
	Maintenance Management	Asset performance data are collected and available for analysis.	Asset performance data are not collected. **Initial Level**	Asset performance data are not collected. **Initial Level**
	Work Management	Work is performed efficiently based on asset and work prioritization.	Work is prioritized based on a 9-level priority index. **Defined Level**	Work is prioritized based on a 9-level priority index. **Defined Level**
	Work Management	Work Management data are collected and available for analysis	Work management data are collected and used to modify Preventative Maintenance Plans and work performance efficiency. **Defined Level**	Work management data are not collected. **Initial Level**
Condition Assessment and Remaining Useful Life	Business Process for Condition Assessment	A structured process is in place to evaluate system and asset condition.	A process is in place to assess asset condition at a regular interval. Actual condition assessment has not kept up with the prescribed schedule due to staff/budget limitations. **Repeatable Level**	A process is in place to assess asset condition at a regular interval. Actual condition assessment has not kept up with the prescribed schedule due to staff/budget limitations. **Repeatable Level**
	Condition criteria and definitions	Condition criteria and definitions are in place.	There is no definition or criteria for asset condition. **Initial Level**	There is no definition or criteria for asset condition. **Initial Level**
	RUL	Policy, procedures and criteria for estimating RUL of assets are in place and RUL assessments are performed in accordance with the policy.	There is no formal policy to assess remaining useful life. HHWP has utilized industry curves in the past. **Initial Level**	There is no formal policy to assess remaining useful life. **Initial Level**
	Policy for updating RUL	A policy is in place that provides for the review of estimated RUL of assets on a regular basis.	A policy is not in place to evaluate remaining useful life. **Initial Level**	A policy is not in place to evaluate remaining useful life. **Initial Level**
	Condition Assessment Register	Asset condition is monitored in the asset registry.	Asset condition is monitored in Maximo. **Repeatable Level**	Asset condition is captured in various condition assessment reports. **Initial Level**
Replacement Planning	Rehabilitation and Replacement Planning	Infrastructure rehabilitation and replacement planning methodology is in place and planning is conducted in accordance with the methodology.	Replacement planning is performed biennially as part of budget preparation and CIP planning. There is no formal replacement planning program in place. **Repeatable Level**	Replacement planning is performed biennially as part of budget preparation and CIP planning. There is no formal replacement planning program in place. **Repeatable Level**
	Rehabilitation and Replacement Funding	A funding plan is in place and maintained for infrastructure rehabilitation and replacement.	Funding for infrastructure renewal is via rates and identified during biennial CIP planning. **Repeatable Level**	Funding for infrastructure renewal is via rates and identified during biennial CIP planning. **Repeatable Level**
	Rehabilitation and Replacement Expenditure Policy	A policy for the expenditure of rehabilitation and replacement is in place and funds are allocated in accordance with the plan.	Dedicated funds for asset renewal do not. **Initial Level**	Dedicated funds for asset renewal do not exist. **Initial Level**
Service Level	Service Level definitions for asset management	Service Level goals are defined and applied to each asset as appropriate.	Formal LOS criteria and goals do not exist but will be developed with asset management plans. Maximo will store LOS. **Repeatable Level**	LOS criteria and goals exist for facilities but not for assets. **Initial Level**

Table 5. Evaluation Conclusions Summary

Criteria	Sub criteria	Description	HHWP	WST
Connection to Other Plans	Capital Improvement Plan	Asset Management plan elements and principles are an integral part of other planning documents where asset renewal, funding and replacement are considered.	Of the Fiscal 2020 Strategic Plan Asset Management Objectives only LOS goals are being developed. The remaining goals include developing a uniform approach to asset management across the utility, develop an investment process and manage threats. Of these a uniform approach to asset management is not in place or under development for both HHWP and WST and an investment policy tied to asset renewal is not in place. Threat management is not formally addressed. **Initial Level**	Of the Fiscal 2020 Strategic Plan Asset Management Objectives only LOS goals are being developed. The remaining goals include developing a uniform approach to asset management across the utility, develop an investment process and manage threats. Of these a uniform approach to asset management is not in place or under development for both HHWP and WST and an investment policy tied to asset renewal is not in place. Threat management is, however, being formally addressed with a risk and resiliency assessment and the formalization of mutual aid programs. **Repeatable Level**
Supply Chain	Business Process and Policy for Supply Chain	Business Processes and Policies for Supply Chain are in place and followed.	Business processes for supply chain are in place. **Defined Level**	Business processes for supply chain are in place. **Defined Level**
	Item Master Export	Item Master is developed and applied to assets in the asset registry	An Item Master exists. **Defined Level**	An Item Master exists. **Defined Level**
	Warehouse Management	Warehouses (virtual or physical) exist with inventory managed in logical rows, shelves, bins, etc.	A Warehouse is established and configured for logical materials storage. **Defined Level**	A Warehouse is established and configured for logical materials storage. **Defined Level**
	Warehouse Management	Supply chain processes are connected to the Work Order.	Materials are issued to the work order. **Defined Level**	Materials are issued to the work order. **Defined Level**
	Warehouse Management	Parts are reserved against work orders	Parts are not reserved against work orders. **Initial Level**	Parts are not reserved against work orders. **Initial Level**
	Warehouse Management	Physical and Cycle Counts are performed at regular intervals.	Annual physical counts are performed. Monthly cycle counts are performed. **Managed Level**	Annual physical counts are performed. No cycle counts are performed. **Defined Level**
Staffing to Support Asset Management	Staff matrix and job description	Staff matrices and job descriptions dedicated to support work and asset management exist	A staffing plan with appropriate staffing levels for work, asset and warehouse management exist. The staffing level appears to be appropriate. **Defined Level**	A staffing plan with appropriate staffing levels for work, asset and warehouse management exist. The staffing level appears to be appropriate. **Defined Level**

Table 6. SFPUC Asset Management Recommendations

Recommendations	Asset Registry	Risk Procedures	Operation and Maintenance	Condition Assessment and Remaining Useful Life	Replacement Planning	Service Level	Supply Chain
Enhancements to SFPUC's Current Asset Management Planning							
Develop a uniform approach to risk assessment including consequence of failure and likelihood of failure definition, risk definition, and risk thresholds and develop a policy for application across the entire utility. This can be achieved by completing the development of the risk framework and risk assessment tool for HHWP and including WST.		X					
WST join in the ISO-55001 Gap Analysis and asset management planning that HHWP is conducting.	X	X	X	X	X	X	
Near Term, One to Three Years							
Combine all work and asset management standards for uniform application to HHWP and WST uniformly. Abolish standards and procedures specific to one Division.	X	X	X	X	X	X	X
Develop a policy and process to review the asset registry in Maximo for accuracy. Maximo should have current, existing assets properly classified and documented with appropriate attributes. This review and update should be conducted at least every 5 years.	X						
Complete the development of the asset hierarchy, classification and attributes and apply new structure to both HHWP and WST uniformly.	X						
Review and update current asset definition policy. Policy should consider not only asset value but asset criticality, maintenance requirements, and participation in Lock-Out Tag-Out operations.	X						
Develop a uniform policy and business processes for work management, asset creation and modification, and work prioritization. This uniform policy should be developed as a utility standard for application to HHWP and WST collectively.			X				
Participate in, or increase participation in, the Northern California Maximo User Group (NorCal MUG). NorCal MUG meets bi-annually to confer on best practices in the use of Maximo and includes presentations by users, consultants, and IBM.	X	X	X	X	X	X	X
Long Term, Three to Five Years							
Evaluate asset criticality at least every five years, after a major CIP or when a significant modification to a system is implemented.		X					
Maintain a risk register in Maximo noting the total risk score and the criticality and condition score.		X					
Configure Maximo for automated workflow processes for work and maintenance management.			X				
Develop a policy and method for estimating remaining useful life.				X	X		
Develop a replacement planning program to forecast asset renewal needs and costs. Link this forecast to the establishment of utility rates. Use this forecast to inform CIP planning efforts.	X			X	X	X	
Develop LOS criteria and goals and connect maintenance planning with LOS requirements by asset as identified as a Fiscal 2020 Strategic Plan Asset Management Objective.			X		X	X	
Develop a uniform investment process linked to asset management priorities across the utility as identified as a Fiscal 2020 Strategic Plan Asset Management Objective.				X	X		
Formalize the asset management approach uniformly across the utility as identified as a Fiscal 2020 Strategic Plan Asset Management Objective.	X	X	X	X	X	X	
Develop a formal warehouse management plan to be applied to both HHWP and WST. The plan should renew business processes and policies for inventory counts and reconciliation, establish procedures for maintaining critical spare parts that can be shared between HHWP and WST.							X

Table 6. SFPUC Asset Management Recommendations

Recommendations	Asset Registry	Risk Procedures	Operation and Maintenance	Condition Assessment and Remaining Useful Life	Replacement Planning	Service Level	Supply Chain
Evaluate spare parts lists and begin stocking spare parts in the warehouse for asset maintenance work.			X				X
Eliminate the practice of undocumented storerooms with "invisible" inventory that is not valued or carried in the finance ledger.							X
Phase 2 Audit Recommendations							
Evaluate SFPUC's use of Maximo as a work and asset management tool. This includes evaluated Maximo's asset registry, maintenance management, supply chain, workflow, and other modules.	X	X	X	X	X	X	X
Participate in the HHWP effort to complete the ISO-55000 gap analysis and establish asset management plans, risk management policies and the risk management tool. This will allow BAWSCA to follow the development of the program versus waiting for a post-implementation review and will keep BAWSCA informed of progress towards completion of the gap analysis and SFPUC asset management principles and policies.	X	X	X	X	X	X	X

APPENDIX A

BAWSCA Asset Management Audit SFPUC Compiled Comments with West Yost Responses

BAWSCA Asset Management Audit SFPUC Compiled Comments with West Yost Comments

Comment No.	Chapter	Section	Page Number	SFPUC Comments and Planned Edits	West Yost Response
1	1.0	1.0	1	The entire water system is named the Hetch Hetchy Regional Water System. Therefore, the sentence should read "The divisions are the Hetch Hetchy Water and Power (HHWP) Division, responsible for operating the Hetch Hetchy Regional Water System east of Tesla, and the Water Supply and Treatment (WST) Division, responsible for operating the Hetch Hetchy Regional Water System at Tesla and west of Tesla."	Noted, we will make this clarification in the final report
2	1.0	1.3.1	5	"Maintenance practices are developed and maintenance is being performed." HHWP does have additional information demonstrating the coordination and scheduling of maintenance activities, including the metrics for measuring schedule performance. We also have additional information demonstrating critical facility reliability and availability.	Acknowledged. No change to text needed.
3	1.0	1.3.2.2	6	In general, the near term recommendations do not appear achievable within a one year time frame at current levels of staffing.	Acknowledged, horizon recommendations may be modified longer. We will edit the final report to read Near Term within 1 to 3 years and Long Term within 3 to 5 years.
4	1.0	1.3.2.2	6	"Develop a policy and process to review the asset registry in Maximo for accuracy." Good recommendation and will likely be a recommendation in our ISO55001 gap analysis. Note for your interest that this type of review is currently taking place at WST. This never came up in the interview so West Yost may be unaware of current WST efforts. The estimate is it would take a couple of years to completely review all WST assets in Maximo. This process involves more than an asset registry update. It is also getting job plans standardized and streamlined. The effort currently underway is expected to add 3,000 to 4,000 assets into Maximo.	Acknowledged. No change to text needed.
5	1.0	1.3.2.2	6	"This review and update should be conducted at least every 5 years." Once the asset registry is complete, is should only need to be re-assessed after major CIP projects or other significant changes. It would be more appropriate to conduct as needed.	We caution that assets can be removed from service and replaced for reasons other than capital improvement projects. This can occur during routine maintenance activities and not properly captured in Maximo. For this reason West Yost suggest an audit at a regular interval such as every 5 years. We will revise the final report to read "It is recommeded SFPUC perform a review and update of its asset registry at approximately five-year intervals"
6	1.0	1.3.2.2	6	"Complete the development of asset hierarcy, classification, and attributes and apply new structure to both HHWP and WST uniformly." Please refer to the comment made in the cover letter. When considering the costs of standardization, SFPUC does not currently think it is worthwhile.	West Yost advocates continually searching for opportunites to align strategies and agrees there is a cost. This applies to configuration and standardization. But there are many potential benefits to a unified asset registry that have the potential to improve asset management efficiencies and cost savings. -A unified approach provides greater overall collaboration between staff when both systems use the same configuration. -Consistent classifications and attributes allow for shared data and metrics such as profiling equipment failure, equipment standards sharing of inventory stores. -a unified standard can be more efficient to develop and maintain than separate standards for the same segment of the system. -Note that formalizing the asset management approach uniformly across the utility was mentioned in the Fiscal 2020 Strategic Plan Asset Management Objectives We will edit the final report to read: "It is recommended SFPUC look for opportunities to align its asset hieracy, classification and attributes for both HHWP and WST. Formalizing the asset management approach uniformly across the utility was mentioned in the Fiscal 2020 Strategic Plan Asset Management Objectives. Further a unified approach provides: 1) greater overall collaboration between staff when both systems use the same configuration. 2) consistent classifications and attributes allow for shared data and metrics such as profiling equipment failure, equipment standards sharing of inventory stores, and 3) a unified standard can be more efficient to develop and maintain than separate standards for the same segment of the system."
7	1.0	1.3.2.2	6	"Review and update current asset definition policy. Policy should consider not only asset value but asset criticality, maintenance requirements, and participation in Lock- Out Tag-Out operations." WST's policy already includes criticality and maintenance requirements in the current asset definition. However, we have regulatory and safety requirements and not participation in LOTO operations as the additional criteria. We have small PVC ball valves that are part of LOTO all the time but that does not mean they should be assets in Maximo. On the other hand, low value assets in the aqueous ammonia system are in Maximo because of CalARP compliance.	The focus of this recommendation is to develop a definition for assets that are to be managed programmatically and using Maximo. This applies to assets to be maintained, assets that pose certain risk threshold, assets that may have a minimum value and assets to be used for isolation or LOTO. We understand that other policies address LOTO, however, Maximo can be used to consolidate to a single asset registry with comprehensive listing of assets for all management needs. We will edit the report to read: "Review and update current asset definition policy. Policy should consider not only asset value but asset criticality and maintenance requirements. While SFPUC manages LOTO through its existing regulatory and safety policies, SFPUC should consider also including LOTO in the asset definition policy."
8	1.0	1.3.2.2	6	"Participate in, or increase participation in, the Northern California Maximo User Group." SFPUC has participated in the past but hasn't found it to be very worthwhile.	We will remove this recommendation from the final report.
9	1.0	1.3.2.3	7	"Maintain a risk register in Maximo noting the total risk score and the criticality and condition score." We think risk scores should be developed for a subset of assets in Maximo, but not for the tens of thousands of assets these two divisions currently maintain.	We will edit the report to read: "Maintain a risk register in Maximo noting the total risk score and the criticality and condition score. This can be addressed simply using the asset hierarchy with criticality evaluated at the process or subprocess level with child assets inheriting the criticality. Condition can then be evaluated for assets with higher criticality."
10	1.0	1.3.2.3	7	"Configure Maximo for automated workflow processes for work and maintenance management." This makes sense for some assets where review and administration is required. We agree with the statement in those cases and intend to use workflow processes where it provides value to the process.	We will edit the report to read: "Configure Maximo for automated workflow processes for work and maintenance where minimum data collection points are required and where process efficiencies may be increased".
11	1.0	1.3.2.3	7	"Implement the Fiscal 2020 Strategic Plan Asset Management Objectives to develop LOS criteria and goals and connect maintenance planning with LOS requirements by asset." We think you mean that there should be recognition of how each asset may contribute to meeting the existing enterprise-wide LOS goals. We do not think that each individual asset should have an LOS goal/requirement. Please clarify.	We acknowledge assessing LOS for individual assets can be daunting. However, each asset can and should have a level of service goal. Although it doesn't necessarily need to be specifically developed for the asset as it can be inherited with input from LOS goals higher in the assets hierarchy. Note the measure of asset failure is related to the assets ability to perform at its intended level of service. We will edit the report to read: "Implement the Fiscal 2020 Strategic Plan Asset Management Objectives to develop LOS criteria and goals and connect maintenance planning with LOS requirements by asset. LOS goals can be inherited from higher process or subprocess levels in the asset hierarchy to reduce the analysis required."
12	1.0	1.3.2.3	7	"Eliminate the practice of undocumented storerooms with "invisible" inventory that is not valued or carried in the finance ledger." Staff thinks it may be better to spend our energy improving our critical spare parts identification and making sure they are stocked.	We agree that improving the mangement of critical spare parts is an essential component to a robust asset management program. However this should be prioritized with other elements of storeroom management. Unmanaged and informal storerooms are often a source of fiscal losses. This includes: -Critical Spare Parts cannot be managed outside of formal warehouses. -Materials costs not captured at the asset level. -Purchasing and expensing more than is needed for use across multiple fiscal years is not a fiscally responsible accounting of ratepayer dollars We feel undocumented storerooms should be eliminated.
13	2.0	2.0	8	"Hetch Hetchy System and Regional Water System" should be "Hetch Hetchy Regional Water System." A similar revision is necessary in the second paragraph.	Noted, we will make this clarification in the final report
14	2.0	2.0	8	BAWSCA has 26 customers. SFPUC has 27 wholesale customers (there is one very small customer that is not a BAWSCA member.)	Noted, we will make this clarification in the final report
15	2.0	2.0	8	This section would benefit from a more complete description of SFPUC and its various enterprises/businesses.	Noted, we will make this clarification in the final report
16	3.0	3.1.3	10	When does redundancy to a system come into consideration in the Evaluation Criteria? If a system is redundant (such as having backup pumps for a chemical process or if say, Baden is a backup facility to HTWTP) to another, is that reflected under "Risk Procedures?" Authors might consider a clarification.	We will edit the final report to include the following: "Factors influencing consequence of failure include Environmental, Finacial, Safety, Operational and Capacity impacts. There are many subfactors such as asset redundancy that are considered in the analysis."
17	5	5.1.2	23	There are other ways to define a linear asset in Maximo besides the Maximo Linear Asset Module. As discussed in our interview, we are looking at different ways we may segment a linear asset while maintaining the integrity of the facility.	Acknowledged. No change to text needed.
18	5.0	5.1.3	23	"Risk data for all assets is not currently populated in Maximo". As discussed in the interview, our intent will be to house risk-based data (LOF, COF, Installation Date) in Maximo and download it to the capital planning tool for analysis and decision-making.	Risk is also an important consideration in maintenance planning for which Maximo is the management tool. We feel risk ratings should be included in Maximo and any other planning tool. No modification to the report is planned.
19	5.0	5.1.4	23	1) HHWP does have a PdM program for transformers, breakers, generator bearings, and the oil pressure sets. 2) The paragraph following the bulleted list of SOPs should read, "Work order planning and scheduling is performed by a group dedicated to this function for 13 different shops." 3) Tracked work statuses should include SAPPR (Supervisor Approved) between Waiting Approval and Planner Approved.	Noted, we will make this clarification in the final report
20	5.0	5.1.5	24	Fixed Asset inspected every 1 - 10 years not 3 - 10.	Noted, we will make this clarification in the final report
21	5.0	5.1.6	25	"Internal accounting policies prevent mixing funds and expenditures across water and power but do not prevent R&R funds from being expended on non-R&R needs." Unclear what this means. Please clarify.	We attempted to identify any controls that exist on dedicaed funds such as for rehabilitation and replacement. This sentence is intended to state that accounting policies prevent comingling fund expenditures between utilities (Water vs Power) but do not prevent the comingling of funds within a utility. We will add clarification to this paragraph: "As such there is no control policy to prevent dedicated R&R funds from being expended on CIP or maintenance needs."

BAWSCA Asset Management Audit SFPUC Compiled Comments with West Yost Comments					
Comment No.	Chapter	Section	Page Number	SFPUC Comments and Planned Edits	West Yost Response
22	5.0	5.2.1	27	Because WST did not prepare written responses to the interview questions, information extracted from the verbal interview was inaccurate or incomplete in some areas. The following dozen or so comments are intended to clarify WST's interview input. Text in quotation in the next dozen or so comments represents new additions or modifications. For context and clarity, sentences right before the new additions or modifications are included in the comments. Maximo is used as the registry for managed assets. The initial Maximo registry was established in 1999 when Maximo was first brought online and was loosely imported from a previous database. At that time, staff performed data scrubbing, although data standards did not exist. The Maintenance Planning Group adds and modifies assets and is the registry owner with sole permission to add or modify assets and attributes. "Maintenance Planning works with Maintenance Engineering and capital project teams to import new assets and equipment data sheets that come from capital projects into Maximo. Maintenance Planning is currently working closely with the System Operations group to field verify asset inventory at select facilities and making updates and corrections to the asset registry at these facilities as necessary with the goal of going through all WST treatment facilities in the next couple of years. This process includes creating and standardizing PM records and developing and standardizing job plans for similar assets. WST expects to add 3,000 to 4,000 assets that were part of WSIP to the asset registry as a result of this effort. Fixed assets make up the majority of the assets in Maximo for WST assets."	Noted, we will make this clarification in the final report
23	5.0	5.2.1	27	The asset registry is about "75 to 80" percent complete and includes approximately 13,000 assets. An estimated 3,000 to 4,000 assets from WSIP are not registered. The asset registry is being updated to create additional classifications and attributes and staff is focusing on populating more attributes. The asset registry hierarchy currently follows a Location/Process/Equipment structure. A policy from 2010 governing classifications and hierarchy is presented in Appendix H. "Staff reports this policy is followed most of the time but is outdated in meeting current asset management practices. WST management retained a consultant to work with Maintenance Planning, Maintenance Engineering and System Operations to update existing policy including development of an expanded hierarchy structure, capturing additional attributes, and improving the equipment data sheets with a focus on new assets and attributes being readily importable into Maximo to avoid delays in the assets getting into Maximo following the completion of capital projects. The updated policy is expected to be completed in summer of 2020."	Noted, we will make this clarification in the final report
24	5.0	5.2.1	28	A 2008 Policy defines assets as greater than $5,000 value for Finance purposes. In practice, however, there are assets valued lower in the registry due to asset criticality, maintenance needs, run-to-fail assets, and regulatory requirements. Lock-Out Tag-Out assets are not considered. "Staff is updating asset definition standard which will include the elimination of run-to-fail assets in Maximo."	Noted, we will make this clarification in the final report
25	5.0	5.2.3	29	The sentence should say, "Labor and materials data are logged or captured against a work order or asset, but not tool data."	Noted, we will make this clarification in the final report
26	5.0	5.2.4.1	29	Under linear assets, WST assesses steel pipes once every 20 years and PCCP every 10 years.	Noted, we will make this clarification in the final report
27	5.0	5.2.4.2	29	Vertical Assets were last inspected in 2009 although periodic, informal assessments are ongoing. "Stationary engineers, house plumbers, electricians and electronic maintenance technicians perform routine PMs and as part of that work perform informal condition assessments." As noted earlier, WSIP renewed a considerable amount of infrastructure.	Noted, we will make this clarification in the final report
28	5.0	5.2.4.2	29	Asset condition is not noted in the asset registry in Maximo but is documented in separate reports or memoranda. Staff recognizes they are not where they want to be on condition assessment and want a more robust methodology. "The asset management policy update will include a more analytical procedure to analyzing and reporting asset condition to plan for asset replacement and refurbishment."	Noted, we will make this clarification in the final report
29	5.0	5.2.5	30	The statement that "Risk policy is not considered" is more appropriately characterized as "Risk and level of service goals are considered."	Noted, we will make this clarification in the final report
30	5.0	5.2.7	30	In Table 3, objective 4, the WST response should be changed to "Risk and Resiliency Assessment (RRA) has been completed. WST has emergency response procedures and plans in place, and two emergency interties with neighboring water agencies. Emergency Mutual aid is in place through participation in the California Water/Wastewater Agency Response Network (CalWARN)."	Noted, we will make this clarification in the final report
31	5.0	5.2.8	30	Purchase Requests and Purchase Orders are managed in Maximo. The Purchase Request is initiated in Maximo and approved in the finance system (Oracle PeopleSoft). Warehouse management is in Maximo. Warehouses stock primarily consumable, and not asset-related, materials. Spare parts are stored at individual facilities outside of warehouse and inventory control management. "Inventory of spare parts is managed by individual work crews in System Operations and the trades on both sides of the bay. Tools are managed in Maximo and issued to work crews."	Noted, we will make this clarification in the final report.
32	5.0	5.2.8	30	Materials are received at the central warehouse in Millbrae and are directly entered into Maximo. Materials sent out of the warehouse are issued to staff only through work orders. Returns are processed at the warehouse and restocked back into Maximo. Material reservations are not used for work orders and kitting is not performed. "Staff practices for stocking spare parts vary between the different work crews and trades."	Noted, we will make this clarification in the final report
33	5.0	5.2.9	31	The Staff Plan has been revised to match comparable staff at HHWP supporting asset management. WST Asset Management Services include the following positions: 0923 Maintenance Planning Manager (1) 7262 Asset Planners (3) Materials Management/Warehouse Operations include the following positions: 1931 Senior Parts Storekeeper (1) 1934 Storekeeper (3)	Noted, we will make this clarification in the final report
34	6.2	Table 5	35	It should be noted that IT is currently in the process of procuring a vendor to assist with integrating Maximo data with GIS data.	Noted, we will make this clarification in the final report
35	6.2	Table 5	41	"Replacement Planning, Rehab and Replacement Expenditure Policy" The sentence is incomplete: Dedicated funds for asset renewal do not…	The sentence should read "Dedicated funds for asset renewal do not exist. This will be clarified in the final report.
36	6.2	Table 5	41	Service Level definitions for asset management "LOS criteria and goals do not exists." LOS exists for facilities now but not for assets. SFPUC staff does not think it makes sense for each asset to have an individual LOS goal.	Reference Comment 11 for LOS of Assets. We will edit the final report to read: "LOS ratings exist for Facilities but not for assets."
37	6.2	Table 5	42	"Connection to Other Plans" It is unclear why the respective ratings were given for this section. Please clarify.	The ratings of Repeatable and Initial should have been reversed. We will edit the final report to read Initial for HHWP and Repeatable for WSP
38	6.2	Table 6	44	These recommendations should be revised as appropriate based on review comments provided.	We will address each comment as noted in our responses.

APPENDIX B

State of the Regional Water System, SFPUC September 2018,
Section 3 Asset Management

State of the Regional Water System

Hetch Hetchy Regional Water System

Services of the San Francisco Public Utilities Commission

September 2018

3. Asset Management Program Overview

An asset management program allows a utility to minimize the total cost of owning and operating facilities, while delivering specified LOS at an acceptable level of risk. Asset management is an entire life-cycle process. Implementing such program requires a regular practice of acquiring data on assets, evaluation of these data to determine any shortcomings in maintenance or need for capital projects, implementation of modified maintenance practices or completion of capital upgrades, and a practice of documenting the resulting performance for later use.

The SFPUC is striving towards integration of the following functions that collectively create an asset management program as discussed in this chapter:

- **Define LOS:** Establish, publish, and regularly review LOS and related performance objectives.
- **Document Asset Inventory and Condition:** Perform periodic condition assessment of assets and determine actual performance as related to the LOS.
- **Plan/Analyze:** Perform planning tasks that help identify performance shortcomings and, where needed, modify maintenance practices and/or generate capital project scopes that eliminate the performance gaps and prioritize work.
- **Develop Budget:** Review cost estimates of new or modified work, compare to the existing budget, and prepare revised budgets for decision makers' review. In parallel, SFPUC Finance staff help prioritize and structure the budget (including the CIP) by providing financing options and limitations.
- **Implement/Operate:** Carry out maintenance programs, as adjusted, and complete any capital projects.
- **Obtain/Apply Feedback:** Record available data for use in informing planning and budgeting.

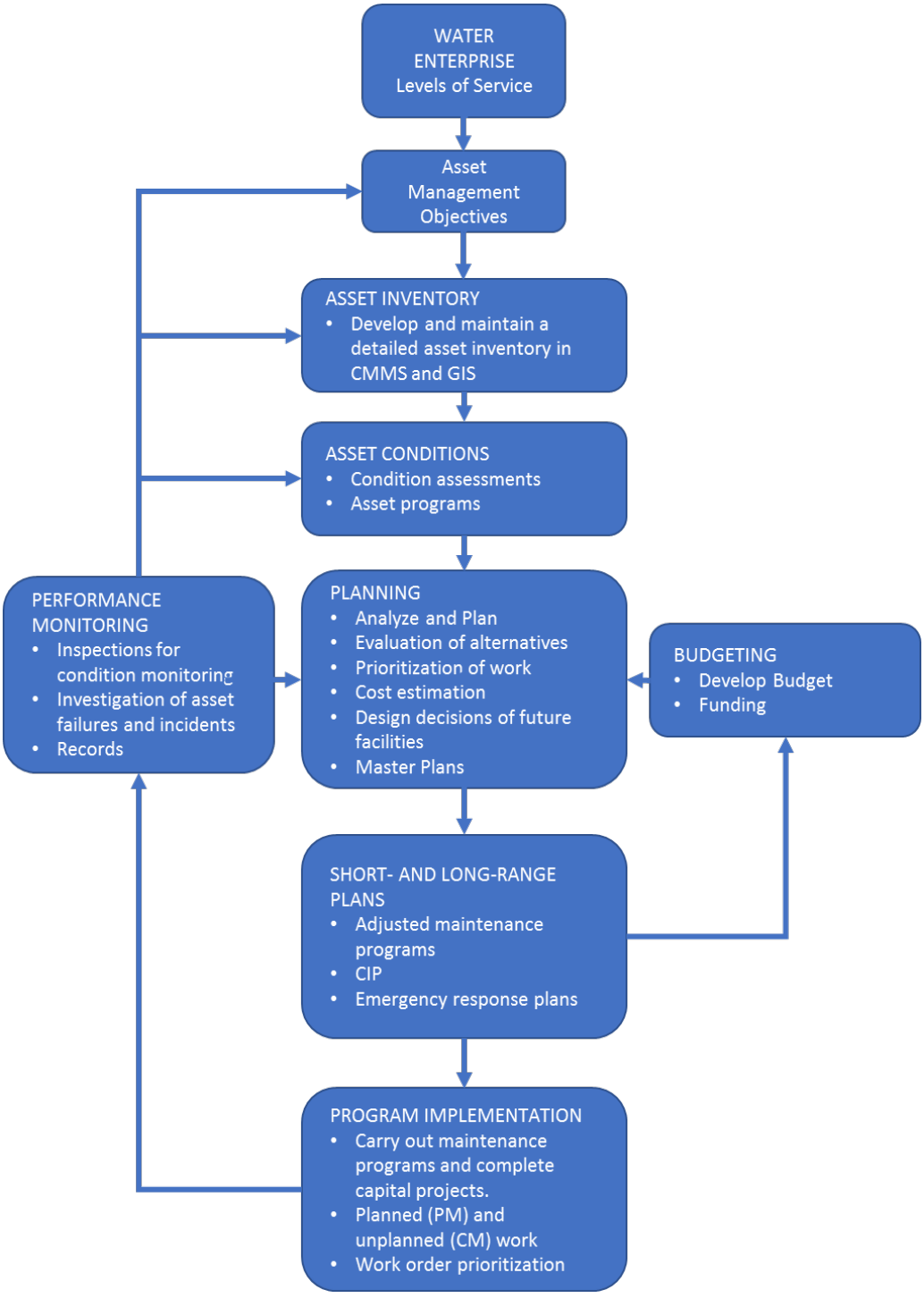
The diagram presented in Figure 3-1 applies to both HHWP and WSTD and illustrates how these functions should work together.

3.1 Performance Objectives

As a general matter, a utility's LOS represents broad, system-wide performance objectives that guide the management of the utility and that can be communicated and understood by ratepayers. LOS can evolve over time, reflecting changes to regulatory requirements, system demands, adoption of new reliability standards, and the willingness of ratepayers to pay.

Overall, the performance of the system is the collective performance of the system's individual assets. The challenge then becomes creating an asset management program for individual assets that ensures that broad system-wide performance is achieved—and doing this in a cost-effective manner. Below, the broader policy-level objectives (i.e. LOS) are discussed first (Section 3.1.1), followed by the asset management program objectives (Section 3.1.2) that have been designed to achieve the policy-level objectives.

Figure 3-1: Asset Management Program Processes



3.1.1 Levels of Service for the Regional Water System

In 2008, the SFPUC adopted LOS Goals and Objectives for the Water Enterprise in conjunction with the approval of the WSIP Programmatic Environmental Impact Report. Those LOS provided the basis for many of the WSIP project designs and are presented below.

Proposed updated LOS Goals and Objectives have been developed and were presented to the SFPUC Commission on October 24, 2017, but have not been considered for adoption (see Appendix I). However, the proposed LOS represent guidance that the Water Enterprise is using in day-to-day operations. They do not represent any reduction from the adopted LOS Goals and Objectives, and cover areas that were not included in 2008, such as In-City Delivery Reliability. Also, a number of LOS have been added that relate to our workforce and our role in the communities we serve, consistent with the SFPUC's 2020 Strategic Plan.

The LOS goals (shown in bold italic headings below) and accompanying objectives (shown in the bullets following the headings) address six areas for improvement: water quality, seismic reliability, delivery reliability, water supply, sustainability and cost-effectiveness.

WATER QUALITY – ***maintain high water quality***

- Design improvements to meet current and foreseeable future federal and state waterquality requirements.
- Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources.
- Continue to implement watershed protection measures.

SEISMIC RELIABILITY – ***reduce vulnerability to earthquakes***

- Design improvements to meet current seismic standards.
- Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallons per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion connecting points from the regional system to customers) in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco regions, respectively.
- Restore facilities to meet average-day demand of 300 mgd within 30 days after a major earthquake.

DELIVERY RELIABILITY – ***increase delivery reliability and improve the ability to maintain the system***

- Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service.

- Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages.
- Provide operational flexibility and system capacity to replenish local reservoirs as needed.
- Meet the estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.

WATER SUPPLY – ***meet customer water needs in nondrought and drought periods***

- Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during nondrought years for system demands through 2018.
- Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.
- Diversify water supply options during nondrought and drought periods.
- Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.

SUSTAINABILITY – ***enhance sustainability in all system activities***

- Manage natural resources and physical systems to protect watershed ecosystems.
- Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat.
- Manage natural resources and physical systems to protect public health and safety

COST-EFFECTIVENESS – ***achieve a cost-effective, fully operational system***

- Ensure cost-effective use of funds.
- Maintain gravity-driven system.
- Implement regular inspection and maintenance program for all facilities.

3.1.2 Asset Management Objectives

As mentioned above, a more specific set of objectives is used to guide capital and maintenance planning and is referred to collectively as asset management objectives. The asset management objectives provide the necessary detail to connect daily workforce priorities with the broader ratepayer service expectations (i.e., LOS). Table 3-1 lists these objectives and provides a status on each.

Table 3-1: Asset Management Objectives

Objective	WSTD	HHWP
Develop and maintain a detailed asset inventory	Roughly 13,000 assets of an estimated 30,000 asset inventory has been set up in detail in our CMMS (Maximo)	All assets where maintenance is performed is included in our CMMS (Maximo). This includes about 15,000 assets
Regularly complete asset condition assessments	Plants were systematically walked through once, over a 3 year period; since then (2011) we have relied upon observations of plant operations staff. Dam, pipelines and right of way assessments are performed regularly. Our buildings and grounds are not systematically assessed.	HHWP performs condition assessment by facility (an aggregation of assets at the facility level). There is a backlog due to funding, facility availability for assessment and staff resources.
Use a computerized maintenance management system (CMMS) to centralize all asset data	Maximo	Maximo
Perform preventive[2] and predictive[3] maintenance to reduce corrective maintenance (CM) and unplanned outages where cost-effective (minimize life-cycle cost), or when system risks to unplanned outages warrant increased maintenance costs	A significant level of preventive maintenance is performed in line with this objective, though no analysis confirming reduction of corrective maintenance or impact on life-cycle cost has been performed.	The program includes preventative maintenance (consistent with industry standards) and predictive maintenance to prevent unplanned outages or risk to operations is high. We do not perform reliability centered maintenance.
Prioritize CM[4] to increase system reliability	Noting first that a higher objective is to reduce CM, yes, operational risk is a primary driver in how we prioritize	In 2018, a reliability process was developed to address failures and determine root cause. The process has not

[2] Preventive maintenance involves regularly performed, planned tasks that are scheduled based on either time passed or meter triggers. This is done to reduce the possibility of asset failure.

[3] Predictive maintenance relies on conducting maintenance based on trends within equipment data. This technology is tied to condition-based monitoring systems for reading the output (condition) of an asset's variables. Predictive maintenance is based on predicting when an asset needs attention rather than simply replacing a part when it could have lasted longer.

[4] Corrective maintenance is maintenance which is carried out after failure detection, and is aimed at restoring an asset to a condition in which it can perform its intended function.

Objective	WSTD	HHWP
	CM at our plants, along with staff safety.	been implemented as of this date.
Complete peer review of maintenance programs to ensure that the scope of maintenance is consistent with industry standards	In 2016 a peer review was performed to identify the maintenance program needs with respect to coming up to industry standards.	Not all assets in Maximo have gone through peer review. PMs were originally developed by HHWP Maintenance Engineering and Operations and are consistent with industry standards. Modifications to PMs can be recommended by either Operations or Maintenance Engineering. Modifications are reviewed by Maintenance Engineering.
Develop expenditure reports that compile costs for facilities, assets, and maintenance programs—a quick way to tell where money is going and what it is accomplishing.	Expenditure reporting at the facility level has been established as an objective for staff to implement in FY19.	We have collected the information but have not set up reports.
Update the 10-year CIP and annual operating budget by integrating data from condition assessments, estimates of remaining useful life, failure analyses, replacement costs, maintenance programs, and LOS into a well-informed forecast of capital and R&R costs.	Information from conditions assessments has been used in the updating of the current 10-year CIP.	Conditions are not performed by asset but by facility. In 2017, HHWP began the process of developing an Asset Risk tool to evaluate criticality, likelihood of failure and consequence of failure for facilities and linear systems. The tool includes replacement costs and LOS are included in the criticality rating.
Investigate asset failures and document the root cause of failure	Documentation and investigation of major systems failures and some asset failures is routinely performed.	HHWP has developed a reliability process to address failures and determine root cause. The process has not been implemented as of this date.
Plan facility maintenance to minimize risk to customers	Focused planning of preparation for high production periods is performed regularly to reduce customer risks during Hetch	Asset Risk Tool in development

Objective	WSTD	HHWP
	Hetchy source outages.	
Maintain emergency response plans (listed in Appendix B)	Regular updates and training on plant risk management plans are performed; Dam emergency action plans are exercised and updated.	Yes. Out of the seven plans that are listed in Appendix B, we have either reviewed or updated the plans, if needed, since 2016.
Design future facilities based on information gathered through the asset management program.	This is an ideal we are working toward by pushing for capital project design services to include O&M engineering provisions.	Yes

These asset management objectives become even more critical for the RWS now that most of the WSIP assets are complete and in need of an appropriate maintenance program.

3.2 Asset Inventory

The objective of the Asset Inventory is to develop and maintain an accurate inventory and recording system for the multitude of assets in the RWS. This process involves several databases which house the asset inventory, condition, performance history, and location. Three primary databases support asset management processes: the CMMS (MAXIMO), the Fixed-Asset Accounting System (FAACS), and the geographic information system (GIS).

3.2.1 CMMS (MAXIMO)

A primary function of the CMMS is as a work order system that records and schedules maintenance and operations support by trades staff and engineers. Increasingly, though, the CMMS is being used to support asset management and capital planning, because it contains asset condition, performance history, and cost of maintenance. Improving the linkage between capital projects and the CMMS is ongoing. Ideally, engineering drawings showing equipment and assets would be automatically added to the CMMS once project closeout is complete and installed equipment is verified.

The CMMS allows thousands of pieces of equipment over seven counties to be compiled in a simple, searchable inventory. The CMMS includes complete descriptions of each asset, along with installation dates and performance histories; most assets are also geolocated in CMMS and GIS.

Along with regular standardized assessments, asset condition is also supplemented by maintenance reports and operator observations. Asset information is aggregated up to the facility level. Aggregated information provides management with actual performance of individual assets and larger facilities, and remaining useful life. The CMMS contains labor and materials expenditure data that permit accurate estimation of asset value and replacement costs. A process to ensure quality assurance of CMMS data is still under development but there is no timeline for completion.

3.2.2 Geographic Information System

The GIS program used by WSTD provides GIS support to mission-critical core programs such as Pipeline Inspection, Underground Service Alert, and Emergency Response. GIS has also been identified as a key component of succession planning, due to its ability to record information about assets and store this information where it can be intuitively retrieved by new employees.

Information about assets is recorded in various GIS libraries, including pipeline alignments, property rights and boundaries, and appurtenance locations (valves, vaults, manholes, service connections, etc.). GIS also records peripheral data such as leak history; and geotechnical data, including liquefaction potential, corrosion potential, and locations of known earthquake faults. Links in the GIS data also reference engineering drawings (plans and profile as-builts).

Multiple web-based mapping applications have been created to view the GIS data. These web applications can be securely viewed on desktop computers, laptops, phones, and tablets, both onsite and off. WSTD has created cloud-based web applications specifically dedicated to emergency response. These cloud-based applications offer far greater reliability and accessibility in the event of a natural disaster.

WSTD is working toward integrating CMMS with the GIS system. This will allow geographic data for assets to be directly available in the CMMS. There are also numerous GIS-based displays that can be used to view work orders geographically in the office or on mobile devices in the field.

To integrate these systems, both must have data that accurately reflect the assets on the ground and are named according to the asset classification index used in the CMMS. WSTD is currently creating GIS data by using site surveys that inventory assets. Once the GIS data accurately reflect the assets, the CMMS will be updated using the GIS data, and the two systems will be integrated. The overall schedule is to finish in about 4 years or 2023. It is the data acquisition part of the project that controls the timeline. Field crews are currently scheduled to complete field assessments in February of 2022. After that, data will be input into GIS and then Maximo within 6 months. The majority of the data collection is being performed by the Regional Cross Connection Controls Project (this project is discussed in Section 4.2.5). The first batch of data, BDPL Nos. 3 and 4, is being used to configure and test the system integration in FY19.

3.2.3 Fixed-Asset Accounting System

The FAACS was used to compute the value of a facility or fixed asset net of depreciation. This was the primary database used for the SFPUC's financial statements. The new PeopleSoft Financials and Procurement system went live on July 3, 2017 as the new financial system of record of the CCSF, and is used to develop and publish SFPUC's financial statements. When capital projects are completed, project managers communicate facility and asset details to SFPUC Financial Services staff. PeopleSoft is used to compute the value of a facility or fixed asset, net of depreciation.

Depreciation begins at substantial completion using the straight-line method over the estimated use lives of related assets, which range from 1 to 100 years for equipment, and 1 to 200 years for buildings, structures, and improvements. The computerized maintenance management system, Maximo, has been interfaced with PeopleSoft utilizing the same project cost structure to better

align project and maintenance expenditures with fixed assets. The SFPUC will continue to collaborate with the CCSF Controller's Office to plan future enhancements for asset management functionality within the PeopleSoft system.

3.3 Condition Assessments

The assets in the RWS are periodically inspected through three separate assessment programs, each essentially using a risk-based approach: 1) fixed assets, 2) linear assets, and 3) dams.

The first program addresses fixed assets. Facility inspections are prioritized and repeated every 3 to 10 years, depending on each facility's importance in meeting LOS. WSTD uses three tiers of classification for facilities in the Bay Area, with Tier 1 representing the most important classification. There are about 100 facilities in the three tiers. Although inspections are performed at the facility level, condition data in the CMMS are recorded at the asset level. At HHWP, condition assessments on critical assets with a life expectancy of greater than 25 to 30 years are performed on a case-by-case basis. Early in the asset's life cycle, inspections and limited assessments coincide with scheduled maintenance activities. As assets move through their life cycle, the information gathered from previous preventative maintenance reports as well as from performance deviations identified by operators is used to schedule more comprehensive condition assessments. For critical assets with a lesser life expectancy, assessments are built into the asset's routine preventative maintenance program.

Linear assets (e.g., pipelines and roads) are assessed with a second program. Inspection frequency is dictated by pipeline conditions, ability to shut down the pipeline (usually the pipelines must be drained), operational problems associated with pipeline failures, potential liabilities, and the rate of degradation observed in prior inspections.

Dams use a third inspection and monitoring program, usually performed with regulatory oversight. The program is conservative, considering the high liability associated with dams, and the importance to the region's water supply. The major components of the program consist of: regular inspection and monitoring, regulatory reporting, maintenance, repairs, planning studies (stability studies, inundation map updates, and other), and emergency planning.

For all three condition assessment programs, a risk-based approach recognizes two key components: consequence of failure and probability of failure. The risk of failure is the consequence of failure combined with the probability of failure (risk = consequence × probability).

- **Consequence of failure:** severity of impact of the failure on the RWS should the asset fail. Consequences of an asset's failure will impact the RWS LOS described above.
- **Probability of failure:** likelihood that failure arising from any deficiencies will occur.

An asset's failure will impact LOS, but criticality criteria need to be defined to assess the impact of failure that an asset has on RWS and the defined LOS. The following criticality criteria are used to quantify the overall consequence of failure of an asset.

- **Water delivery:** insufficient water quantity (including interruption in water supply) and loss of fire suppression capabilities.

- **Drinking water quality:** degradation of water quality, which could result in loss of life and detrimental effects on human health.
- **Environmental:** harmful discharge to air, land, or water caused by human or mechanical failure.
- **Safety:** impacting the safety of the public or SFPUC staff.
- **Public perception:** damage to the SFPUC's reputation and the loss of consumer confidence in the SFPUC's ability to provide reliable and safe drinking water.
- **Financial:** loss of revenue if supplies cannot be made, increased expenses if regulatory fines are levied.

In general, facilities are deemed high risk when there is a relatively high probability of failure, and failure would lead to major operational consequences based on the criticality criteria defined above (i.e., loss of water supply and/or failure to meet water quality objectives). For condition assessment priority, it is important to note that this assignment of risk occurs at the facility level (such as HTWTP). Actual maintenance, which is performed on the individual assets in a facility, is prioritized using a method like the one discussed in the following section. Prior and next assessments at RWS facilities, linear assets, and dams are listed in Appendix C.

3.3.1 Facility Assessment Program

Formal assessment of most facilities began about 20 years ago, when the scoping process for the WSIP began. Most WSTD Tier 1 facilities were revisited in 2009, with assessments of Tier 2 facilities following in 2010. After these first rounds were completed, subsequent inspections were scheduled on a repeatable cycle. Many Tier 1/critical facilities were significantly modified by capital projects, which created challenges for capturing an accurate asset inventory. Although improving every year, many facilities still have incomplete inventory of assets in Maximo. A few critical facilties are well documented with about 95 percent of the assets in Maximo. Appendix C details the condition assessment priorities for facilities, dams, and linear assets.

For consistency and efficiency, all assets in a facility, such as a pump station or treatment plant, are assessed at the same time. Facilities completed under the WSIP have been be added to the appropriate condition assessment schedules. In some circumstances (e.g., specialized coatings and liners), assets must be inspected within the applicable warranty period, often 1 to 2 years after substantial completion. Tunnel inspection is particularly difficult and hazardous due to the presence of potentially explosive gas in many SFPUC tunnels. Despite these challenges, the SFPUC has been able to inspect four major tunnels in recent years (Crystal Springs By-Pass Tunnel, 2011; Mountain Tunnel, 2008 and 2017; CRT, 2015; and Irvington Tunnel No. 1, 2015).

Pre-Assessment Planning

Prior to conducting condition assessments, all records of maintenance performed since the previous assessment are reviewed by Maintenance Engineering staff. This includes, but is not limited to: CM logs, preventative maintenance logs, O&M manuals, standard equipment templates, relevant installation or as-built drawings, and relevant equipment specifications or

technical data sheets. Capital project deliverables (equipment lists, data sheets, and O&M manuals) are verified with existing CMMS data and onsite conditions.

If equipment requires an unusually high level of maintenance or displays unusually poor performance (compared to manufacturer's specifications and recommendations), Maintenance Engineering staff determines whether equipment is properly specified, engineering processes are appropriately designed, and equipment is installed properly. Maintenance Engineering then makes improvement recommendations to the facility manager, as appropriate.

Field Assessment

Assets are assessed in the field using standard asset condition assessment forms unique to the asset category (e.g., mechanical, electrical, structural, or linear). The facility assessment team consists of an operator, a facility manager,[5] a maintenance planner, a maintenance engineer, and any specialty tradesperson. For each assessed facility asset, the assessment team verifies that all asset details have been recorded on the equipment form. For each asset, the asset name, location, brief description, CMMS identification code, and date placed in service are recorded on the standard asset condition assessment form. If any information is missing, that is also noted.

Each assessed asset is visually inspected to observe its general condition. This observation is categorized using a numerical scale, and described on the forms. Equipment is also observed in operation, to the extent possible, and field observations or observed failures are recorded on the asset condition assessment forms. Corrective actions or remedies are identified and recorded.

Other recorded details include inspection date, assessment team, date of next inspection, time to complete the assessment, and estimated remaining useful life. Digital photos are taken of the asset, as required.

Post-Assessment Analysis

Following completion of all assets in a tier, Maintenance Engineering reviews data collected during the assessments, design records, and maintenance history records, and then completes a condition assessment report. Maintenance Engineering determines whether the process engineering is adequately designed and whether the equipment was properly specified and installed. The report also recommends improvements to maintenance or equipment upgrades/ respecification; new process engineering, if warranted; and parts/materials lists for essential spare parts. The goal of the report is to provide actionable recommendations to management that will lower life-cycle costs and reduce unplanned outages.

3.3.2 Linear Asset Program

The linear assets of the RWS include pipelines, tunnels, and penstocks, as well as watershed roads. This section primarily addresses pipeline inspections, which are usually performed inside a dewatered pipeline. The SFPUC continues to perform pipeline inspections to

[5] Staff leads for facilities vary; typically, chief stationary engineers manage treatment facilities and pump stations, plumber supervisors manage pipelines and vaults, and building superintendents manage buildings and corporation yards.

proactively find potential problems with transmission pipelines before major problems occur; as with facility condition assessments, pipeline inspections are risk-based.

Pipeline inspections are scheduled through a four-step process. First, a long-range recurrence inspection schedule is created based on date of the last inspection and the pipeline material. Second, criticality of the pipeline is considered, particularly if a segment of pipe will be relied upon with no redundancy during other outages. Third, the condition of the pipe found on the previous inspection is considered. Last, schedules are adjusted by up to 2 years (sooner or later) to accommodate construction and other system outages that can affect the cost of performing the shutdown and inspection. If a pipeline is particularly critical, cost is a minor factor.

The pipeline inspection program in the Bay Area began in 1990, with the dedication of two engineers to the task. During the early 1990s, utility plumbing crews were expanded to prepare pipelines for interior inspections, support inspections, and replace any inoperable appurtenances. Since the inception of the inspection program at WSTD, 139 miles of the 229 miles pipeline were inspected at least once in the inspection program, and 90 miles of pipeline have never been inspected (30 miles of which is newer pipelines built between 2012 and 2015). HHWP has been performing condition assessments on the SJPLs since 2006 and has inspected more than 42 miles of pipe.

There are a variety of pipeline types and sizes that require specific inspection techniques to detect flaws and assess conditions particular to each pipeline. Each type of flaw requires unique repair methods to restore the pipeline. Some flaws are significant enough, or extensive enough, to warrant replacement or slip-lining.

Most inspections of pipelines use visual methods to detect flaws. The most common category of pipeline is WSP, representing more than half of the total distance of transmission pipelines. Riveted pipelines, the oldest in the transmission system, also make up a significant portion of the total. RCP is also inspected visually, but has flexible joints, a unique feature. Steel "lockbar" pipeline develops flaws similar to those of WSP. A combination of acoustic sounding (with a ball peen hammer) and visual inspections is performed for all pipelines.

Inspections of steel pipe sections of the SJPL are performed with a HHWP inspection device.[6] The device identifies areas of thin wall that require repair and/or replacement of long sections of pipe with significant corrosion. Spot repairs guided by such inspection data are one of the best options to extend the life of the asset at the least cost.

Due to the liabilities associated with PCCP and the prevalence of this pipe in other water systems across the world, special technologies have been developed to inspect and detect the unique flaws that can develop in PCCP. An electromagnetic device is towed through a dewatered pipeline section by a specialized contractor to determine the number of broken prestressed wires that surround the pipeline (when intact, these wires provide most of the hoop strength). A baseline of current wire breaks is typically established for each pipe section using prior inspection data or a calibration section of pipeline of known condition (if available). Then

[6] More information on the HHWP inspection tool is available at this link: Advanced Method of Condition Assessment for Large-Diameter Mortar-Lined Steel Pipelines. https://infrastructure.sfwater.org/fds/fds.aspx?lib=HHWP&doc=210945&data=65603895

additional wire breaks can be detected/monitored through real-time monitoring using acoustic fiber optic cable inserted into the pipeline (while it is in service), or by additional inspections.

These proven methods have been used throughout the industry for more than 10 years and are reliable. Details of linear asset condition and inspection techniques are included in Appendix D and Appendix E.

The valve exercise program is designed to extend the useful life of valves, increase reliability, and reduce life-cycle costs. The valve exercise program is based on specifications outlined in the valve manufacturer's O&M Manual, as well as best management practices (BMPs). See Section 4.2.3 for a description of the transmission valve exercise program.

3.3.3 Dam Assessment Program

The SFPUC owns and operates 22 dams that are part of the RWS, of which 15 dams—including 11 regional dams outside San Francisco and four dams in San Francisco—are under the jurisdiction of the California DSOD (Table 3-2). The RWS includes the six dams under DSOD jurisdiction in Tuolumne County (Early Intake Dam, Lake Eleanor Dam, Moccasin Dam (aka Lower Moccasin Dam),[7] O'Shaughnessy Dam, Priest Dam, and Cherry Valley Dam); two in Alameda County (Calaveras Dam and Turner Dam); three in San Mateo County (San Andreas, Pilarcitos, and Lower Crystal Springs); and four in San Francisco County (University Mound [North and South] and Sunset Reservoir [North and South]). This report does not cover the other dams in San Francisco County that are not part of the RWS and serve only local residents in San Francisco. In addition, the SFPUC owns, operates, and maintains several smaller dams in the RWS that are not under the jurisdiction of the DSOD (see Table A-1 in Appendix A for the full list of RWS dams).

As shown in Table 3-2, each dam receives a hazard classification from the DSOD with respect to dam safety. This classification is based solely on downstream hazard considerations in the unlikely event of dam failure resulting in an uncontrolled release of water, not the actual condition of the dam or its critical appurtenant structures. The downstream hazard is based solely on potential downstream impacts to life and property should the dam fail when operating with a full reservoir. This hazard is not related to the condition of the dam or its appurtenant structures.

- Low - No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.
- Significant - No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
- High - Expected to cause loss of at least one human life.
- Extremely high - Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

[7] Moccasin Upper Dam is an appurtenance of Moccasin Dam.

Table 3-2: DSOD Jurisdictional Dams in the Regional Water System

Dam	County	Year Built	Reservoir Vol. (AF)	Downstream Hazard Class	EAP in Place	Inundation Maps Due	Evaluations Underway	DSOD Condition Assessment
Calaveras	Alameda	1925	96,800	Extremely High	Yes	1-Jan-18		(in construction)
James H. Turner	Alameda	1964	50,500	Extremely High	Yes	1-Jan-18	Spillway	Fair
Lower Crystal Springs	San Mateo	1888	69,300	Extremely High	Yes	1-Jan-18		Satisfactory
Pilarcitos	San Mateo	1866	3,100	High	Yes	1-Jan-19		Satisfactory
San Andreas	San Mateo	1870	19,027	High	Yes	1-Jan-19	Spillway	Satisfactory
O'Shaughnessy	Tuolumne	1923/38	360,360	Extremely High	Yes	1-Jan-18	Spillway	Satisfactory
Cherry Valley	Tuolumne	1956	273,500	Extremely High	Yes	1-Jan-18	Spillway	Satisfactory
Early Intake	Tuolumne	1925	115	Low	Yes	Not Required		Fair
Lake Eleanor	Tuolumne	1918	27,113	High	Yes	1-Jan-19		Satisfactory
Moccasin	Tuolumne	1930	554	High	Yes	1-Jan-19	Spillway, Dam	Poor
Priest	Tuolumne	1923	1,706	High	Yes	1-Jan-19		Satisfactory
Sunset North Basin	San Francisco	1938	274	Extremely High	Yes	1-Jan-18		Satisfactory
Sunset South Basin	San Francisco	1960	268	Extremely High	Yes	1-Jan-18		Satisfactory
University Mound North Basin	San Francisco	1885	182	Extremely High	Yes	1-Jan-18		Satisfactory
University Mound South Basin	San Francisco	1937	249	Extremely High	Yes	1-Jan-18		Satisfactory

Notes:

Downstream Hazard Classification: (classification is based solely on downstream hazard considerations, not the actual condition of the dam or appurtenant structures.):

Low – No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.

Significant – No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.

High – Expected to cause loss of at least one human life.

Extremely High – Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

Definitions of downstream hazard classification and DSOD condition assessment can be found at https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-safety-of-dams/Files/Publications/DSOD-Dam-Rating-Information-and-FAQs.pdf

AF = acre-feet
CIP = Capital Improvement Program
DSOD = Division of Safety of Dams
EAP = Emergency Action Plan
WSIP = Water System Improvement Program

Of the nine jurisdictional dams in the Bay Area, Lower Crystal Springs is a concrete gravity arch dam; the other eight (Calaveras, Turner, San Andreas, Pilarcitos, University Mound North and South, and Sunset North and South) are earth embankment dams. See Appendix A for additional detail.

The system also includes several other smaller, nonjurisdictional dams. UCSR is relatively large in terms of storage volume by comparison to the others, but only impounds water 3 to 10 feet above the adjacent LCSR.

Dam Safety Program

HHWP, WSTD, and City Distribution Division (CDD) implement ongoing comprehensive dam safety programs to monitor, inspect, and maintain the dams to ensure public safety downstream. HHWP updated its Dam Safety Program in 2014. In FY18, WSTD updated its Dam Safety Program, which extends beyond the minimum requirements of the DSOD, outlined in the California Water Code, Division 3 – Dams and Reservoirs.

This extensive program establishes policies, objectives, and expectations as they relate to dam safety, including a surveillance and monitoring program. The SFPUC has adopted the following long-term commitments as they relate to the operation of their six dams.

- The dams and appurtenant structures will be operated in a manner that keeps them operationally and structurally safe.
- The dams will be maintained in a safe and nondefective condition to prevent degradation of the dam and appurtenant structures, and to maintain serviceability.
- The dams will be subjected to regular preventive and CM activities, jointly implemented by Maintenance Engineering and O&M staff for HHWP and WSTD. Dam maintenance records will be maintained by the Maintenance Engineering Staff. Example preventive and CM activities include crack repairs, vegetation and rodent control, ground repairs, instrumentation repairs, and valve and electrical system repairs.
- Nonroutine, specialized, and large -scale dam maintenance work and studies will be addressed by the Division's CIP. They will be designed by consulting engineers and will include projects such as instrumentation upgrades, and dam, spillway, or outlet retrofits. Planning projects may include studies such as seismic stability evaluations, inundation map updates, and emergency planning.
- Routine surveillance, monitoring, and reporting of the dam conditions will be performed in accordance with the surveillance and monitoring program. These activities include regular engineering inspection and analysis; reporting of instrumentation readings and measurements, such as piezometer, seepage, rain gage, and reservoir level readings; and engineering surveys of the dams for differential movement.
- The dams will be inspected once a year by staff from Engineering and Surveying, Dam Safety Program and other Division personnel and/or consultants, as deemed necessary or prescribed by the protocols specific to each Water Enterprise Division. DSOD personnel will be invited to participate in these inspections. The results of the annual inspections will be

documented in the Dam Inspection or Surveillance and Monitoring Report, and submitted by Engineering staff for management review in accordance with Division procedures. A copy of the Dam Inspection or Surveillance and Monitoring Report will be sent to the DSOD upon completion of this review.

- The valve exercising program requires the SFPUC to operate the adit valves and emergency release valves for each dam once per year. Every 3 to 5 years, DSOD inspectors, along with the Division engineer and inspector, will need to witness the valve exercising for each dam. A wet test with all the valves opened all the way is preferred. When environmental restrictions prevent the full release of water downstream (as was the case for Turner Dam for many years before 2018), a dry test will be done by opening and closing the emergency release valves with the adit valves closed (thus not allowing any water to go downstream). After testing, the emergency release valve is then closed and the adit valves are opened and closed.

- WSTD participates in the Bay Area Dam Owners Group (a local collaborative effort with SCVWD, Contra Costa Water District, and EBMUD), including peer review and information sharing on topics such as dam safety and monitoring, environmental permits for dam maintenance, emergency preparedness, seismic stability analyses, and operational restrictions.

3.4 Planning

Identifying any shortcomings between desired performance and actual performance, and then determining how to close the gaps with capital projects, modified maintenance, or enhanced staff training is the primary function of the planning process. A well-designed planning process involves thorough research, broad involvement by staff and stakeholders, and documentation of assumptions and decisions. As discussed above, knowledge of asset condition is paramount to this process.

3.4.1 Develop and Review Maintenance Programs

Maintenance procedures for assets originate from manufacturer documentation that is usually delivered at the time of asset acceptance (either delivery sign-off or during project closeout). A capital project can typically generate hundreds of new assets and procedures. Tracking to ensure delivery of this information is a separate effort, and is discussed below.

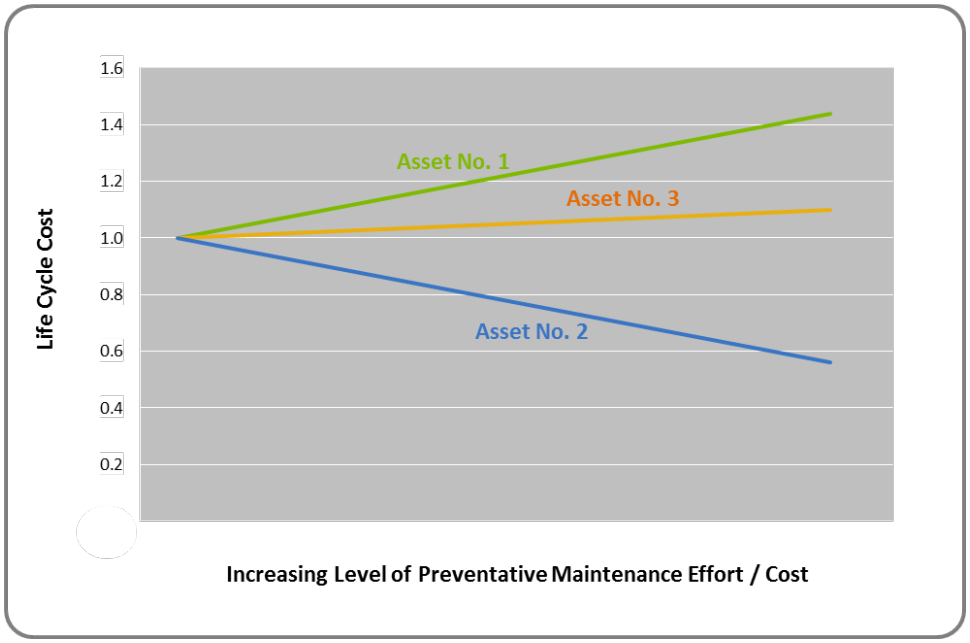
These procedures must be translated into "job plans" that outline the specific sequence of maintenance tasks, the frequency and timing of the procedures, and which work crews must work together to complete the tasks. These translation and set-up functions are performed by maintenance planners, and a maintenance engineer confirms the technical aspects of the maintenance tasks.

In 2015, WSTD began using external maintenance experts to review the job plan for Baden Pump Station to ensure that appropriate maintenance was being performed and documented. This peer review ensured that the scope of maintenance was understood and appropriately prioritized. Reports are also reformatted into easier-to-read summaries that can be quickly generated from the work order database. These reports allow managers to track how often and

how thoroughly maintenance is being performed at a facility, compared to objective industry standards. Such standards may ask whether the appropriate critical work tasks are being completed; identify how work is currently being documented; identify how accomplished work is being reported; determine whether the maintenance team is appropriately staffed. The review effort was initiated at the Baden Pump Station and is now focused on the SVCF. The review also concluded that typical industry standard has a ratio of one planner to 30 staff. WSTD's planner to staff ratio is 1:60. HHWP is currently not using these tools.

The decision on whether and/or when to perform preventive maintenance (PM) is based on two objectives: to minimize unplanned outages (reliability) and to minimize life-cycle costs. For a given level of reliability, higher levels of PM can result in different life-cycle cost scenarios, depending on the asset. This is illustrated by the three hypothetical examples on Figure 3-2.

Figure 3-2: Preventive Maintenance Prioritization Methodology



For hypothetical Asset No. 1, increasing PM activities increasingly adds to the overall life-cycle cost due to its low replacement value. The maintenance strategy employed in this case should appropriately be "run to fail" (assuming reliability is unaffected). Examples include off-the-shelf electronics and sensors, as well as inexpensive pumps or motors that require little or no PM.

For Asset No. 2, increasing PM activities continues to lower the overall life-cycle cost, a typical result for large-value assets. Investment in corrosion protection is an excellent justification for paying higher PM costs to reduce overall life-cycle costs. Without proper corrosion protection—which could cost as little as $10,000 a year—a $100-million pipeline can have its useful life reduced by 50 percent.

For Asset No. 3, increasing PM activities slightly increases overall life-cycle costs. Although the goal of any PM program is to lower overall life-cycle costs, the role of certain assets in water system reliability (or any part of LOS) may warrant deviation from this goal. If high operational consequences result when a chlorine injection pump that has little redundancy experiences an

unplanned outage, the higher life-cycle costs attributed to maintenance (assuming that the maintenance is effective at increasing useable life and/or reliability) may be warranted to reduce system risk. Also note that in general, when maintenance is not cost-effective, system reliability can still be addressed by adopting a maintenance plan that essentially consists of predicting the component's remaining useful life and then replacing it when it reaches 85 to 95 percent of that value. Many systems in the RWS in contact with corrosive chemicals fall into this category.

3.4.2 Compile Performance and Failure Reports

Equipment and asset failure reporting is a critical function of asset management. Incidents that occurred in FY17 and FY18 did not disrupt water service to customers. These incidents included: chemical leaks/overfeeds in the Sunol Valley region, UV lamp breaks/lamp failures at the TTF, various equipment failures throughout the RWS, communication issues between facilities in the East Bay Field, and operator errors. Two of the more significant events were the TTF UV lamp failures and lamp breaks, and SCADA issues that led to off-spec water events. In regard to the TTF UV lamp failures and lamp breaks, WSTD has been closely working with the UV manufacturer to further troubleshoot the incidents to determine the root cause. In addition, a consultant is being hired to evaluate causes outside of just the UV system.

One of the SFPUC's goals during a RWS emergency is passing on the most accurate and current information to the wholesale customers. The SFPUC's primary notification tool is i-INFO, which allows the SFPUC to reach out to the largest group in the least amount of time, and pass along the most current and accurate information available. Where individual customers may be impacted to a greater extent, individual calls are made using the contact information provided by the wholesale customers. As more information becomes available, i-INFO is used to keep customers apprised of significant developments.

A powerful tool to help wholesale customers make decisions is eDna. eDna is the SCADA historian linked to the SCADA network. This information is transmitted in near real time. The critical detention time and water quality data used for notifications and operational decisions is available to the wholesale customers.

Appendix F contains a full list of incidents during the reporting period, along with the root cause of the failure. Corrective actions are documented in individual failure reports. Any of the following circumstances can trigger an incident report: partial or total unplanned outage of a facility (or "near miss"), unplanned discharge to the environment, drinking water quality violation (or anything reportable under the drinking water permit), employee injury (or anything reportable under California OSHA requirements), and chemical spills or leaks that are reportable to regulatory agencies such as Alameda County, San Mateo County, San Joaquin County, and the California Governor's Office of Emergency Services.

Failures from inadequate preventative maintenance can be addressed by reviewing procedures, designating critical equipment in CMMS, ensuring that condition assessments are performed, and periodically reviewing incident reports with all (not just affected) staff.

After an unplanned failure of an asset or facility is reported by operations or detected by SCADA, the SFPUC completes a simple, streamlined Incident Report that records a description,

chronology, possible root cause, and suggested corrective action for the incident. Near misses also count as incidents, even though no realizable operations impacts occur. For example, when a redundant chemical feed pump fails and results in use of a backup, no significant operational impact would have been felt, but the failure is still significant. Other opportunities to gather and trend asset/facility failures (even when they do not reach the level of seriousness of an "incident") come from the SFPUC's internal notification system, i-INFO (the SFPUC's emergency notification software), weekly operations meetings, and CM work orders generated by MAXIMO.

The relevant incident details are recorded in the CMMS. Typical root cause of common failures include: inadequate PM, inadequate design, poor specifications, inadequate training for staff, poor procedures, poor communications, and operator error. Sometimes failures fall outside of these categories, or the reason for a failure is unknown. Typical remedies can include: replacement in kind, modified maintenance, modified operations, revised equipment specifications, and/or enhanced monitoring and training. Recording the performance histories in the CMMS allows long-term review for a piece of equipment or facility (all pieces of equipment are parts of larger facilities). Most importantly, a corrective action plan is developed for each incident. Details for FY17 and FY18 incidents for HHWP and WSTD are shown in Appendix F. Since the 2016 State of the Regional Water System Report, the definition of "incidents" has expanded to include regulatory violations. The increased number of reportable incidents has more than doubled due to this change.

3.4.3 Complete Master Plans

An essential planning function is provided through regular updates of master plans. Typically, master plans cover certain facility classes, such as water treatment plants; general reliability areas, like seismic or corrosion protection; or groups of related assets in a specific geographic location, such as the peninsula low-pressure zone. The plans are updated in a staggered schedule, with one or two completed each year to moderate workload and facilitate integration into the CIP. The scope of master plans extends beyond a simple condition assessment that may be conducted for a given facility on a regular 3-year or 5-year cycle. Master plans include broader asset and/or operational options and LOS factors. For example, a condition assessment documents an asset's state of repair and performance and normally generates a corrective work order or review of the PM; a master plan, on the other hand, will consider whether the asset should be repaired, replaced in kind, upgraded, or abandoned if rendered obsolete. Master plans also occur at the facility level, not the asset level, which allows analyses of how groups of assets are functioning together in a given facility (allowing an engineering process review). Master plans also consider broader failure modes, such as seismicity and large-scale facility structural vulnerabilities; and broader planning objectives, such as relation to the adopted LOS. The master plan schedule is an important reference document and is included in the CIP.

Table 3-3 list schedules for the relevant master plans. Appendix C provides schedules of major condition assessments.

Table 3-3: Master Plan/Inspection Schedule – Bay Area

Program	FY Start	FY Completion
Corrosion Protection (completed)[8]	2009	2010
Dam Maintenance Program – Stability Study Update LCSD[9] San Antonio/Turner Dam San Andreas Dam	2012 2018 2018	2014 2019 2019
Peninsula High-Pressure Zone (PPSU)[10, 11, 12]	2014	2015
Communication Systems	2014	2017
Water Storage – Pilarcitos System Improvements	2015	2019
Chemical Feed Systems – SVCF	2016	2019
Peninsula Low-Pressure Zone Pipelines	2016	2017
Irvington Tunnel Nos. 1 and 2 (Existing)[13]	2015	2015
BDPL Nos. 3 and 4[14]	2016	2019
Alameda Siphons, Calaveras Pipeline, San Antonio Pipeline, SABPL	2017	2018
BDPL Nos. 1, 2, and 5 [15, 16]	2017	2018
SVWTP Reliability Upgrade	2020	2021
HTWTP	2019	2020
Vaults, pump stations, chemical systems, storage tanks, field equipment, etc.	*Ongoing 5-year, 7-year, or 10-year condition assessment cycle.*	

Notes:
BDPL = Bay Division Pipeline
FY = fiscal year
HTWTP = Harry Tracy Water Treatment Plant
LCSD = Lower Crystal Springs Dam
PPSU = Peninsula Pipelines Seismic Upgrade
SABPL = San Antonio Backup Pipeline
SVWTP = Sunol Valley Water Treatment Plant
SVCF = Sunol Valley Chloramination Facility

[8] Schiff Associates, "*Corrosion Survey for Transmission Pipelines Contract No. CS-904.C*," SFPUC, July 2010.
[9] URS report, "*Lower Crystal Springs Dam Structural Evaluation*" (SFPUC, 2013).
[10] Related documents include San Francisco Water Alliance, "*Peninsula Improvement Program Final Report*," SFPUC, March 2002.
[11] Related documents include San Francisco Water Alliance, "*Peninsula Improvement Program Technical Memo 2, Hydraulic Modeling of Emergency Operations*," SFPUC, November 2001.
[12] MWH/Lee report, "*San Andreas Pipeline No. 2 Extension, Conceptual Engineering Report*," SFPUC, June 2015.
[13] Related documents include URS Corporation, "*Final Technical Memorandum No. 8-01D (New) Tunnel Hydraulics*," SFPUC CS-820, March 2008 SHOULD BE 2015 report reference.
[14] Related documents include URS Corporation, "*Bay Division Pipeline 4 Reaches A and D Condition Assessment*," SFPUC, June 30, 2008.
[15] Related documents include Engineering Management Bureau, Water Infrastructure Partners and Project Management Bureau, "*Bay Division Pipeline Reliability Upgrade Phase 2 AAR,*" SFPUC, July 2004.
[16] Related documents include Engineering Management Bureau, Water Infrastructure Partners and Project Management Bureau, "*Bay Division Pipeline Reliability Upgrade Phase 3 CER*," SFPUC, January 2005.

3.5 Budgeting

Since FY15, the CCSF has adopted a 2-year budget (both operating and capital). The 2-year budget is prepared and adopted during even-numbered FYs and becomes effective for the two succeeding years. The SFPUC's CIP is updated each year to coincide with the annual updates of the CCSF's CIP. Mid-budget cycle adjustments are minimized.

The capital budget process runs parallel with the Water Enterprise's operating budget requests, the 10-year Capital Plan, and the 10-year Financial Plan. During budget preparation, managers must forecast operating expenses for the next two FYs. The task requires anticipation of asset completion and the necessary staff and resources needed to maintain them. This is particularly challenging with new groundwater wells coming on line in FY18 and FY19, which involves phased testing and operation, and specialized staff. On the capital side, more iteration is required between finance staff and operations staff as they work together to complete the CIP. Rate projections, reserve balances, and financing options each affect the size of the CIP, particularly in the first 2 years of the 10-year Plans. The SFPUC has a Budget Steering Committee that guides the schedule and process for budget updates every 2 years. The budget process generally follows the schedule shown in Table 3-4, beginning in odd-numbered FYs and ending in even-numbered FYs.

Table 3-4: Budget Update Schedule

Date	Budget and CIP Milestone
Spring and Summer	The SFPUC Budget Steering Committee meets to discuss budget and CIP development process.
September	The SFPUC Budget Steering Committee distributes Budget Policy and Procedures document to staff.
September	Staff receive a budget instruction memorandum from General Manager; Unifier system available for staff to submit CIP projects.
September and October	Staff submits projects in Unifier, including description of project, justification, impact if the project is not implemented, budget by project phase, proposed schedule, and risk ranking.
October and November	Executives approve potential projects, and Finance begins funding analysis.
November	Budget staff consolidates all budget submittals into proposed operating and capital budget adjustments for review by Executive Team.
December	Executive Team considers project need, financial impact, and staffing considerations to determine final proposed budget and CIP.
January and February	Commission budget workshops and adoption.
End of February	Budget submitted to Mayor/Controller's office.
March and April	Review by Mayor's Budget Analyst, City Capital Planning Committee, and Controller's Office.
May and June	Board of Supervisors budget review and adoption.

Notes:
CIP = Capital Improvement Program
SFPUC = San Francisco Public Utilities Commission

During the fall and before the Commission budget workshops, staff meets with the Bay Area Water Supply and Conservation Agency to review potential projects in the CIP and confirm capital program priorities. Following internal review by senior management, various Commission workshops are held to discuss the budget with staff in January and February. CIP and budget materials are publicly available in advance of the meetings, in accordance with Commission rules. Rate hearings are held later in the spring. The Mayor's office reviews the SFPUC's budget before presenting the citywide budget to the Board of Supervisors. Finally, the Board of Supervisors reviews and ultimately adopts the budget, usually in late June. Each of these reviews can modify aspects of the SFPUC's budget.

3.6 Implementation

The planning process refines and guides maintenance programs and scoping of capital projects. The major maintenance programs are outlined in detail in Section 4, along with their corresponding accomplishments from FY17 and FY18, as well as plans for future work. Maintenance prioritization in a program, and across programs, is discussed above.

3.6.1 Types of Maintenance Performed

All maintenance programs consist of different type of work orders, although most consist of work orders for either preventive or corrective maintenance. A full list of work order type is shown below for reference.

- **Preventive Maintenance:** This refers to work on a specific asset that is interval- or condition-based. Besides traditional PM, PM work orders in the CMMS include diagnostic testing, servicing and overhauls, compliance/regulatory items, and scheduled inspections. Only assets have associated PMs.

- **Corrective Maintenance:** This refers to unplanned failure or reduced performance on a specific asset that is discovered through field observation, condition assessment, report by an operator, SCADA alarm, or customer report.

- **System Operations:** This refers to work directly supporting operations, but not including maintenance-related work.

- **Capital Support (i.e., WSIP):** This refers to maintenance work in direct support of a capital or R&R project. This includes activities such as dewatering/disinfecting pipelines to support construction, performance testing, and attending project meetings.

- **Administration:** This work type is for O&M staff performing indirect work associated with administrative activities, such as completion of timecards (eTime), training, and safety tailgate meetings.

- **Other:** This refers to miscellaneous operational or maintenance work that does not fit the categories indicated above. One example is corporation yard maintenance.

In practice, the fundamental Reliability Centered Maintenance concept is reflected in maintenance efforts in the RWS that are focused on maintaining reliability of critical assets and

that strive to be conditions-based. Work is screened through the maintenance planning group (as described below) and reviewed by the O&M Manager to ensure that work on critical assets is prioritized prior to being scheduled and disseminated to maintenance staff.

As described above, work orders are labeled in the CMMS by type, but the planning/ prioritization process uses additional terms to delineate CM work: planned or unplanned (PM and other work order types are usually categorized as planned).

- **Planned work.** Whether corrective, preventative, or another type, a work order is considered to be planned if a job plan is written and reviewed in the CMMS, the normal approval process is followed, all permits are secured, and appropriate notifications occur. Even after an unplanned failure of asset occurs, the corresponding corrective work order could still be planned. Most planned work is routine and regular.

- **Unplanned work.** Work that skips one or more planning steps due to urgency is characterized as unplanned work. Approvals for work scope, timing, use of overtime, and job parameters can be verbal, as directed by management. Work orders in this category are sometimes created after or during the work.

3.6.2 Work Order Prioritization

This section describes the general process used to prioritize work orders for the RWS, with some differences in actual practice between WSTD and HHWP acknowledged. Prioritization by mid-level managers is required due to the volume of work, and the higher level of perspective needed to gauge the importance of potential tasks—including determining when work orders should not be performed, because the work is not cost-effective or because the work would make it impossible to maintain system reliability.

Work Order Approval and Scheduling

Once a work order has been fully developed and has been appropriately cataloged, the work order enters the approval and scheduling phase, where it is reviewed and approved by the Planning Manager. Once approved, staff may charge labor and materials against the work order until it has been closed, cancelled, or completed. Blanket work orders are usually approved at the beginning of the FY.

Blanket work orders cover only three types of work: 1) general tasks to be completed at a treatment facility by operations staff only; 2) indirect administrative work for supervisors; and 3) staff training. This type of work order is entered into the CMMS through the work request or the work order tracking screens. All blanket work orders follow the same general principles as other work orders and can appear as either child or parent work orders. However, blanket work orders are established at the beginning of each FY, and after preliminary review are immediately approved. All blanket work orders remain open throughout the FY but are closed at the end of each FY.

For all nonblanket work orders, maintenance planning staff schedule the work order depending on the priority level assigned, nature of the work, and availability of staff and materials.

Work order approval and scheduling decisions are made based on the same methodology as the condition assessment program, in that work is prioritized according to the operational consequences of reduced performance level or total failure of a piece of equipment. A CM work order may involve in-kind replacement, upgrade, repair, or demolition and site remediation when the asset is no longer needed.

Work Order Priority System

After PM activities are determined to be appropriate, completion priority generally uses the same logic. That is, the first PM activities to be scheduled are those that reduce the most life-cycle cost and those that increase system reliability the most. Predictive maintenance is not currently performed, but a method using the SCADA system is being explored.

Because work orders of all types are generated on a daily basis, a standardized system is used to prioritize work based on the urgency of completion. In the CMMS, each approved work order receives a priority ranking:

> **(9) Emergency:** The existence of an imminent threat to life or limb, an imminent catastrophic threat to the environment, or an imminent threat of catastrophic equipment failure exists **(usually declared by management)**.
>
> **(8) Operational Failure:** A personal injury, unscheduled shutdown of critical equipment, harm to the environment, or sustained breach of water quality resulting in a Regional Water Quality Control Board or SWRCB DDW violation has occurred, and immediate action must be taken.
>
> **(7) Urgent Work:** High Probability of Failure. Urgent action needed to prevent Priority 8 or 9 occurrences. These situations are usually found during PM inspections, but may result from general observations while in an area.
>
> **(6) Regulatory Compliance PM:** Regulated Testing, Maintenance, and Inspection Activities; these work orders will typically emanate from a regulating body such as the Department of Transportation (DOT), the Department of Motor Vehicles (DMV), OSHA, WECC, CPUC, Regional Water Quality Board, or SWRCB. Examples of this type of work might include DOT vehicle inspections, DMV smog testing, protective relay testing and maintenance, or ROW vegetation management inspections.
>
> **(5) High Criticality Asset PM:** Preventive/Predictive Maintenance on critical assets, support of WSIP or Hetch Hetchy System Improvement Program construction projects, or a limited window of opportunity (such as a shutdown).
>
> **(4) Standard PM:** Preventive/Predictive Maintenance/Safety/Code Corrections.
>
> **(3) Routine Work:** Schedulable maintenance repairs, as a result of PM or general observation, regular/routine work, and cottage remodel work.
>
> **(2) Low Priority Work:** Work that enhances system or mission performance.
>
> **(1) Desirable Work:** No direct effect on system or mission performance if not done.

Maintenance Backlog Management

The maintenance backlog is defined simply as a combination of work orders that have been submitted and approved, but are awaiting work initiation; and work that has been identified but not yet approved to proceed. Most of the backlog tends to be low-priority work orders that continually fail to get scheduled due to the presence of higher-priority work. Backlog work orders can also consist of deferred PM. Planning staff monitor outstanding work orders and reinitiate priority ones with trades supervisors.

On a weekly basis, all work in the backlog is reviewed for potential scheduling. At WSTD, priority of the work is used first to screen the work that gets scheduled. In each priority group, assuming all things are equal, the "oldest" work order is scheduled first. The remaining work is scheduled according to "age," in descending order, until either the schedule is full or there are no more remaining work orders among that priority group. Any work order older than one FY is cancelled. Meetings among mid-level managers and trades supervisors ensure that priority work remains in the system.

HHWP staff place work requests into a backlog where managers responsible for their specific work groups approve and commit resources to jobs that are to be performed in the upcoming 30 to 45 days. The HHWP's Asset Management Services group plans and schedules maintenance activities for crafts 7 to 14 days in advance to allow for sufficient notification and coordination to occur.

Performance is tracked using metrics that evaluate:

- labor availability;
- actual work performed on Scheduled versus Unscheduled work (1 week in advance); and
- actual work performed on Forecast work (2-week look-ahead).

As schedule success increases, reactive work decreases, demonstrating an improvement in the maintenance and management of HHWP assets.

Hetch Hetchy is always striving for continual improvement in its maintenance program, which is demonstrated by the implementation of a comprehensive work order life cycle. The work order life cycle begins with initiation and continues through review, approval, execution, feedback, closeout, and updating job plans and asset information as appropriate, all of which are documented by standard operating procedures. This process ensures a standardized approach across all work groups that is measurable and encourages staff participation at all levels.

3.6.3 Capital Project Completion and Closeout Reporting

One of the major responsibilities of the SFPUC during the WSIP is to ensure that appropriate asset management deliverables are received by operations staff and archived by project teams and contractors prior to project closeout. These deliverables include complete sets of equipment manuals (also called O&M Manuals), warranty information, record and as-built drawings, equipment inventory sheets, and in some cases specialized trainings, operating permits/ agreements, and service agreements.

Project closeout is an important step in the overall asset management program. When asset management deliverables are received at project closeout, the information is incorporated into the asset management program. For example, asset inventory data such as equipment lists and identifications are incorporated into the CMMS asset register. Manufacturer-recommended PM cycles are used to develop job plans and PM schedules.

WSIP Construction Management Procedures 32 and 33 describe the Contract Closeout and "Record Documents" submittals, respectively. The Contract Closeout procedure outlines the process by which verifications are made for satisfactory completion of contract work. The Record Documents procedure specifies the process by which record information is collected and documented in construction drawings and at completion of projects, and by which final project record documents are produced, certified, and archived. Projects designated as completed (meaning Final Completion) have 3 to 6 months before the project is closed out. During that time, O&M manuals, Equipment Data Sheets, and Record Drawings are collected and compiled.

WSIP closeout deliverables are audited each quarter and reported to the WSIP and Water Enterprise management, with formal reports beginning in FY12. The most recent tracking sheet is included in Appendix G. As shown in Appendix G, outstanding deliverables exist. Accordingly, Water Enterprise staff actively pursue these deliverables with the various WSIP project teams. Obtaining deliverables from the earliest WSIP projects can be costly (and often unbudgeted)—and difficult, because the earliest projects worked off of less-complete specifications in this area. Still, comparing Appendix G from the 2012 version of this report (when the data were first tracked) shows the task to be nearly complete after years of effort.

Warranty periods are also tracked so that operations staff can thoroughly test components and/or inspect them prior to the expiration of contractor or supplier warranties. Advanced planning is required for inspections of interior pipeline linings, because these actions require additional facility shutdowns at the same time as construction-driven shutdowns.

3.7 Ongoing Program Implementation

Going forward, the approach to maintenance is to reduce the CM and move toward more PM and even predictive maintenance. As more PM is implemented, more costly CM should be avoided. Predictive maintenance will be implemented in situations where it can be shown to be cost-effective.

With WSIP construction winding down in FY19, a big initiative in the coming years will be to ensure that asset inventory is accurate (adding new assets, deleting obsolete or replaced assets, and maintaining existing assets). Rehabilitation and upgrade projects occurring at the same facility make this a challenge. Implementing this shift in approach requires acceptance of ownership and associated responsibilities of all new assets constructed and/or installed in the RWS as part of the WSIP.

Another area of improvement is to accurately record total maintenance and R&R costs of assets in the RWS. Currently, maintenance functions are performed by multiple divisions and groups in the SFPUC, city departments outside the SFPUC, and outside specialists. Finally, significant maintenance is performed in treatment facilities as part of the daily work routines of assigned water treatment plant staff. This work should be better integrated into the CMMS for a more complete picture of asset management at these facilities.

APPENDIX C
Interview Questions

ASSET REGISTRY

- Please discuss the procedures for creating and modifying assets.
  In particular, please address QA/QC and establishment of maintenance programs for the asset.
- Please discuss the level of completeness of the asset registry in Maximo.
  Speak to the asset listing and attributes.
- Please discuss the asset hierarchy.
  How do you use it?
  Is it used consistently and uniformly across the Enterprise?
- Please discuss the Asset Classification Domain and its versatility in classifying assets.
  There appear to be a mix of asset classifications as well as projects, problems, etc. in the Domain.
- Please discuss the asset attribute domain and its versatility in describing asset characteristics or details.
  To simplify domains, are subtype used as well as descriptive attributes?
- How does SFPUC determine assets to be included in the fixed asset registry and Maximo
  Do you have a policy that defines an asset for these purposes?
- Is the asset registry audited or reviewed for accuracy at some frequency?
  If so, what is the frequency and what is the procedure?

IT CAPABILITIES TO SUPPORT AM

Please discuss or identify the software tools used for asset management.

- Please provide a Data Flow Diagram and discuss the integration functionality between asset management systems
- Please discuss the modules used with Maximo.
- Please discuss the discovery tools you use for asset management systems.
- Please discuss the platforms in use for mobile or remote connectivity.
- Please discuss the IT support roles and staff dedicated to asset management. Please include contract vendors.
- Please discuss your replacement policy for asset management software tools and network infrastructure.
- Please discuss the budget for IT support and services.
  Please focus on staff and replacement of hardware and software.
  Please address license and maintenance renewal contract management
- Please provide and discuss your network diagram.
- Please discuss the Patch Management Plan for Asset Management systems.
- Please discuss the network security plan for asset management systems including mobile connectivity.

RISK PROCEDURES

- Please discuss SFPUC's Risk Policy.
  Please speak to the definitions of risk parameters, the interpretation of the risk parameters to assign a risk rating, and the thresholds for action.
- Does SFPUC have a formal process to evaluate criticality?
  Please speak to a schedule for evaluating risk parameters, criticality and the risk register.
- The 2018 State of the Regional Water System Report mentions an Asset Risk Tool. Please describe what this tool provides.
- Are risk and the risk parameters contained in the asset registry? Please discuss.
- Please discuss the criticality criteria in use for all assets.
  What are the core parameters and criteria?
  How are they weighted?

O&M IMPROVEMENT

- Please discuss your preventative and predictive maintenance program.
- Please discuss the business processes/practices in use for work management.
  How is Maximo used during the work order lifecycle?
- Please discuss/describe the data that is collected and how it is used to evaluate asset performance.
- Please discuss how work is prioritized.
  Please discuss how work backlog is managed.
- Please describe the work management data collected. How is it used to monitor performance and improve efficiencies?

CONDITION ASSESSMENT AND REMAINING USEFUL LIFE (RUL)

- Please discuss how condition assessments are performed for all regional SFPUC assets.
  What interval are assets evaluated?
  What tiers of assessment are performed?
  How are assets selected for detailed evaluation?
- Please discuss the criteria in use for all assets and classifications.
  What are the core parameters and criteria?
  How are they weighted?
- Please discuss how the remaining useful life of assets are assessed and quantified.
  Please incorporate policy and procedure into your response.
- Is the RUL program audited or reviewed for accuracy or new methodologies assessed at some frequency? If so, what is the frequency and what is the procedure?
- Is asset condition noted and maintained in the asset registry? Please discuss.

REPLACEMENT PLANNING

- Please discuss how infrastructure rehabilitation and replacement is forecast and planned.
- Please discuss how infrastructure rehabilitation and replacement is funded.
- Does an expenditure policy exist for infrastructure rehabilitation and replacement? Please Discuss.

SERVICE LEVEL GOALS

- Please discuss if and how Service Level is interpreted at the asset level for decision-making.
  Please incorporate how Maximo is utilized in your discussion.

CONNECTION TO OTHER PLANS I.E. STRATEGIC PLAN, CIP, ETC.

- The Fiscal 2020 Strategic Plan has a goal to provide reliable service and value to customers. Please discuss how SFPUC is implementing the Objectives.

  OBJECTIVES
  1. Establish quantifiable operational and capital Level of Service (L.O.S) goals by enterprise.
  2. Formalize our asset management approach across SFPUC.
  3. Establish a uniform investment prioritization process linked to asset management priorities across SFPUC.
  4. Ensure SFPUC can mitigate, respond to, and recover from threats and disasters.

SUPPLY CHAIN

- Please discuss your procedures, policies and processes for supply chain.
  Please speak to how Maximo is used in the office and remotely, and warehouse management practices and accounting rules for inventory control.
- The Item Master provided for review primarily includes consumables such as nuts, bolts, janitorial supplies, etc.
  Please comment on your inventory of spare parts, critical spare parts, critical assets, etc. that apply directly to managed assets.
- Please discuss the management of warehouses and the layout of inventory (shelving and row layout, etc.).
  Please discuss how virtual warehouses are managed, if any.
- Please discuss any process of linking warehouse issuances to work orders including kitting and reservations.
- Please discuss your inventory control practices.

STAFF PLAN

- Please discuss the staff roles dedicated directly to asset management practices.

  Please address Warehouse Technicians and Managers, Maintenance Schedulers, Data Managers, and IT Staff.

APPENDIX D

HHWP Response to Questions

INTRODUCTION

The following questions are intended to generate discussion about San Francisco Public Utilities Commission's (SFPUC's) asset management program. Together with the data supplied by SFPUC, the discussion surrounding these questions will be used to evaluate the current asset management program.

Please prepare to discuss each question as it relates to both Hetch Hetchy Water and Power (HHWP) and the Water Supply and Treatment Division (WSTD). In some cases, responses may differ between the two divisions and it will be important to quantify the extent of the program related to each operating division.

HHWP Response to Questions

Criteria	Sub Criteria	Description	Question
Asset Registry	Business Processes for Asset Creation and Modification	Business Processes are developed and followed such that asset registry is maintained at highest level of accuracy.	Please discuss the procedures for creating and modifying assets. In particular, please address QA/QC and establishment of maintenance programs for the asset. Assets with a value of $5,000 and greater, or assets which require maintenance are entered in Maximo. Assets are created by AMS personnel only. New assets are entered by 7262 Maintenance Planners. HHWP has a documented procedure for entering Rotating Assets (MAXSOP-1056); however, we do not have a procedure for creating Assets, although many of these steps are similar. We currently do not employ a formal QA/QC process for asset data entry. We expect this to be identified in the ISO 55001 Gap Analysis. Maintenance programs for assets are taken from manufacturers recommendations and compiled by the 7262 Maintenance Planners into the Maximo PM module and submitted to HHWP Engineering for review and approval.
	Asset Registry	Asset Registry is complete and represents an appropriate cross-section of assets.	Please discuss the level of completeness of the asset registry in Maximo. Speak to the asset listing and attributes. There are 17,381 Operating assets listed in the HH site in Maximo. Of these, 9013 have asset classifications. I would estimate there are approximately 85% of HHWP assets listed in Maximo. As new assets are created in Maximo, classifications are assigned, and attribute information is populated. Previous versions of Maximo relied upon a Keyword field. This field was more extensively used. There are some 14241 assets with Keyword identifiers. We continue to catch up.
	Asset Registry Hierarchy	Asset Hierarchy is well-defined and provides sufficient detail to assess cost, risk, and work at multiple levels.	Please discuss the asset hierarchy. The HHWP Asset/Location hierarchy is under reconstruction. We are transitioning to a Location based hierarchy, which will facilitate navigation from the Site level to the component or assembly level within the Location module. This will provide many benefits, including ease of navigation, the ability to leverage naming conventions in the Location module, the use of auto-numbering for assets (as the location will provide precise information), the use of Maximo Systems with greater accuracy, the ability to classify locations to facilitate more meaningful reporting information, and the elimination of pseudo assets.

			How do you use it? As we transition, we are still able to report costs at the asset and location level at any point in the hierarchy. We continue to use the hierarchy to sort, group, and store assets. Is it used consistently and uniformly across the Enterprise?
	Asset Classification Domain	Asset Classification structure is sufficiently detailed to define assets individually by type without significant generalization.	Please discuss the Asset Classification Domain and its versatility in classifying assets. The Maximo Asset Classification Domain is very versatile. We are able to build hierarchies within the domain. This will be useful to ascertain a better understanding of our assets. Rather than simply looking for valves, we can set up the hierarchy with sub-types of valves. There appear to be a mix of asset classifications as well as projects, problems, etc. in the Domain. That is correct – there is no enforced asset classification standardization.
	Asset Attribute Domain	Asset attributes are detailed by classification to provide sufficient asset data and knowledge.	Please discuss the asset attribute domain and its versatility in describing asset characteristics or details. The attribute domain is very versatile. Every attribute is available to add to a classification, and if an attribute does not exist, it is easy to create a new one. To simplify domains, are subtypes used as well as descriptive attributes? We use descriptive attributes as well as classification sub-types.
	Asset Definition	A definition of an asset, for the purposes of asset management planning, exists and is used to develop the asset registry.	How does HHWP determine assets to be included in the fixed asset registry and Maximo? Assets with a value of $5000.00 and greater, or assets which require maintenance are entered in Maximo. Do you have a policy that defines an asset for these purposes? There were draft policies and guidelines created, but I do not know if they were ever adopted for the SFPUC.
	Policy for updating asset registry	A policy is in place that provides for the review of the asset registry and updating on a regular basis.	Is the asset registry audited or reviewed for accuracy at some frequency? There isn't a formal audit procedure. If so, what is the frequency and what is the procedure?
IT capabilities to support AM	List of software tools such as Maximo, GIS, InfoAsset, etc. including version		Please discuss or identify the software tools used for asset management.
	Data Flow Diagram	A data flow diagram is in place that documents data integrations between asset management software tools.	Please provide a Data Flow Diagram and discuss the integration functionality between asset management systems
	Modules for software tools		Please discuss the modules used with Maximo.

	Discovery Tools	Discovery Tools are in use for hardware and software.	Please discuss the discovery tools you use for asset management systems.
	Mobile connectivity Platform	Mobile computing is in use on a reliable network system.	Please discuss the platforms in use for mobile or remote connectivity. How are mobile units being used? What information is being collected? What information is being provided to the mobile units?
	IT Staffing dedicated to Asset Management Systems	Sufficient staff positions are authorized and filled that are dedicated to management of Asset Management hardware and software management. Vendors are contracted for support as needed.	Please discuss the IT support roles and staff dedicated to asset management. Please include contract vendors.
	Infrastructure replacement and refresh policy	A policy is in place for the replacement of aging IT infrastructure including hardware and software dedicated to asset management.	Please discuss your replacement policy for asset management software tools and network infrastructure.
	IT budget for asset management hardware and software support.	Sufficient budget is allocated for IT hardware, software, and staff.	Please discuss the budget for IT support and services. Please focus on staff and replacement of hardware and software. Please address license and maintenance renewal contract management
	LAN/WAN Platforms (diagram/map)	Local Area Networks (LAN) and Wide Area Network (WAN) plans are developed that document network configuration.	Please provide and discuss your network diagram.
	Patch Management Plan	A Patch Management Plan is in place and is followed to keep software products current to achieve optimum performance.	Please discuss the Patch Management Plan for Asset Management systems.

	Security Plan – Public/Private access, Firewall	A Security Plan is in place that provides security against cyber threats.	Please discuss the network security plan for asset management systems including mobile connectivity.
Risk procedures	Risk Policy	A Risk Policy is in place that interprets Criticality and Condition to develop Risk Ratings for assets as well as defines thresholds for action based on Risk.	Please discuss SFPUC's Risk Policy. HHWP is currently working with a consulting firm to develop a risk-based capital planning tool. This tool will take an asset centric view as well as a project centric view to ascertain system risk. Please speak to the definitions of risk parameters (e.g. LOF/COF factors), the interpretation of the risk parameters to assign a risk rating, and the thresholds for action. Likelihood of Failure will be based on asset age and Iowa curves. This data will be modified using maintenance records, where appropriate, to ascertain effective asset age. Consequence of failure categories and weightings are being developed. Once these have been completed, assets will be scored. It must be noted, at this point in our maturity, we will not be including all 17000 assets in the risk model. We are beginning with a sample of representative assets at the assembly level.
	Business Process for Criticality Assessment	A structured process is in place to evaluate system and asset criticality.	Does SFPUC have a formal process to evaluate criticality? HHWP is developing a process to evaluate criticality based on COF, as it impacts levels of service. Please speak to a schedule for evaluating risk parameters, criticality and the risk register. HHWP is actively working on this now. A completion schedule has not been established.
	Description of Risk management tools currently in use	Risk assessment tools exist and are used to evaluate criticality and condition of assets and systems.	The 2018 State of the Regional Water System Report mentions an Asset Risk Tool. Please describe what this tool provides. The Risk Based Capital Planning tool, currently under development, will provide an overall view of risk, based on asset condition. It will also show how that risk is mitigated, based on capital improvement projects due to be performed. The tool will also allow for what if scenarios. The tool is being configured to evaluate risk at the functional level, facility level, or the asset class.
	Risk Register	A Risk Register is in place for all systems and assets.	Are risk and the risk parameters contained in the asset registry? Please discuss. Maximo currently has an Asset Risk tab. It was configured based on work done at the SFPUC Waste Water Enterprise. HHWP has entered data for some assets into this tab. After working with the consultant, we realize the current configuration will not suffice. It is my preference to house asset data in Maximo, so additional assets can be added to the model as we mature; and let the Risk Tool house the data it creates.
	Criticality criteria and definitions	Criticality criteria and definitions are in place.	Please discuss the criticality criteria in use for all assets. What are the core parameters and criteria? How are they weighted? Whilst these are still being refined, the core parameters are: 45% - Water Delivery 5% - Power 15% - Regulatory/Contractual/Environmental 15% - Safety 5% - Public Perception

			15% - Operational Flexibility The criteria for each are still under development.
O&M improvement	Maintenance Management	Preventative maintenance activity is performed as required by the manufacturer or the specific asset performance.	Please discuss your preventative and predictive maintenance program. HHWP's preventive maintenance program is based, primarily, on manufacture's recommendations. Any deviations are evaluated and approved by HHWP Maintenance Engineering. Preventive maintenance activities are compiled in the Maximo PM module, and the ensuing work orders are scheduled accordingly. HHWP does not currently engage in predictive maintenance.
	Maintenance Management	Predictive maintenance activity is performed as required by the manufacturer or the specific asset.	
	Maintenance Management	Business Processes exist for work and maintenance management.	Please discuss the business processes/practices in use for work management. How is Maximo used during the work order lifecycle? At HHWP we currently schedule the work activities of thirteen shops. We have a dedicated Planning and Scheduling section to coordinate and schedule work for these shops. The Planning and Scheduling section comprises two 7219 Maintenance Schedulers, four 7262 Maintenance Planners, one 5602 Clearance Planner, and one 7263 Planning and Scheduling Manager. Weekly work schedules are coordinated, compiled, executed and reported against. The work management process begins and ends with Maximo. Whether it is an ad hoc work order, a PM work order, or a capital improvement project work order, it begins in Maximo. Requests for ad hoc work are submitted via the Service Request (SR) module in Maximo. The Planners address the SRs and create the ensuing work orders. PM work orders are generated, by our Schedulers, every week, with sixteen days lead time to allow for advanced scheduling. Project work is created by the Planners from SR's submitted by the Project Manager. Where practical and effective, material is preloaded into the job plans of PM work orders. Ad hoc work orders requiring material have that material included in the work plan of the work order prior to work order approval. Section Managers are accountable for the work their crews perform, and they must approve their work orders. Material and labor estimates are available to the approving manager, within the work order. Once approved, work orders can be scheduled. The schedules are compiled by the Schedulers, based on our Logical Process. The schedule is conveyed to the Section Manager for review and comment. Following review and comment, the Schedulers make any requested changes and issue the Final Schedule. The work crews execute their scheduled work and record time against the work order, via eTime. Work logs are entered by many of the of the crews, and more are following with the use of Maximo Mobile.
	Maintenance Management	Asset performance data are collected and	Please discuss/describe the data that is collected and how it is used to evaluate asset performance. A Reliability Reporting pilot program was discussed, compiled, and agreed upon, by management and the assembled team.

		available for analysis.	This program is designed to identify, respond, repair, analyze, and implement mitigation measures to prevent future occurrences of a similar kind. This program will provide the following data, Asset Availability, Asset Reliability, Mean Time Between Failure, and Mean Time to Repair. The program will provide documented work packages of each incident. These packages will be structured in a manner that allows for total cost reporting and ease of communication to see what each craft involved did on the job, through the use of work logs of all related work orders from the originating work order.
	Work Management	Work is performed efficiently based on asset and work prioritization.	Please discuss how work is prioritized. Work orders are prioritized according to MAXSOP-1002 (cell F76 in the response document) when they are created. This provides a guide to scheduling. HHWP has developed a weekly communication process beginning with the Management's Objectives Meeting, which is held each Tuesday at 1:00. HHWP managers review and comment on work to be performed in the near (up to six seeks) and long (up to six years) term, establishing priority and windows of opportunity. These priorities are disseminated to the crews via the Operations Meeting, held on Thursdays at 07:30, focusing on the next week. All of the work for the week being discussed will appear on the schedule for that week. Please discuss how work backlog is managed. To manage the backlog of work, work orders are segregated into different statuses. Work orders begin in WAPPR (waiting approval), they are planned and reviewed and put in a status of PAPPR (Planner approved), indicating they can now be scheduled. Managers may place a work order in the QUEUE (four to twelve weeks out), COMMIT (approved and to be done within four weeks), or to place them on the next schedule, where they will go to INPRG (in progress). We provide managers with a graphical report of their backlog (cell ### in the response document). This report is an interactive display of their work load (their Bucket). It is an image of a Bucket, stratified into the statuses mentioned above. Managers may indicate a status change in this report, and AMS will make those changes in Maximo.
	Work Management	Work Management data are collected and available for analysis.	Please describe the work management data collected. How is it used to monitor performance and improve efficiencies? HHWP measures schedule compliance. HHWP issues weekly work scheduled to its crews, and we measure compliance with those schedules. We measure Crew Availability, Supervisor Deployment, Management Effectiveness (Logical Performance), we combine Crew Availability and Supervisor Deployment to gauge Schedule Performance, and we combine Schedule Performance and Management Effectiveness to gauge overall Schedule Effectiveness. We periodically look at Actuals to Estimates to revise PM estimates and check job plans. We publish PM Generated vs PM Completed, as a measure of our ability to keep up with our maintenance programs. Work order data is also used to perform staffing analysis. We look at the demand on a work group in a given period, analyze their completion ratio for all work types, and apply that ratio to incomplete work created in the period being analyzed. It is understood work not completed was effort spent working on tasks created in a different period from that being analyzed.

Condition Assessment and Remaining Useful Life (RUL)	Business Process for Condition Assessment	A structured process is in place to evaluate system and asset condition.	Please discuss how condition assessments are performed for all regional SFPUC assets. At what interval are assets evaluated? What tiers of assessment are performed? Please explain. How are assets selected for detailed evaluation? (Please see 2018 SWRS Report.): The assets in the RWS are periodically inspected through three separate assessment programs, each essentially using a risk-based approach: 1) fixed assets, 2) linear assets, and 3) dams. The first program addresses fixed assets. Facility inspections are prioritized and repeated every 3 to 10 years, depending on each facility's importance in meeting LOS. At HHWP, condition assessments on critical assets with a life expectancy of greater than 25 to 30 years are performed on a case-by-case basis. Early in the asset's life cycle, inspections and limited assessments coincide with scheduled maintenance activities. As assets move through their life cycle, the information gathered from previous preventative maintenance reports as well as from performance deviations identified by operators is used to schedule more comprehensive condition assessments. For critical assets with a lesser life expectancy, assessments are built into the asset's routine preventative maintenance program. Linear assets (e.g., pipelines and roads) are assessed with a second program. Inspection frequency is dictated by pipeline conditions, ability to shut down the pipeline (usually the pipelines must be drained), operational problems associated with pipeline failures, potential liabilities, and the rate of degradation observed in prior inspections. Dams use a third inspection and monitoring program, usually performed with regulatory oversight. The program is conservative, considering the high liability associated with dams, and the importance to the region's water supply. The major components of the program consist of: regular inspection and monitoring, regulatory reporting, maintenance, repairs, planning studies (stability studies, inundation map updates, and other), and emergency planning. For all three condition assessment programs, a risk-based approach recognizes two key components: consequence of failure and probability of failure.
	Condition criteria and definitions	Condition criteria and definitions are in place.	Please discuss the criteria in use for all assets and classifications. What are the core parameters and criteria? How are they weighted? These processes are currently in development through the development of asset management plans for each asset category.
	Condition Assessment Register	Asset condition is monitored in the asset registry.	Is asset condition noted and maintained in the asset registry? Please discuss. There is a field in the Asset Registry to store a numeric rating of asset condition. The results of the 2009 power asset condition assessments have been entered into Maximo. RUL is currently based on age (installation date) minus life expectancy. However, Maximo does not currently drive replacement of assets. As we progress with the risk tool, we will rely upon the installation date, condition data, survivor curves, and likelihood

			of failure to contribute to the risk analysis to prioritize asset replacement.
	RUL	Policy, procedures, and criteria for estimating RUL of assets are in place and RUL assessments are performed in accordance with the policy.	Please discuss how the remaining useful life of assets are assessed and quantified. Please incorporate policy and procedure into your response. Hetch Hetchy Water and Power does not have a policy for establishing or estimating the remaining useful life (RUL). Traditionally we have used Iowa Curves, engineering judgement, and adjustments for condition assessment.
	Policy for updating RUL	A policy is in place that provides for the review of estimated RUL of assets on a regular basis.	Is the RUL program audited or reviewed for accuracy or new methodologies assessed at some frequency? If so, what is the frequency and what is the procedure? Please see above response.
Replacement Planning	Rehabilitation and Replacement Planning	Infrastructure rehabilitation and replacement planning methodology is in place and planning is conducted in accordance with the methodology.	Please discuss how infrastructure rehabilitation and replacement is forecast and planned. What is the frequency of updates to the plan? Capital projects that support the RWS are organized into a 10-year CIP that is adopted each year and integrated into the SFPUC's Financial Plan and rate-setting calculations. Major updates to the CIP generally happen every 2 years, in coordination with the overall budget process (see Section 3.5 of the State of the Regional Water System Report). For budgetary purposes, the RWS CIP is contained in two planning documents: the Water CIP (Section 5.2.1) and the HHWP CIP (Section 5.2.2). The Water CIP includes capital projects related to the RWS west of AEP, TTF, and the retail-funded local distribution system. The HHWP CIP includes projects east of AEP funded by water revenues (retail and wholesale), power revenues, and projects funded jointly from each enterprise.
	Rehabilitation and Replacement Funding	A funding plan is in place and maintained for infrastructure rehabilitation and replacement.	Please discuss how infrastructure rehabilitation and replacement is funded. Please see response above.
	Rehabilitation and Replacement Expenditure Policy	A policy for the expenditure of rehabilitation and replacement is in place and funds are allocated in accordance with the plan.	Does an expenditure policy exist for infrastructure rehabilitation and replacement? Please Discuss. HHWP uses CCSF Accounting Policies & Procedures as well as the Controller's Office Fixed Asset Definitions & Guidelines to determine expenditures that qualify as fixed assets and are therefore eligible for Rehabilitation and Replacement funding.
Service Level Goals	Service Level definitions for asset management	Service Level goals are defined and applied to each asset as appropriate.	Please discuss if and how Service Level is interpreted at the asset level for decision-making. Please incorporate how Maximo is utilized in your discussion. As part of the Risk-Based Capital Planning tool inputs, HHWP is developing a process to evaluate criticality of each asset based on consequence of failure (including Levels of Service)

			and likelihood of failure. For Levels of Service, we created criteria for ability to deliver and frequency and level of rationing. Maximo will be used to store asset information (asset age, and condition, etc.) to be used in calculating likelihood of failure.
Connection to other plans (ie: Strategic Plan, CIP, Master Plans, etc)	Capital Improvement Plan	Asset Management plan elements and principles are an integral part of other planning documents where asset renewal, funding, and replacement are considered.	The Fiscal 2020 Strategic Plan has a goal to provide reliable service and value to customers. Please discuss how SFPUC is implementing the Objectives. OBJECTIVES 1. Establish quantifiable operational and capital Level of Service (LOS) goals by enterprise. 2. Formalize our asset management approach across SFPUC. 3. Establish a uniform investment prioritization process linked to asset management priorities across SFPUC. 4. Ensure SFPUC can mitigate, respond to, and recover from threats and disasters.
Supply Chain	Business Process and Policy for Supply Chain	Business Processes and Policies for Supply Chain are in place and followed.	Please discuss your procedures, policies, and processes for supply chain. Please speak to how Maximo is used in the office and remotely, and warehouse management practices and accounting rules for inventory control. Maximo is our system of record for inventory control and asset management to include the following functions: service requests, work order generation, purchase requisition/order processing, material receiving, bill payment, tools, and critical spare-part management. Inventory purchasing is accomplished through a dedicated chart of account (COA) and utilizes a re-order report, generated from MAXIMO, to inform re-order decisions made by warehouse staff. All inventory items are designated with an item number that have corresponding bin location/storeroom association. Inventory items are received in Maximo, placed in the proper bin location, and then issued with a Maximo Work Order as required. Work orders (required for stock issues) are typically charged to specific a job/asset and the appropriate COA used for that job. Although used by field personnel to generate work orders and conduct assessments, Mobile Maximo is not used for inventory management purposes.
	Item Master Export	Item Master is developed and applied to assets in the asset registry.	The Item Master provided for review primarily includes consumables such as nuts, bolts, janitorial supplies, etc. Please comment on your inventory of spare parts, critical spare parts, critical assets, etc. that apply directly to managed assets. Consumable material is the cornerstone of our inventory. However, we do track a critical spare inventory in MAXIMO. Critical spares possess unique item numbers and are stored in designated bin locations throughout the project. Item Master module contains both Active and Inactive items. Currently, HHWP tracks 2300 active inventory items and only 75 critical spares. Critical spares are linked to specific assets in MAXIMO and are managed jointly between Materials Management and Asset Management sections. Use of a critical spare requires a work order to “issue” the critical spare to a specific job or asset and corresponding cost center.

	Warehouse Management	Warehouses (virtual or physical) exist with inventory managed in logical rows, shelves, bins, etc.	Please discuss the management of warehouses and the layout of inventory (shelving and row layout, etc.). Please discuss how virtual warehouses are managed, if any. All Moccasin inventory items possess fixed location in our warehouse. Items are sorted, stored, and tracked utilizing a series of shelving, bins, and racks. Items are located and stored by warehouse isle/row/bin (e.g. 7-3-4). Virtual warehouses are not used at HHWP for inventory stock items.
	Warehouse Management	Supply chain processes are connected to the Work Order.	Please discuss any process of linking warehouse issuances to work orders including kitting and reservations. All warehouse issues are charged to a work order. Typically, items are not reserved; however, reservations are occasionally used with "pre-loaded" work orders that are created by our Asset Management Team. These work orders reserve items and typically track back to assets and help inform overall project costs for planners and project managers. Kitting is not done at HHWP although it could be done at any time.
	Warehouse Management	Parts are reserved against work orders.	
	Warehouse Management	Physical and Cycle Counts are performed at regular intervals.	Please discuss your inventory control practices. SFPUC Finance and Hetch Hetchy Management require an annual inventory for accountability and to maintain inventory control. Physical inventory procedures are specified in the Materials Management Standard Operating Procedure Manual. At the end of each fiscal year, warehouse staff perform a physical count of materials to verify inventory quantities and values in MAXIMO and F$P. Additionally, the San Francisco Administrative code requires that every other year a full inventory must be completed by staff not involved in the warehouse processes of purchasing and receiving inventory. The biennial inventory results are summarized in a memo to SFPUC Management from SFPUC Finance. Additionally, cycle counts are conducted on an ongoing basis to ensure that the on-hand inventory as indicated in Maximo is correct and up-to date. Cycle count procedures are specified in the Materials Management Standard Operating Procedure Manual.
Staff Plan	Staff matrix and job description	Staff matrices and job descriptions dedicated to support work and asset management exist.	Please discuss the staff roles dedicated directly to asset management practices. Please address Warehouse Technicians and Managers, Maintenance Schedulers, Data Managers, and IT Staff. HHWP Asset Management Services comprises the following positions, 0931 Asset Management Services Manager (1) 7262 Asset Planner (2) 7263 Planning and Scheduling Manager (1) 7262 Maintenance Planner (4) 7219 Maintenance Scheduler (2) Materials Management/Warehouse Operations positions include the following: 1944 Materials Coordinator (1) 1942 Assistant Materials Coordinator (2) 1931 Senior Parts Storekeeper (3) How often are the staff needs updated?

			Staffing needs are comprehensively evaluated each two-year budget cycle.

APPENDIX E

HHWP West Yost Meeting Notes

HHWP West Yost Meeting Notes		
Criteria	SubCriteria	HHWP Meeting Notes
Asset Registry	Business Processes for Asset Creation and Modification	Asset Registry, Business Process for Asset Creation and Modification. Procedures for creating and modifying assets. Assets are $5K or greater. Assets come in many different ways - purchased thru cap budget - good tracking on those. Assets through CIP are slow to come, and when they arrive are overwhelming and then back-burnered. Have a lot to do in this area. Audit in the field to compare with Maximo? No, don't currently do this. Would be desirable. Don't really have the resources to do this.
	Asset Registry	Have 17,400 assets in Maximo. Jeff believes this is 85 to 90 percent of assets. Over 9000 have asset classifications. Some attribute information may be missing. As new assets are created, classes are assigned, attribute information is completed. 14,200 have a key word. Still catching up in this area. Per Mike, looking only at Regional Water System. If Scott were to break down to water system, would be close to 90 to 95 percent. Valves are there, pipelines are there. Need more accurate information - replacing pipes with different material types. SJPL broken down into PL1, 2, 3. Some segments being replaced with pipelines of different materials. These are not yet documented. This should come up in the gap analysis. Not using the Maximo linear application. Would use a location hierarchy to delineate a segment. SJPLs 1, 2 and 3 are single assets. Crossovers - SJPL 4 (6.5 miles) Oakdale to first crossover. SJPL4 segment 2 (9-11 MILES), crossover 3 to Tesla Portal. Asset Registry is miles long - 50 miles Oakdale to Tesla. Water assets more complete than electrical side. PHs have a lot of small components. On the water side, have a more complete picture. May not be capturing everything at the crossovers.
	Asset Registry Hierarchy	Asset Hierarchy. Jeff wants to reconstruct hierarchy to better navigate to the component level. Use the structure for reporting. Can report at facility or subassembly level. Can navigate to the items. e.g. fleet all in one area. Would like to make navigation easier and make reporting more meaningful. Mike asked for example -- areas, places, facilities, assemblies, subassemblies, component. To make things findable, start with O'Shaunessy, ____, Moccasin, Foothill Tunnel. Break things down by area. When using the system, and if you were interested only in water conveyance, could then see all of it as a system, rather than by area. Would not need to wade through power equipment, etc. Would be able to report out by system. When using location, would asset assembly be location? For example. Oil pressure sets -- tank, two pumps, compressor. Each of these are sub-assemblies in the OPS. Pump 2 location -- pump and motor. This allows to auto-number assets in the system. Current hierarchy is a mix. Makes navigation difficult. Provided WY with hierarchy on previous go round.
	Asset Classification Domain	Asset Classification Domain, Asset Attribute Domain. Classification system in Maximo is good. For better or worse can create assets at Division level without SFPUC approval. Was an effort to get everyone to use a template for motors, for example. That didn't go well. Everyone documents things differently. HHWP tries to keep things simple. Attribute that is created is available, or can create an attribute on the fly. Is there an interest to standardize classifications? Scott - yes. He would like to be able to say how many transformers do we have? What about tunnels - are they lined, unlined. Valves - what type of valves, how are we exercising them. Current classification is valve with subtype. If they need something different, will look to the gap analysis. Need to know exactly what they are looking for right now. Would be good to break it out to make it easier to tabulate information.
	Asset Attribute Domain	
	Asset Definition	Asset Definition - what is used to define asset? $5K or greater this is the amount that SFPUC wants to track. Asset - typically they would have to do something to it. Turbidity meter - go out and flush it. Venturi meter - need to calibrate it.
	Policy for updating asset registry	

HHWP West Yost Meeting Notes		
Criteria	SubCriteria	HHWP Meeting Notes
IT capabilities to support AM	List of software tools such as Maximo, GIS, InfoAsset, etc. including version	
	Data Flow Diagram	
	Modules for software tools	
	Discovery Tools	
	Mobile connectivity Platform	
	IT Staffing dedicated to Asset Management Systems	
	Infrastructure replacement and refresh policy	
	IT budget for asset management hardware and software support.	
	LAN/WAN Platforms (diagram/map)	
	Patch Management Plan	
	Security Plan - Public/Private access, Firewall	
Risk procedures	Risk Policy	Risk procedures - Risk Policy. Currently, building a model. Looking at assets and the POF, LOF. When it comes to SFPUCs risk policy, not specific information. What assets do I have to have in place to meet LOS. Translate LOS into risk. Have developed a mapping - water reliability, power reliability, safety, etc. Based on LOS, this is how they are defining LOF and COF. LOF based on Iowa curves. Age of asset is in Maximo. Working with consultant to use Iowa curves. Sometimes where they don't use equipment as hard, can modify the information based on performance. COF is looking at LOS. Look at modes of failure, how many months would they be out. Defining LOF and COF. Classic risk matrix - in the process of developing it. By the time they are done, will have a 5 x 5 matrix to develop a heat map for assets. What is different, will look at a string of linear assets that are needed to deliver water. Look at the entire train, not individually. Historically, power assets have not been looked at in relation to water delivery. Rim Fire - had to de-energize.
	Business Process for Criticality Assessment	
	Description of Risk management tools currently in use	

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		Put water through bypasses, which they can do for a limited period of time. With the risk definition, is there a policy? For example, 5s need to be replaced. Per Margaret, all depends on money. Will be a stepwise analysis, looking at whether it is a 5 for safety, 5 for delivery. Working through this over the next couple of years. Risk model and what-if scenarios. The model has different curves, uses Monte Carlo simulation to look at different failures. If we only have $70M to put towards power assets, can include those projects in the model and see how that impacts the LOS. Will be able to show if $30M additional funding, how does that change the LOS? Will be able to put in modified curves to see how investments change the picture over time. It is not a simple spreadsheet. Played with the model around 9 years ago. Building on that. Working with Will Williams at B&V. Mike worked with Will briefly on a DWR project. Per Margaret, looking at a high level. Won't always have the money that you need, so want to understand the best use of funds to manage risk. Have been trying to get this done since 2011. Fire, storm events have slowed things down. For a lot of HHWP folks, have started to visually recognize how important power assets are during emergencies. Bypass actually hydro mined -- didn't dissipate all the head and mined concrete. Not designed to sustain 275 mgd for a long period of time. BAWSCA will see another project for bypasses at Moccasin and _____. Every time there was a project for WSIP, HHWP needed to be on line. Risk assessment questions -- all in progress.
	Risk Register Criticality criteria and definitions	Risk register - what are they doing in Maximo. WW Enterprise spent a lot of effort looking at this. Criterion is based on WWE work, not HHWP work. The page can be customized for each division, so as HHWP develops the criteria, will modify this page. HHWP model is more complicated -- 1 to 500 to capture a number of different factors. Risk model - Per Scott, it would be valuable to put it back into Maximo to identify the priority of the asset -- this would show someone that this asset is more important than the one I want to work on.
O&M improvement	Maintenance Management Maintenance Management Maintenance Management	O&M Improvement. Preventive Maintenance and PDM programs. Have a PM program currently that is managed in Maximo. Have scheduled PMs have job plans. PMs are listed on a weekly basis, 16 days in advance for scheduling. Have company job plans, sequence job plans based on work to be performed. Job plan gets associated with a PM. Don't like to go too far with the PMs. Are they completing work within the time needed for PMs? Going generous on PM timelines. Haven't started measuring yet but will do so. Currently track PMs issued and PMs completed, but it doesn't get the timeframe. Working towards answering the question. Maintenance Mgt. Schedule work at two shops. Schedule regulatory PMs first. Next, do previous PMs not completed. Planners provide info. Schedule is dynamic through week until Friday, when it is locked down. Using SIMs package for scheduling. Have used an internal product in VBA for the last 12 years. Not easy to trouble-shoot. If they use a Maximo based product, get support. All shops using the scheduler in March. Visual Scheduler by a Canadian firm that integrates with Maximo. Supervisors can use and it allows them to report availability. Can schedule each individual crew member. The work that Scott and others have put together. Supervisors can see the benefit of using the new tool. It was a long haul to get there. A lot of work. All begins in Maximo. Change management is the hard part. People may decide it won't work for this. Culture change is tough. "Culture eats change for breakfast." Documentation - don't have formal work processes written out. Will be coming with the AM Plans. See cell F67 of worksheet. Workflow folder. SOP on Supervisor Approval of Work Orders. Purpose, scope responsibilities, instructions.

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Criteria	SubCriteria	HHWP Meeting Notes
	Maintenance Management	Asset Performance Data collected and available. Put together a reliability program. Intend to implement. Put this together in 2018 but got sidetracked due to other priorities. Talked about resurrecting program. Currently collect this information for hydroelectric units. This is not yet implemented fully across the board. Scott included this in the data package (reliability program - highlighted in yellow). Are they marking when asset removed from service, brought back on. Scott intends to do this. Have an obligation to NRC to report information. Was recording this same information in Maximo. Need to document failures, track reliability and availability and measure efforts to see if they are changing the repair times, response times. Would collect this data in Maximo, collect downtime data, and can then use this to track reliability. Same staff in hydro and water. They are accustomed to dealing with regulatory requirements.
	Work Management	Have a Priority SOP 1-9, 9 highest priority. Have a communication process that they have developed based on Incident Command. Had a few emergencies, and once they got the hang of the emergency management system, and Scott realized that they could use this for other work. Meet on Tuesdays at mgt level and establish near-term (6 weeks) and long-term (6 years) timeframe. What are the constraints. ROW, Power, Planners, etc. Establish the priorities for the objectives. On Thursdays, have the Ops meeting where information is conveyed to the rank and file. Schedulers develop schedules. See graphic showing Communication and Coordination process. Scott thinks that they are doing a good job here. Per Margaret, this has helped to establish management priorities. Not only just to coordinate, but sends the message down on the priorities. Who decides if this work order needs to go before that work order (see cell X77 in spreadsheet) MAXSOP-1002-Priority Codes Rev 2. SOP on Priority Codes. Defines nine levels of work -- 9 emergency, operational failure, urgent, regulatory compliance, high criticality asset PM, standard PM, routine work, low priority work, desirable work. How would you say that a particular work order is a 4 or a 5? Will define criticality based on LOS. Not yet defining risk score in Maximo. Once this is available, this will help to show criticality. Currently based on gut of managers. Information being communicated to the workers. Backlog - use work order status to breakup the backlog into buckets for each manager. Manager gets a graphical display of workload. Want to have no more than two weeks of WIP. Want to have four weeks of work in approved status. Want to have 8 weeks of work in the queue. Display of bucket tool -- FDS.aspx. If you click on the bucket, will show the particular work orders associated with the particular portion of the bucket. Backlog, available queue space, in queue, available workload space, committee, in progress. Right now, scheduling one week ahead, but this tool helps to visualize what is ahead. The new tool aligns with the current tool that is being used. In queue is unapproved work that managers want to get to in the next 3 months.
	Work Management	Measure journeyman, supervisor and manager. Ask supervisor for crew availability. Measure whether journeyman shows up. Have liberal leave policies, so measure who shows up vs expected to show up. Measure ability to focus on scheduled work. Have a logical process -- send schedule to manager, get input, lock down logical schedule. The closer that they can get to working on logical schedule, the better. They are about 81% of goal. 60% of work is scheduled. Still have break-ins. Schedule performance and schedule effectiveness. How well am I meeting my PM goal, and how can the schedule be modified. Have identified critical PM and it is not getting done -- this will be a next step.
Condition Assessment	Business Process for	How are condition assessments performed? At what interval? What tiers of assessment? Don't have an established procedure. This will come from the

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and Remaining Useful Life (RUL)	Condition Assessment Condition criteria and definitions Remaining Useful Life (RUL) Policy for updating RUL Condition Assessment Register	gap analysis and the tool, this will be coming. Since 2006, have been doing formal assessments of assets. Stepping through the project. Though they may have gone through several of the assets, they may not have done condition assessments. Doing a preliminary report on this. Assets that have been performed have been tiered. Where they are doing the best is on the tunnels. Inspection frequency of 15 years. Have made it into CRT twice since Margaret has been here. Condition assessments to date have been reports, but haven't been fed back into Maximo. With the plans coming on board, will have a defined formal process. Will define what needs to be done and at what frequency. Some of the smaller work gets back into Maximo, but the larger picture will be part of the AM Plans. Where are the regulations going, where do we need to be? Condition assessments have been done by B&V, Stantec. Dam CA provides a good snapshot of what will be in the AM Plans. Alameda East for water assets. Irvington for power assets. Assets include the lime plant. Tesla Disinfection Facility part of Regional System. Leach field is part of the compound (roads, water distribution, etc at Cherry, O'Shaunessy, etc). All of these assets included. Condition criteria, asset condition (page 9). Risk tab in the asset registry is included by criterion. Can be customized by each Division. Working on customizing this with the risk tool that is being developed. Currently carrying a COF and LOF. LOF will come from age and Iowa curves. Asset evaluation/condition assessment information - can keep this in Maximo and can provide a quantitative score.
Replacement Planning	Rehabilitation and Replacement Planning Rehabilitation and Replacement Funding	The City has a two-year budget cycle. Plan for a 10-year period. Coordinate with Infrastructure - they have a form that has been include in documentation. Form is used to prioritize -- has a rating. Is in line with the strategic objectives. Is not as comprehensive as what they are doing with the new risk tool. HH & Infrastructure work together -- rolls up to the Enterprise. Work with Power, Water Supply & Treatment as well. R/R processes are SFPUC-wide processes. Cheryl - have a process to integrate information collected in field assessments, both outside of the CIP process and inside the CIP process. An example would be - condition assessments on the valves on the face of O'Shaunessy. Prioritized and scheduled work over the next 15 years. Continuing to evaluate assets -- valves on diversion bypass from O'Shaunessy to Canyon Tunnel. Will continue previous work, but these valves have a higher risk, so how do we re-prioritize. As they learn more about an asset, re-prioritization is done to accommodate new findings. Cheryl - when they find a problem or something that needs to be addressed, if a capital project, have a form. Job request form which is basic information -- an idea - need a better way to operate this valve or facility. Gross cost estimate is developed (0-50K, 50K - 100K, etc). That form goes to a committee Ops Mgr, Finance, Engineering. What is the problem and do we want to tackle right now? If the JIFs yes, then have a different form to develop more detailed scope (JIF form). Presented to the GIF committee for consideration. This process was set up by Cheryl to make sure that crews are accountable and mgt accountable for spending their money most effectively. Is this information logged in Maximo? Per Margaret, it is more of a service request. If DIFF committee decides it needs to be done, looks at who can do it. Regardless of level of involvement, will generate JIF. Example: Looked at the need to replace the transformer because the gas levels were dangerously high. Put together a project to replace the transformer. Replace, test, crews to assist. Executed in due course. Started out as a PM. Crews identified an issue. Escalated to Engineering. Engineering agreed that there was a problem. JIF (job initiation form) was prepared. Went through the process. JIF committee meets weekly. Could be 5-minute meeting, could be 30-minute meeting. If it is put on hold because it can be deferred, it could go into a backlog. Look at opportunities to schedule. WS&T and HHWP. Coordination meeting every two months. There is a master worksheet that tracks work

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		going on. WS&T would not override priorities by HHWP. If summertime, have to have at least 240 mgd going to the Bay Area. Sets the constraints for planning. Right now, in shutdown mode and deliveries are local. When they come back on, will be replenishing local storage.
	Rehabilitation and Replacement Expenditure Policy	Expenditure policies for R/R. Cheryl - use City/County of SF asset policies. Asset, $ amounts classified. R/R funds can only be used for existing asset or for new asset to replace existing asset. Per Cheryl, policies are not as prescriptive as she would like. Mike - is there anything that has $100M in an account, is there any policy doc that says this can't be used for a new asset related to growth. Have money set aside for R/R. In 2018, after floods, identified need for new projects to address. Had to go back to the Commission and show what was needed, where the money is coming from. Capital Plans and R/R budgets are defined when they are submitted to the Commission to approve the changes. Controls at those levels are strict -- water appropriation, power appropriation. Can't use water appropriation to fix a generator, for example. Budget - bond funded. Get about $3.5M per year for R&R. Cheryl reviews to determine money being used appropriately. She follows general accounting principles to determine whether bond funding can be used or R&R budget needs to be used. An independent audit is required for the capital plan, based on bond requirements. Auditor looks at whether bonds are being used for appropriate purpose. Look at things by a group of assets. For example, look at penstock, Canyon Power Tunnel, Kirkwood PH. When looking at Kirkwood PH, how much can they get thru the PH.
Service Level goals	Service Level definitions for asset management	Service Level Goals. When they look at different assets - Mtn Tunnel - what is the capacity, what is the constraint, etc. If I can deliver 300 mgd, okay, since SJPLs constrained to 300 mgd. Go thru each asset, review mode of failure. If failure of Canyon Tunnel before Mtn Tunnel, this is not as bad because could put water down the river and bring it back into Cherry or Eleanor. If a failure at Canyon Tunnel, can probably survive 8 months. If Mtn Tunnel or Foothill Tunnel, could only survive for 3 months. Have had a process for various projects. Used a value engineering approach to make best use of funds.
Connection to other plans ie: Strategic Plan, CIP, etc	Capital Improvement Plan	Use of other Docs. Per Margaret, LOS's run the capital program. The City will work more on a formalization of the AM approach. Scott is meeting with others to discuss AM programs and where they are going. Looking to ISO 50001 for compliance. Each Division at different levels of maturity with regards to where they are. Risk model will be fed by the asset registry. The Strategic AM plan will look at all the elements together. Specific objectives in the Fiscal 2020 Strategic Plan…
Supply Chain	Business Process and Policy for Supply Chain	Supply Chain Business Process and Policy for Supply Chain All of their purchases go thru Maximo. Start with a work order. Requisition feeds a work order. Some businesses don't tie back to an asset (cleaning supplies, toilet paper). Once PO is cut, it transfers to an Oracle system at SFPUC. Not everyone in the City use Maximo. Then it goes thru an approval process in Finance in the City. They make sure money is encumbered out of right pot of money, etc. Inventory purchases. Thru Maximo. Issue purchase to the work order. When people come to get items in the warehouse, they have to have a work order. There is a monthly consumable work order for supplies. Set up the work orders at the beginning of the FY. Can track warehouse consumables. Monthly consumable work order (based on annual work order). Can track each section is using in consumables from the warehouse. When they receive inventory items. Bin locations, item numbers. Have a storeroom association. Very typical warehouse layout. Before they are placed on the shelf they are received in Maximo. Mostly use desktops with Maximo. Starting to use mobile Maximo. No scanning or barcoding capability yet. Determined it wasn't cost effective. Others Use Data Supply, but also track

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		things with manual (paper copy) receipts. Not seeing the value added to implement it here. Seems like it would slow things down. If someone has issued parts for a work order and they need to be returned. Happens rarely but can return items in Maximo.
	Item Master Export Warehouse Management	Most of the warehouse is consumable inventory (highest dollar value). Track spares in Maximo. Item Master contains both active and inactive items. If you were to look at all of SFPUC there would be 10s of 1000s of items. Consumables are the cornerstone of their inventory. But do include items like parts for vehicles. Also maintain parts for cottages here. Parts would be one of the 2300 active items in the inventory. Alan doesn't think they are in Item Master. Item Master - assigns serial number for e ach type of asset. Like having a bill of materials. Critical spares - a couple ways they get critical spares. Can have a project where they are purchased in advance. Can track those in Maximo. They have a process for issuing critical spares through work orders. How are critical spares identified? Previously, gut feeling. Now, more deliberate based on experience. Have a metric for those. Do vetting to determine what a critical spare is. Not the same as leftover parts.
	Warehouse Management Warehouse Management	Warehouse process. Issue an item, it tracks back to a work order. Don't typically reserve items but are starting to do so. Ultimate goal is to understand the cost to see the benefit of reserving item. Do you look at parts availability? They can do that. In a work order, do we know what is going to be used? Yes - getting to that level, but don't get it all the time.
	Warehouse Management	Physical and cycle counts. Required annual inventory. Every other year have an outside audit. Count all 2300 items annually. Usually pretty accurate. Cycle counting weekly. Have a reporting on inventory adjustments on a monthly basis. Automated report that is generated from Maximo. Generated monthly, and then they can track it down. Outside audit - print out inventory and manually count each item. Then provide a reconciliation. If have Maximo at the desktop, print out count sheets. Do a reconciliation. When the auditors come, they have a number of items to expect. Internal inventories are blind count. One main warehouse. Annex next to warehouse. Sometimes critical spares are stored at the facility location. Per Cheryl, have had problems with critical spares. Used to store in the old powerhouse. But due to asbestos issues, need to suit up to go in the facility. Currently don't have a good facility and need a new one. Don't have enough space. Had a project in the budget, but it didn't go through. Do not have enough square footage to store all the things they would like to store. But do have a good handle on what they have, where it is. Replacement tools. Most recent audit on tools for tech shop. Look at what they have and then inventory. Doing the same for critical spares. An effort to manage rolling stock in the future. Planning to check out through the warehouse. Equipment that is used by multiple crafts. What went out. What shape it is in when returned. Sometimes share equipment between different groups. Will be looking at making sure everyone has the right equipment, it is being stored where needed, etc. to make work more efficient. Materials Management Staffing. A large part of work dedicated to purchasing IT services for software. IT purchasing < 10K. About 2000 purchases a year. Everyone is cross-trained, so things don't stop if someone absent. Fuel - a person is dedicated to fuel (50% of job responsibility). Work with EJ Ward and Maximo on fuel management. Pretty sophisticated problems. Communications between all the sites. EJ Ward is a fuel mgt system that communicates with Maximo. Lucky spends a fair amount of his day working on fuel mgt. Cheryl System is problematic - have communications structure issues that compound the problems. A program downloads EJ Ward data into Maximo. It should happen daily, but if communication problems, less frequently. Inventory - manage $390K - 500K per year in the warehouse. Turn that 2 to 2-1/2 times. Of 400K, 20% of that is fuel. HHWP ahead of the

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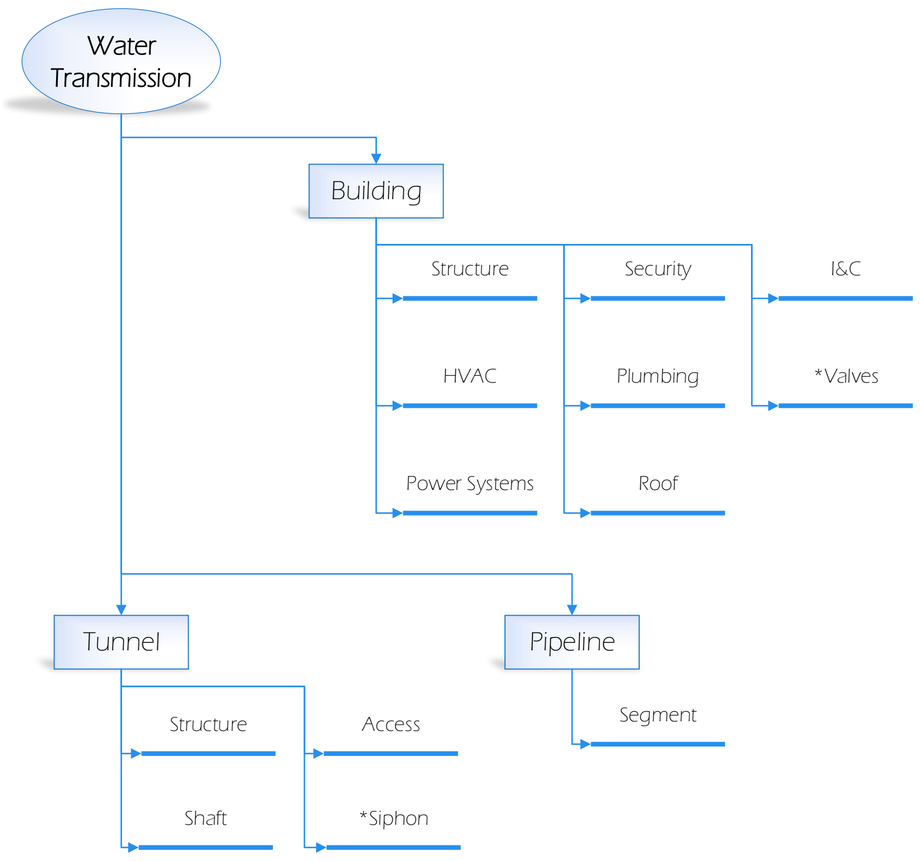
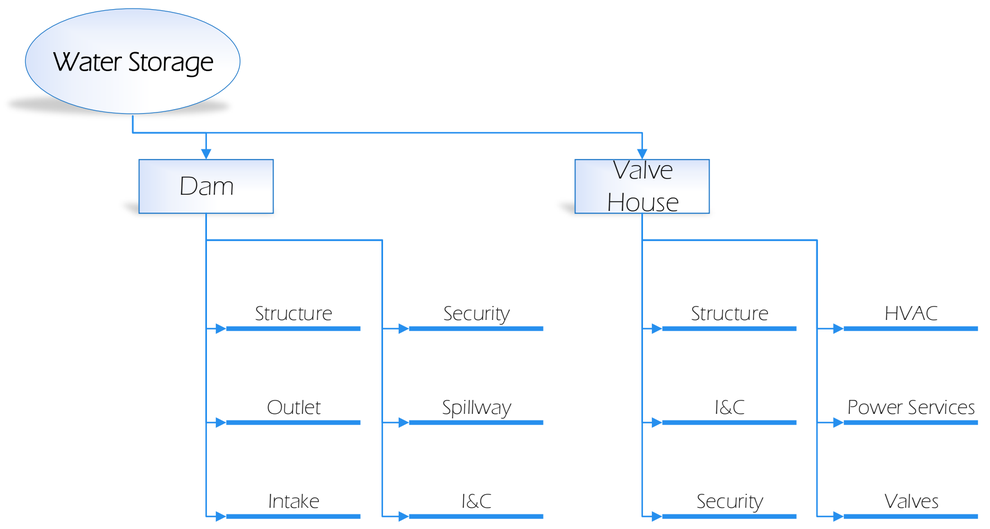
Criteria	SubCriteria	HHWP Meeting Notes
		curve in terms of retirements. Helped them to identify things that need to be put into place going forward. Need to capture that institutional knowledge. If we have follow-up questions, reach out to Cheryl or Margaret. They will provide the entire package electronically. They will send to Michelle to send to us.
Staff Plan	Staff matrix and job description	Just hired a staffing a maintenance mgr. Will be hiring a clearance mgr. Will take the lead in system shutdowns. This will free up others to focus more on maintenance activities. AM/Asset Integrity vs. Maintenance. -- Implementation side vs analysis side. A couple of years ago, restructured the group. Started out with schedulers/planners. Have branched out. Asset services, scheduling, ____ AM - maintaining data, creating PMs. This will be left to the Asset Group, not planners. There is a chart that Scott has identified that shows what each section is responsible for. This is what they are working towards. Clearance planner - 5602 - Promotion from planner. Org and coordinate system outages and maintenance outages. Right now, out for 30 days and doing a lot of work. Scott planned this outage. In the future, the Clearance Planner would plan this outage. Would facilitate the coordination/planning. Would gather generator availability data. Any time a generator is down, there is a clearance issued. They would handle this. They will coordinate with WS&T at the two-month planning meetings. Meeting with WS&T on Friday. Is HHW&P completely autonomous? Regional coordination - this is what each of us have going on. This is how we are operating, etc. Shutdown coordination - this is a list of jobs we have agreed to. Have a long-term view of work to identify constraints, can put jobs together, etc. There is a bit of overlap here. Sometimes WS&T provides staff for some projects. Processes are completely different by Division. Don't overlap in work processes. Both use Maximo but use it very differently. Division of financial responsibility. If WS&T wants work done by HHW&P, there is a specific account. Specific processes are specific to each Division. Scott is in Benicia but stays up here during the week. When they set up their group focused on planning and scheduling. At WS&T, focus on assets. HHWP and WS&T worked individually on their deliverables. Scott will be leaving. Per Cheryl, he has been a great partner working with the accounting side of things. Looking for person to replace Scott. Know how they want to look at the different groups. Looking for AM manager. Reciprocity with CalPERS. Not in CalPERS. The one thing that Margaret has seen is that it was a long journey bringing the workers along. Now they work with the tools and make suggestions. Have gone through a lot of the cultural change and now people are seeing the benefits.

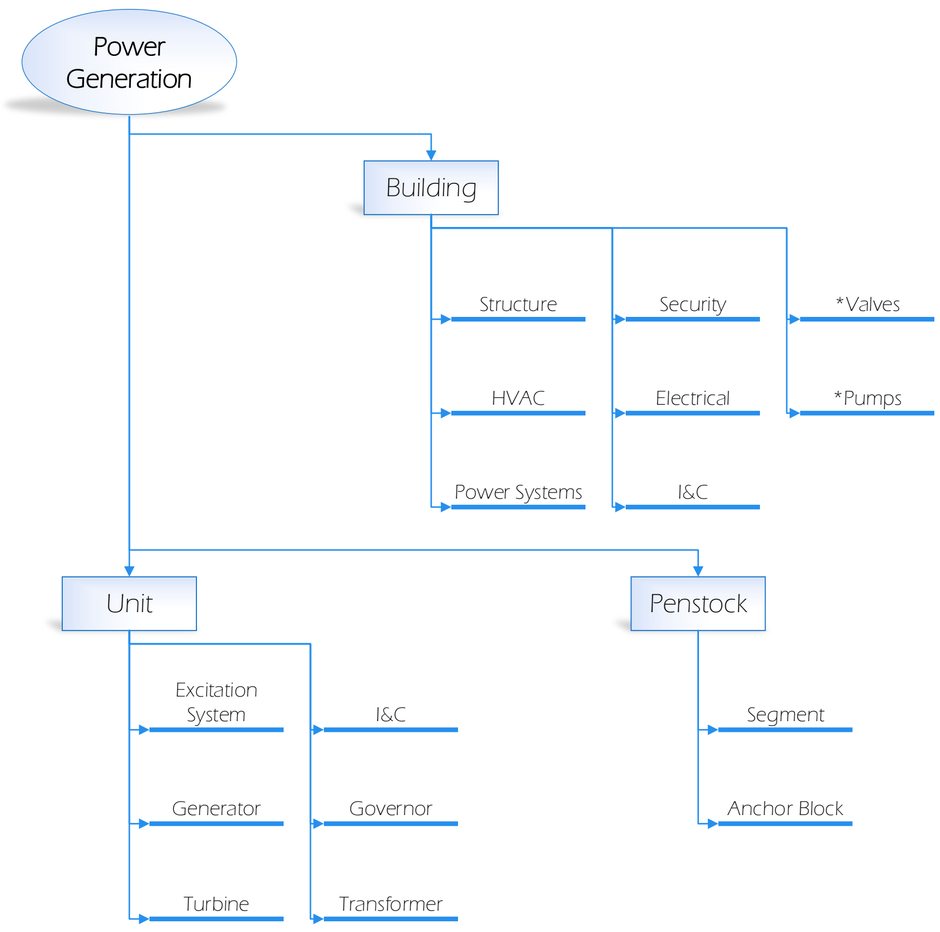
APPENDIX F

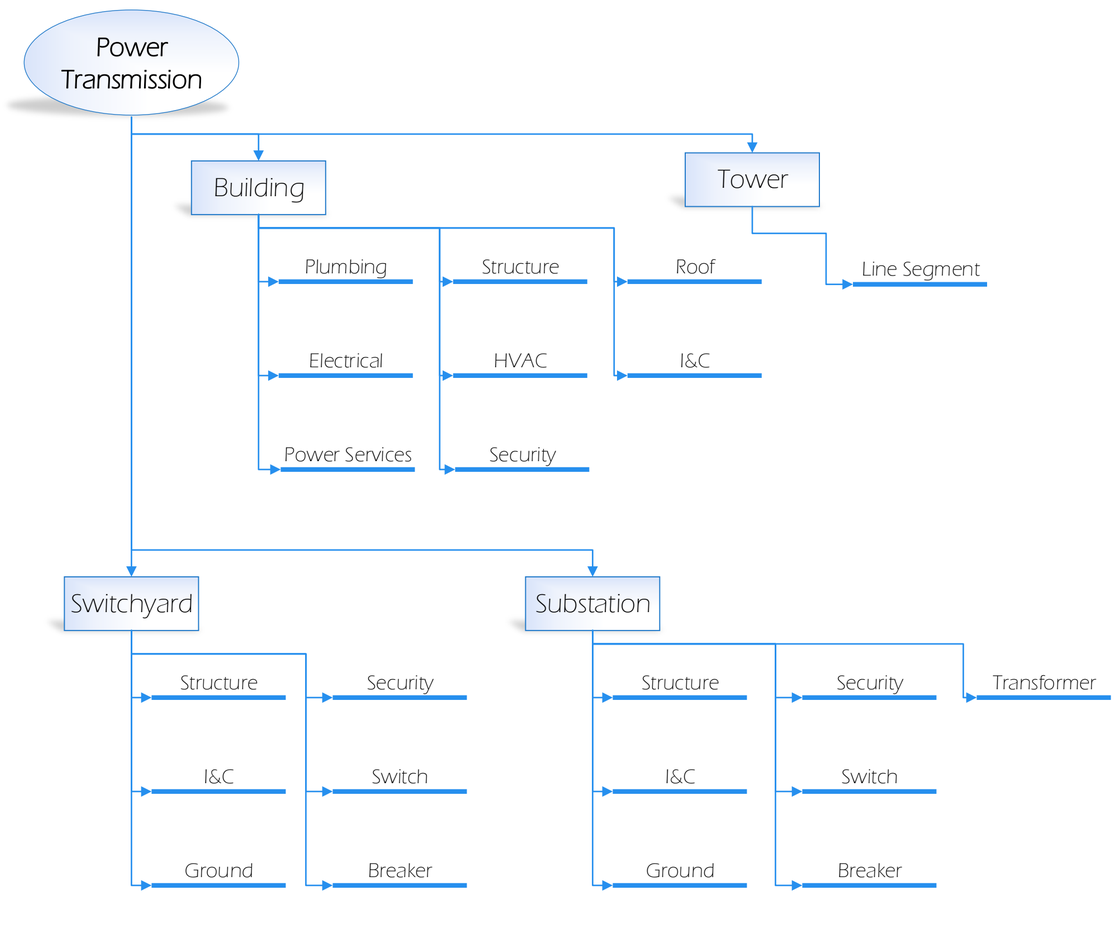
HHWP Asset Hierarchy Index

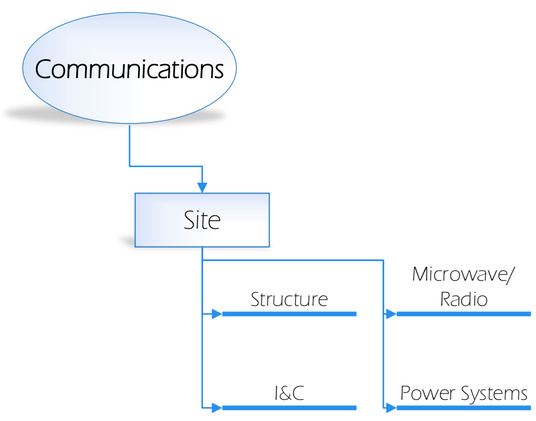
Hetch Hetchy Water and Power: Major Facility and Assembly Types by System

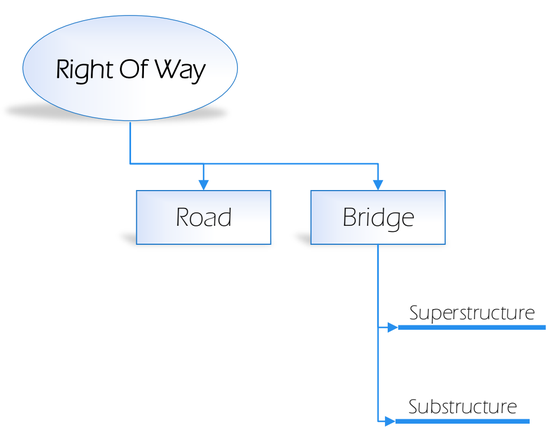


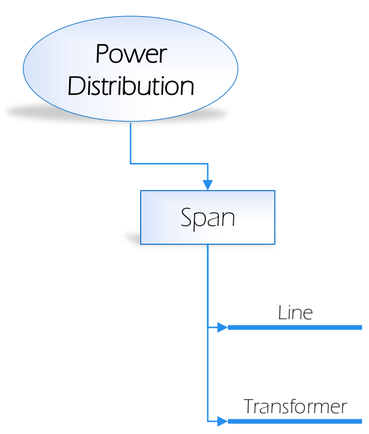


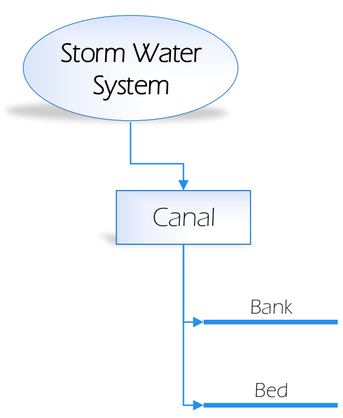


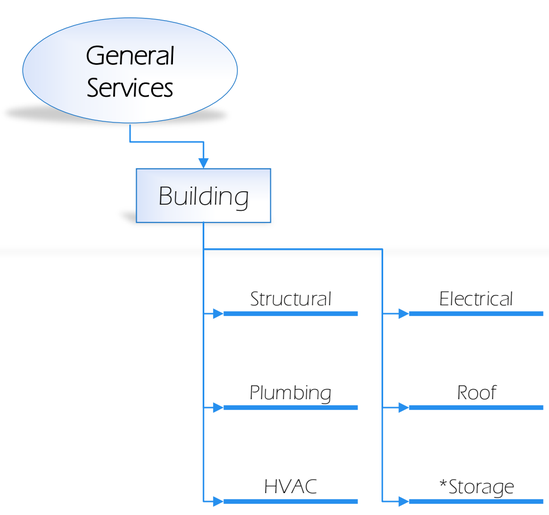












APPENDIX G

Asset Classification Attribute Domain

ASSETATTRIBUTEID	ASSETATTRID	DESCRIPTION	DATATYPE	MEASUREUNITID	DOMAINID	ATTRDESCPREFIX
5668	# MODULES AI	No. of Analog Input Modules	ALN			
5670	# MODULES AO	No. of Analog Output Modules	ALN			
5664	# MODULES DI	No. of Digital Input Modules	ALN			
5666	# MODULES DO	No. of Digital Output Modules	ALN			
5663	# OF RACKS	Number of Racks	ALN			
6844	001 MANUFACTURER	MANUFACTURER	NUMERIC			
6846	002 MODEL NUMBER	MODEL NUMBER	NUMERIC			
6848	003 ORDER NUMBER	ORDER NUMBER	NUMERIC			
6850	004 ID NUMBER	ID NUMBER	NUMERIC			
6852	005 SERIAL NUMBER	SERIAL NUMBER	NUMERIC			
6854	006 ENGINE	ENGINE	NUMERIC			
6856	007 FRAME	FRAME	NUMERIC			
6858	008 TYPE	TYPE	NUMERIC			
6860	009 HORSEPOWER	HORSEPOWER	NUMERIC			
6784	01_SSRATING	Overall Side Sewer Rating	ALN		SSRATING	
6862	010 VOLTAGE	VOLTAGE	NUMERIC			
6864	011 PHASE	PHASE	NUMERIC			
6866	012 AMPS	AMPS	NUMERIC			
6868	013 HZ	HERTZ	NUMERIC			
6870	014 SER. F.	SERVICE FACTOR	NUMERIC			
6872	015 KVA	KVA	NUMERIC			
6874	016 KW	KW	NUMERIC			
6876	017 SIZE	SIZE	NUMERIC			
6878	018 RPM	RPM	NUMERIC			
6880	019 BEARINGS	BEARINGS	NUMERIC			
6786	02_SSTVID	Side Sewer TV ID	ALN			
6882	020 FILTER	FILTER	NUMERIC			
6884	021 IMPELLER	IMPELLER	NUMERIC			
6886	022 GPM	GPM	NUMERIC			
6888	023 HEAD	HEAD	NUMERIC			
6890	024 WEIGHT	WEIGHT	NUMERIC			
6892	025 REBUILD DATE	REBUILD DATE	NUMERIC			
6894	026 LUBRICANT	LUBRICANT	NUMERIC			
6896	027 VALVE SIZE	VALVE SIZE	NUMERIC			
6898	028 DUTY	DUTY	NUMERIC			
6900	029 INS. CLASS	INS. CLASS	NUMERIC			
6788	03_NOTV	Unable to Televise	ALN		NOTVSS	
6902	030 AMBIENT DEGREES	AMBIENT DEGREES	NUMERIC			
6904	031 REF NO	REF NO	NUMERIC			
6906	032 FUEL TYPE	FUEL TYPE	NUMERIC			
6908	033 CODE	CODE	NUMERIC			
6910	034 WARRANTY DATE	WARRANTY DATE	NUMERIC			
6912	035 INSTALLATION DATE	INSTALLATION DATE	NUMERIC			
6914	036 S.F.A.	S.F.A.	NUMERIC			
6916	037 RATIO	RATIO	NUMERIC			
6804	04_BREAKINPIPE	Break In Pipe	ALN		MAJMIN	
6824	04_CAMERASUBMERGED	Camera Submerged	ALN		MAJMIN	
6792	04_COLLAPSE	Collapse	ALN		MAJMIN	
6790	04_CRACKS	Cracks	ALN		MAJMIN	
6814	04_DEBRIS	Debris	ALN		MAJMIN	
6796	04_DEFECTIVEPIPE	Defective Pipe	ALN		MAJMIN	
6798	04_DEFORMATION	Deformation	ALN		MAJMIN	
6820	04_ENCRUSTSCALE	Encrustation & Scale	ALN		MAJMIN	
6794	04_FRACTURE	Fracture	ALN		MAJMIN	
6818	04_GREASE	Grease	ALN		MAJMIN	
6822	04_INFILTRATION	Infiltration	ALN		MAJMIN	
6806	04_LINEDEVIATIONS	Line Deviations	ALN		MAJMIN	
6816	04_OBSTRUCTION	Obstruction	ALN		MAJMIN	
6800	04_OPENJOINTS	Open Joints	ALN		MAJMIN	
6808	04_REVERSEGRADE	Reverse Grade	ALN		MAJMIN	
6810	04_ROOTS	Roots	ALN		MAJMIN	
6802	04_SAGINPIPE	Sag In Pipe	ALN		MAJMIN	
6812	04_SILT	Silt	ALN		MAJMIN	
6826	04_SURVEYABANDONED	Survey Abandonned	ALN		MAJMIN	
6828	04_UNCLASSIFIED	Unclassified	ALN		MAJMIN	
6100	A	A	ALN			
5688	A EXPAN MOD	Analog Expansion Module	ALN			
5908	A PRMT EXP D	Air Permit Expiration Date	ALN			
6199	A/C BELT	A/C BELT NO.	ALN			
5909	ABRASTN PROT	Abrastion Protection	ALN			
5910	AC AMPS	AC Amps	ALN			
5911	AC INPUT	AC Input	ALN			
8934	AC VOLTAGE INPUTS	THE NUMBER OF AC VOLTAGE INPUTS	ALN			
5912	ACC GAT MATL	Access Gate Material	ALN			
5913	ACC GATE SIZ	Access Gate Size (H,W,L)	ALN			
5914	ACC GATE TYP	Access Gate Type	ALN		ACCESS GATE TYPE	
5915	ACCEPT DATE	Accepted Date	ALN			
5589	ACCESS	Access	ALN			
5702	ACCESSORIES	Accessories	ALN			
6142	ACCOUNT NO.	Account Number	ALN			
5916	ACCURACY	Accuracy	ALN			
5917	ACT CTRL TYP	Actuator Control Type	ALN		ACT CONTROL TYPE	
5591	ACT TYPE	Actuator Type	ALN			
5918	ACTUATOR	Actuator (Y/N)	ALN			
5919	ACTUATOR TYP	Actuator Type	ALN		ACTUATOR TYPE	
8804	ADDLCOMMENTS	Additional Comments	ALN			
8806	ADDLTIMENEED	Note Additional Time Needed	ALN			
5779	ADDRESS	Street address and name	ALN			
9082	ADDRESS NO.	Address Number	ALN		STRNAMES	
10442	ADDRESS NOTES		ALN			
10444	ADDRESS NUM	Address Number	ALN			
8970	ADDRESS NUMBER		NUMERIC			
5920	ADDRESS1	Address1	ALN			
5921	ADDRESS2	Address2	ALN			
5922	AERATION TYP	Aeration Type	ALN		AERATION TYPE	
6086	AFILT	AFILT	ALN			
9992	AGGREGATE MATERIAL	Aggregate Material Size	ALN			
5923	AGO DRV TYPE	Access Gate Operator Drive Typ	ALN		AGO DRIVE TYPE	
5669	AI CAT #	Analog Input Catalog No.	ALN			
7184	AIC	AMP INRUSH CURRENT	ALN			

5924	AIR CAPACITY	Air Capacity	ALN			
6184	AIR FILTER #	AIR FILTER NO.	ALN			
5603	AIR FLOW	Free Air Delivery	ALN	CFM		
5925	AIR PMT REQD	Air Permit Required	ALN			
10256	AIR TEMPERATURE	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
8582	AIR VALVE	10"AVV,12"AVV	ALN			
5926	ALARM TYPE	Alarm Type	ALN			
6087	ALLOY	ALLOY	ALN			
5927	ALM EVT MGMT	Alarms And Event Management	ALN			
6197	ALT BELT	ALT BELT NO.	ALN			
9782	ALWAYS PROGRAM TO STANDARD TIME	ALWAYS PROGRAM TO STANDARD TIME	ALN			
6238	AMB TEMP	AMB TEMP	ALN	C		
7182	AMP		ALN			
7188	AMP FRAME	AF	ALN			
7186	AMP TRIP	AT	ALN			
6088	AMPS	AMPS	ALN	AMPS		
5928	AMPS 1-PHASE	Amps Single Phase	ALN			
5929	AMPS 3-PHASE	Amps Three Phase	ALN			
5930	AMT OF FEEDS	Amount of Feeds	ALN			
5931	AMT OF MEDIA	Amount of Media	ALN			
5932	AN INP CAT N	Analog Input Catalog Number	ALN			
5933	AN OUT CAT N	Analog Output Catalog Number	ALN			
8904	ANALOG		ALN		YES/NO	
8928	ANALOG INPUTS	THE NUMBER OF ANALOG INPUTS	ALN			
8930	ANALOG OUTPUTS	THE NUMBER OF ANALOG OUTPUTS	ALN			
5934	ANGL OF VIEW	Angle Of View	ALN			
5935	ANSI RATING	ANSI Rating	ALN			
5671	AO CAT #	Analog Output Catalog No.	ALN			
5787	APN	Assessors Parcel Number	ALN			
7602	APPCOMPONENT	Application Component	ALN			
5574	APPLICATION	Application	ALN			
5936	APPROVALS	Approvals	ALN			
7086	APPROXIMATE WEIGHT		ALN			
7366	ARC FLASH HAZ	Arc Flash Hazard/Risk Category	ALN			
9778	ARC FLASH HAZARD/RISK CATEGORY	Arc Flash Hazard/Risk Category	ALN			
7822	ARC FLASH LABEL REQUIRED	YES or NO	ALN			
5837	AREA	Building Square Footage	ALN			
9990	AREA OF FACILITY	Area of Facility	NUMERIC	SF		
10030	AREA OF IMPACT	The proximity of the detcetion relative to the line.	ALN	FT		
5937	AREA SERVED	Area Served	ALN			
7248	ARM	ARM LENGTH, NONE, OTHER	ALN			
5808	ARM LENGTH	Pole arm length	ALN			
5789	ARM OWNER	Owner of Street Light Arm	ALN			
5938	ARMATUR CONN	Armature Connection	ALN			
8726	ASSET CATEGOGY		ALN			
8154	ASSET CATEGORY	Asset Category (Keyword)	ALN			
8184	ASSETWORK #	ASSET WORKS NUMBER (EQUIP ID)	ALN			
8728	ASSIGENED REPAIR LOCATION		ALN			
5939	ASSIGN TO	Assign To	ALN			
6202	ASSIGNED	ASSIGNED TO	ALN			
8146	ASSIGNED REPAIR LOCATION	Assigned (Maintenance) Repair Location	ALN			
9350	ASSIGNED TO	Group or person the radio is assigned to.	ALN			
5448	ASSIGNTO	PERSON ASSIGN TO	ALN			
5453	ASTO SEAT	ASTO SEAT	ALN			
5781	ATTACHMENT	Items attached to pole	ALN			
5940	AUDIO	Audio	ALN			
5627	AUX CONTACTS	Auxilary Contacts	ALN			
5595	AUX SWI RATE	Auxiliary Switch Rating	ALN			
5941	AUX TRAFFIC	Auxillary Traffic (Y/N)	ALN		YES/NO	
6188	AUX. ENG. MF	AUX. ENG. MFG.	ALN			
9425	AUX. ENGINE COOLANT CAPACITY	Aux. Engine Coolant Capacity	NUMERIC	GAL		
9424	AUX. ENGINE COOLANT TYPE	Aux. Engine Coolant Type	ALN			
7213	AUX. ENGINE MAKE	AUX. ENGINE MAKE	ALN			
7214	AUX. ENGINE MODEL	AUX. ENGINE MODEL	ALN			
9423	AUX. ENGINE OIL CAPACITY	Aux. Engine Oil Capacity	NUMERIC	QT		
9422	AUX. ENGINE OIL TYPE	Aux. Engine Oil Type	ALN			
9421	AUX. ENGINE SERIAL #	Aux. Engine Serial Number	ALN			
7215	AUX. ENGINE SIZE	AUX. ENGINE SIZE	ALN			
9428	AUX. WATER PUMP MFG.	Aux. Water Pump Manufacture	ALN			
9429	AUX. WATER PUMP MODEL #	Aux. Water Pump Model Number	ALN			
9432	AUX. WATER PUMP OIL CAPACITY	Aux. Water Pump Oil Capacity	NUMERIC	GAL		
9431	AUX. WATER PUMP OIL TYPE	Aux. Water Pump Oil Type	ALN			
9430	AUX. WATER PUMP SER. #	Aux. Water Pump Serial Number	ALN			
5942	AVB	AVB	ALN			
9562	AWG	WIRE SIZE	ALN			
5943	AWWA RATING	AWWA Rating	ALN			
9606	B W TANK CAPACITY	Black Water Tank Capacity	NUMERIC	GAL		
5728	B. BREAK TYP	Branch Breaker Type	ALN			
10081	BAAQMD SRC NO	BAAQMD Source Number	ALN			
9980	BACKFLOW PREVENTER MODEL NUMBER	Backflow Preventer Model Number	ALN			
5456	BALANCE	BALANCE	ALN			
10252	BAROMETRIC PRESSURE	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
5823	BASIN	Watershed Basin Location	ALN			
5721	BATT CHARGER	Battery Charger	ALN			
5696	BATT DIM	Battery Dimensions- WxHxD	ALN			
5694	BATT RATING	Battery Amp-Hours	ALN			
5692	BATTERY	Battery Model	ALN			
5944	BATTERY CHGR	Battery Charger	ALN			
5693	BATTERY TYPE	Battery Type	ALN			
7793	BATTERY WEIGHT		ALN	LBS		
9062	BAUD	Baud Rate	NUMERIC			
5769	BAUD RATE	Baud rate for modem	NUMERIC			
10446	BAUD RATE	Baud rate for modem	ALN			
5945	BCS MFG	Burner Control System Manufact	ALN			
5946	BCS MODEL	Burner Control System Model	ALN			
6089	BDATE	BDATE	ALN			
5947	BEAD/MESH SZ	Size of Beads/Mesh	ALN			
5490	BEARING TYPE	Bearing Type	ALN		BEARING TYPE	
6216	BEARINGS	BEARINGS	ALN			
5948	BEARNG RTD N	Bearing RTD Number	ALN			
5949	BEARNG RTD T	Bearing RTD Type	ALN			

5950	BELT LENGTH	Belt Length	ALN		COMPACTOR	
6186	BELT NO.	BELT NO.	ALN			
6137	BELT SIZE	Drive Belt Size	ALN			
9522	BID ITEM	Bid Item	ALN			
5521	BIL	bil	ALN	KV		
9754	BIL PRIMARY WINDING	BIL PRIMARY WINDING	ALN			
9756	BIL SECONDARY WINDING	BIL SECONDARY WINDING	ALN			
5951	BKFLW PR VLV	Backflow Prevention Valve	ALN		VALVE TYPE	
5952	BKFLW PREV	Has Backflow Prevention Y/N	ALN		YES/NO	
5953	BLCK HTR VOL	Engine Block Heater Voltage	ALN			
5954	BLCK HTR WAT	Engine Block Heater Wattage	ALN			
5836	BLDG HEIGHT	Building Height	ALN			
5845	BLDG REHAB.	Building Rehabilitation	ALN			
5955	BLDGFOOTPRNT	Building Foot Print	ALN			
5720	BLK HEAT PHS	Block Heater Phase	ALN			
5719	BLK HEAT V	Block Heater Voltage	ALN	VOLTS		
7982	BLKLOT	Block Lot	ALN			
5718	BLOCK HEATER	Block Heater	ALN	WATTS		
8602	BLOW OFF		ALN			
5956	BLOWER DRIVE	Blower Drive Type	ALN		BLOWER DRIVE	
5957	BLOWER MATL	Material	ALN			
5958	BLOWER TYPE	Blower Type	ALN		BLOWER TYPE	
8662	BLOWOFF	12"BO	ALN			
5959	BLT PRSS TYP	Belt Press Type	ALN		BELT PRESS TYPE	
5576	BODY MAT.	Body Material Type	ALN			
6250	BODY TYPE	BODY TYPE	ALN			
5960	BOIL CTL SYS	Boiler Control System	ALN			
5961	BOIL FUL TYP	Boiler Fuel Type	ALN		BOILER FUEL TYPE	
5962	BOILER TYPE	Boiler Type	ALN		BOILER TYPE	
5963	BOOM LENGTH	Boom Length	ALN			
5964	BOWL	Bowl	ALN			
5965	BOWL SPEED	Bowl Speed	ALN			
5726	BRAKE TYPE	Type of Brakes	ALN			
5711	BREAKER SIZE	Breaker Size	ALN			
5966	BREAKER TYPE	Breaker Type	ALN		BREAKER TYPE	
5967	BRKR MFG	Breaker Manufacturer	ALN			
5968	BRKR RATING	Breaker Rating	ALN			
5969	BRKR SERIAL	Breaker Serial Number	ALN			
5970	BRKR TRIP SZ	Breaker Trip Size	ALN			
5895	BSE-1 LEVEL	ASCE 41 Earthquake Hazard	ALN			
5896	BSE-2 LEVEL	ASCE 41 Earthquake Hazard	ALN			
5628	BUCKET SIZE	Bucket Size - H	ALN	INCHES		
6069	BUILDING	Building/Structure	ALN			
5588	BURIED/VALUT	Buried/Vault/Building	ALN			
5535	BUS BR RATE	BUS BRACING RATING	ALN			
5971	BUS BRC RTNG	Bus Bracing Rating	ALN			
5680	BUS CTRL	Bus Controller	ALN			
5684	BUS IO LINK	Bus IO Link Interface	ALN			
7462	BUS MATERIAL	CU or AL	ALN			
8826	BUS RATING		NUMERIC	AMPS		
5682	BUS RECEIVE	Bus Receiver	ALN			
5972	BUS RECEIVER	Bus Receiver	ALN			
5683	BUS SCAN	Bus Scanners	ALN			
5973	BUS TRANS	Bus Trans	ALN			
5681	BUS TRANSS	Bus Transmitter	ALN			
5730	BUS TYPE	Bus Type	ALN			
5746	BUSHINGS HV	Bushings HV - Quantity, Style	ALN			
5747	BUSHINGS LV	Bushings LV - Quantity, Style	ALN			
5509	BYPASS	Bypass	ALN			
5523	C LATCH	closing latching rating	ALN			
5641	C LATCH RATE	Closing - Latching Rating	ALN	KA		
10284	CABLE LENGTH		ALN			
10282	CABLE TYPE		ALN			
6158	CAGE	Cage	ALN			
5974	CAKE DISCHRG	Cake Discharge	ALN			
5868	CALC RATIO	Calculation Ratio	ALN			
8462	CALIBRATED	Calibrated	ALN			
8444	CALIBRETED	Caclbrated	ALN			
6135	CAPACITY	Capacity	ALN			
5975	CAPACITY BTU	Capacity (BTUs)	ALN			
7791	CAPICITY		ALN	AH		
7722	CAPICTY		ALN	KVA		
5976	CASING	Casing	ALN			
6208	CAT.#	#	ALN			
5860	CATALOG NO.	Catalog Number	ALN			
10234	CC		ALN			
9624	CCD CAMERA MFG	CCD Camera Manufacture	ALN			
9626	CCD CAMERA MODEL	CCD Camera Model	ALN			
9628	CCD CAMERA SER #	CCD Camera Serial Number	ALN			
9638	CCTV CABLE DRUM MFG	CCTV Cable Drum System Manufacture	ALN			
9640	CCTV CABLE DRUM MODEL	CCTV Cable Drume Model	ALN			
9642	CCTV CABLE DRUM SER #	CCTV Cable Drum Serial Number	ALN			
5977	CEIL FIN TYP	Ceiling Finish Type	ALN			
5978	CEILING HT	Ceiling Height	ALN			
7790	CELL TYPE		ALN			
5695	CELL VOLTAGE	Cell Voltage	ALN			
5979	CERT DATE	Certification Date	ALN			
5980	CERT LOC	Certification Location	ALN			
5981	CERT YEAR	Certification Year	ALN			
6090	CERT#	CERT#	ALN			
5982	CERTIFIED BY	Certified By	ALN			
5983	CFM	CFM	ALN			
7604	CHANGETYPE	Type of Change	ALN			
5764	CHANNEL 1	Unit of measure	ALN	KW		
9788	CHANNEL 1 (KWH OR GKWH)		ALN			
5765	CHANNEL 2	Unitof measure	ALN	KW		
9790	CHANNEL 2 (KVARH OR GKVARH)		ALN			
5766	CHANNEL 3	Unit of measure	ALN	KW		
9792	CHANNEL 3 (KWH OR GKWH)		ALN			
5767	CHANNEL 4	Unit of measure	ALN	KW		
9794	CHANNEL 4 (KVARH OR GKVARH)		ALN			

10448	CHANNEL 1	CHANNEL 1 (KWH OR GKWH)	ALN			
10450	CHANNEL 2	CHANNEL 2 (KVARH OR GKVARH)	ALN			
10462	CHANNEL 3	CHANNEL 3 (KWH OR GKWH)	ALN			
10464	CHANNEL 4	CHANNEL 4 (KVARH OR GKVARH)	ALN			
9822	CHARACTER LABEL	Character Label	ALN			
10288	CHARGE REGULATOR	Y/N, TYPE	ALN			
5984	CHEM TRMT	Has Chemical Treatment Y/N	ALN		YES/NO	
5985	CHEMICAL TYP	Chemical Type	ALN			
6169	CIRCUIT	circuit	ALN			
5488	CIRCUIT NUM	Circuit Number	ALN			
7464	CIRCUIT SPACE QTY	X-CIRCUIT SP	ALN			
5986	CITY	City	ALN			
9186	CL, TA, TV, CA		ALN			
6083	CLASS	CLASSIFICATION	ALN		CLASS	
7082	CLASS/BIL		ALN			
6175	CLASSIFICATI	SECURITY CLASSIFICATION	ALN			
8808	CLEAN	Clean to Make Accessible	ALN			
9202	CLEANMSR	Clean Measurement	NUMERIC	FT		
9204	CLNMSRV	Reason for Clean Footage Variance	ALN			
5528	CLOSE COIL A	closing coil current	ALN	AMPS		
5525	CLOSING TIME	closing time	ALN	CYCLES		
5987	CMPRSS MT HP	Compressor Motor Horsepower	ALN			
5988	CMPRSSR DRVE	Compressor Drive Type	ALN		COMPRESSOR DRIVE	
5989	CMPRSSR MATL	Compressor Material	ALN			
5990	CMPRSSR TYPE	Compressor Type	ALN		COMPRESSOR TYPE	
5991	CNFINED SPCE	Confined Space (Y/N)	ALN		YES/NO	
5992	CNFN SPC MRK	Confnd Spc Mrkr on Vault Lid	ALN		YES/NO	
5452	CO	CO #	ALN			
5994	CO2 RATE	CO2 Rate	ALN			
5581	COATING	Coating	ALN			
6237	CODE	CODE	ALN			
5995	CODE LETTER	Code Letter	ALN			
5996	COF FIN RISK	COF Financial Risk	ALN		COF FINANCIAL RISK	
5997	COF OPR IMPC	COF Operational Impact	ALN		COF OPERAT IMPACT	
5998	COF PB I RSK	COF Public Impact Risk	ALN		COF PUB IMPACT RSK	
5999	COF REG IMPC	COF Regulatory Impact	ALN		COF REGULAT IMPACT	
6000	COF SCORE	Consequence Of Failure Score	ALN			
6001	COF SFTY RSK	COF Safety Risk	ALN		COF SAFETY RISK	
5626	COIL SIZE	Coil Size	ALN			
8542	COLOR	STREET LIGHT POLE COLOR	ALN			
5678	COMM COPROCE	Co-Processor Comm Module	ALN			
6002	COMM PROTCL	Communication Protocol	ALN			
8922	COMM PROTOCOL SUPPORTED		ALN			
6003	COMM TYPE	Communication Type	ALN		COMMUNICATION TYPE	
6078	COMMENTS	Comments	ALN			
5855	COMMENTS 2	Comments	ALN			
5573	COMMUNICATIO	Wireless or Hardwired	ALN			
6004	COMMUNICATN	Communication	ALN			
6005	COMPACTOR	Compactor	ALN		COMPACTOR	
6006	COMPARTMENTS	Compartments	ALN			
7264	COMPLIANCE TYPE	GOP, TOP, GOP & TOP, OTHER	ALN			
7504	COMPONANTS	COMPONANTS INCLUDED	ALN			
7510	COMPONENTS	CONTACTOR,RELAY,OTHER	ALN			
8850	COMPRESSED AIR REQUIRNMENT		ALN	Y/N		
6007	COMPRESSOR	Compressor	ALN			
6008	COMPRSS MFG	Compressor Manufacturer	ALN			
6009	COMPRSS MODL	Compressor Model Number	ALN			
6010	CON FIRE ALM	Connected to Fire Alarm Sys	ALN		YES/NO	
6011	CON NRGY MGT	Connected to Energy Mgmt Sys	ALN		YES/NO	
6012	COND RISK BY	Condition/Risk Assessed By	ALN			
6013	COND UNT MFG	Condensing Unit Manufacturer	ALN			
6014	COND UNT SER	Condensing Unit Serial Number	ALN			
6015	CONFG PROTCL	Configuration Protocol	ALN			
7062	CONFIGURATION HIGH	DELTA, WYE	ALN			
7064	CONFIGURATION LOW	DELTA, WYE	ALN			
7010	CONFIGURATION PHASE	1, 2 , OR 3 PH	ALN			
7006	CONFIGURATION PRIMARY	DELTA, WYE	ALN			
7008	CONFIGURATION SECONDARY	DELTA, WYE	ALN			
8810	CONFINEDSPACE	Note Confined Space	ALN			
8790	CONFVALVLOC	Confirm Valve Location	ALN			
6091	CONID	CONID	ALN			
6016	CONN INLT SZ	Connection Inlet Size	ALN			
6017	CONN OULT SZ	Connection Outlet Size	ALN			
6018	CONNECTORS	Connectors	ALN			
6019	CONST MATL	Construction Material	ALN			
5833	CONST. TYPE	Construction Type	ALN			
6020	CONSTCTRCTR	Construction Contractor ID	ALN			
9362	CONSTRUCTION INSPECTION TYPE	CONSTRUCTION INSPECTION TYPE	ALN		CONINSP_TYPE	
6143	CONSUMER	Consumer	ALN			
10182	CONTACT RATING		ALN	AMPS		
5708	CONTINUE KVA	kVA-Continuous	ALN	KVA		
5707	CONTINUE KW	kW-Continuous	ALN	KW		
5533	CONTRACT #	Contract Number	ALN			
6072	CONTRACT NAM	Contract Name	ALN			
6073	CONTRACT NO.	Contract Number	ALN			
7960	CONTRACT_ID_CSD	Contract Number	ALN			
6075	CONTRACTOR	Contractor	ALN			
6167	CONTROL	Control	ALN			
7268	CONTROL TEST PROCEDURE	RELATED CTP #, OR NONE	ALN			
7148	CONTROL TYPE	ATS/MANUAL/RECEPT	ALN			
6021	CONTROL UNIT	Control Unit	ALN			
6207	CONTROL V	CONTROL VOLTAGE	ALN	VOLTS		
5527	CONTROL VOLT	Control voltage	ALN			
9978	CONTROLLER MODEL NUMBER	Controller Model Number	ALN			
6022	CONVEYOR BLD	Conveyor Blade	ALN			
6023	CONVEYOR DRV	Conveyor Drive Type	ALN			
6024	CONVEYOR TYP	Conveyor Type	ALN		CONVEYOR TYPE	
6025	CONVEYR MATL	Conveyor Material	ALN			
5744	COOL CLASS	Cooling Class	ALN			
5887	COOLANT	Cooolant Type	ALN			
6026	COOLANT CAP	Coolant Capacity	ALN			

6027	COOLING	Cooling	ALN			
9776	COOLING CLASS	COOLING CLASS	ALN			
5617	COOLING TYPE	Cooling Type/Method	ALN			
6028	COOLNG CPCTY	Cooling Capacity	ALN			
6029	COOLNT CPCTY	Engine Coolant Capacity	ALN			
5993	CO-PRC COM M	Co-Processor Comm Module	ALN			
5685	COPROCE MOD	Co-Processor Module	ALN			
5882	CORECOIL		ALN			
6161	CORROSION	Corrosion Remarks	ALN			
10036	COUNTY	The county of location.	ALN			
6215	COUPLING	COUPLING	ALN			
6030	COUPLING SIZ	Coupling Size	ALN			
6031	COUPLING TYP	Coupling Type	ALN			
8946	CPU FAMILY		ALN			
5673	CPU PART	CPU Part No.	ALN			
6032	CPU PT NO	CPU Part Number	ALN			
8942	CPU SPEED	OPERATING SPEED OF THE CPU	ALN			
9608	CRANE CAPACITY	Crane Load Capacity	ALN	LB		
6033	CRANE TYPE	Crane Type	ALN		CRANE TYPE	
9630	CRAWLER MFG	Crawler Manufacture	ALN			
9632	CRAWLER MODEL	Crawler Model	ALN			
9634	CRAWLER SER #	Crawler Serial Number	ALN			
5479	CRITCODE	CRITICALITY	ALN			
7658	CRONTASK	Interface Associated Cron Task	ALN			
6623	CROSSARM	Number of crossarms	ALN			
9364	CROSSBORE_TYPE	CROSSBORE_TYPE	ALN		CROSSBORE_TYPE	
9862	CT - RATIO	CT - Ratio	ALN			
5751	CT RATIO	CT RATIO	NUMERIC			
10466	CT RATIO	CT RATIO	ALN			
6034	CTL TRANS SZ	Control Transfer Size	ALN			
5625	CTRL TRNS SZ	Control Transfer Size	ALN			
6035	CTRL VOLT	Control Voltage	ALN			
6036	CTRLLR MFG	Controller Manufacturer	ALN			
6037	CTRLLR MODEL	Controller Model	ALN			
6038	CTRLLR SER	Controller Serial Number	ALN			
6039	CTU MFG	CTU Manufacturer	ALN			
6040	CTU MODEL	CTU Model Number	ALN			
6041	CTU SERIAL	CTU Serial Number	ALN			
6042	CTU VERSION	CTU Version	ALN			
5560	CUL GIS ID	Culvert GIS Indentification	ALN			
5546	CULV #		NUMERIC			
5566	CULV ID	Culvert Identification	ALN			
5565	CULV NUM	Culvert Number	ALN			
8936	CURRENT DIFFERENTIAL INPUTS		ALN			
9184	CURRENT RANGE	CT CURRENT RANGE	ALN			
5656	CURVE DELAY	Delay Time Curve	ALN			
7996	CUSTOMER	Customer	ALN			
8404	CUSTOMER ADDRESS	Customer Address	ALN			
9068	CUSTOMER ID	Customer ID	ALN			
8402	CUSTOMER NAME	Customer Name	ALN			
8422	CUSTOMER PHONE NUMBER	Customer Phone Numner	ALN			
10468	CUSTOMER ID	Customer ID	ALN			
6624	CUTOUT	Cutout	ALN			
6043	CUTTER	Cutter	ALN			
5590	CYCLE	Cycle	ALN			
6044	CYCLE COUNT	Cycle Count	ALN			
6045	CYCLE COUNTR	Cycle Counter	ALN			
6046	DAMP MTR MDL	Damper Motors Model	ALN			
6627	DAMP MTR MFG	Damper Motors Manufacturer	ALN			
6628	DAMP MTR NO	Damper Motors Number of Motors	ALN			
6629	DAMPER TYPE	Damper Type	ALN		DAMPER TYPE	
6092	DATE	DATE	ALN			
9048	DATE INSTALLED	Date Installed	ALN			
5861	DATE MFG	Date of Manufacture	ALN			
6249	DATE REC	In Service Date	ALN			
6145	DATE SET	Date Set	ALN			
5547	DATE SURV	Date	ALN			
9028	DAYS OF STORAGE	Days of Storage	ALN			
7606	DBCOMPONENT	DB Configuration Component	ALN			
7622	DBMS	DBMS for Change	ALN		ITDBMS	
6630	DC	DC	ALN			
5510	DC AMPS	DC AMPA	ALN	AMPS		
7732	DC INPUT VOLTAGE		ALN	VOLTS		
5511	DC V RANGE	DCV Range	ALN	VOLTS		
5691	DC V. RANGE	Battery String Voltage	ALN			
6631	DCDA	DCDA	ALN			
7970	DECOM_YEAR	Year This Pipe Was/Will Be Replaced or Abandoned	ALN			
9006	DELTA OR WYE	Delta or Wye	ALN			
10470	DELTA OR WYE	Delta or Wye	ALN			
8142	DEPT # / NAME	Department # and Department Name	ALN			
5816	DEPTH	Pipe Depth	ALN			
5828	DEPTH END	Transport End Depth	ALN			
5829	DEPTH END 2	Transport End Depth	ALN			
7998	DEPTH_CSD	Depth	NUMERIC	FT		
6192	DESCRIPTION	Description	ALN			
7502	DESCRIPTION USE	STC,RTU,DATA,COMM,OTHER	ALN			
6632	DESICANT L C	Desicant has a life cycle? Y/N	ALN		YES/NO	
6633	DESICNT BRND	Brand of Desicant	ALN			
6634	DESICNT WGHT	Desicant Weight	ALN			
6229	DESIGN	DESIGN	ALN			
7870	DESIGN LETTER	B, C, D, OTHER	ALN			
7608	DEVDATE	Date to Development	ALN			
5759	DEVICE ID	Programmed ID	ALN			
5646	DEVICE TYPE	Type- Switch, Transmitter	ALN			
6635	DG INP CAT N	Digital Input Catalog Number	ALN			
6636	DG OUT CAT N	Digital Output Catalog Number	ALN			
5665	DI CAT #	Digital Input Catalog No.	ALN			
5551	DIAM IN	Diameter in Inches	ALN			
6637	DIAMETER	Diameter	ALN			
5825	DIAMETER IN	Inside Diameter of Pipe	ALN			
5824	DIAMETER OUT	Outside Diameter of Pipe	ALN			

6638	DIFF SPEED	Differential Speed	ALN			
6639	DIFFUSR CPC	Diffuser Capacity	ALN			
6640	DIFFUSR MATL	Diffuser Material	ALN			
8902	DIGITAL		ALN		YES/NO	
8924	DIGITAL INPUTS		ALN			
8926	DIGITAL OUTPUTS	THE NUMBER OF DIGITAL OUTPUTS	ALN			
6641	DIM (H,W,D)	Dimensions (H X W X D)	ALN			
5607	DIMENSIONS	Dimensions- LxWxH	ALN	INCHES		
7736	DIMENTIONS INCHES	HXDXW	ALN	INCHES		
6642	DIR OF MVMT	Direction of Movement	ALN			
5480	DIRECT	DIRECTIONS	ALN			
6643	DISC MATL	Disc Material	ALN			
5578	DISC TYPE	Disc Type	ALN			
6157	DISC.	Disc.	ALN			
5577	DISC. MAT	Disc Material	ALN			
6134	DISCHARGE S	Discharge Size	ALN			
6644	DISCHARGE SZ	Discharge Size	ALN			
10472	DISCONNECT CAPABLE	Disconnect Capable	ALN			
8215	DISCRIPTION		ALN			
5723	DISPLACEMENT	Displacement	ALN			
6645	DISPLY DAMPN	Display Dampening	ALN			
5473	DIST1	DISTANCE 1	ALN			
5476	DIST2	DISTANCE 2	ALN			
5804	DISTRICT	Supervisor District	ALN		DISTRICT	
5760	DMAND INTRVL	Interval lenght	ALN	MINUTES		
5667	DO CAT #	Digital Output Catalog No.	ALN			
7966	DOC_HYPERLINK	Document Hyperlink	ALN			
7506	DOOR OR COVER TYPE	HINGE DOOR,LOCKABLE,SCREW COVER,OTHER	ALN			
6646	DOOR TYPE	Type of Door	ALN			
5822	DOWN. INVERT	Downstream Invert of Pipe	ALN			
5474	DR1	DIRECTION 1	ALN			
5477	DR2	DIRECTION 2	ALN			
6647	DRAIN BASIN	Drainage Basin	ALN			
6648	DRAIN IN VLT	Has Drain in Vault	ALN		YES/NO	
9998	DRAIN LENGTH	Drain Length	NUMERIC	FT		
10000	DRAIN WIDTH	Drain Width	NUMERIC	IN		
7122	DRAWING		ALN			
7152	DRAWING	Drawing Number	ALN			
6649	DRIV SD BRNG	Drive Side Bearing	ALN			
6136	DRIVE BELT	Drive Belt	ALN			
5643	DRIVE TO	Motor Driven By Drive	ALN			
6174	DRIVE TYPE	DRIVE TYPE	ALN			
6650	DRIVEN SHEAV	Driven Sheave	ALN			
6651	DRNKNG FOUNT	Has Drinking Fountain(s) Y/N	ALN		YES/NO	
6652	DRV END BR N	Drive End Brg Number	ALN			
6653	DRVE GR MATL	Drive Gear Material	ALN			
6654	DRYER TYPE	Dryer Type	ALN		DRYER TYPE	
6655	DSCHRG PRSSR	Discharge Pressure	ALN			
6656	DSGN WND SPD	Design Wind Speed	ALN			
6657	DUCT BANK TY	Duct Bank Type	ALN			
6658	DUCT LENGTH	Duct Length	ALN			
6659	DUCT MATL	Duct Material	ALN			
6660	DUCT SIZE	Duct Size	ALN			
6661	DUCT TYPE	Duct Type	ALN			
6232	DUTY	DUTY	ALN			
6093	DWG#	DWG#	ALN			
8144	E RESPONDER	Emergency Responder	ALN			
6094	EAMPS	EAMPS	ALN			
6662	EFFICIENCY	Efficiency	ALN			
6095	EFRME	EFRME	ALN			
6096	EHPWR	EHPWR	ALN			
9322	EINSPM	Electroscan Inspection Measurement	NUMERIC	FT		
9324	EINSPV	Reason for Electroscan Footage Variance	ALN			
6210	EJ WARD #	FUEL CARD #	ALN			
7792	ELECROLYTE VOLUME		ALN	GAL		
6663	ELECTRC AREA	Electrical Area	ALN			
10232	ELECTRICAL		ALN			
10254	ELECTRICAL CONDUCTIVITY	Y/N, MAKE, MODEL.	ALN			
6097	ELEV	ELEV	ALN			
8682	ELEVATION	FT	ALN			
6664	ELEVATOR TYP	Elevator Type	ALN			
8562	EMAIL	Contact Email Address	ALN			
6665	EMG STP TSTD	Emergency Stop Tested Y/N	ALN		YES/NO	
6098	EMOTR	EMOTR	ALN			
8848	EMULSION POLYMER CONNECTION	Size	NUMERIC			
6239	ENCL	Type of Enclosure	ALN			
6666	ENCL TYPE	Enclosure Type	ALN			
6667	ENCLOSURE	Enclosure	ALN			
6668	ENCODER	Encoder	ALN			
5819	END CONNECT	End Connections	ALN			
6220	END PLAY	END PLAY	ALN			
5564	END PT		ALN			
7654	ENDPT	Interface End Point	ALN			
5609	ENG MODEL	Engine Model	ALN			
5716	ENG MODEL NO	Engine Model Number	ALN			
5717	ENG SERIAL N	Engine Serial Number	ALN			
5610	ENG TYPE	Engine Type	ALN			
7204	ENG. MAKE	ENGINE MAKE	ALN			
7205	ENG. MODEL	ENGINE MODEL	ALN			
7203	ENG. SIZE	ENGINE SIZE	ALN			
7202	ENG. TYPE	ENGINE TYPE	ALN			
7206	ENG. YEAR	ENGINE YEAR	ALN			
6099	ENGIN	ENGIN	ALN			
6179	ENGINE	ENGINE	ALN			
7282	ENGINE HP	ENGINE HP	ALN			
7284	ENGINE MAKE	ENGINE MAKE	ALN			
5715	ENGINE MFR	Engine Manufacturer	ALN			
7288	ENGINE MODEL	ENGINE MODEL	ALN			
7290	ENGINE SERIAL NO.	ENGINE SERIAL NUMBER	ALN			
7292	ENGINE SIZE	ENGINE SIZE	ALN			
7294	ENGINE TYPE	ENGINE TYPE	ALN			

7296	ENGINE YEAR	ENGINE YEAR	ALN			
6669	ENGN CYLINDR	Number of Cylinders	ALN			
6670	ENGN FUEL	Engine Fuel Type	ALN			
6671	ENGN FUEL CP	Fuel Capacity	ALN			
6672	ENGN HP	ENGINE HORSEPOWER	ALN			
6673	ENGN MFG	Engine Manufacturer	ALN			
6674	ENGN MODEL	Engine Model Number	ALN			
6675	ENGN NOISE	Noise Rating	ALN			
6676	ENGN SERIAL	ENGINE SERIAL NUMBER	ALN			
7652	ENTERPRSVC	Interface Enterprise Service	ALN			
6677	EQ DEL DATE	Equipment Delivery Date	ALN			
6678	EQ SOURCE	Equipment Source (Fed By)	ALN			
7986	EQP_ADDRESS_NUM	Location Where Lateral Exits Property - Number	ALN			
7990	EQP_ADDRESS_STREET	Location Where Lateral Exits Property - Street	ALN			
7784	EQUALIZATION CHARGE		ALN	VPC		
6679	EQUIP DESC	Equipment Description	ALN			
6680	EQUIP TYPE	Equipment Type	ALN			
6171	EQUIP. HEIGH	EQUIP. HEIGHT	ALN			
6172	EQUIP. WEIGH	EQUIP. WEIGHT	ALN			
5518	EQUIPMENT	name of equipment	ALN			
6068	EQUIPMENT CO	Equipment Cost	ALN			
6681	EQUIPMENT ID	Equipment ID	ALN			
6101	ERPM	ERPM	ALN			
6102	ESER#	ESER#	ALN			
6944	EST_VOLUME	Estimated Volume	ALN		EST_VOLUME	
6682	ESTABLISHMNT	Establishment	ALN			
5676	ETHERN CTRL	Ethernet Controller	ALN			
5677	ETHERN INTER	Ethernet Interface	ALN			
6683	ETHERNET CTL	Ethernet Controller	ALN			
6684	ETHERNET INT	Ethernet Interface	ALN			
8910	ETHERNET PORTS		ALN			
6103	ETYPE	ETYPE	ALN			
6104	EVOLT	EVOLT	ALN			
6685	EXCITATION	Excitation	ALN			
5496	EXCITATION A	Excitation Amps	ALN			
5495	EXCITATION V	Excitation Volts	ALN			
5714	EXCITER TYPE	Exciter Type	ALN			
5686	EXPAN MEM	Expansion Memory Module	ALN			
5687	EXPAN MOD	Expansion Module	ALN			
6686	EXPANDER	Expander	ALN			
6687	EXT MATL	Exterior Material	ALN			
5842	EXT. FINISH	Exterior Finish Type	ALN			
7656	EXTSYS	Interface External Systemn	ALN			
6688	EYE WSH STN	Eye Wash Station	ALN			
9602	F W TANK CAPACITY	Fresh Water Tank Capacity	NUMERIC	GAL		
9824	FACILITY CODE	Facility Code	ALN			
10474	FACILITY CODE	Facility Code	ALN			
9902	FACILITY_CODE	Facility Code	ALN			
8302	FAMIS DIV/SECT	FAMIS DIV/SECTION	ALN		FAMIS DIV/SECTION	
6689	FAN BLD MATL	Fan Blade Material	ALN			
6690	FAN BLD PTCH	Fan Blade Pitch	ALN			
6691	FAN DRIV TYP	Fan Drive Type	ALN			
6692	FAN DRIVE	FAN DRIVE	ALN		FAN DRIVE	
6693	FAN MOTOR	Fan Motor	ALN			
6694	FAN SENSOR	FAN SENSOR	ALN		FAN SENSOR	
6695	FAN SIZE	Fan Size	ALN			
6696	FAN TYPE	FAN TYPE	ALN		FAN TYPE	
6697	FC TO FC LEN	Length Face to Face	ALN			
6698	FDS MFG	Flame Detection System Manufac	ALN			
6699	FDS MODEL	Flame Detection System Model	ALN			
5531	FED BY	Equipment Power Source	ALN			
6700	FEED COMPRT	Feed Compartment	ALN			
6701	FEED PORTS	Feed Ports	ALN			
5502	FEEDS	MCC - Equip (Load)	ALN			
7364	FEEDS PANEL	Feeds Panel	ALN			
6702	FENCE LENGTH	Fence Length	ALN			
6703	FENCEWLL TYP	Fence Wall Type	ALN			
6105	FFILT	FFILT	ALN			
6704	FIBER	Fiber	ALN			
8914	FIBER OPTIC CONNECTION TYPE		ALN			
7662	FIELD	FIELD to Change/Add	ALN			
5451	FIG	FIG #	ALN			
6705	FILL FLUID	Fill Fluid	ALN		FILL FLUID	
6190	FILTER #2	FILTER SIZE #2	ALN			
6706	FILTER MEDIA	Filter Type Media	ALN			
6189	FILTER SIZE	FILTER SIZE	ALN			
6707	FILTER TYPE	Filter Type	ALN		FILTER TYPE	
6708	FIN EFFCNCY	Financial Efficiency	ALN			
6709	FIRE RATED	Fire Rated	ALN		YES/NO	
10230	FIRE SAFETY		ALN			
7250	FIXTURE CONTROL	PHOTO CELL, OTHER	ALN			
7244	FIXTURE QTY		ALN			
7246	FIXTURE STYLE	COBRA, SINGLE/DOUBLE HEAD, OTHER	ALN			
6710	FIXTURE TYPE	LUMINARE, HID, HPS, OTHER	ALN			
5484	FL EFFIC	Full Load Efficiency	ALN			
6711	FL FINTYPE	Floor Finish Type	ALN			
6712	FL FN INS DT	Floor Finish Install Date	ALN			
6713	FL FN MFG ID	Floor Finish Manufacturer ID	ALN			
6714	FLANGE WIDTH	Width of Flange	ALN			
6715	FLASH RATING	Flash Rating	ALN			
8284	FLEET DEPT	FLEET DEPARTMENT & NAME	ALN			
6716	FLFOOTPRNT	Floor Foot Print	ALN			
5583	FLNG PATRN	Flange Drill Pattern	ALN			
5584	FLNG THICK	Flange Thickness	ALN			
5585	FLNG TO FLNG	Flange to Flange measurement	ALN			
6106	FLOAD	FLOAD	ALN			
7783	FLOAT VOLTAGE		ALN	VOLTS		
6717	FLOOR DESC	Floor Description	ALN			
6718	FLOOR ID	Floor ID	ALN			
10224	FLOOR LIVE LOAD		ALN			
9904	FLOOR_RM_AREA	Floor, Room, Area	ALN			

6719	FLOW CAPACTY	Flow Capacity	ALN			
6720	FLOW RATE	Flow Rate	ALN			
6721	FLR FIN TYP	Floor Finish Type	ALN			
6722	FLTR MOTR HP	Filter Motor Horsepower	ALN			
6248	FLUID CAP	Fluid Capacity	ALN			
5745	FLUID TYPE	Fluid Type	ALN			
6723	FLYWHEEL	Flywheel	ALN			
7302	FNAME	First Name	ALN			
8956	FORM FACTOR	RACK SIZE OF THE DEVICE (1U, 3U, ETC.)	ALN			
6724	FOUNTAIN TYP	FountainTypes	ALN			
6107	FRAME	FRAME	ALN			
6725	FRAME RATE	Frame Rate	ALN			
6726	FRAME SIZE	Frame Size	ALN			
5489	FREQUENCY	Frequency	ALN	HZ		
7208	FRONT AXLE CAP	FRONT AXLE CAP	ALN			
7216	FRONT TIRE SIZE	FRONT TIRE SIZE	ALN			
8182	FUEL CARD #	FUEL CARD NUMBER	ALN			
6727	FUEL CNSMPTN	Fuel Consumption Full Load	ALN			
5611	FUEL CONSUMP	Fuel Consumption	ALN			
6195	FUEL FILTER	FUEL FILTER	ALN			
6728	FUEL RESERVE	Fuel Reserve	ALN			
6166	FUEL TYPE	FUEL TYPE	ALN			
5462	FUELCAP	FUEL CAPACITY	ALN			
6201	FUELTYPE	FUEL TYPE	ALN			
6148	FULL	As Found	ALN			
6729	FULL LD AMPS	Full Load Amps	ALN			
6151	FULL LEFT	As Left	ALN			
5555	FUNCTION	Function	ALN			
6730	FUNCTIONLTY	Functionality	ALN			
5632	FUSE AMPS	Fuse Amperage	ALN	AMPS		
7442	FUSE INFO	FUSE Y/N, SIZE & TYPE	ALN			
5631	FUSE TYPE	Fuse Type	ALN			
8122	FUTURE_REPLC_DATE	Future Replacement Date	ALN			
9604	G W TANK CAPACITY	Grey Water Tank Capacity	NUMERIC	GAL		
6108	GAL	GAL	ALN			
6731	GAS COMP	Gas Composition	ALN			
6732	GAS MAX FLOW	Flare Gas Max Flow	ALN			
6221	GASKET THICK	GASKET THICKNESS	ALN			
6733	GAT SEAL TYP	Gate Seal Type	ALN		GATE SEAL TYPE	
6734	GATE MATL	Gate Material	ALN			
6735	GATE TRAVEL	Gate Travel	ALN			
6736	GATE TYPE	Gate Type	ALN		GATE TYPE	
5773	GATEWAY	IP Address Gateway	ALN			
6226	GEAR	GEAR	ALN			
6737	GEARBOX DRIV	Gearbox Drive Type	ALN		GEARBOX DRIVE	
6738	GEARBOX TYPE	Gearbox Type	ALN			
5709	GEN MODEL NO	Generator Model Number	ALN			
5710	GEN SERIAL N	Generator Serial Number	ALN			
5704	GEN TYPE	Generator Type	ALN			
8954	GENERATION	MODEL GENERATION (G5, G6, G7, ETC.)	ALN			
6739	GENERATR RPM	Generator RPM	ALN			
6740	GENERATR TYP	Generator Type	ALN		GENERATOR TYPE	
7972	GID	GIS Internal System ID	ALN			
7962	GIS_CREATED_BY	GIS Created By	ALN			
7968	GIS_CREATED_DATE	GIS Created Date	ALN			
5858	GIS_ID	GIS ID#	ALN			
7964	GIS_UPDATED_BY	GIS Updated By	ALN			
7312	GLACCOUNT	GL Account	ALN			
5722	GOV TYPE	Governor Type	ALN			
6109	GPM	GPM	ALN			
6741	GPS COORD X	GPS Coordinates - X	ALN			
6742	GPS COORD Y	GPS Coordinates - Y	ALN			
6743	GPS COORD Z	GPS Coordinates - Z	ALN			
5553	GRADE	Grade	ALN			
6744	GREASE TRAPS	Grease Traps Y/N	ALN		YES/NO	
10308	GREATEST DEPTH	GREATEST DEPTH BENEATH THE SURFACE	ALN	FT		
7952	GRID_ID	Grid ID	ALN			
6745	GRINDNG MECH	Grinding Mechanism	ALN		YES/NO	
8702	GVW		ALN			
6183	GVWR	GVWR	ALN			
5734	H. VOLT BIL	High Voltage BIL	ALN			
7728	HARMONIC DISTORTION THD	PERCENT	ALN			
6746	HAS ACTUATOR	Has Actuator	ALN		YES/NO	
6747	HAS TAG NO	Has Tag Number on Vault	ALN		YES/NO	
6748	HAS VLT LOCK	Has Vault Lock	ALN		YES/NO	
6110	HEAD	HEAD	ALN			
5513	HEADWALL	Stone Headwall (Y/N)	ALN			
6749	HEIGHT	Height	ALN			
7562	HH-APPLICATION USE	UTILITY or PREMISES NON-UTILITY TYPE	ALN			
7382	HH-POLE CLASS	CLASS 1,2,3,4,5,6,7,8,9, OTHER	ALN			
6986	HH-POLE CONSTRUCTION	TRI, VERTICAL, CROSS ARM QTY & __', OTHER	ALN			
6984	HH-POLE INSTALLATION	ANGLE, DE, DDE, STORED, TANGENT, OTHER	ALN			
6982	HH-POLE LENGTH		NUMERIC	FT		
7682	HH-POLE PURPOSE	POWER,DATA/COM,SIGNAL/CONTR,OTHER	ALN			
6990	HH-POLE SPECIES	CEDAR, FIR, HEMLOCK, LARCH, PINE, SPRUCE, OTHER	ALN			
6988	HH-POLE SUPPORT	DOWN GUY QTY & __", NONE, POLE, OTHER	ALN			
6992	HH-POLE TREATMENT	GROUP: A-AIR SEASONED, B-BOULTON, C-STEAM COND, D-KILN DRY, OTHER	ALN			
8082	HH-PRC STATUS	NONE, 4292, 4293, OTHER	ALN			
8246	HI PRESSURE	REFRIG PSI	ALN			
6244	HIGH VOLT	Voltage	ALN			
7512	HIGHEST VOLTAGE CIRCUIT SPEC		ALN			
6750	HMI MFG	HMI Manufacturer	ALN			
6751	HMI MODEL	HMI Model Number	ALN			
6752	HMI SERIAL	HMI Serial Number	ALN			
6753	HMI VERSION	HMI Version	ALN			
6754	HORSEPOWER	Horsepower	ALN			
9686	HOSE REEL MFG.	Hose Reel Manufacture	ALN			
9688	HOSE REEL MODEL #	Hose Reel Model Number	ALN			
9690	HOSE REEL SER. #		ALN			
8960	HOT PLUG	HOT SWAPABLE?	ALN		YES/NO	
5661	HOUSING	Housing	ALN			

5572	HOUSING MATE	Housing material	ALN			
6111	HP	HP	ALN	HP		
6206	HP.	HORSEPOWER	ALN			
6755	HVAC TYPE	HVAC Type	ALN		HVAC TYPE	
5864	HVRATING	High Voltage Rating	NUMERIC			
7974	HYD_JO	Hydraulics Job Order Number	ALN			
5612	HYDRA FLOW	Hydraulic Flow	ALN	GPM		
9427	HYDRAULIC SYSTEM FLUID CAPACITY	Hydraulic System Fluid Capacity	NUMERIC	GAL		
9426	HYDRAULIC SYSTEM FLUID TYPE	Hydraulic System Fluid Type	ALN			
6230	HZ	CYCLES	ALN			
6228	I.D. NUMBER	I.D. NUMBER	ALN			
6756	I-BEAM HGHT	I-Beam Height	ALN			
6112	ID	ID	ALN			
5859	ID_NUM	ID Number	ALN			
9024	IF NOT, PT RATIO	IF NOT, PT RATIO	ALN			
9816	IF PV, WHAT IS MASTER METER NUMBER?	If PV, What is master meter Number?	ALN			
10476	IF NOT PT RATIO	IF NOT PT RATIO	ALN			
6757	IGN SYS MFG	Ignition System Manufacturer	ALN			
6758	IGN SYS MODL	Ignition System Model	ALN			
6759	IMAGE SENSOR	Image Sensor	ALN			
6760	IMAGE SETT	Image Settings	ALN			
6113	IMP	IMP	ALN			
5458	IMP DIA	Impeller Diameter	ALN			
5601	IMP DIAM.	IMP DIA	ALN			
5743	IMPEDANCE	Impedance-% Z	ALN			
9774	IMPEDANCE %	IMPEDANCE %	ALN			
6761	IMPELLR DIAM	Impeller Diameter	ALN			
6762	IMPL SD BRNG	Impeller Side Bearing	ALN			
6114	IN SP	IN SP	ALN			
5558	IN TOP IN	In Top	ALN			
6211	INBOARD	INBOARD BEARING	ALN			
6766	IND COIL D S	Indoor Coil Drain Size	ALN			
6767	IND COIL TYP	Indoor Coil Type	ALN			
9966	INDIVIDUAL PAVER SIZE	Individual Paver Size	ALN			
5446	ING. KEY	ING. KEY NUMBER	ALN			
9994	INITIAL AGGREGATE VOLUME	Initial Aggregate Volume	NUMERIC	CUF		
5556	INLET COND	Pipe Inlet Condition	ALN			
6768	INLET CONN	Inlet Connection	ALN			
10304	INLET ELEVATION	INVERT ELEVATION AT THE TUNNEL INLET	ALN	FT		
6769	INLET PRESS	Inlet Pressure	ALN			
6770	INLET TEMP	Inlet Temperature	ALN			
6771	INLT MST CNT	Inlet Moisture Content	ALN			
6763	IN-OUT BUS	Input-Output Bus	ALN			
6764	IN-OUT DROP	Input-Output Drop	ALN			
6765	IN-OUT PANEL	Input-Output Panel	ALN			
6772	INP VOLT RNG	Input Volt Range	ALN			
6773	INP-OUTP RSP	Input-Output R/S/P	ALN		INPUT-OUTPUT RSP	
6774	INP-OUTP TYP	Input-Output Type	ALN		INPUT-OUTPUT TYPE	
6251	INPUT	Input	ALN			
7842	INPUT AMP		ALN			
5503	INPUT AMPS	Input Amperage	ALN	AMPS		
5505	INPUT KVA	Input kilovolt Ampere Rating	ALN	KVA		
5506	INPUT KW	Input Kilowatt	ALN	KW		
6252	INPUT POWER	Input Power	ALN			
7372	INPUT RPM	Input RPM	ALN	RPM		
6253	INPUT SPEED	Input Speed	ALN			
5658	INPUT V RNG	Control Input Volt Range	ALN	VOLTS		
7844	INPUT VOLT		ALN			
5504	INPUT VOLTS	Input Voltage	ALN	VOLTS		
6233	INS CLASS	INS CLASS	ALN			
6254	INS MGMT MNT	Install, Mgmt & Maintenance	ALN			
5460	INS. CLASS	Motor Insulation Rating	ALN			
9582	INSIDE DIA	INSIDE DIAMETER	ALN			
5445	INSPECTED	INSPECTED BY	ALN			
7298	INSPECTED BY	INSPECTED BY	ALN			
6066	INSTALL DATE	Installation Date	ALN			
9052	INSTALLER	Installer	ALN			
6255	INSTR A FLTR	Instrument Air Filters	ALN			
6256	INSTRMT SVC	Instrument Service	ALN		INSTRUMENT SERVICE	
6257	INSTRMT TYPE	Instrument Type	ALN		INSTRUMENT TYPE	
5742	INSUL SYS	Insulation System	ALN			
6258	INSULAT CLSS	Insulation Class	ALN			
6259	INSULAT MATL	Insulation Material	ALN			
7018	INSULATION TYPE (CONSTRUCTION)	DRY, OIL, ASKAREL, LESS-FLAMMABLE, NON-FLAMMABLE	ALN			
6149	INT.	As Found	ALN			
6152	INT. LEFT	As Left	ALN			
5450	INTER CO	INTER CO	ALN			
10478	INTERNAL IP	Internal IP Address	ALN			
9800	INTERNAL IP ADDRESS	Internal IP Address	ALN			
9802	INTERNAL PORT	Internal Port	ALN			
7786	INTERNAL RESISTANCE AT 77°F		ALN	VPC		
10480	INTERNAL PORT	INTERNAL PORT	ALN			
5642	INTERRTIME	Interrupting Time	ALN	CYCLES		
5524	INTERRUPTING	interrupting time	ALN			
6260	INTRCPTR TYP	Interceptor Type	ALN			
6261	INTRRPT AMPS	Interrupting Amps	ALN			
6262	INTRRPT RTNG	Interrupter Rating	ALN			
6242	INVDATE	INVENTORY DATE	ALN			
5442	INVEBY	INVENTORIED BY	ALN			
8000	INVERT	Invert Elevation (bottom of manhole)	NUMERIC	FT		
7650	INVOCATIONCHNL	Interface Invocation Channel	ALN			
5650	IO BUS	Input-Output Bus	ALN			
5651	IO DROP	Input-Output Drop	ALN			
5649	IO PANEL	Input-Output Panel	ALN			
5652	IO R/S/P	Input-Output Rack/Slot/Point	ALN			
5653	IO TYPE	IO Type- AI, AO, DI, DO	ALN			
6263	IP RATING	IP Rating	ALN			
9976	IRRIGATION TYPE	Irrigation Type	ALN			
9814	IS THIS A PV METER?	Is this a PV meter?	ALN			
9812	IS THIS METER BILLED OR NOT?	Is this meter billed or not?	ALN			
8002	IS_SEWDRAIN	Sewer Drain? Y/N	ALN			

5570	ISOLATING DI	Isolating Diaphragm	ALN			
6204	ISSUE DATE	DATE OF ISSUE	ALN			
9462	ITEM COLOR	Item Color	ALN			
7104	ITEM DESCRIPTION		ALN			
10402	ITEMAMPS	ITEM AMPS	NUMERIC	AMPS		
10394	ITEMBENDRADIUS	ITEM BEND RADIUS	ALN			
10348	ITEMCOLOR	ITEM COLOR	ALN			
10358	ITEMCONTAINER	ITEM CONTAINER	ALN			
10384	ITEMDEPTH	ITEM DEPTH	ALN			
10342	ITEMDESC	ITEM DESCRIPTION	ALN			
10386	ITEMGAUGE	ITEM GAUGE	ALN			
10350	ITEMGRADE	ITEM GRADE	ALN			
10420	ITEMGRNGRL1	ITEM GRAINGER CATEGORY LEVEL 1	ALN			
10422	ITEMGRNGRL2	ITEM GRAINGER CATEGORY LEVEL 2	ALN			
10424	ITEMGRNGRL3	ITEM GRAINGER CATEGORY LEVEL 3	ALN			
10382	ITEMHEIGHT	ITEM HEIGHT	ALN			
10406	ITEMHORSEPOWER	ITEM HORSEPOWER	NUMERIC	HP		
10352	ITEMINDUSTRYSTD	ITEM INDUSTRY STANDARD	ALN			
10388	ITEMINSIDEDIAMETER	ITEM INSIDE DIAMETER	NUMERIC	IN		
10360	ITEMLENGTH	ITEM LENGTH	ALN			
10346	ITEMMATL	ITEM MATERIAL	ALN			
10390	ITEMOUTSIDEDIAMETER	ITEM OUTSIDE DIAMETER	NUMERIC	IN		
10400	ITEMPHASE	ITEM PHASE	ALN			
10408	ITEMSERVICE1	ITEM SERVICE 1	ALN			
10410	ITEMSERVICE2	ITEM SERVICE 2	ALN			
10354	ITEMSIZESTD	ITEM SIZE STANDARD	ALN			
10344	ITEMTYPE	ITEM TYPE	ALN			
10412	ITEMUSEDON	ITEM USED ON	ALN			
10414	ITEMUSEDONMAKE	ITEM USED ON MAKE	ALN			
10416	ITEMUSEDONMODEL	ITEM USED ON MODEL	ALN			
10418	ITEMUSEDONYEAR	ITEM USED ON YEAR	ALN			
10396	ITEMVOLTAGE	ITEM VOLTAGE	NUMERIC	VOLTS		
10398	ITEMVOLTAGETYPE	ITEM VOLTAGE TYPE	ALN			
10356	ITEMVOLUME	ITEM VOLUME	ALN			
10392	ITEMWALLTHICKNESS	ITEM WALL THICKNESS	NUMERIC	IN		
10404	ITEMWATTS	ITEM WATTS	NUMERIC	WATTS		
10362	ITEMWIDTH	ITEM WIDTH	ALN			
6264	JURISD	Jurisd	ALN			
7466	KAIC	X-KAIC RATING	ALN			
6180	KEY NO.	KEY NUMBER	ALN			
5466	KEYWORD	MAXIMO KEYWORD	ALN			
5755	KH	METER CONSTANT	ALN			
9188	KH-TV <150V		ALN			
9190	KH-TV >150V		ALN			
5467	KV	KILOVOTS	ALN			
8362	KV BIL		ALN			
5863	KVA	KILOVOLTAMP	NUMERIC		KVA	
7066	KVAMPS	KILOVOLT AMPS	ALN			
6115	KW	KW	ALN			
5735	L. VOLT BIL	Low Voltage BIL	ALN			
5796	L1 LUMINAIRE	Light Style	ALN		LUMINAIRE	
5797	L1 SIDE	Fixture Location on Pole	ALN		SIDE	
5798	L1 TYPE	Lamp Type	ALN		LAMP TYPE	
5807	L1 WATT	Fixture Wattage	ALN	WATTS	WATTAGE	
5799	L2 LUMINAIRE	Fixture Style	ALN		LUMINAIRE	
5801	L2 SIDE	Fixture Location on Pole	ALN		SIDE	
5802	L2 TYPE	Lamp Type	ALN		LAMP TYPE	
5813	L2 WATT	Fixture Wattage	ALN	WATTS	WATTAGE	
5803	L3 LUMINAIRE	Fixture Style	ALN		LUMINAIRE	
5805	L3 SIDE	Fixture Location on Pole	ALN		SIDE	
5806	L3 TYPE	Lamp Type	ALN		LAMP TYPE	
5814	L3 WATT	Fixture Wattage	ALN	WATTS	WATTAGE	
7402	LAMP TYPE & SPEC		ALN			
6265	LAST UPDT DT	Last Updated Date	ALN			
6266	LASTPAINT DT	Last Painted Date	ALN			
9674	LAT LAUNCHER MFG	Lateral Launcher Manufacture	ALN			
9676	LAT LAUNCHER MODEL	Lateral Launcher Model	ALN			
9678	LAT LAUNCHER SER #	Lateral Launcher Serial Number	ALN			
5568	LAT NORTH	Distance North	ALN			
5853	LATERAL LOAD	Lateral Load Capacity psf	ALN			
10484	LATITUDE	LATITUDE	ALN			
8952	LAYER	FUNCTIONAL LAYER OF THE SWITCH	ALN			
7872	LCOK ROTOR CODE LETTER	A, B, C...	ALN			
5552	LENGHT FT	Length in Foot	ALN			
6193	LENGTH	LENGTH	ALN			
6267	LENS	Lens	ALN			
6070	LEVEL	Level	ALN			
6268	LF CY STATUS	Life Cycle Status	ALN			
9668	LG CRAWER MFG	Large Crawler Manufacture	ALN			
9670	LG CRAWLER MODEL	Large Crawler Model	ALN			
9672	LG CRAWLER SER #	Large Crawler Serial Number	ALN			
6269	LGTH PER REV	Length per Revolution	ALN			
5580	LH OR RL OP	Left or Rt. Hand Open	ALN			
5444	LICENSE	LICENSE NUMBER	ALN			
6270	LIFE SAFETY	Life Safety	ALN		YES/NO	
5832	LIFECYC.COST	Life Cycle Cost	ALN			
6271	LIGHT TYPE	Type of Lights	ALN			
6272	LIGHTNG TYPE	Lighting Type	ALN			
10026	LINE	Transmission line of concern, with this detection.	NUMERIC			Line
5619	LINE VOLTS	Service Voltage	ALN	VOLTS		
10310	LINED-UNLINED	LINED AND UNLINED LENGTH	ALN			
6273	LINER TYPE	Liner Type	ALN			
10062	LINES	Transmission line of concern, with this detection.	ALN			Line
6274	LIQD LIN DRY	Liquid Line Dryers	ALN			
5884	LIQUID		ALN			
7304	LNAME	Last Name	ALN			
6275	LNDSCPMNTDBY	Landscaping Maintained By	ALN			
7211	LOAD CAPACITY	LOAD CAPACITY	ALN			
10488	LOAD INTERVAL	LOAD PROFILE INTERVAL (5MIN OR 15MIN)	ALN			
7726	LOAD POWER FACTOR	POWER FACTOR	ALN			
9030	LOAD PROFILE INTERVAL	Load Profile Interval (5min or 15min)	ALN			

6276	LOAD SD BRNG	Load Side Bearing	ALN			
6277	LOC ADDRESS	Location Address	ALN			
8216	LOCATION		ALN			
6067	LOCATION	Physical Location	ALN			
9342	LOCATION / GROUP	Physical Location / Group Assigned To	ALN			
10490	LOCATION ADDRESS	LOCATION/ADDRESS	ALN			
9842	LOCATION UNIT	Location Unit	ALN			
7882	LOCK ROTOR CODE LETTER	A, B, C...	ALN			
9942	LOCKED	Locked	ALN	Y/N		
6278	LOCN CLASS	Location Classification (y/n)	ALN			
5548	LONG WEST	Distance West	ALN			
10486	LONGITUDE	LONGITUDE	ALN			
9910	LOOP_NUMBER	Loop Number	ALN			
6150	LOW	As Found	ALN			
6153	LOW LEFT	As Left	ALN			
8244	LOW PRESSURE	REFRIG PSI	ALN			
6246	LOW VOLT	Voltage	ALN			
6235	LR AMPS	LR AMPS	ALN			
5562	LRMS CODE		ALN			
6279	LUBE CAPACTY	Lube Capacity	ALN			
6280	LUBE FILTERS	Lube Oil System Filters	ALN			
6281	LUBE HEATER	Lube Oil System Heater	ALN			
6282	LUBE HT XCHG	Lube Oil System Heat Exchange	ALN			
6283	LUBE MOTOR	Lube Oil System Motor	ALN			
6284	LUBE PUMP	Lube Oil System Pump	ALN			
6285	LUBE SPEC	Lube Spec	ALN			
6286	LUBE SUMP	Lube Oil System Sump	ALN			
5602	LUBE TYPE	Lubrication Type	ALN			
6287	LUBRCTN TYPE	Lubrication Type	ALN			
9441	LUBRICANT GREASE TYPE	Lubricant Grease Type	ALN			
6139	LUBRICATION	Lubrication	ALN			
6288	LUBRICTN GR	Lubrication Grade	ALN			
5782	LUMINAIRE	Light Style	ALN			
5865	LVRATING	Low Voltage Rating	NUMERIC			
6289	LWR DIFF LRL	Lower Differential LRL	ALN			
6290	LWR GAGE LRL	Lower Gage LRL	ALN			
6291	LYOUT DRWLOC	Site Layout Drawing Location	ALN			
6292	M BRKR SIZE	Main Breaker Size	ALN			
6293	M BRKR TYPE	Main Breaker Type	ALN			
6294	M FUSE SIZE	Main Fuse Size	ALN			
6295	M FUSE TYPE	Main Fuse Type	ALN			
5727	M. BREAK AMP	Main Breaker Amperage	ALN	AMPS		
5621	M. BREAK SZ	Main Breaker Size	ALN			
5622	M. BREAK TYP	Main Breaker Type	ALN			
5623	M. FUSE TYP	Main Fuse Type	ALN			
10492	MAC ID	MAC ID	ALN			
10040	M-ADDRESS	Mailing address	ALN			
8828	MAIN BREAKER		NUMERIC	AMPS		
8830	MAIN BREAKER AIC		ALN			
6296	MAIN DRIVER	Main Driver	ALN			
9026	MAIN MEMORY	MAIN MEMORY (KB)	NUMERIC	KB		
8221	MAIN POWER		ALN			
10482	MAIN MEMORY KB	Main Memory (KB)	ALN			
6297	MAINTD BY	Maintained By	ALN			
6177	MAKE	MAKE	ALN			
8822	MAKE/MODEL		ALN			
8622	MANHOLE	24"MH	ALN			
6116	MANUF		ALN			
7110	MANUFACTURE		ALN			
6079	MANUFACTURER	Manufacturer	ALN			
9742	MANUFACTURER DATE	MANUFACTURER DATE	ALN			
9066	MASTER METER ID	Master Meter ID	ALN			
10494	MASTER METER ID	Master Meter ID	ALN			
5512	MATERIAL	Street Pole Material Type	ALN			
9464	MATERIAL TYPE	Material Type	ALN			
7090	MATERIAL TYPE	PORCELAIN...	ALN			
9996	MATERIAL TYPE	Material Type	ALN			
5549	MATERIALS OF	Materials of Construction	ALN			
5455	MAX AMB	MAX AMB	ALN	C		
6298	MAX AMB TEMP	Maximum Ambient Temperature	ALN			
6299	MAX CFM	Maximum CFM	ALN			
6300	MAX FILTRATN	Maximum Filtration	ALN			
6301	MAX HEAT REL	Flare Gas Max Heat Release	ALN			
6302	MAX KVAR	Maximum Kvars	ALN			
5605	MAX PRESSURE	Max Pressure	ALN	PSI		
6303	MAX VOLT	Rated Maximum Voltage	ALN			
6304	MAX VOLTAGE	Maximum Voltage	ALN			
5519	MAX VOLTS	max voltage	ALN	KV		
5457	MAX. KVAR	MAX. KVAR	ALN			
5758	MAXIMO ID	Maximo ID	ALN			
5463	MAXRUN	MAXIMUM RUN TIME ON FULL TANK	ALN			
6305	MCC TYPE	Motor Control Center Type	ALN			
10042	M-CITY	Mailing City	ALN			
6117	MDATE	MDATE	ALN			
6160	MEASURING UN	Measureing Unit	ALN			
10226	MECHANICAL		ALN			
6218	MECHANICAL S	MECHANICAL SEAL	ALN			
6306	MEDIA TYPE	Media Type	ALN			
8958	MEMORY SLOTS	THE NUMBER OF MEMORY SLOTS THIS DEVICE HAS	ALN			
10496	METER BILLED	Is this meter billed or not?	ALN			
9102	METER CLASS	Meter Style # or Style Name	ALN			
8968	METER DEVICE ID	Meter Device Identification	ALN			
9002	METER FORM	Meter Physical Arrangement	ALN			
5752	METER MULTIP	MULTIPLIER	NUMERIC	KW		
9034	METER MULTIPLIER IN METER	Meter Multiplier in Meter	ALN			
6140	METER NO.	Meter Number (S/N)	ALN			
8424	METER PICK UP BY	Meter Pickup By	ALN			
8382	METER READING	METER READING	ALN	CUF		
8442	METER RETURNED BY	METER RETURNED BY	ALN			
10498	METER SN	Meter Serial Number	ALN			
8964	METER TYPE	Meter Type	ALN			

9242	METER VOLTAGE	Meter Operating Voltage	NUMERIC	VOLTS		
10500	METER CLASS	Meter Style # or Style Name	ALN			
10502	METER DEVICE ID	Meter Device Identification	ALN			
10504	METER FORM	Meter Physical Arrangement	ALN			
10506	METER MFG	Meter Manufacturer	ALN			
10508	METER MULTIPLIER	Meter Multiplier in Meter	ALN			
10510	METER SERIES	Meter Series	ALN			
10512	METER TYPE	METER TYPE	ALN			
10514	METER VOLTAGE	Meter Operating Voltage	ALN			
9502	MFG	MANUFACTURER	ALN			
6307	MFG YEAR	Manufactured Year	ALN			
6247	MFG. DATE	MANUFACTURER DATE	ALN			
6118	MFGD	MFGD	ALN			
6063	MFR	Manufacturer	ALN			
6308	MGV MFG	Main Gas Valves Manufacturer	ALN			
6309	MGV MODEL	Main Gas Valves Model	ALN			
6310	MGV NO VLV	Main Gas Valves Number of Valv	ALN			
6311	MGV SIZE	Main Gas Valves Size	ALN			
8006	MH_TYPE	Manhole Type	ALN			
5550	MILE	Miles	ALN			
6312	MIN ILLUMNTN	Minimum Illumination	ALN			
9662	MINI CAMERA MFG	Mini Camera Manufacture	ALN			
9664	MINI CAMERA MODEL	Mini Camera Model	ALN			
9666	MINI CAMERA SER #	Mini Camera Serial Number	ALN			
8844	MINIMUM OPERATING WATER PRESSURE	Dynamic pressure	NUMERIC			
6313	MIXER TYPE	Mixer Type	ALN			
5464	MOBL-STATION	MOBILE OR STATIONARY UNIT	ALN			
8217	MODEL	MODEL	ALN			
6119	MODEL	MODEL	ALN			
6080	MODEL NO.	Model #	ALN			
7036	MODEL NUMBER		ALN			
6084	MODEL YEAR	MODEL YEAR	ALN			
6178	MODEL YR.	MODEL YEAR	ALN			
6314	MOMENTRY AMP	Momentary Amps	ALN			
6315	MONITOR DEVC	Monitoring Device Type	ALN			
10010	MONITORING EQUIPMENT PRESENT	Monitoring Equipment Present	ALN	Y/N		
6316	MOTOR	Motor	ALN			
5487	MOTOR FED BY	Motor Fed By	ALN			
6317	MOTOR HP	Motor Horsepower	ALN			
8852	MOTOR MANUFACTURER		ALN			
5616	MOTOR MOD NO	Motor Model No.	ALN			
5593	MOTOR RATING	Motor Rating	ALN			
8854	MOTOR SERIAL NO		ALN			
6318	MOTOR SIZE	Motor Size (HP)	ALN			
6319	MOTOR SPEED	Motor Speed	ALN			
6320	MOTOR TYPE	Motor Type	ALN			
6321	MOTR HTR TYP	Motor Heater Type	ALN		MOTOR HEATER TYPE	
7088	MOUNTING ANGLE FROM VERTICAL		ALN			
6120	MSEAL	MSEAL	ALN			
10044	M-STATE	Mailing State	ALN			
6322	MSTR RD MFG	Master Radio Manufacturer	ALN			
6323	MSTR RD MOD	Master Radio Model Number	ALN			
6324	MSTR RD SERL	Master Radio Serial Number	ALN			
6325	MSTR RD VERS	Master Radio Version	ALN			
6326	MT HTR VOLT	Motor Heater Voltage	ALN			
6327	MTR HTR WATT	Motor Heater Wattage	ALN			
8322	MTU_BADGE_NUM_ADD	MTU BADGE NUMBER TO ADD	ALN			
8328	MTU_BADGE_NUM_REMOVE	MTU BADGE NUMBER TO REMOVE	ALN		YES/NO	
7542	MTU_ID_NUMBER	MTU ID Number	ALN			
8324	MTU_PORT_NUM_ADD	MTU PORT NUMBER TO ADD	ALN		MTU_PORT_NUM	
7544	MTU_PORT1_NUMBER	MTU Port 1 Number	ALN			
7546	MTU_PORT2_NUMBER	MTU Port 2 Number	ALN			
5753	MULTI MV90	MULTI MV90	NUMERIC	KW		
9804	MV90 TCP/IP	MV90 TCP/IP	ALN			
10516	MV90 TCPIP	MV90 TCPIP	ALN			
7042	MVA	MILLION VOLT AMPS	ALN			
6328	MWY HATCH SZ	Manway Hatch Size	ALN			
6329	MX ALL PRSSR	Maximum Allowable Pressure	ALN			
6330	MX BLT SPEED	Maximum Belt Speed	ALN			
6331	MX CS P	Maximum Casing Pressure	ALN			
6332	MX DMTR CS P	Maximum Diameter Casing Pres	ALN			
6333	MX INTRRPT A	Maximum Interrupting Amps	ALN			
6334	MX OPER PRSS	Maximum Operating Pressure	ALN			
6335	MX OPER TEMP	Maximum Operating Temperature	ALN			
6336	MX PRESSURES	Maximum Pressures	ALN			
6337	MX TRVL DIST	Maximum Travel Distance (in)	ALN			
6338	MX XS DMTR P	Maximum Excess Diameter Press	ALN			
10046	M-ZIP	Mailing Zip Code	ALN			
7922	NAFA CODE	NAFA Fleet Management Code	ALN			
8782	NAME	Name	ALN			
6065	NAME OF EQUI	Name of Equipment	ALN			
6176	NAME OF EQUP	NAME OF EQUIP	ALN			
6339	NATL BRD NO	National Board Number	ALN			
6121	NB #	NB #	ALN			
10518	NEM PROGRAM	Does this meter belong to NEM program?	ALN			
9820	NEM PROGRAM?	Does this meter belong to NEM program?	ALN			
6340	NEMA DESGN	NEMA Design	ALN			
6341	NEMA RATING	NEMA Rating	ALN			
5620	NEMA SIZE	NEMA Size	ALN			
5594	NEMA TYPE	Enclosure NEMA Type	ALN			
5485	NEMADSNCODE	NEMA Design Code	ALN			
5771	NETWORK INFO	IP Address	ALN			
5537	NEUTRAL	NEUTRAL	ALN			
5700	NEUTRAL CODE	Neutral Code: Solid or Switched	ALN			
6342	NICE	Nice	ALN			
6343	NO AIR DMPR	Number of Air Dampers	ALN			
6344	NO AN INP MD	Number of Analog Input Modules	ALN			
6345	NO AN OUT MD	Number of Analog Output Module	ALN			
6346	NO DG INP MD	Number of Digital Input Module	ALN			
6347	NO DG OUT MD	Number of Digital Output Modul	ALN			
6348	NO OF BLADES	Number of Blades	ALN			

6349	NO OF BUCKET	Number of Buckets	ALN			
6350	NO OF BURNER	Number of Burners	ALN			
6351	NO OF CABNTS	Number of Cabinets	ALN			
7342	NO OF CELLS	Number of Cells	ALN			
6352	NO OF CMP MT	Number of Compressor Motors	ALN			
6353	NO OF COMPRS	Number of Compressors	ALN			
6354	NO OF DIFFUS	Number of Diffusers	ALN			
6355	NO OF DOORS	Number of Doors	ALN			
6356	NO OF FANS	Number of Fans	ALN			
6357	NO OF FILTRS	Number of Filters	ALN			
6358	NO OF FIXTRS	Number of Fixtures	ALN			
6359	NO OF FLOORS	Number of Floors	ALN			
6360	NO OF FN BLD	Number of Fan Blades	ALN			
6361	NO OF FOUNT	Number Of Fountain(s)	ALN			
6362	NO OF GROVES	Number Of Groves	ALN			
6363	NO OF LIGHTS	Number of Lights	ALN			
6364	NO OF MOTORS	Number of Motors	ALN			
6365	NO OF POLES	Number of Poles	ALN			
6366	NO OF RACKS	Number of Racks	ALN			
6367	NO OF SECT	Number of Sections	ALN			
6368	NO OF SINKS	Number of Sinks	ALN			
6369	NO OF STAGES	Number of Stages	ALN			
6370	NO OF STALLS	Number of Stalls	ALN			
6371	NO OF TAPS	Number of Taps	ALN			
6372	NO OF TRANSF	Number of Transformer(s)	ALN			
6373	NO OF TURNS	Number of Turns	ALN			
6374	NO OF VANES	Number of Vanes	ALN			
6375	NO OF WINDOW	Number of Windows	ALN			
7368	NO OF WIRES	Number of Wires	ALN			
6376	NO PKG SPC	Number of Parking Spaces	ALN			
5729	NO. CIRCUIT	Number of Circuits	ALN			
5697	NO. OF BATT	Number of Batteries	ALN			
5701	NO. OF POLES	Number of Poles	ALN			
5579	NO. OF TURNS	# of Turns Open/Close	ALN			
5644	NO. PULSE	Pulse Number	ALN			
5538	NO. SECTIONS	NUMBER OF SECTIONS	ALN			
8004	NODE_MATERIAL	Node Material	ALN			
8008	NODE_STATUS	Node Status	ALN			
8010	NODE_TYPE	Node Type	ALN			
6377	NOM EFF RTNG	Nominal Eff Rating	ALN			
8012	NOTE	Note	ALN			
5811	NOTES	Comments	ALN			
6378	NPSH	NPSH	ALN			
6379	NPSHA	NPSHA	ALN			
6380	NXT CERT DT	Next Certification Date	ALN			
5587	O & M MANUAL	O & M Manual	ALN			
6381	O RING MATL	O Ring Material	ALN			
6122	O&M	O&M	ALN			
5497	O&M MANUAL	O&M Manual	ALN			
5534	O&M MANUEL	o&m manual	ALN			
6382	O2 TRANS CAP	Oxygen Transfer Capacity	ALN			
7646	OBJSTRUC	Interface Object Structure	ALN			
5834	OCCUPANCY	Building Occupancy	ALN			
6942	OCCURRENCE_TYPE	Occurrence Type	ALN		OCCURRENCE_TYPE	
7142	OCPD	OVER-CURRENT PROT DEVICE TYPE & AMP	ALN			
7034	OCPD & SIZE	FUSE __A, BREAKER __A, RELAY	ALN			
6123	OFILT	OFILT	ALN			
6124	OFMC	OFMC	ALN			
5468	OIL	OIL CAPACITY	ALN			
6185	OIL FITER #	OIL FILTER NO.	ALN			
6383	OIL INTRCPTR	Oil Interceptors Y/N	ALN		YES/NO	
5888	OIL LEVEL		ALN			
5890	OIL TEMP	Oil Temp	ALN			
5618	OIL TYPE	Oil Type	ALN			
5892	OILTEMPHI		ALN			
5624	OL PROTECT	Overload Protection	ALN			
10520	OLD METER NUMBER	Old Meter Number	ALN			
6384	OP CONDITION	Operating Conditions	ALN			
6385	OPER LIC REQ	Operator License Required	ALN		YES/NO	
8784	OPERATEVALVE	Operate Valve 20% and Return to Previous Position	ALN			
8908	OPERATING SYSTEM		ALN			
10184	OPERATING TEMPURATURE		ALN	DEG		DEGREES
8824	OPERATING VOLTAGE		ALN	VOLTS		
5596	OPERATION	Operation	ALN			
5586	OPERATOR TYP	Operator Type	ALN			
6386	OPP END BR N	Opposite End Brg Number	ALN			
6387	OPP END BRNG	Opposite End Bearing	ALN			
6388	OPR MECH MOD	Operating Mechanism Model	ALN			
6389	OPR MECH TYP	Operating Mechanism Type	ALN			
6125	ORDER	ORDER	ALN			
6225	ORDER NO.	ORDER NUMBER	ALN			
6390	ORIENTATION	Orientation	ALN			
6391	ORIG FND SRC	Original Funding Source	ALN			
5571	ORING	Type of o ring	ALN			
6062	OTHER	Other	ALN			
7112	OTHER INFO		ALN			
7150	OTHER INFO		ALN			
5557	OUT COND	Pipe outlet Condition	ALN			
5559	OUT TOP IN	Out Top	ALN			
6392	OUT VOLT RNG	Output Volt Range	ALN			
6212	OUTBOARD	OUTBOARD BEARING	ALN			
6393	OUTL MST CNT	Outlet Moisture Content	ALN			
6394	OUTLET CONN	Outlet Connection	ALN			
10306	OUTLET ELEVATION	INVERT ELEVATION AT THE TUNNEL OUTLET	ALN	FT		
5569	OUTPUT	4-20 mA	ALN			
7846	OUTPUT AMP		ALN			
5507	OUTPUT AMPS	Output Amperage	ALN	AMPS		
6395	OUTPUT DAMPN	Output Dampening	ALN			
5499	OUTPUT KVA	Kilovolt Ampere Rating	ALN	KVA		
5500	OUTPUT KW	kilowatt	ALN	KW		
7374	OUTPUT RPM	Output RPM	ALN	RPM		

5592	OUTPUT SPEED	Output Speed	ALN			
5659	OUTPUT V RNG	Control Output Volt Range	ALN	VOLTS		
7848	OUTPUT VOLT		ALN			
5508	OUTPUT VOLTS	Output Voltage	ALN	VOLTS		
6396	OUTSIDE DIAM	Outside Diameter	ALN			
6397	OVERALL HGHT	Overall Height	ALN			
7730	OVERLOAD	PERCENT	ALN			
5857	OWNER	Physical ownership	ALN			
10038	OWNER2	Physical ownership continued	ALN			
5870	P CONNTYPE	Connection Type	ALN			
5869	P CURRENT		ALN			
5867	P VOLTAGE		NUMERIC			
6198	P/S BELT	P/S BELT NO.	ALN			
6224	PACKING	PACKING	ALN			
6399	PACKING MATL	Packing Material	ALN			
6219	PACKING SIZE	PACKING SIZE	ALN			
8882	PAD SIZE		ALN			
5481	PAGE	GATEBOOK PAGE NUMBER	NUMERIC			
5447	PAINT CODE	PAINT CODE	ALN			
6245	PAMOUNT	PURCHASE AMOUNT	NUMERIC			
6400	PAN RANGE	Pan Range	ALN			
6401	PAN/TILT/ZM	Pan/Tilt/Zoom	ALN			
6168	PANEL FED BY	Panel Fed By	ALN			
7468	PANEL SECTION QTY	1,2,3,4, or OTHER	ALN			
7470	PANEL TYPE	SWG,SWB,MDP,MMLC,SUB-PANEL,PANELBOARD,LOAD CENTER,OTHER	ALN			
10034	PARCEL NUMBER	County Parcel Number	ALN			
6402	PARENT BLDG	Parent Building ID	ALN			
6403	PARKING LOTS	Has ParkingLot(s) Y/N	ALN		YES/NO	
8786	PARKINGRESTRICTIONS	Note Parking Restrictions	ALN			
9722	PART NO		ALN			
6162	PART NO.	Part Number	ALN			
6404	PART NUMBER	ID # 292752919	ALN			
5761	PASSWORD 1	Programed PW 1	ALN			
5762	PASSWORD 2	Programed PW 2	ALN			
10522	PASSWORD 1	Programed PW 1	ALN			
10524	PASSWORD 2	Programed PW 2	ALN			
9968	PAVER BRAND	Paver Brand	ALN			
9962	PAVER TYPE	Paver Type	ALN			
5441	PCB LABEL	PCB Label	ALN			
6405	PCK UP SETT	Pick Up Settings	ALN			
5443	PDATE	PURCHASE DATE	ALN			
6406	PERM MAGNET	Has Permanent Magnet	ALN		YES/NO	
8022	PERMIT_NUMBER	Permit Number	ALN			
7522	PF%		ALN			
6407	PG E ACCT NO	PG&E Account Number	ALN			
6408	PGV MFG	Pilot Gas Valve Manufacturer	ALN			
6409	PGV MODEL	Pilot Gas Valve Model	ALN			
6410	PGV NO VLV	Pilot Gas Valve Number of Valv	ALN			
6411	PGV SIZE	Pilot Gas Valve Size	ALN			
6061	PHASE	Phase	ALN		PHASE	
9244	PHASES	Number of Electrical Phases	ALN			
9544	PH-GND	MAX PHASE TO GROUND VOLTAGE	ALN			
5768	PHONE #	Modem Phone #	NUMERIC			
9796	PHONE # (IF MODEM)		ALN			
9042	PHONE LINE SHARED	Shared phone line (Y/N)	ALN	Y/N	YESORNO	
9798	PHONE LINE SHARED? (Y/N)	Phone Line Shared? (Y/N)	ALN			
10526	PHONE NO	Phone # (if modem)	ALN			
9044	PHONE PASSWORD 1	Phone Password 1	ALN			
9046	PHONE PASSWORD 2	Phone Password 2	ALN			
10528	PHONE SHARED	Phone Line Shared? (Y/N)	ALN			
9542	PH-PH VOLTAGE	MAX GUARDED PHASE TO GUARDED PHASE VOLTAGE	ALN			
6194	PHS	Phase with List	ALN		PHASE	
6412	PHYSICAL ADD	Physical Address	ALN			
7092	PHYSICAL LOCATION		ALN			
9964	PICP AREA	Permeable Interlocking Concrete Pavement Area	NUMERIC	SF		
9948	PIPE DIAMETER	Pipe Diameter	NUMERIC	IN		
9952	PIPE LENGTH	Pipe length	NUMERIC	FT		
5815	PIPE LINER	Pipe Liner Material	ALN			
5809	PIPE MATERIA	Pipe Material Type	ALN			
9950	PIPE MATERIAL	Pipe Material	ALN			
5554	PIPE TYPE	Pipe Design	ALN			
5826	PIPE USAGE	Pipe Usage	ALN			
8042	PIPE_ALTNAME_CSD	Alternate Pipe Name	ALN			
7950	PIPE_LENGTH_CSD	Pipe Length	NUMERIC	FT		
7946	PIPE_MATERIAL_CSD	Pipe Material	ALN			
7958	PIPE_NICKNAME_CSD	Pipe Nickname	ALN			
7954	PIPE_OWNER_CSD	Pipe Owner	ALN			
7944	PIPE_SIZE_CSD	Pipe Size	ALN			
7956	PIPE_STATUS_CSD	Pipe Status	ALN			
7942	PIPE_TYPE_CSD	Pipe Type	ALN			
7948	PIPE_USE_CSD	PIpe Use	ALN			
6141	PIPELINE	Pipeline	ALN			
6413	PKG INSTRMTS	Instrument Package Instruments	ALN			
6414	PKG INTRLCKS	Instrument Package Interlocks	ALN			
7314	PLANNER_SHOP	Planner/Shop	ALN			
7788	PLATE DIMENTIONS NEGATIVE		ALN	INCHES		
7787	PLATE DIMENTIONS POSITIVE		ALN	INCHES		
5654	PLC ADDRESS	PLC Address	ALN			
10228	PLUMBING		ALN			
6415	PMT CMPLIANT	Sampler Permit Compliant (Y/N)	ALN		YES/NO	
6064	PN	Part Number	ALN			
9974	POAP AREA	Porous Asphalt Pavement Area	NUMERIC	SF		
6416	POF SCORE	Probability Of Failure Score	ALN			
7192	POLE	QTY OF POLES	ALN			
6626	POLE CLASS	Pole classification	ALN			
5800	POLE HEIGHT	Height of pole	ALN			
5812	POLE NUMBER	Street Light pole number	ALN			
5788	POLE OWNER	Owner of Street Light Pole	ALN			
7242	POLE TYPE MATERIAL	WOOD, ALUM, STEEL, CONCRETE, OTHER	ALN			
5778	POLETYPE	Street Light Pole Type	ALN			
10004	PONDING DEPTH AS DESIGNED	Ponding Depth As Designed	NUMERIC	IN		

8166	PONUMB	PURCHASE ORDER NUMBER	ALN			
9064	PORT #	Port Number	ALN			
10530	PORT NUM	Port Number	ALN			
8948	PORTS	NUMBER OF PORTS	ALN			
5793	POSITION X	X GPS Position	ALN			
5790	POSITION Y	Y GPS Position	ALN			
6417	POSITIONER	Has Positioner	ALN		YES/NO	
6418	POWER	Power	ALN			
6419	POWER FACTOR	Power Factor	ALN			
10202	POWER RATING	VOLTAGE RANGE	ALN			
5615	POWER SOURCE	Power Source	ALN			
5674	POWER SUPPLY		ALN			
6420	PPE REQD	PPE Required Y/N	ALN		YES/NO	
5498	PPE REQUIRED	ARC Flash Rating	ALN		PPE REQUIRED	
6243	PPRICE	PUCHASE PRICE	ALN			
6421	PRCS MEM CLK	Processors, Memory And Clock	ALN			
6422	PRESSUR DROP	Pressure Drop	ALN			
5604	PRESSURE	Pressure	ALN			
6423	PRESSURE RTG	Pressure Rating	ALN			
6424	PRIM VOLT	Primary Voltage	ALN			
9760	PRIMARY	PRIMARY	ALN			
8522	PRIMARY CONTAINER TYPE	Primary Container Type (DRUM or TOTE)	ALN			
5732	PRIMARY V	Primary Voltage H	ALN			
9744	PRIMARY VOLTS (H)	Primary Volts (H)	ALN			
6425	PRIME OUTPUT	Prime Output	ALN			
7316	PRIORITY	Work Order Priority	ALN			
10032	PRIVATE PROPERTY	Is this detection of private property?	ALN		YES/NO	
6426	PRMT EXP DT	Permit Expiration Date	ALN			
6427	PROBE TYPE	Probe Type	ALN			
6428	PROC STR TYP	Process Structure Type	ALN		PROCESS STRUCT TYP	
6429	PROCESS	Process	ALN			
6430	PROCESS NUM	Process Number	ALN			
6431	PROCESS TYPE	Process Type	ALN		PROCESS TYPE	
6432	PROCESS VAR	Process Variable	ALN			
5648	PROCESS VARI	Process Variable	ALN			
8944	PROCESSORS	NUMBER OF PROCESSORS (CPU)	ALN			
6433	PROCSS INPUT	Process Input	ALN			
7610	PRODDATE	Date to Production	ALN			
5689	PROG INTERF	Programmer Interface Module	ALN			
6434	PROGRAM	Program	ALN			
9032	PROGRAM TO STANDARD TIME	Confirm meter programmed to PST	ALN		YESORNO	
8326	PROGRAM_MTU	PROGRAM MTU	ALN		YES/NO	
7582	PROGRAMMTU	CSB needs to program the MTU?	ALN		YES/NO	
5810	PROJECT	Original Project Division	ALN		PROJECT	
6074	PROJECT MGR.	Project Manager	ALN			
7992	PROPERTY_ADDRESS_NUM	House Number of Property Served By Lateral	ALN			
7994	PROPERTY_ADDRESS_STREET	Street of Property Served By Lateral	ALN			
6435	PROT RLY TYP	Protective Relay Type	ALN			
5633	PROTECT DEV	Protective Device	ALN			
5530	PROTECTIVE D	protective device	ALN			
6436	PROTECTV DEV	Protective Device	ALN			
5599	PRSR RATING	Pressure Rating	ALN			
6437	PRSSR RATING	Pressure Rating	ALN			
6438	PRSSR REL RT	Pressure Relief Rating	ALN			
5471	PR-SYS1	PR-SYSTEM1	ALN			
5472	PR-SYS2	PR-SYSTEM2	ALN			
6126	PSI	PSI	ALN			
6127	PSIZE	PSIZE	ALN			
5750	PT RATIO		NUMERIC			
6398	P-TRAP	P-Trap	ALN			
5655	PU SETTINGS	Pick Up Settingss	ALN			
7648	PUBLISHCHNL	Interface Publish Channel	ALN			
6164	PULLEY SIZE	Pulley Size	ALN			
6439	PULLEYS	Pulleys	ALN			
5754	PULSE MULTIP	PULSE MULTIP	NUMERIC			
9036	PULSE MULTIPLIER IN METER (KE) (KWH/PULSE)	Pulse Multiplier in Meter (Ke) (kWh/pulse)	ALN			
9784	PULSE MULTIPLIER IN METER (KE) (KWH/PULSE) = (KH/P/R)/1000	Pulse Multiplier in meter (Ke) (kWh/pulse) = (Kh/P/R)/1000	ALN			
6440	PULSE NUMBER	Pulse Number	ALN			
10532	PULSE REVOLUTION	PULSES/REVOLUTION	ALN			
10534	PULSE MULTIPLIER	Pulse Multiplier in meter (Ke) (kWh/pulse) = (Kh/P/R)/1000	ALN			
5756	PULSE/REV	Pulse constant	NUMERIC			
9786	PULSES/REVOLUTION	PULSES/REVOLUTION	ALN			
6441	PUMP	Pump	ALN			
6442	PUMP CAPACTY	Pump Capacity	ALN			
6443	PUMP DRV TYP	Pump Drive Type	ALN		PUMP DRIVE TYPE	
6444	PUMP SHF TYP	Pump Shaft Type	ALN		PUMP SHAFT TYPE	
6445	PUMP SL TYP	Pump Seal Type	ALN		PUMP SEAL TYPE	
5614	PUMP TYPE	Pump Type	ALN			
6446	PURGE FLOWRT	Purge Flowrate, SCFM	ALN			
10536	PV MASTER METER NUMBER	If PV What is master meter Number?	ALN			
10538	PV METER	Is this a PV meter?	ALN			
10540	PV SYSTEM OWNER	If PV who owns the system?	ALN			
9818	PV SYSTEM OWNER?	PV SYSTEM OWNER?	ALN			
6447	PVB	PVB	ALN			
9970	PVCP AREA	Pervious Concrete Pavement Area	NUMERIC	SF		
5712	PWR FACTOR	Power Factor	ALN			
6448	PWR MONITOR	Power Monitor (if applicable)	ALN			
6449	PWR SU PT NO	Power Supply Part Number	ALN			
8104	QTY OF BATTERIES		ALN			
8102	QTY OF BATTERY CELL		ALN			
7020	QTY OF INSULATION		NUMERIC	GAL		
7012	QTY OF WIRE		ALN			
6138	QUANTITY	Quantity	ALN			
9986	QUICK COUPLER	Quick Coupler	ALN	Y/N		
9988	QUICK COUPLER SIZE	Quick Coupler Size	NUMERIC	IN		
5672	RACK UNIT	Rack Unit Part No.	ALN			
10290	RADIO ANTENNAE	Y/N, MODEL, CABLE TYPE, CABLE LENGTH.	ALN			
7221	RADIO ID NO.	RADIO ID NUMBER	ALN			
10242	RAIN GAUGE	MAKE, TIPPING BUCKET Y/N, GEONOR Y/N, TORPEDO.	ALN			
8938	RAM	RANDOM ACCESS MEMORY SIZE	ALN			
8940	RAM TYPE	TYPE OF RANDOM ACCESS MEMORY	ALN			

6450	RANG MIN SPN	Range Min Span	ALN			
5645	RANGE	Range	ALN			
5520	RATE V RNG F	voltage range factor	ALN	K		
9914	RATE_STUDY_CATEGORY	Rate Study Cost Allocation Category	ALN			
6451	RATED AMPERG	Rated Amperage	ALN			
7084	RATED CURRENT		ALN			
7862	RATED FREQUENCY		ALN			
5630	RATED MAX V	Rated Voltage Range Factor	ALN	KV		
7864	RATED TEMPERATURE		ALN			
6452	RATED VOLTAG	Rated Voltage	ALN			
6453	RATING KW	Rating (kW)	ALN			
5731	RATING KVA	kVA Rating	ALN	KVA		
6454	RATING PLUG	Rating Plug	ALN			
6128	RATIO	RATIO	ALN			
5561	RD NAME		ALN			
5774	READING CH.1	Meter reading	NUMERIC	KWH/KVAR		
5775	READING CH.2	Meter reading	NUMERIC	KWH/KVAR		
5776	READING CH.3	Meter reading	NUMERIC	KWH/KVAR		
5777	READING CH.4	Meter reading	NUMERIC	KWH/KVAR		
7209	REAR AXLE CAP	REAR AXLE CAP	ALN			
9692	REAR CAM. MFG.	Rear Camera System Manufacture	ALN			
9694	REAR CAM. MODEL #	Rear Camera System Model Number	ALN			
9696	REAR CAM. SER. #	Rear Camera System Serial Number	ALN			
7217	REAR TIRE SIZE	REAR TIRE SIZE	ALN			
6147	REASON	Reason for Test	ALN			
6455	RECDWG	Recdwg	ALN			
9070	RECODER ID	Recoder ID	ALN			
9806	RECORDER ID	Recorder ID	ALN			
10542	RECORDER ID	RECORDER ID	ALN			
6456	RED COMM MOD	Redundancy Comm Module	ALN			
5679	REDUND COMM	Redundancy Comm Module	ALN			
6457	REDUNDANCY	Redundancy	ALN			
5454	REF	REF #	ALN			
6458	REFRIG AMT	Refrigerant Amount	ALN			
6459	REFRIG CHRG	Refrigerant Charge	ALN			
6460	REFRIG COOLN	Refrigerant Coolants	ALN			
6461	REFRIG OIL	Refrigerant Oil	ALN			
6462	REFRIG TYPE	Refrigerant Type	ALN			
6191	REFRIGERANT	REFRIGERANT	ALN			
6463	REFRIGERATED	Refigerated (Y/N)	ALN		YES/NO	
5786	REGION	Regions	ALN			
6155	REGISTER	Register	ALN			
7724	REGULATION	REGULATION PERCENT	ALN			
6464	REGULATORY	Regulatory	ALN			
6465	REHAB CTRCTR	Rehab Contractor ID	ALN			
5846	REHAB DATE	Bldg. Rehab. Date	ALN			
6466	REHAB TYPE	Rehab Type	ALN			
9222	REHABFT	Rehab Footage	NUMERIC	FT		
10248	RELATIVE HUMIDITY	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
7262	RELAY TYPE	CKT, CT, MP, EM, PT, OTHER	ALN			
6467	RELIABILITY	Reliability	ALN			
8906	REMOTE		ALN		YES/NO	
8150	REPAIR LOCATION GL ACCT	Repair (Maintenance) Location GL Acct.	ALN			
8148	REPAIR LOCATION INDEX CODE	Repair Location Index Code	ALN			
9224	REPAIRFT	Repair Footage	NUMERIC	FT		
9226	REPLACE	Replace Asset	ALN			
7904	REPLACEMENT VEHICLE	REPLACEMENT VEHICLE (NEW)	ALN			
8724	REPLACEMENT VEHICLE (NEW)		ALN			
8788	REPLACEREPAIR	For Replacement or Add'l Repairs, Make a child W/O, Print It and give to Planning With Your PM W/O	ALN			
7976	REPLC_CONT_ID	Contract Number That Will Replace/Abandon This Pipe	ALN			
7978	REPLC_HYD_JO	Hydraulics Job Order Number That Will Replace/Abandon This Pipe	ALN			
7984	REPLC_LENGTH	Replacement Length	NUMERIC	FT		
7980	REPLC_NOTE	Notes About Future Replacement	ALN			
7318	REPORTED_BY	Reported By	ALN			
9636	REPORTING SYS SOFTWARE	Reporting System Software Version	ALN			
5856	REROOF DATE	Date Re-roofed/Replaced	ALN			
6468	RESERVOIR	Reservoir	ALN			
5613	RESERVOIR SZ	Reservoir Size	ALN			
5893	RESET		ALN			
6469	RESOLUTIONS	Resolutions	ALN			
5516	RESP. SUPV.	RESPONSIBLE SUPERVISOR	ALN			
6205	RETURN DATE	DATE OF RETURN	ALN			
8014	RIM_ELEVATION	Rim Elevation	NUMERIC	FT		
6470	RISK SCORE	Risk Score	ALN			
6471	RK UNT PT NO	Rack Unit Part Number	ALN			
6472	RM MAINT DT	Room Maintenance Date	ALN			
6473	RMMAINTDESC	Room Maintenance Description	ALN			
6474	RNG MIN SPAN	Range Min Span	ALN			
5514	ROAD WIDTH	Road Width	NUMERIC	FEET		
5849	ROOF AREA	Total Square Footage	ALN			
5847	ROOF CLASS	Classification A,B,C,non-rated	ALN			
10222	ROOF LIVE LOAD		ALN			
5851	ROOF PITCH	Pitch: Flat, Slight, Dramatic	ALN			
5850	ROOF SHAPE	Shape: Gabled,Hipped,Flat	ALN			
5848	ROOF TYPE	Type: membrane,tar&gravel	ALN			
6071	ROOM	Room	ALN			
6475	ROOM DESC	RoomDescription	ALN			
6476	ROOM ID	Room ID	ALN			
6477	ROOM TYPE	Room Type	ALN			
6478	ROTATE	Rotate	ALN			
6479	ROTATION	Rotation	ALN			
6480	ROTATION DIR	Rotation Direction	ALN		ROTATION DIRECTION	
6481	RP	RP	ALN			
6482	RPDA	RPDA	ALN			
6129	RPM	RPM	ALN	RPM		
7642	RPTNAME	Report Name	ALN			
7644	RPTTOOL	Report Development Tool	ALN		ITRPTTYPES	
8932	RTD INPUTS	THE NUMBER OF RTD INPUTS	ALN			
6234	RUN TIME	RUN TIME	ALN			
5873	S CONNTYPE	Connection Type	ALN			
5872	S CURRENT		ALN			

5871	S VOLTAGE		NUMERIC			
8482	SA ID NUMBER	SERVICE ADDRESS NUMBER	ALN			
6483	SAFETY STOP	Safety Stop (Y/N)	ALN		YES/NO	
6484	SAMPLE	Sample	ALN		YES/NO	
6485	SAMPLER TYPE	Sampler Type	ALN			
5522	SC RATING	short circuit rating	ALN	KA		
7624	SCHEMA	Database Schema for Change	ALN			
6486	SCR HUB SIZE	Screw Hub Size	ALN			
6487	SCR OPEN SIZ	Screen Opening Size	ALN			
6488	SCREEN TYPE	Screen Type	ALN		SCREEN TYPE	
6489	SCREW WIDTH	Screw Width	ALN			
7626	SCRIPTLOC	SQL Script Location	ALN			
6490	SCRUBBER TYP	Scrubber Type	ALN			
6491	SCRW BLDE DM	Screw Blade Diameter	ALN			
6492	SCRW THCKNSS	Screw Thickness	ALN			
6213	SEAL	SEAL	ALN			
7370	SEAL TYPE	Seal Type (Packing, Mechanical)	ALN			
6217	SEALS	SEALS	ALN			
6222	SEAT TYPE	SEAT TYPE	ALN			
5635	SEC 1. BUS	Section 1 Amperage	ALN	AMPS		
5540	SEC 2 BUS	SECTION 2 AMPERAGE	ALN			
5636	SEC 2. BUS	Section 2 Amperage	ALN	AMPS		
5541	SEC 3 BUS	SECTION 3 AMPERAGE	ALN			
5637	SEC 3. BUS	Section 3 Amperage	ALN	AMPS		
5542	SEC 4 BUS	SECTION 4 AMPERAGE	ALN			
5638	SEC 4. BUS	Section 4 Amperage	ALN	AMPS		
5543	SEC 5 BUS	SECTION 5 AMPERAGE	ALN			
5639	SEC 5. BUS	Section 5 Amperage	ALN	AMPS		
5544	SEC 6 BUS	SECTION 6 AMPERAGE	ALN			
5640	SEC 6. BUS	Section 6 Amperage	ALN	AMPS		
6493	SEC AMPS	Secondary Amps	ALN			
6494	SEC VOLT	Secondary Voltage	ALN			
5539	SEC.1 BUS	SECTION 1 AMPERAGE	ALN			
7322	SECLEVEL	Security Level	ALN			
7306	SECLEVELS	Security Levels (separate with commas)	ALN			
9762	SECONDARY	SECONDARY	ALN			
5733	SECONDARY V	Secondary Voltage X	ALN			
9746	SECONDARY VOLTS (X)	Secondary Volts (X)	ALN			
6495	SECR CTRCTR	Security Contractor ID	ALN			
6496	SECT 1 BUS	Section 1 BUS	ALN			
6497	SECT 2 BUS	Section 2 BUS	ALN			
6498	SECT 3 BUS	Section 3 BUS	ALN			
6499	SECT 4 BUS	Section 4 BUS	ALN			
6500	SECT 5 BUS	Section 5 BUS	ALN			
6501	SECT 6 BUS	Section 6 BUS	ALN			
6203	SECUR CLASS	SECURITY CLASS	ALN			
6502	SECURITY	Security	ALN			
6503	SECURITY SYS	Security System (Y/N)	ALN		YES/NO	
5844	SEIS.UP DATE	Seismic Upgrade Date	ALN			
5905	SEISM. RATE2	Seismic Priority Rating 2nd	ALN			
5906	SEISM. REC.2	Seismic Recommendation 2nd	ALN			
5907	SEISMIC COST	Seismic Rehab. Cost	NUMERIC			$
5897	SEISMIC CURR	Facility Meets Current Stand.	ALN			
5902	SEISMIC DAT2	Seismic Eval Date 2	ALN			
5900	SEISMIC DATE	Seismic Eval Date	ALN			
5841	SEISMIC DES;	Seismic Design Cat.A,B,C,D,E,F	ALN			
5901	SEISMIC EV.2	Seismic Eval. (ASCE 31) 2	ALN			
5894	SEISMIC EVAL	Seismic Eval. Ex. Bld. ASCE 31	ALN			
5840	SEISMIC PERF	Seismic Perf. Cat. A,B,C,D,E	ALN			
5903	SEISMIC RATE	Seismic Priority Rating	ALN			
5904	SEISMIC REC.	Seismic Recommendation	ALN			
5843	SEISMIC UP.	Seismic Upgrade Type	ALN			
5839	SEISMIC USE	Seismic Use Group I,II,III	ALN			
5838	SEISMIC ZONE	Building Seismic Zone	ALN			
10544	SELF CONTAINED	Self-contained (Y/N)?	ALN			
9022	SELF-CONTAINED	SELF-CONTAINED (Y/N) CT/PTs Included	ALN		YESORNO	
6504	SER COMM MOD	Serial Communication Module	ALN			
8218	SERIAL	SERIAL NUMBER	ALN			
5675	SERIAL COMM	Serial Communication Module	ALN			
8262	SERIAL NO		ALN			
6081	SERIAL NO.	Serial Number	ALN			
7102	SERIAL NUMBER		ALN			
8912	SERIAL PORTS		ALN			
5662	SERIES	Series	ALN			
9302	SERVICE ADDRESS	Service Address	ALN			
5660	SERVICE DUTY	Service Duty	ALN			
7874	SERVICE FACTOR		ALN			
5757	SERVICE VOLT	incoming volts	ALN	VOLTS		
9304	SERVICE VOLTAGE	Service voltage (incoming) of electric service before meter	ALN	VOLTS		
6236	SF	SF	ALN			
6505	SHAFT	Shaft	ALN			
6506	SHAFT DIAM	Shaft Diameter	ALN			
6214	SHAFT DIAM.	SHAFT DIAMETER	ALN			
6507	SHAFT LENGTH	Shaft Length	ALN			
6165	SHAFT SIZE	Shaft Size	ALN			
6508	SHAFT TYPE	Shaft Type	ALN			
5770	SHARED LINE		ALN	Y/N		
10006	SHARED MAINTENANCE RESPONSIBILITY	Shared Maintenance Responsibility	ALN	Y/N		
6509	SHEAVE DIAM	Sheave Diameter	ALN			
6241	SHOP	SHOP #	ALN			
10028	SHORT CODE	Detection Concern, I.E. Grow-In or Fall-In	ALN			
7785	SHORT CURCUIT CURRENT		ALN	AMPS		
6510	SHUTTER TIME	Shutter Time	ALN			
5783	SIDE	Lamp Position on Fixture	ALN			
6511	SIGNAGE TYPE	Signage Type	ALN			
5647	SIGNAL TYPE	Signal Type	ALN			
6512	SINK TYPE	Type of Sinks	ALN			
7612	SITE	Site ID	TABLE		SITE	
6513	SITEAREA	Site Area	ALN			
7308	SITEID	Site ID	ALN			
6514	SITELOC NOTE	Site Location Notes	ALN			

6130	SIZE	SIZE	ALN			
10008	SIZE OF DRAINAGE MANAGEMENT AREA	Size of Drainage Management Area	NUMERIC	SF		
5817	SLOPE	Slope for the Asset	ALN			
8950	SLOTS	THE NUMBER OF SLOTS	ALN			
6131	SN/#	SN/#	ALN			
10264	SNOW DEPTH	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
10266	SNOW PILLOW	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
5690	SOFTWARE	Software	ALN			
6515	SOFTWARE VER	Software Version	ALN			
10250	SOIL MOISTURE	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
5818	SOIL TYPE	Soil Surrounding Asset	ALN			
10286	SOLAR RADIATION	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
10258	SOLAR SHIELD	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
8484	SP ID NUMBER	SERVIICE POINT NUMBER	ALN			
5494	SPACE HT FED	Space Heater Fed	ALN			
5492	SPACE HT SZ	Space Heater Size	ALN			
5493	SPACE HT V	Space Heater	ALN			
10024	SPAN	A specific section of a transmission line, between towers.	ALN			Span
9504	SPEC	SPECIFICATION	ALN			
6209	SPEC#	#	ALN			
10022	SPECIES	Species of tree or vegetation.	ALN			
6516	SPEED	Speed	ALN			
6517	SPEED RANGE	Speed Range	ALN			
6518	SPIL-PRF PVB	Spill-Proof PVB	ALN			
6154	SPINDLE	Spindle	ALN			
9984	SPRAY HEAD MODEL NUMBER	Spray Head Model Number	ALN			
9982	SPRAY HEAD TYPE	Spray Head Type	ALN			
7702	SPTDOC	Additional Supporting Documents Location	ALN			
5634	SRVC VOLTAGE	Service Voltage	ALN	VOLTS		
5483	SRVC. FACT	Service Factor	ALN			
8350	SSO_DISCOVERY_TIME	Time of SSO Discovery	ALN			
8352	SSO_EST_END_TIME	Estimated SSO End Time	ALN			
8354	SSO_EST_VOLUME	Estimated SSO Volume (gallons)	NUMERIC			
8348	SSO_GTE_1000_GAL	Is overflow greater than 1,000 gallons? YES/NO	ALN		YES/NO	
8346	SSO_REACH_BAY_WATER	Did overflow reach Bay water? YES/NO	ALN		YES/NO	
6519	ST PRSS VSSL	State Pressure Vessel Number	ALN			
6520	STABILITY	Stability	ALN			
10546	STANDARD TIME	ALWAYS PROGRAMMED TO STANDARD TIME	ALN			
5706	STANDBY KVA	kVA-Standby	ALN	KVA		
5705	STANDBY KW	kW-Standby	ALN	KW		
7362	STANDBY SOURCE	Standby Source (Fed By)	ALN			
6231	START	START	ALN			
5563	START PT		ALN			
9074	START READ TIME	Start Read Time	ALN			
10548	START READ TIME	Start Read Time (COLUMN IS TEXT)	ALN			
6163	STARTER	Starter	ALN			
5486	STARTER SIZE	Starter Size	ALN			
6521	STARTNG METH	Starting Method	ALN			
6522	STATE	State	ALN			
6523	STATUS	Status	ALN			
5792	STBLOCK	Street Block Number	NUMERIC			
6524	STD MAX TRVL	Standard Max Travel (speed)	ALN			
6525	STDBY OUTPUT	Standby Output	ALN			
6526	STEAM FLW RT	Steam Flow rate	ALN			
6527	STEAM PRESSR	Steam Pressure	ALN			
6528	STEM LENGTH	Stem Length	ALN			
6529	STEM MATL	Stem Material	ALN			
6223	STEM SIZE	STEM SIZE	ALN			
6530	STEM TYPE	Stem Type	ALN			
5763	STNDRD TIME	Time Zone	ALN	Y/N		
10002	STORAGE SIZE	Storage Size	NUMERIC	GA		
8164	STOREROOM	WHERE TOOL IS STORED	ALN			
5835	STORIES	Number of Floors	ALN			
8024	STP_NEEDED	STP Needed? Y/N	ALN			
5475	STR	STREET	ALN			
6159	STRAINER	Strainer	ALN			
5515	STREAMBED	Part of Stream Channel (Y/N)	ALN			
6531	STREET	Street	ALN			
5784	STREET ADDRE	Address closest to pole	ALN			
5791	STREET BLOCK	Street Block Number	ALN			
5794	STREET NAME	Name of the street	ALN			
5795	STREET TYPE	Type of street	ALN		STREET TYPE	
8802	STREETCLEANING	Note Street Cleaning	ALN			
8026	STRIPING	Striping? Y/N	ALN			
5461	STRTTYP	START TYPE MANUAL OR AUTO	ALN			
5898	STRUC. COND.	Concrete Metal Condition	ALN			
6532	STRUCT COND	Structural Condition	ALN			
9944	STRUCTURE MATERIAL	Structure Material	ALN			
6082	STYLE	ABB,STYLE	ALN			
6170	STYLE:	STYLE	ALN			
5772	SUBNET MASK	IP Address Subnet Mask	ALN			
10550	SUBNET MASK	IP Address Subnet Mask	ALN			
6533	SUBSTNT C DT	Substantial Completion Date	ALN			
5749	SUBTYPE	subtype	ALN			
6534	SUCT LIN DRY	Suction Line Dryers	ALN			
6535	SUCTION SIZE	Suction Size	ALN			
6536	SUITE NUMBER	Suite Number	ALN			
6537	SUPP PROTCLS	Supported Protocols	ALN			
6144	SUPPLIES	Supplies	ALN			
7514	SUPPLY CIRCUIT SPEC		ALN			
7424	SUPPLY FROM		ALN			
5567	SURV DATE		ALN			
9780	SURVEYOR NAME	SURVEYOR NAME	ALN			
6538	SVC COND	Service Condition	ALN			
6539	SVC FACTOR	Service Factor	ALN			
6540	SVC PROVIDER	Service Provider	ALN			
6541	SVC VOLTAGE	Service Voltage	ALN			
5699	SWITCH EMERG	Emergency Power Source	ALN			
5698	SWITCH NORM	Normal Power Source	ALN			
6542	SWITCHGEAR	Switchgear	ALN		SWITCHGEAR	
6543	SYS INTEGRTN	System Integration Support	ALN			

6544	SYSTEM RISK	System Risk	ALN			
6545	SYSTEM TYPE	System Type	ALN		SYSTEM TYPE	
7628	TABLES	List of Tables for Change	ALN			
5608	TANK CAP	Air Receiver Tank Capacity	ALN			
5883	TANK FITTING		ALN			
6546	TANK MATL	Tank Material Type	ALN		TANK MATERIAL TYPE	
7212	TANK SIZE	TANK SIZE	ALN			
6547	TANK TYPE	Tank Type	ALN		TANK TYPE	
5736	TAP 1	Tap 1	ALN			
5737	TAP 2	Tap 2	ALN			
5738	TAP 3	Tap 3	ALN			
5739	TAP 4	Tap 4	ALN			
5740	TAP 5	Tap 5	ALN			
5820	TAP INFORM	Tap Size/Location, Lateral Tap	ALN			
6548	TAP TYPE	Tap Type	ALN			
9764	TAPS VOLTAGE 1	TAPS VOLTAGE 1	ALN			
9766	TAPS VOLTAGE 2	TAPS VOLTAGE 2	ALN			
9768	TAPS VOLTAGE 3	TAPS VOLTAGE 3	ALN			
9770	TAPS VOLTAGE 4	TAPS VOLTAGE 4	ALN			
9772	TAPS VOLTAGE 5	TAPS VOLTAGE 5	ALN			
5881	TAPSETTING		ALN			
5874	TAPVOLT 1		ALN			
5875	TAPVOLT 2		ALN			
5876	TAPVOLT 3		ALN			
5878	TAPVOLT 5		ALN			
5879	TAPVOLT 6		ALN			
5880	TAPVOLT 7		ALN			
5877	TAPVOLT4		ALN			
7210	TARE WEIGHT	TARE WEIGHT	ALN			
9482	TASK ORDER	Task Order Number	ALN			
9054	TCP/IP	IP ADDRESS	ALN			
5449	TDH	Total Dynamic Head	ALN			
6549	TEMP RATING	Temperature Rating	ALN			
5713	TEMP RISE	Temperature Rise	ALN			
6550	TEMPERATURE	Temperature	ALN			
7022	TEMPERATURE CLASS	A, B, C, OTHER	ALN			
6146	TEST DATE	Test Date	ALN			
7614	TESTDATE	Date to Test	ALN			
7286	TESTING INTERVAL	1YR, 2YR, 5YR, 10YR, OTHER, NO TESTING REQ	ALN			
6132	TEXT	TEXT	ALN			
6133	TEXT0	TEXT0	ALN			
6085	TEXT1	TEXT1	ALN			
6047	TEXT2	TEXT2	ALN			
6048	TEXT3	TEXT3	ALN			
6049	TEXT4	TEXT4	ALN			
6050	TEXT5	TEXT5	ALN			
6051	TEXT6	TEXT6	ALN			
6052	TEXT7	TEXT7	ALN			
6053	TEXT8	TEXT8	ALN			
6054	TEXT9	TEXT9	ALN			
6055	TEXTA	TEXTA	ALN			
5491	THERM SENS	Thermal Sensors	ALN			
7868	THERMALLY PROTECTED	YES / NO	ALN			
6551	THGHPT DRY S	Throughput Dry Solids	ALN			
6552	THRGHPT FLOW	Throughput Flow	ALN			
6553	TILT RANGE	Tilt Range	ALN			
9050	TIME INSTALLED	Time Installed	ALN			
7866	TIME RATING	CONTINUOUS, 5, 15, 30, 60 MINUTES	ALN			
10552	TIME INSTALLED	TIME INSTALLED	ALN			
6187	TIRE SIZE	TIRE SIZE	ALN			
6056	TITLE	TITLE	ALN			
6240	TOOL TYPE	TOOL TYPE	ALN			
8162	TOOLDESCRIPTION	DESCRIPTION	ALN			
5545	TORQUE	Torque	ALN			
7789	TORQUE SETTING		ALN	IN/LBS		
5885	TOTAL		ALN			
5598	TOTAL HEAD	Total Head	ALN			
5459	TOTAL WEIGHT	WEIGHT	ALN			
5725	TOW TYPE	Tow Type	ALN			
6554	TP LD MX TRV	Top Loaded Max Travel (speed)	ALN			
6555	TRAFFIC PLAN	Traffic Plan Required	ALN		YES/NO	
8800	TRAFFICCOND	Note Traffic Conditions	ALN			
5724	TRAIL WEIGHT	Trailer Weight	ALN	LBS		
6156	TRAIN GEAR	Train Gear	ALN			
6181	TRANS	TRANSMISSION	ALN			
6196	TRANS FILTER	TRANSMISSION FILTER	ALN			
7219	TRANS MAKE	TRANSMISSION MAKE	ALN			
7220	TRANS MODEL	TRANSMISSION MODEL	ALN			
5748	TRANS TYP	Transformer Type	ALN			
5703	TRANS TYPE	Transition Type	ALN			
7218	TRANS TYPE	TRANSMISSION TYPE	ALN			
7802	TRANSFER SWITCH USE	SDS, NON-SDS	ALN			
6625	TRANSFORMER	Transformer	ALN			
7024	TRANSFORMER CONSTRUCTION	AUTO, INDUCTION	ALN			
9750	TRANSFORMER FED BY	TRANSFORMER FED BY	ALN			
9752	TRANSFORMER FEEDS	TRANSFORMER FEEDS	ALN			
9748	TRANSFORMER TYPE (DRY-OIL)	TRANSFORMER TYPE (DRY-OIL)	ALN			
7026	TRANSFORMER TYPE SYSTEM	GROUNDED, NON-GROUNDED	ALN			
6556	TRANSFRM TYP	Transformer Type	ALN		TRANSFORMER TYPE	
7734	TRANSIENT PROTECTION	V FOR 10 US WITH 40 OHM	ALN	VOLTS		
6557	TRANSPORTABL	Transportable	ALN		TRANSPORTABLE	
6558	TREATMENT	Treatment	ALN			
6559	TRFFC PLN NO	Traffic Plan Number	ALN			
5529	TRIP COIL A	tripping coil current	ALN	AMPS		
5526	TRIP DELAY	permissible tripping delay	ALN	SECONDS		
6560	TTL DYN HEAD	Total Dynamic Head	ALN			
7804	TTRANSFER SWITCH USE 2	AUTO, MANUAL	ALN			
6561	TUBING MATL	Tubing Material	ALN			
7902	TURN IN DATE	TURN IN DATE	ALN			
8798	TURNSTO20	Note Number of Turns to Equal 20%	NUMERIC			
9206	TVMSR	TV Measurement	NUMERIC	FT		

9208	TVMSRV	Reason for Camera/TV Footage Variance	ALN			
6562	TYP CHM TR U	Type of Chem Treatment Used	ALN			
6057	TYPE	TYPE	ALN			
7508	TYPE CONSTRUCTION	METAL,SS,WOOD,OTHER	ALN			
6563	TYPE DEVICE	Type of Device	ALN			
6564	TYPE EXT FIN	Type of Exterior Finish	ALN			
7482	TYPE INSTALL	SURFACE,FREE-STAND,FLUSH,SEMI-FLUSH	ALN			
7014	TYPE MOUNT	POLE, PAD, PLATFORM, SUBSTATION, VAULT	ALN			
8220	TYPE OF CONTROL		ALN			
9972	TYPE OF DRAINAGE MANAGEMENT		ALN			
9946	TYPE OF DRAINAGE MANAGEMENT AREA	Type of Drainage Management Area	ALN			
8219	TYPE OF SERVICE		ALN			
7144	TYPE SYSTEM	SEPARATELY OR NON-SEPARATELY DERIVED	ALN			
7146	TYPE USE	REDUNDANT/STANDALONE	ALN			
5862	TYPE.	Type Transformer	ALN		TYPE.	
6565	TYPOFCABINET	Type of Cabinet	ALN			
6566	UNDR-WRTR LB	Under-writer Lab	ALN			
10556	UNIT NUM	Unit Number	ALN			
9912	UNIT_NUMBER	Unit Number	ALN			
9906	UNIT_PROCESS_NUMBER	Unit Process Number	ALN			
5886	UNTANKING		ALN			
5821	UP. INVERT	Upstream Invert of Pipe	ALN			
6567	UPPER URL	Upper URL	ALN			
5501	UPS FED BY	Source (line)	ALN			
7310	USERID	User ID (Entered by IT)	ALN			
6568	USERS	Users	ALN			
5482	V_TYPE	OLD VALVE TYPE?	ALN			
5600	VAC RATING	Vacuum Rating	ALN			
9433	VACUUM BLOWER MFG.	Vacuum Blower Manufacture	ALN			
9434	VACUUM BLOWER MODEL #	Vacuum Blower Model Number	ALN			
9437	VACUUM BLOWER OIL CAPACITY	Vacuum Blower Oil Capacity	NUMERIC	PT		
9436	VACUUM BLOWER OIL TYPE	Vacuum Blower Oil Type	ALN			
9435	VACUUM BLOWER SER #	Vacuum Blower Serial Number	ALN			
6227	VALVE	VALVE	ALN			
6569	VALVE CONN	Valve Connection	ALN		VALVE CONNECTION	
6570	VALVE FUNCTN	Valve Function	ALN			
5597	VALVE NO.	Valve Number	ALN			
6571	VALVE SEAL	Valve Seal	ALN			
6572	VALVE TYPE	Valve Type	ALN		VALVE TYPE	
8796	VALVECONDITION	Note Condition of Valve, Make Minor Repairs	ALN			
6573	VALVES	Valves	ALN			
6574	VAULT ACCESS	Vault Access Type	ALN		VAULT ACCESS	
6575	VAULT LADDER	Vault Ladder Type	ALN		VAULT LADDER TYPE	
6576	VAULT LID TY	Vault Lid Type	ALN		VAULT LID TYPE	
6577	VAULT TYPE	Vault Type	ALN		VAULT TYPE	
6578	VAV BOX	Variable Air Volume (VAV) Box	ALN			
9210	VCMSR	Inspection Measurement	NUMERIC	FT		
9212	VCMSRV	Reason for Video Coding Footage Variance	ALN			
5517	VEH. REPLACE	VEHICLE REPLACED	ALN			
7201	VEHICLE HEIGHT	VEHICLE HEIGHT	ALN			
8722	VEHICLE REPLACE (OLD)	VEHICLE REPLACE (OLD)	ALN			
8502	VEHICLE REQUIREMENT	Specific Vehicle Required Due To Location Restrictions/Capacity	ALN			
6579	VENDOR	Vendor	ALN			
7032	VENTING REQ CLEARANCES		NUMERIC	FT		
8794	VERIFYIDTAG	Verify ID Tag, Secure if not secured	ALN			
5852	VERT. LOAD	Vertical Load Capacity psf	ALN			
6580	VFD TYPE	Variable Frequency Drive Type	ALN		VFD TYPE	
6581	VIBR MONITOR	Has Vibration Monitor Y/N	ALN		YES/NO	
6582	VIDEO CMPRSS	Video Compression	ALN			
6583	VIDEO INPUT	Video Input	ALN			
6584	VIDEO OUTPUT	Video Output	ALN			
6585	VIDEO STRMNG	Video Streaming	ALN			
8792	VISIBLYINSPECT	Visibly Inspect	ALN			
6586	VLT COND ACC	Vault Condition - Access	ALN			
6587	VLT COND OVR	Vault Condition - Overall	ALN			
6588	VLT CONSTRNT	Vault Constraints	ALN			
6589	VLT COVER SZ	Vault Cover Size	ALN			
6590	VLT CVR COMP	Vault Cover Composition	ALN			
6591	VLT LD COND	Vault Lid Condition	ALN			
6592	VLT LD DRAIN	Has Vault Lid Drain	ALN		YES/NO	
6593	VLT LOCK TYP	Vault Lock Type	ALN		VAULT LOCK TYPE	
6594	VLV BODY MAT	Valve Body Material	ALN			
6595	VLV SEAL TYP	Valve Seal Type	ALN			
6596	VLV SEAT MAT	Valve Seat Material	ALN			
6597	VLV STM DMTR	Valve Stem Diameter	ALN			
5582	VLV. END CON	Valve End Connection	ALN			
5575	VLV-CLASS	Valve Class	ALN			
5470	VLV-SIZE	VALVE SIZE	NUMERIC			
5469	VLV-TYPE	VALVE TYPE	ALN			
7162	VOLT	VOLTAGE SYSTEM	ALN			
6598	VOLT 1-PHASE	Voltage Single Phase	ALN			
6599	VOLT 3-PHASE	Voltage Three Phase	ALN			
5657	VOLT RATING	Power Supply Ratings	ALN			
6600	VOLT REGULTN	Voltage Regulation	ALN			
6601	VOLT RNG FCT	Rated Voltage Range Factor	ALN			
7190	VOLT SYST	VOLTAGE SYSTEM	ALN			
6173	VOLTAGE	Voltage	ALN	VOLTS	VOLTS	
6602	VOLTAGE CLSS	Voltage Class	ALN			
9810	VOLTAGE LEVEL	Voltage Level (P, S, T, X)	TABLE			
9072	VOLTAGE LEVEL (P, S, T, X)	VOLTAGE Level (P, S, T, X)	TABLE			
9864	VOLTAGE LEVEL (P/S/T/X)	VOLTAGE LEVEL (P/S/T/X)	ALN			
9182	VOLTAGE RANGE	PT VOLTAGE RANGE	ALN			
5629	VOLTAGE SIZE	Voltage Size	ALN			
7422	VOLTAGE SPEC		ALN			
10554	VOLTAGE LEVEL	Voltage Level (P S T X)	ALN			
7106	VOLTAMPS		ALN			
6058	VOLTS	VOLTS	ALN			
7002	VOLTS PRIMARY		ALN	VOLTS		
7004	VOLTS SECONDARY		ALN	VOLTS		
5830	VOLUME FT3	Volume Cubic Feet	ALN			
5831	VOLUME MGAL	Volume MGAL	ALN			

6200	W/P BELT	W/P BELT NO.	ALN			
5899	WALL COND.	Wall Infiltration or Spalling	ALN			
6603	WALL FIN TYP	Wall Finish Type	ALN			
5532	WARRANTY	warranty date	ALN			
6076	WARRANTY (FR	Warranty (from)	ALN			
6077	WARRANTY (TO	Warranty (to)	ALN			
8846	WATER CONNECTION	Size	NUMERIC			
6604	WATER PRESSR	Water Pressure	ALN			
8842	WATER SUPPLY	GPM	NUMERIC			
5785	WATTAGE	Fixrue wattage	NUMERIC			
7108	WATTS		ALN			
6605	WAVE FORM	Wave Form	ALN			
6606	WEB REQMNTS	Web Browsing Requirements	ALN			
7266	WECC COMPLIANCE	PRC-005, OTHER	ALN			
6059	WEIGH	WEIGH	ALN			
5606	WEIGHT	WEIGHT	ALN	LBS		
7028	WEIGHT DRY		NUMERIC	LB		
7030	WEIGHT FILLED		NUMERIC	LB		
9954	WEIR STRUCTURE	Weir Structure	ALN	Y/N		
6607	WELDER TYPE	Welder Type	ALN		WELDER TYPE	
6182	WHEEL BASE	WHEEL BASE	ALN			
5827	WIDTH	Width in Feet	ALN			
7738	WIEGHT		ALN	LBS		
5741	WIND CONFIG	Winding Configuration	ALN			
10246	WIND DIRECTION	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
5854	WIND LOAD	Wind Load Capacity psf	ALN			
10244	WIND SPEED	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
8344	WIND_DIRECTION	Wind Direction	ALN			
8342	WIND_SPEED	Wind Speed	ALN			
5866	WINDING	Winding	ALN			
9758	WINDING CONFIGURATION (DELTA OR Y)	WINDING CONFIGURATION (DELTA OR Y)	ALN			
7016	WINDING MATERIAL	COPPER, ALUMINUM	ALN			
5889	WINDINGTEMP		ALN			
6608	WINDNG RTD N	Winding RTD Number	ALN			
6609	WINDNG RTD T	Winding RTD Type	ALN			
6610	WINDOW TYPE	Type of Windows	ALN			
5891	WINDTEMPHI	Winding Temp High	ALN			
5536	WIRES	WIRES	ALN			
8062	WO_PKG	Work Order Package/Sequence	ALN			
7320	WONUM	Work Order Number	ALN			
10262	WOOD FUEL	Y/N, MAKE, MODEL, SERIAL NUMBER.	ALN			
6611	WRNTY DLVRY	Warranty Based on Delivery	ALN			
6612	WRNTY INSTL	Warranty Based on Installation	ALN			
6613	WSTMGTCTRTID	Waste Management Contractor ID	ALN			
6614	WTR TRMT TYP	Type of Water Treatment	ALN			
9908	WWE_SYSTEM	WWE System	ALN			
9882	X COORDINATES	X Coordinates	ALN			
6615	XPANSION VLV	Expansion Valves	ALN			
5478	X-STR	CROSS STREET	ALN			
5780	XSTREET	Cross Street Name	ALN			
9884	Y COORDINATES	Y Coordinates	ALN			
5465	YEAR	YEAR MODEL	ALN			
6616	YK BSS DMTR	Yoke Boss Diameter	ALN			
6617	ZIP	Zip	ALN			
6060	ZONE	ZONE	ALN			
6618	ZONE DESC	Zone Description	ALN			
6619	ZONE ID	Zone ID	ALN			
6620	ZONE TYPE	Zone Type	ALN			
6621	ZONING	Zoning	ALN			
6622	ZOOM	Zoom	ALN			

APPENDIX H

WST West Yost Meeting Notes

WST West Yost Meeting Notes		
Criteria	**SubCriteria**	**HHWP Meeting Notes**
Asset Registry	Business Processes for Asset Creation and Modification	Maximo is used. Maintenance Planning Group adds and modifies assets and are the registry owners. QAQC is monitored primarily during asset creation vs updates. No formal program to update the asset registry. Assets are evaluated for completeness as staff resources are available. New projects generate an equipment list (Equipment Data Sheet) that Maintenance Planners import into Maximo. The Equipment Data Sheet is QA/QC'd only about 10%. Initial Maximo registry in 1999 was loosely imported from previous database and had scrubbing, data standards or role/permission-based control.
	Asset Registry	Staff follows the CMMS Business Practices Policy (2011). This policy is being updated. Asset Registry is about 85% complete. ~13000 assets are in the registry and ~3000 to 4000 are not registered. Registry is being updated to add classifications and attributes. Staff is focusing on populating more attributes. Staff want to incorporate more asset identification and loading during the design process.
	Asset Registry Hierarchy	Location is the primary indicator. Currently follow a Facility, Process, Subprocess structure. Not a proper hierarchy but will develop one as part of the registry expansion above.
	Asset Classification Domain	Attributes and Classifications are enterprise-wide. Staff wants to pare the domain down as it is broad. Maximo Best Practices Group governs Maximo.
	Asset Attribute Domain	
	Asset Definition	2008 Policy defines assets as >$5,000 value for Finance purposes. In reality there are assets valued lower in the registry due to criticality. Plan is to tighten the definition and captured asset more. Staff does consider criticality, maintenance needs, run-to-fail, and regulatory requirements in asset selection. Asset Life is not considered. No formal process. Periodic condition assessment activity will identify asset mods and new assets. Input from field staff as to asset accuracy is acted upon and assets are modified accordingly.
	Policy for updating asset registry	
IT capabilities to support AM	List of software tools such as Maximo, GIS, InfoAsset, etc. including version	
	Data Flow Diagram	
	Modules for software tools	
	Discovery Tools	

WST West Yost Meeting Notes		
Criteria	SubCriteria	HHWP Meeting Notes
	Mobile connectivity Platform	
	IT Staffing dedicated to Asset Management Systems	
	Infrastructure replacement and refresh policy	
	IT budget for asset management hardware and software support.	
	LAN/WAN Platforms (diagram/map)	
	Patch Management Plan	
Risk procedures	Security Plan - Public/Private access, Firewall	No formal risk policy. No risk rating for assets. Work order priority is based on work type and institutional knowledge and not formal related risk. Staff does formal planning of work using collaboration and institutional knowledge. No formal Risk Program but priority is discussed. Monthly meetings (East Bay and West Bay) to prioritize work.
	Risk Policy	
	Business Process for Criticality Assessment	Criticality is evaluated at the Facility/Process level during bi-annual budgeting.
	Description of Risk management tools currently in use	
O&M improvement	Risk Register	Some assets are flagged as critical in Maximo (ad hoc). Not a formal process but during CIP planning staff uses a 123 priority scale.
	Criticality criteria and definitions	
	Maintenance Management	PM and PdM programs follow manufacturer specifications and institutional knowledge. PM's are run-time and calendar based as well as regulatory based. Regulatory related PM's are given high priority.

WST West Yost Meeting Notes		
Criteria	SubCriteria	HHWP Meeting Notes
		SCADA is not integrated so run-time and other asset relate data are manually loaded into Maximo and scheduled.
	Maintenance Management	
	Maintenance Management	Maintenance Planners set up PM's in Maximo. The CMMS Business Practices Policy includes a 9-level priority hierarchy, classifies work type (Corrective, Preventative, Administrative, Operations and Project), role-based responsibilities, backlog management, and work order status'. Work is manually planned and scheduled. Backlog is managed by maintenance supervisors. Planners and Managers can change status. Maximo workflow is not used. Reporting is used to identify follow-on or corrective work and modify maintenance plans.
Condition Assessment and Remaining Useful Life (RUL)	Maintenance Management	Asset performance data is used more for life cycle management. Line staff use institutional knowledge for decision-making. Would like a more data-centric approach. PdM is only Vibration Analysis currently. Actuals are not readily collected. LINEAR ASSETS 20-year rolling outlook that has waned slightly in past 10-years. Tunnels - 20 years Steel pipe - 10 years PCCP - 5 years visual and electromagnetic analysis PUC has developed its own electromagnetic condition assessment. PUC performs some pipe lining repairs in-house and other work is with contractors. Sunol facility has a plate rolling facility for repairing PCCP. Good emergency preparedness with a lot of pipe stockpiled around the service area. VERTICAL ASSETS Periodic asset walkdowns WSIP renewed a lot of infrastructure. Older facilities are ad hoc. Last condition assessment was in 2009.
	Work Management	
	Work Management	
	Business Process for Condition Assessment	
	Condition criteria and definitions	LINEAR ASSETS Typically based on visual inspection and sounding. Doing some leak detection using acoustic listening. Inspections scheduled by age and material. VERTICAL ASSETS Typically vibration and visual inspection Horizontal Assets based on asset age and condition. Vertical Assets are based on age Staff recognizes they are not where they want to be on replacement planning and want a more robust methodology. New CMMS policy will develop a more analytical procedure.
	Remaining Useful Life (RUL)	
	Policy for updating RUL	Vertical assets are evaluated bi-annually during CIP planning Horizontal assets are evaluated during the periodic 5, 10 or 20-year cycle.

WST West Yost Meeting Notes		
Criteria	SubCriteria	HHWP Meeting Notes
	Condition Assessment Register	Asset condition is not noted in the asset registry in Maximo. Condition is documented in separate reports of memoranda.
Replacement Planning Service Level goals	Rehabilitation and Replacement Planning	
	Rehabilitation and Replacement Funding	R/R funding is maintained in different funds by facility. Funding is from rates. No policy is in place for fund expenditures.
	Rehabilitation and Replacement Expenditure Policy	
	Service Level definitions for asset management	LOS is not measured or maintained at the asset level.
Connection to other plans ie: Strategic Plan, CIP, etc	Capital Improvement Plan	1. Quantifiable Operational and Capital LOS goals by enterprise is a Commission-level objective. Not defined yet 2. There is no formalized approach to asset management other than to use Maximo. There is a culture of collaboration which does support asset management. 3. Prioritization is done during the CIP process but no uniform prioritization guidelines. 4. Currently conducting an RRA. Good emergency mutual aid through Cal WARN.
Supply Chain	Business Process and Policy for Supply Chain	Maximo is used for PR/PO. Initiates in Maximo and then approved in PeopleSoft (financial). Maximo used for warehouse management. Receiving is done in Maximo.
	Item Master Export	Warehouse not used for asset parts. Mostly consumables. Spare parts are at facilities and are not managed as part of inventory control. Tools are managed in Maximo and are issued to work orders.
	Warehouse Management	Central Receiving warehouse is in Millbrae. Other storerooms are not in Maximo.
	Warehouse Management	Materials reservations are not performed. Work order parts are ordered directly for the work order or from informal parts storage described above.
	Warehouse Management	
	Warehouse Management	Staff conducts annual physical inventory. Losses are documented. No cycle counting.
Staff Plan	Staff matrix and job description	Engineering Two mechanical engineers and one electrical engineer support troubleshooting.

WST West Yost Meeting Notes		
Criteria	SubCriteria	HHWP Meeting Notes
		Dam Management/ROW Management/USA and GIS. Maintenance Maintenance Staff are all certified Operators. One Maintenance Manager, Three Maintenance Planners No Warehouse Management Electricians and Technicians. Operations Stationary Engineers

APPENDIX I

WST Asset Classification and Hierarchy Index

Water Supply & Treatment Division
Interoffice Memorandum

To: David A. Briggs

From: Kent Nelson

Date: April 2, 2010

Subject: Asset Classification Index

PURPOSE

The primary purpose of this memorandum is to summarize the classification of assets applied to the Computerized Maintenance Management System (CMMS) database. Asset classification at the CMMS level must also be consistent with capital project planning (and its corresponding budgeting) and the fixed-asset database which is used for a variety of financial functions. Therefore, a secondary purpose of this memorandum is to demonstrate the use of a consistent asset classification system for all SFPUC functions.

DISCUSSION

All assets in the Regional Water System are included in one of five general classes: transmission, storage, treatment, buildings and watersheds, and equipment (see Figure 1). Below this level of general classification, assets are individually identified, generally as stand-alone distinct facilities, such as Harry Tracy Water Treatment Plant, etc.. Assets are given unique identification numbers and tracked in the Fixed Asset Accounting System (FAACS). Assets are entered into FAACS by Finance Department staff following capital project close-out by Infrastructure Division staff. FAACS is used to compute the present value of assets net of depreciation, which is usually assumed to be linearly projected over a length of time unique to each class of asset (for example, 50 years for a pump station, 75 years for a pipeline, etc.).

There are roughly 150 individual assets in the RWS, not including individual rolling stock and other large operating equipment.

The CMMS system operates at a level immediately below FAACS picking up all of the related equipment and components that are maintained to support a given asset. There are thousands of pieces of equipment and components in the CMMS. The CMMS houses data related to equipment (and therefore, asset) condition, performance history, expenditures on maintenance, and types of maintenance performed.

Condition assessment and performance data are an important linkage between data in the CMMS and data in FAACS; that is, when investments are made in preventative maintenance, the assumed depreciation in FAACS would ideally be modified.

A consistent index system is presently being developed between the capital planning, FAACS, and CMMS so that the capital project management, financial accounting, and long-term maintenance functions for an asset can be consistently referenced. Within the CMMS, all assets are systematically named using unique twelve-digit alpha-numeric codes in the following format:

XXX-YYY-ZZZ-###

where:

XXX = Facility Location Code,

YYY = Process Code,

ZZZ = Equipment Type Code, and

= Identification Number

Tables 1, 2 and 3 define MAXIMO each Facility Location, Process and Equipment Type Codes, respectively, used in this process. Table 1 also summarizes the facility type of each asset that corresponds to the asset hierarchy established for the regional water system.

Figure 1: Asset Hierarchy for Regional Water System

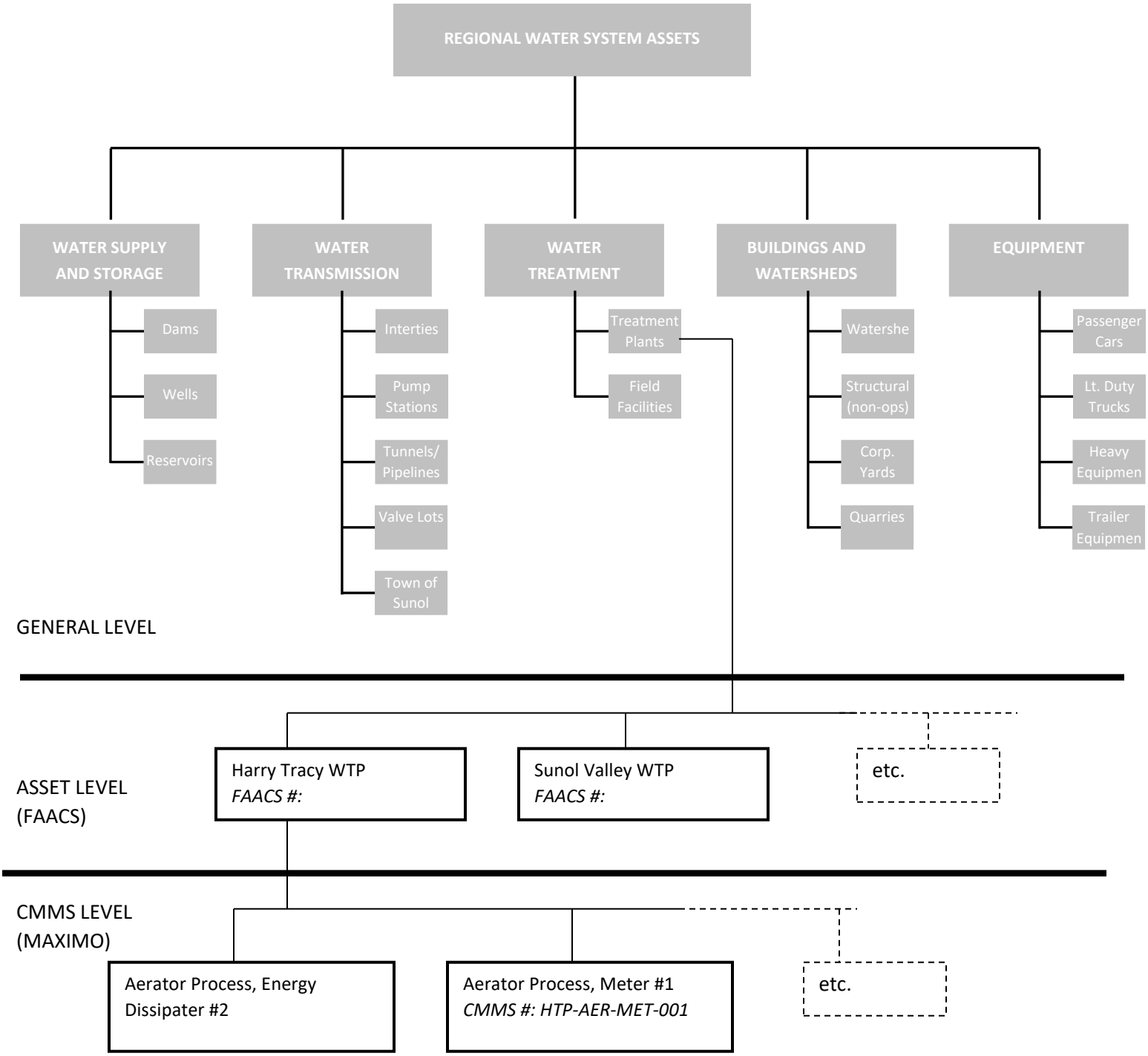


Table 1: MAXIMO Facility Location Codes

Facility Name	Location Code	Asset Type
Millbrae Yard	MBR	Corporation Yard
Sunol Yard	SYD	Corporation Yard
Alameda Creek Diversion Dam	ACD	Dam
Calaveras Dam	CLD	Dam
Crystal Springs Dam	CSD	Dam
Pilarcitos Dam	PLD	Dam
San Mateo Creek Dam No. 1 (Mud Dam No. 1)	SD1	Dam
San Mateo Creek Dam No. 2 (Mud Dam No. 2)	SD2	Dam
San Andreas Dam	SND	Dam
Stone Dam	STD	Dam
Turner Dam	TRD	Dam
EBMUD Intertie	EBI	Intertie
SCVWD Intertie	SCI	Intertie
Casey Quarry	CSQ	Quarry
East Bay Wells	EBW	Well
Mount Allison Radio Station	MAL	Structure (non op)
Sawyer Ridge Radio Station	SAW	Structure (non op)
Skyline Quarry	SKY	Quarry
Town of Sunol Distribution System	SUN	Town of Sunol
Baden Pump Station	BPS	Pump Station
Crystal Springs Pump Station	CPS	Pump Station
Pulgas Pump Station	PPS	Pump Station
San Antonio Pump Station	SPS	Pump Station
Calaveras Reservoir	CAR	Reservoir
Castlewood Reservoir	CWR	Reservoir
Lower Crystal Springs Reservoir	LCR	Reservoir
Niles Reservoir	NIL	Reservoir
Pulgas Balancing Reservoir	PBR	Reservoir
Pilarcitos Reservoir	PIL	Reservoir
San Andreas Reservoir	SAN	Reservoir
San Antonio Reservoir	SAT	Reservoir
Upper Crystal Springs Reservoir	UCR	Reservoir
Harry Tracy Water Treatment Plant	HTT	Treatment Plant
Lawrence Livermore Lab Site 300 Treatment Facility	LAW	Field Facility
Pulgas Dechloramination Facility	PDF	Field Facility
San Antonio Dechloramination Facility	SDF	Field Facility
Sunol Valley Chloramination Facility	SVC	Field Facility
Sunol Valley Water Treatment Plant	SVP	Treatment Plant
Tesla Treatment Facility	TES	Field Facility
Thomas Shaft	TSH	Field Facility
Alameda East Portal	AEP	Tunnel/Pipeline
Alameda West Portal	AWP	Tunnel/Pipeline
Alameda Siphon No. 1	AS1	Tunnel/Pipeline

Facility Name	Location Code	Facility Type
Alameda Siphon No. 2	AS2	Tunnel/Pipeline
Alameda Siphon No. 3	AS3	Tunnel/Pipeline
Alameda Siphon No. 4	AS4	Tunnel/Pipeline
Bay Division Pipeline No. 2	BD2	Tunnel/Pipeline
Bay Division Pipeline No. 3	BD3	Tunnel/Pipeline
Bay Division Pipeline No. 4	BD4	Tunnel/Pipeline
Bay Division Pipeline No. 5	BD5	Tunnel/Pipeline
Bay Division Pipeline No. 1	BD1	Tunnel/Pipeline
Calaveras Pipeline	CAL	Tunnel/Pipeline
Crystal Springs Bypass Tunnel No. 1 (old)	CB1	Tunnel/Pipeline
Crystal Springs Bypass Tunnel No. 2 (new)	CB2	Tunnel/Pipeline
Crystal Springs Pipeline No. 1	CS1	Tunnel/Pipeline
Crystal Springs Pipeline No. 2	CS2	Tunnel/Pipeline
Crystal Springs Pipeline No. 3	CS3	Tunnel/Pipeline
Crystal Springs-San Andreas Pipeline	CSA	Tunnel/Pipeline
Irvington Portal	IVP	Tunnel/Pipeline
Irvington Tunnel No. 1 (old)	IT1	Tunnel/Pipeline
Irvington Tunnel No. 2 (new)	IT2	Tunnel/Pipeline
Palo Alto Pipeline	PAP	Tunnel/Pipeline
Pulgas Tunnel	PGT	Tunnel/Pipeline
Pleasanton Wells Pipeline	PWL	Tunnel/Pipeline
San Andreas Pipeline No. 2	SA2	Tunnel/Pipeline
San Andreas Pipeline No. 3	SA3	Tunnel/Pipeline
San Andreas Pipeline No. 1	SA1	Tunnel/Pipeline
Stone Dam Tunnel	SDT	Tunnel/Pipeline
San Antonio Pipeline	SPL	Tunnel/Pipeline
Sunset Branch Pipeline	SSB	Tunnel/Pipeline
Sunset Supply Pipeline	SSP	Tunnel/Pipeline
San Mateo Tunnel No. 1	ST1	Tunnel/Pipeline
San Mateo Tunnel No. 2	ST2	Tunnel/Pipeline
Stanford Tunnel	STT	Tunnel/Pipeline
Baden Valve Lot	BAV	Valve Lot
Barron Creek Valve Lot	BCV	Valve Lot
Bear Gulch Valve Lot	BGV	Valve Lot
Bellevue & Pepper Valve Lot	BPV	Valve Lot
Caisson	CAI	Valve Lot
Crystal Springs/El Cerrito Valve Lot	CEV	Valve Lot
Calaveras Valve Lot	CLV	Valve Lot
Capuchino Valve Lot	CPV	Valve Lot
Crawford Valve Lot	CRV	Valve Lot
Dumbarton Valve Lot	DBV	Valve Lot
El Camino Real/Bellview Valve Lot	EBV	Valve Lot
El Camino Real/Millbrae Yard Valve Lot	EMV	Valve Lot
Edgewood Road Valve Lot	ERV	Valve Lot
Guadalupe Valve Lot	GDV	Valve Lot

Facility Name	Location Code	Facility Type
Geneva Valve Lot	GNV	Valve Lot
Grimmer Shutoff Station	GRV	Valve Lot
Hillsborough Valve Lot	HBV	Valve Lot
Mission and Palm Avenue Valve Lot	MPV	Valve Lot
Mountain View/Alviso (Mary)Valve Lot	MAV	Valve Lot
Newark Valve Lot	NKV	Valve Lot
Newark Tunnel Shaft	NWT	Valve Lot
Pulgas Valve Lot	PLV	Valve Lot
Polhemus Valve Lot	PHV	Valve Lot
Paseo Padre Shutoff Station	PPV	Valve Lot
Ravenswood Valve Lot	RAV	Valve Lot
Redwood City Valve Lot	RCV	Valve Lot
Ravenswood Tunnel Shaft	RVT	Valve Lot
Sneath Lane Valve Lot	SNE	Valve Lot
San Pedro Valve Lot	SPV	Valve Lot
Southwest Corner Valve Lot (Stanford Tunnel)	SWV	Valve Lot
Taylor Field Valve Lot	TFV	Valve Lot
Tissiack Valve Lot	TSV	Valve Lot
West Valve House (Stanford Tunnel)	WSV	Valve Lot

Table 2: MAXIMO Process Codes

Process Name	Process Code
Aerator	AER
Aftercooler	AFC
Air Scour	ARS
Aluminum Sulfate	ALS
Anionic	ANI
Aqua Ammonia	AQA
Bypass Connection	BYP
Calcium Thiosulfate	CTS
Carbon Dioxide	CAD
Cationic Polymer	CAT
Chloramination	CHL
Cooling Water	COW
Cross connection	CRC
Dessicant	DES
Domestic Hot Water	DHW
Drainage and Conveyance	DRA
Effluent	EFF
Electrical Power	ELP
Ferric Chloride	FEC
FILTER	FIL

Process Name	Process Code
Filter Aid	FIA
Filter Backwash	FBW
Filtered Water	FIW
Fire Protection	FIP
Flash Mix	FLM
Floccculation	FLO
Fluoride	FLU
HVAC	HVC
Influent	INF
Instrument Air Supply	IAS
Irrigation	IRR
Liquid Oxygen	LOX
Natural Gas	NAT
No Process	***
Non Anionic	NOA
Oxygen	OXY
Ozone Contactor	OZC
Ozone Destruct	OZD
Ozone Generate	OZG
Ozone Process	OZO
Parcel	PAR
Polymer	POL
Potassium Permanganate	POP
Pump Station	PSN
Raw Water	RAW
Refrigerated Process Components	REF
Residuals Thickening & Dewatering	RTD
Road	RDS
Safety	SAF
Sedimentation	SED
Service Connection	SRV
Sludge	SLU
Sodium Bisulfite	SOB
Sodium Hydroxide	SHY
Sodium Hypochlorite	SOH
Structure	STR
Tools	TOL
Transmission Pipeline	TPL
Treated Water-Potable	TWP
Utility Gas Supply	UGS
Utility Water Supply	UWS
Valve Lot	VLO
Wash Water	WAW
Well	WEL

Table 3: MAXIMO Equipment Type Codes

Equipment Type	Equipment Code
Accumulator; Air, Water & Chemical	ACC
Actuator; Electric & Hydraulic	ACT
Adit Structure	ADT
After Cooler	AFC
Air Conditioner	AIR
Air Reciever	ARC
Air Release Valve	ARV
Air Separator	ASP
Air Vaccum Valve	AVV
Analysis Element	AEX
Analysis Indicating Device	AIX
Analyzing Indicating Transmitter	AIT
Automatic Transfer Switch	ATS
Back Flow Preventer	BFP
Back Pressure Valve	BPV
Basin; Flocculation & Sedimentation	BAS
Battery Charger	BAC
Battery Pack and Modules	BAT
Blow off	BOV
Blower	BLO
Boathouse	BOT
Boiler	BOL
Building; Constructed, Modular and Pre-fabricated	BLD
Calibration Column	CAC
Capacitor	CAP
Cathodic Protection Components	CTP
Check Valve	CHV
Chemical; Generated Related System Components	CHE
Circuit Breaker	CBK
Clearwell	CLW
Closed Circuit Television System	CCT
Collectors	COL
Compressor; Air, Natural Gas & Refrigerant	COM
Control Panel; Main & Local	CPA
Cottage	COT
Crane	CRN
Dam	DAM
Datalogger	DAL
Destruct Unit; Ozone & other Process Byproducts	DES
Dewatering Units; Screw & Centrifuge	DWR
Disconnect Switch - Electrical	DSS
Distributed Control System	DCS
Dryer; Air, Dessicant & Refrigerant	DRY
Eductor	EDU

Equipment Type	Equipment Code
Electrical Distribution Panel	EDP
Electrical Pull Box	PBX
Electrical; General Related System Components	ELC
Emergency Light	EML
Emergency Standby Generator	ESG
Eyewash & Safety Shower Safety Station	EYE
Eyewash Station	EWS
Fan; Ventilation	FAN
Feeder - Chemical Treatment	FED
Filter Control Console	FCC
Filter; Dual Bed, Mixed Media & Sand	FIL
Fire Extinguisher	FRX
Fire Protection System Components	FIR
Flocculator	FLC
Flow Control Valve	FCV
Flow Indicating Controller	FIC
Flow Indicating Device	FIX
Flow Measuring Element	FEX
Flow Rate Indicating Transmitter	FIT
Fuel Polishing System & Components	FPS
Fuel System & Components; Natural Gas	FUL
Garage	GAR
Gate	GAT
Gate; for Facility Security	SEG
Gate; Sluice & Slide	GAT
Gauge	GAU
Gear Box; Valve Operator	GBX
General Laboratory & Field Analyzing Instruments	INS
Generator; Ozone & Portable Units	GEN
Harmonic Filter	HRF
Heat Exchanger	HEX
Heater	HTR
Heating Element	HEE
Hopper	HOP
Hydraulic Systems & Components	HYD
Injector	INJ
Input & Output PLC Modules	IOM
Input & Output PLC Panels & Cabinets	IOP
Instrument	INS
Instrument Pull Box	IPB
Inverter; Power	INV
Isolation Diaphragm	ISO
Lagoon	LAG
Level Control Valve	LCV
Level Indicating Controller	LIC
Level Indicating Transmitter	LIT

Equipment Type	Equipment Code
Level Measuring Element	LEX
Level Switch	LSW
Lighting Distribution Panel	LDP
Manhole; Electrical & Inspection	MHO
Manual Transfer Switch	MTS
Meter	MET
Miscellaneous Equipment - General	MIS
Mixer	MIX
Motor	MOT
Motor Control Circuit	MCC
Networks; WAN & LAN & Related Switching Components & Hubs	NET
No Equipment	***
Panel; General Use	PNL
Personal Desktop Computer & Peripheral Components	PCP
Pipeline; Raw & Treated Water	WPL
Position Control Valve	ZCV
Position Indicating Controller	ZIC
Position Indicating Device	ZIX
Position Indicating Transmitter	ZIT
Power	POW
Power Indicating Device	JIX
Power Indicating Transmitter	JIT
Power Supply Units	PSU
Pressure Control Valve	PCV
Pressure Differential Indicating Controller	PDC
Pressure Differential Indicating Transmitter	PDT
Pressure Indicating Controller	PIC
Pressure Indicating Device	PIX
Pressure Indicating Transmitter	PIT
Pressure Measuring Element	PEX
Pressure Regulator	PRE
Pressure Relief Valve	PRV
Pressure Switch	PSW
Programmable Logic Controller	PLC
Pulsation Dampener	PLD
Pump; All types	PMP
Radio; Communication System and Components	RAD
Recovery Pond	RPD
Rectifier	RCT
Relay; Electrical All Functions	REL
Remote Terminal Unit	RTU
Reservoir	RES
Right of Way	ROW
Safety Related Equipment & Devices	SAF

Equipment Type	Equipment Code
Safety Shower	SHO
Scraper	SCR
Seismic Control Unit	SCU
Seismic Control Valve	SCV
Self-Contained Breathing Apparatus	SBA
Service Connection	SCN
Shed	SHD
Solenoid	SOL
Spare	SPR
Speed Indicating Controller	SIC
Speed Indicating Device	SIX
Speed Indicating Transmitter	SIT
Speed Switch	SSW
Strainer	STR
Streaming Current Monitor	SCM
Substation	SUB
Supervisory Control and Data Acquisition	SCA
Switch Board	SWB
Switch; Mechanical & Electrical	SWT
Switchgear	SWG
System	SYS
Tank; Water, Oil & Chemical	TNK
Telephone	TEL
Temperature Control Valve	TCV
Temperature Indicating Controller	TIC
Temperature Indicating Device	TIX
Temperature Indicating Transmitter	TIT
Temperature Measuring Element	TEX
Temperature Switch	TSW
Transformer	TRF
Transient Voltage Surge Suppressor	TRN
Treated Water Reservoir	TWR
Tunnel; Access & Pipeline	TUN
Ultrasonic Level Sensor	ULS
Uninterruptable Power Supply	UPS
Valve	VAL
Valve House	VHS
Vaporizer	VAP
Variable Frequency Drive Unit	VFD
Vault Structure; Pipeline & Access	VLT
Vibration Indicating Device	VIX
Vibration Indicating Transmitter	VIT
Voltage Indicating Transmitter	EIT
Voltage Surge System	VSS
Water	WTR

All existing assets in MAXIMO are now being converted into the new format. This effort is scheduled to be completed by April 1, 2010 and will require additional support for the SFPUC ITS group. Once completed, equipment identification tags using this new format will be created and installed by staff on each piece of equipment.

KRN

APPENDIX J

WST CMMS Business Practices Policy

Procedure Approval							
Author:	krnelson	Date:	10/5/11	Revision #:	01	Date:	
Approved By:		Date:		Supercedes:	7/1/09 original		
Approved By:		Date:					

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San Francisco Public Utilities Commission

Water Supply & Treatment Division

Policies & Procedures

CMMS BUSINESS PRACTICES

Table of Contents

Scope

1.0 Scope:

1.1 These procedures establish the maintenance business practices using the Division's Computerized Maintenance Management System (MAXIMO). This policy shall apply to all maintenance of the regional water system managed by Water Supply and Treatment Division.

Objective

2.0 Objective:

2.1 The objective of these procedures is to document and specify maintenance workflow from inception and input into MAXIMO through final completion and close-out in MAXIMO, and to define common terminology and levels of responsibility for standardization across the Division.

2.2 These procedures are part of a broader effort to reduce unplanned outages, reduce life cycle costs, increase the efficacy and efficiency in tracking work, and provide a higher level of fiscal management and oversight.

Key Definitions

3.0 Key Definitions:

3.1 **Blanket Work Order:** Blanket work orders cover only two types of work: 1) general tasks to be completed at a treatment facility by SYSOPS staff only; and 2) indirect administrative work for supervisors. Blanket work orders are established at the beginning of each fiscal year and after preliminary review, are immediately approved. All blanket work orders remain open throughout the fiscal year but are closed at the end of each fiscal year.

3.2 **Child Work Order:** The lower of two levels of work orders. Child work orders are usually assigned to an individual task or trade working on a larger project under a parent work order. Each child work order can be planned and scheduled individually. Estimated vs. actual costs are accrued by each child work order and then rolled up into the parent

work order. Child work orders of child work orders (grandchild WOs) are not allowed.

3.3 **CIP:** Capital Improvement Program. This program is used to plan expenditures on future capital projects over a specified time period and includes both R&R and the FMF.

3.4 **CMMS:** Computerized Maintenance Management System (e.g. MAXIMO)

3.5 **Corrective Maintenance (CM):** This work type is for any unforeseen equipment trouble or failure that is discovered by field observations/condition assessment or by SCADA alarms. Corrective maintenance can be considered either expected or unexpected work.

3.6 **DTIS:** Department of Telecommunications and Information Systems

3.7 **Expected Work:** Any work taken on a proactive basis that has been pre-scheduled, i.e. any corrective maintenance work order having a priority code of "5 – High", "2 – Normal", or "1 – Low". All expected work requires a job plan.

3.8 **FMF:** Facilities Maintenance Fund. Requires a Project Request Form.

3.9 **Index Code/GL Account:** A number assigned to a work request or work order used to categorize the work by funding source. Operating funds are assigned an index code starting with "4", capital funds (R&R and FMF) are assigned an index code starting with "5", and WSIP funds are assigned an index code starting with "7".

3.10 **Indirect Administrative Work (AD):** This work type is for any indirect charges due to administrative activities such as comp eTime entries, training, Maximo data entry, estimating job plans, purchasing, etc.

3.11 **Job Plans:** Plans that detail the tasks, estimated labor hours, materials, tools, services and JOC labor required to perform a job.

3.12 **JOC:** Job Order Contract

3.13 **KPI:** Key Performance Indicator

3.14 **MAXIMO:** A computerized maintenance work management and asset tracking system. It is used primarily as a management tool to track labor and material charges against equipment/assets, collect historical data for trending analysis, plan and schedule work, and forecast future resource requirements.

3.15 **NRD:** Natural Resources Division

3.16 **O&M:** Operations and Maintenance

3.17 **OPS:** This work type is for any work directly supporting operations, but not maintenance-related work.

3.18 **Parent Work Order:** The higher of two levels of work orders. Parent work orders are usually assigned to an overall project with one or more

child work orders under the parent work order assigned to various tasks or trades required for the project.

3.19 **Preventive Maintenance (PM):** This work type is for any work that is interval based. Besides traditional preventive maintenance, PMs in MAXIMO include but are not limited to compliance items, diagnostic testing, overhauls, renewals of licenses, and scheduled inspections. Preventive maintenance is by definition expected work.

3.20 **R&R:** Repair and Replacement.

3.21 **ROW:** Right-of-Way

3.22 **SFPUC:** San Francisco Public Utilities Commission

3.23 **SOP:** Standard Operating Procedure

3.24 **Sub Object Code:** An additional number assigned to an index code used to categorize the type of expenditure within the specified funding source.

3.25 **SYSOPS:** System Operations

3.26 **Unexpected Work:** Any work taken on a reactive basis that has not been pre-scheduled, i.e. any work order having a priority code of "9 – Emergency", or "8- Failure". All unexpected work shall be CM type and does not require a job plan.

3.27 **Work Order (WO):** This document specifies a task to be completed against a specific piece of equipment/asset or facility and can be created in MAXIMO's work order tracking screen or generated as a result of a preventive maintenance action becoming due. Applicable status codes for all Water Supply and Treatment work orders are as follows:

- **Waiting for approval (WAPPR):** The initial status of a work order when it is created. This is a work order awaiting review by Crew Supervisors to enter a job plan and material estimates.
- **Approval pending more info (PAPPR):** This is the status of a work order where after review by maintenance planning staff, additional information is required from the initiator.
- **In Queue (QUEUE):** This is the status of a work order that has been reviewed and approved by the O&M Manager.
- **Approved (APPR):** This is the status of a work order that is placed on the weekly work load schedule and priority "8" & "9" WOs that have O & M Manager approval.
- **In progress (INPRG):** This is the status of a work order in progress after materials have been received.
- **Waiting for material (WMATL):** This status code is used when insufficient parts or material are available to continue with a work

order that was previously “QUEUE”,”APPR”, or “INPRG”.

- **Waiting for labor (WLABR):** This status code is used when insufficient crews are available to continue with a work order that was previously ”QUEUE”, “APPR”, or “INPRG”.

- **Waiting for plant conditions (WPCOND):** This status code is used when operating constraints at a water treatment facility (treatment plant or field treatment facility) prevent continuing a work order that was previously “APPR” or “INPRG”. This status code is to be used on work orders at water treatment facilities only.

- **Completed (COMP):** Work is finished, but charges may still be outstanding against this work order.

- **Missed PM (MISSEDPM):** This status code is used for preventive maintenance generated WOs that were not performed due to projects, out of service assets, or staffing issues.

- **Closed (CLOSE):** The status code is used to archive a work order after all costs have been recorded against it.

- **Canceled (CAN):** This status code is used to archive a work order that is no longer needed or created by mistake.

3.28 **WQD:** Water Quality Division

3.29 **WSIP:** Water System Improvement Program

3.30 **WSTD:** Water Supply and Treatment Division

Procedure

4.0 Procedure:

4.1 A WO is required for all labor charges and purchases, including any and all emergency work, contracted labor and/or materials.

4.2 Work Order Initial Processing

4.2.1. It is the WOs requestor/initiator’s responsibility to ensure the WO contains all pertinent information, including but not limited to the following.

4.2.2. Enter the appropriate priority code from the pull-down menu:

4.2.2.1. Priority Code 9 – Emergency. This is any work for a situation in which an unscheduled shutdown or failure of critical equipment has occurred or in which an imminent threat to the environment or personal health and safety exists. Work is imperative and cannot be formally planned or scheduled, but it will be given all resources that can be effectively utilized. Overtime is generally approved for work in this priority code. Section or Division Manager approval is required for WOs

using this priority code.

4.2.2.2. Priority Code 8 – Failure. This is work in which an unscheduled shutdown, operation, or failure of equipment has occurred and work requires immediate action. Resources may be directed off schedule. Overtime is generally not approved for work in this priority code. O&M Section or Division Manager approval is required for WOs using this priority code.

4.2.2.3. Priority Code 6 – Regulatory PM. This is mandated maintenance, inspection activities, or testing that is required by a regulatory agency. Examples of this type of work might include DOT vehicle inspections, CMV smog testing, ROW vegetation clearing, dam inspections, etc.

4.2.2.4. Priority Code 5 – High. This is work that if not performed will likely result in system failure or produce safety and/or environmental concerns. This includes safety related work on critical equipment or "project" work related to a scheduled shutdown.

4.2.2.5. Priority Code 4 – PM. This is normal preventive maintenance inspection and testing.

4.2.2.6. Priority Code 2 – Normal. This is work that is non-critical or reoccurring that enhances system reliability and/or efficiency.

4.2.2.7. Priority Code 1 – Low. This is work not directly related to system reliability and/or efficiency and not safety related.

4.2.3. Enter the appropriate Work Type code from the pull-down menu:

4.2.3.1. CM (Corrective Maintenance)

4.2.3.2. PM (Preventive Maintenance)

4.2.3.3. AD (Indirect Administrative Work)

- This work type is used for blanket WOs established for training and supervisor responsibilities.

4.2.3.4. OPS (Operations)

- This work type is used for blanket WOs established for general tasks to be completed at a treatment facility by SYSOPS staff only.

4.2.3.5. PROJECT

- This work type is used for CIP funded WOs. A classification of NW (New Construction NOT WSIP) or WSIP (Work Supporting WSIP) must also be used with this work type.

4.2.4. Enter a short description of the problem in the description area. In the long description field the requestor should give as much detail as possible to assist the crew supervisor in entering the job plan,

and determining the appropriate action.

4.2.5. Enter the appropriate equipment/asset number (if applicable).

4.2.6. Enter the location code where the work is to be performed. Identify location code from the drop-down menu.

4.2.7. Enter the work requestor's name in the "Reported By" window. Enter first letter of first name followed by full last name, no spaces.

4.2.8. Enter the work requestor's work phone number in the "Work Phone" window.

4.2.9. Enter the appropriate Index Code and Sub Object Code from the pull-down menu in the "GL Account" window.

4.2.10. Under the "Failure Class" window, indicate failure class and problem code from the applicable pull-down menus. If repairing a meter, also indicate the meter reading.

4.2.11. If a WO is a follow-up from a previous WO, indicate the originating WO number in the originating record window.

4.2.12. If a WO is a child WO, indicate the parent WO number in the Parent WO window.

4.3 WSTD Supervisor Responsibilities

4.3.1. Initiate work orders.

4.3.2. Under the "Plans" tab, enter a job plan (required), which specifies how, what, and who is needed to perform the work. Include labor estimates for each task, material and tools required, account for total travel time and a task for field safety tailgate meetings if required. Enter safety plans if applicable.

4.3.3. Determine if engineering review is required prior to starting the work for each WO.

4.3.4. Obtain quotes for materials and supplies and submit quotes to admin staff to create purchase requisitions.

4.3.5. Schedule daily work for individual crews on a weekly work load schedule and send list to the maintenance planning staff. When the actual work is initiated, contact maintenance planning staff to change status code of WO from "QUEUE" or "WMATL" to "APPR" or "INPRG".

4.3.6. Oversee work being performed and document a detailed description of the work performed using the Summary and Details window in the "Log" tab on a daily basis.

4.3.7. Keep current with applicable safety rules and regulations.

4.3.8. Initiate follow-up WOs for any additional work required based on feedback from an original call out WO or preventive maintenance inspection.

4.3.9. Accurately report labor hours for each work order into eTime on a daily basis.

4.3.10. Coordinate with maintenance planning staff if insufficient parts or material are available to continue with a WO that was previously "QUEUE", "APPR" or "INPRG". Maintenance planning staff shall then change the status code to "WMATL". Coordinate with maintenance planning staff when sufficient parts or material become available to continue with a WO that was previously "WMATL". Maintenance planning staff shall then change the status code to "INPRG".

4.3.11. Coordinate with maintenance planning staff if insufficient labor is available to continue with a WO that was previously "APPR" or "INPRG". Maintenance planning staff shall then change the status code to "WLABR". Coordinate with maintenance planning staff when sufficient labor becomes available to continue with a WO that was previously "WLABR". Maintenance planning staff shall then change the status code to "APPR" or "INPRG".

4.3.12. Coordinate with maintenance planning staff if operating constraints at a water treatment facility (treatment plant or field treatment facility) prevent continuing with a WO that was previously "APPR" or "INPRG". Maintenance planning staff shall then change the status code to "WPCOND". Coordinate with maintenance planning staff when operating constraints at a water treatment facility are lifted to allow a WO to continue that was previously "WPCOND". Maintenance planning staff shall then change the status code to "APPR" or "INPRG".

4.3.13. At the beginning of each fiscal year, create work orders for all carry over work, create two new blanket WOs having a work type of "AD". All job planning, eTime entry, preparation, approvals, and other administrative work shall be charged against the first blanket WO. All training shall be charged against the second blanket WO. Provide maintenance planning staff with a list of all carryover work. Coordinate with planners and any work involving other crafts.

4.3.14. Perform related duties as assigned by the O&M or Division Manager.

4.4 WO Backlog Tracking Queue

4.4.1. Blanket WOs

4.4.1.1. After initial review, all blanket WOs are immediately approved and shall have a status code of "INPRG" throughout the fiscal year.

4.4.2. All other WOs

4.4.2.1. The maintenance planning staff shall provide a list of all

"WAPPR" status WOs with job plans on Fridays to the O&M Manager for review.

4.4.2.2. The O&M Manager will review all new WOs with job plans and modify priority codes as appropriate based on the nature of the work, current operational configuration of the Regional Water System, cost effectiveness, permitting/regulatory restrictions, and current resource loading.

4.4.2.3. "QUEUE" WOs can then be placed in the weekly work load and scheduled at the discretion of the crew supervisor.

- Mondays – Maintenance planning staff changes all new WOs in "WAPPR" status reviewed by O&M Manager to "QUEUE" status.

- Thursdays – By 11:00 am, the draft of the weekly work load schedule from each supervisor is sent to the planning group to create the next week's schedule.

  This schedule is then available for query by NRD to determine what regulatory issues may affect the tasks for each WO in any watershed and/or ROW lands. At this time, NRD staff will provide input regarding any environmental mitigation and notification requirements for each WO to be included in the job plan.

  This schedule is also available for query to SYSOPS staff to provide input regarding WOs completed at each treatment facility.

- Fridays – By 12 noon, the draft weekly work load schedule for the following week becomes final and no changes can be made without expressed written consent from the O&M or Division Manager.

4.4.2.4. The draft weekly work load schedule can be changed up until it goes final at 12 noon on Fridays. After this point, the schedule is locked in and can only be changed in the event of an emergency, or by authorization of the O&M or Division Manager.

4.4.2.5. Authors of WOs outside of WSTD shall have the ability to review priorities assigned to those work orders and the current status of their WO in MAXIMO. If any changes are required, the WO author shall consult with the O&M Manager.

4.4.2.6. Unforeseen conditions encountered on a job will be evaluated on a case-by-case basis. Under no circumstances shall a job plan on an approved WO be modified.

- If the additional work required is determined to be substantial, a child work order shall be created. Approvals shall be made outside of the scheduling process previously described to allow the additional work to be started immediately.

- If the additional work required is not determined to be substantial, the additional work shall proceed under the original approved WO and documented in the Log Tab.

4.5 WO Closeout

4.5.1. All WOs will be completed or cancelled at the end of every fiscal year. The exceptions are project funded WOs.

4.5.2. Once the tasks of a non-blanket WO have been completed, the responsible supervisor shall notify the maintenance planning staff to change the WO status to “COMP”.

4.5.2.1. When a WO has been in “COMP” status for 90 days, the maintenance planning staff shall change the status of the WO to “CLOSE”, and the WO is recorded into history.

4.6 WSTD KPIs and Monthly Reporting

4.6.1. All KPIs described herein shall be compiled by the maintenance planning staff and reported to the O&M Manager on a monthly basis:

4.6.2. Work Type

4.6.2.1. As a percentage of total labor used (in dollars) for the month, indicate how much was AD, PM, CM, NW, OPS, and PROJECT.

4.6.2.2. As a percentage of total materials purchased (in dollars) for the month, indicate how much was AD, PM, CM, NW, OPS, and PROJECT.

4.6.2.3. As a percentage of total expenditures (labor + materials) for the month, indicate how much was AD, PM, CM, NW, OPS, and PROJECT.

4.6.2.4. As a percentage of total expenditures (labor + materials) for the fiscal year to date, indicate how much was AD, PM, CM, NW, OPS, and PROJECT.

4.6.3. Expected vs. Unexpected Work

4.6.3.1. As a percentage of total number of “INPRG” WOs for the month which is expected work.

4.6.3.2. As a percentage of total number of “INPRG” WOs for the month which is unexpected work.

4.6.4. Work Status

4.6.4.1. For the fiscal year to date, how many WOs are currently “WAPPR”, “QUEUE”, “APPR”, “PAPPR”, “INPRG”, “WMATL”, “WLABR”, “WPCOND”, “COMP”, “CLOSE”, “PROJECT”, and “CAN”.

4.7 WO Authority Limitations

4.7.1. A WO may be generated by anyone in WSTD, NRD or WQD with access to MAXIMO.

4.7.2. No labor can be charged in eTime against any WO, unless its status code is “APPR” or “INPRG”.

4.7.3. The authority to change the WO status codes is limited to the O&M manager and Division Manager.

4.8 WO Initial Review and Approval

4.8.1. Maintenance planning and all supervisory staff shall query MAXIMO on a daily basis for all WOs having a status of “WAPPR”.

4.8.2. For all new WOs having a “WAPPR” status maintenance planning staff shall:

4.8.2.1. Ensure the correct GL account code has been assigned to each WO.

4.8.2.2. Ensure that an accurate and complete job plan and safety plan (if appropriate) have been entered. If not, the WO will not be reviewed by the O&M Manager or placed in a “QUEUE” status.

4.8.2.3. Ensure that accurate failure classes and problem codes are entered.

4.8.2.4. Determine whether the WO should be a Parent WO or a Child WO. Any additional materials for an existing WO that are not detailed in the original job plan shall be procured through a Child WO and associated to the original WO.

4.8.2.5. Ensure that any WO in any watershed or ROW lands has been reviewed by NRD and any environmental mitigation and notification requirements are detailed in the job plan for each WO.

4.8.2.6. Determine if engineering review is required, given the nature of the work. If any engineering review is required, it should be documented in the job plan.

4.8.3. After initial review, if more information is necessary, a WO status will remain in “WAPPR” status initiator provides enough information to appropriately detail the WO.

4.8.4. Weekly, the maintenance planning staff shall send a list of “WAPPR” WOs to the O&M Manager for review. If the O&M Manager approves a WO, the status is changed to “QUEUE”.

4.8.5. If the O&M Manager does not approve the WO, its status is changed to “CAN” and the WO is recorded into history.

4.9 Condition Assessment

4.9.1. Every three years, condition assessments shall be completed for all equipment at all critical facilities.

4.9.2. Critical facilities are defined as the following (in descending order of priority):

4.9.3. TIER 1

- Sunol Valley Water Treatment Plant
- Harry Tracy Water Treatment Plant
- Tesla Treatment Facility
- Baden Pump Station and Valve Lot
- Crystal Springs Pump Station and Valve Lot
- San Antonio Pump Station/Sunol Valley Chloramination Facility
- Pulgas Facility (including balancing reservoir, valve lot, dechloramination system and pump station)
- San Pedro Valve Lot
- Thomas Shaft Treatment Facility

TIER 2

- Alameda East Portal
- Alameda West Portal
- SCVWD-SFPUC Intertie
- EBMUD-SFPUC Intertie
- Sawyer Ridge Radio Station
- Mount Allison Radio Station
- Bellevue and Pepper Valve Lot
- Newark Valve Lot
- Ravenswood Valve Lot
- Redwood City Valve Lot
- Irvington Portal
- Tissiack Valve Lot
- Crawford Valve Lot
- Mission and Palm Valve Lot
- Calaveras Boulevard Valve Lot
- El Camino and Bellevue Valve Lot
- Capuchino Valve Lot
- Edgewood Road Valve Lot

TIER 3

- San Antonio Reservoir Adit Structure
- Calaveras Adit Structure
- Crystal Springs Adit Structure
- San Andreas Adit Structure
- Bay Division Pipeline Caisson Valve House
- Bay Division Pipeline Dumbarton Valve House
- Crystal Springs and El Cerrito Valve Lot
- Casey Quarry Valve House
- El Camino Real/Millbrae Yard Valve Lot
- Green Hills Valve Lot
- Hillsborough Valve Lot
- Mountain View/Alviso Valve Lot
- Stanford Tunnel East Portal
- Stanford Tunnel West Portal
- Upper Alameda Creek Diversion Dam and Tunnel
- Pilarcitos Adit Structure
- Mud Dam and Flow Splitting Box
- Stone Dam and associated gates
- Town of Sunol Pump Station
- Town of Sunol Tanks
- Castlewood Tank
- Pleasanton Wells
- Calaveras Hypolimnotic Oxygenation System
- San Antonio Hypolimnotic Oxygenation System

4.9.4. Pre-Assessment Planning

4.9.4.1. Prior to conducting any condition assessment, all records of maintenance performed since the previous assessment shall be reviewed by Maintenance Engineering staff. This includes, but is not limited to: corrective maintenance logs, preventative maintenance logs, O&M manuals, standard equipment templates, relevant installation or as-built drawings, and relevant equipment specifications or technical data sheets.

4.9.4.2. If equipment has an unusually high level of maintenance required or unusually poor performance (compared to manufacturer's specifications and recommendations), Maintenance Engineering staff shall determine if equipment is properly specified, if engineering processes are

appropriately designed, and if equipment is installed properly. Maintenance Engineering staff shall then make recommendations for improvements to the Section Managers as appropriate.

4.9.5. Performing Condition Assessments

4.9.5.1. Standard asset condition assessment forms shall be used in conducting condition assessments, based on asset category (e.g. mechanical, electrical, structural). Only assets having a value of greater than or equal to $5,000 shall be assessed.

4.9.5.2. The assessment team shall consist of the following:

- Operator, plumber or stationary engineer, as appropriate
- Maintenance planner
- Maintenance engineer
- Any specialty tradesperson, as appropriate

4.9.5.3. For each assessed asset, the assessment team shall verify that all asset details have been recorded on the standard equipment template. If any information is missing, it shall be recorded on the template.

4.9.5.4. For each assessed asset, the asset name, location, brief description, CMMS identification code and date placed in service shall be recorded on the standard asset condition assessment form.

4.9.5.5. Each assessed asset shall be visually inspected to observe its general condition. This observation shall be categorized using a numerical scale as indicated and described on the standard asset condition assessment form.

4.9.5.6. During the assessment, each asset shall be operated to the maximum extent possible. The level of operation shall be recorded on the standard asset condition assessment form.

4.9.5.7. For each assessed asset, any field observations or observed failures shall be recorded on the standard asset condition assessment form.

4.9.5.8. For each assessed asset, any corrective action or remedy shall be identified and recorded on the standard asset condition assessment form.

4.9.5.9. Upon completion of the asset assessment, the inspection date, assessment team, date of next inspection, time to complete the assessment and estimated useful life remaining shall be recorded on the standard asset condition assessment form. If recent digital photos of the equipment are not already included in the CMMS database, then digital photos shall be taken of the asset.

4.9.6. Post-Assessment Analysis

4.9.6.1. Following completion of all assets within a critical facility, Maintenance Engineering shall review all data collected during the assessment and as well as all design records and maintenance history records, then complete a condition assessment report.

4.9.6.2. This report shall include the following:

- Based on design records and maintenance history records, determine if the engineering processes are appropriately designed and if the equipment was properly specified and installed.
- Clearly identify poorly designed processes, improperly specified equipment, and poor equipment installations. Describe causes and provide recommendations for improvement as appropriate.
- Recommend any process changes, maintenance actions, or equipment upgrades to help reduce unplanned outages.
- Determine essential spare parts required to minimize unplanned outages should a failure occur.
- Perform a life-cycle cost analyses for equipment requiring over of $20,000 in annualized maintenance.

4.9.6.3. The condition assessment report shall be submitted to the O&M Manager for review within 30 calendar of completion of all asset assessments at the critical facility.

4.10 Purchasing

4.10.1. All purchase requisitions shall be created in MAXIMO and linked to a specific work order and subsequent index number. Sufficient information shall be provided on the purchase requisition to indicate specifically what is to be purchased, as well as the reason for the purchase.

4.10.1.1. The requestor shall provide a quote to their supervisor with the WO, index code, sub-object, commodity code, and a description of the purchase filled out on the Purchase Request Form.

4.10.1.2. The admin staff will generate the purchase requisition in MAXIMO. The signed Purchase Request Form will then be forwarded to the O&M or SYSOPS Manager for approval in MAXIMO.

4.10.2. Once the O&M or SYSOPS Manager approves the purchase requisition, it will be forwarded to the Division Purchaser for processing. No purchases shall be allowed without a “posted” purchase order.

4.10.3. Upon delivery of the materials, supplies or services, the requestor shall sign and submit the original vendor invoice to the accounting staff for payment processing by the close of business on the

following business day. All invoices must match the original purchase order or the invoice will not be processed and the vendor will not be paid.

4.10.4. All material packing slips shall be received in MAXIMO by warehouse staff, all invoices shall be received in MAXIMO by accounting staff.

4.10.5. All capital equipment purchases (i.e. equipment in excess of $5,000) require completion of an Inventory Decal Form that includes the equipment serial number and installation location. Payment will not be made to the vendor unless this form is completed and submitted to the Division Purchaser. Responsibility for completing this form falls on the original requestor.

4.10.6. Requestors shall not structure purchases to circumvent the City's $10,000 bid limit on purchases.

Implementation

5.0 Implementation:

5.1 It is the responsibility of each employee/supervisor to ensure compliance with this procedure.

5.2 It is the responsibility of the O&M Section Manager to ensure that the procedure is followed and to review this procedure on an annual basis and to update as necessary. For guidance on updating this procedure, refer to the "Policies and Procedures Revision Instructions" procedure.