Santa Clara Valley Water District

File No.: 16-0793

Agenda Date: 6/13/2017
Item No.: *5.3.

BOARD AGENDA MEMORANDUM

SUBJECT:
Risk Analysis of District Assets.

RECOMMENDATION:
Receive the information on risk analysis of District assets.

SUMMARY:
The Board of Directors has adopted the following Board Governance Policies that provide guidance on managing and maintaining District assets:

EL-6. The BAOs shall protect and adequately maintain corporate assets.

6.4. Maintain an Asset Management Program

In support of EL-6, the Board has requested an update on the risk analysis of District assets. In addition, in the Water Utility Asset Management and Maintenance Program update presented to the Board on March 28, 2017, staff indicated that risk information would be presented to the Board at a future date.

The District assesses risk of its assets to identify potential failures that could have serious impacts to District operations, community property, the environment, public safety, and the District's finances and reputation. Risk analysis also provides insight for setting priorities and focusing resources. Risk analysis is the sixth step of the ten-step asset management planning model shown in Attachment 1, and is implemented through the District's asset management programs.

The District owns, operates, and maintains water utility, watershed and administrative assets throughout the County in support of the District's mission. Water utility assets include the equipment and components that make up the District's dams, pipelines, pump stations, water treatment plants, purification center, recharge ponds, and wells. Watershed assets include creek reaches and sub-reaches; and the levees, floodwalls, and point assets such as fish ladders that lie along a creek reach. Administration assets include the District's administration buildings and grounds, information technology (IT) equipment, and fleet equipment and vehicles. Each of these assets must be maintained, repaired, and periodically replaced to keep facilities functioning properly to provide a continued level of service to the community.

With so many assets throughout the County, the job of maintaining facilities is complex and ever growing as more facilities are constructed. It is critical to plan and schedule maintenance efficiently. This is accomplished through the District's asset management and maintenance programs. These programs help staff plan for routine asset maintenance and asset rehabilitations and replacements. Beyond planned maintenance activities, as assets wear or get close to the end of their service life, work must be prioritized to focus efforts on the most critical assets. To accomplish this, staff uses risk as a metric to ensure the most critical needs are being addressed.

This item provides an overview of the District's risk analysis methodology and describes: 1) how the District measures risk for all assets; 2) how the District manages risk for water utility assets; and 3) next steps for asset risk analysis efforts.

The risk measurement methodology presented in Section 1 and the next steps presented in Section 3 apply to all District assets (water utility, watershed, and administration). Section 2, risk management, provides information for water utility assets. Risk management of watershed and administration assets will be covered in a future Board update.

1. Risk Measurement

The District measures risk as Business Risk Exposure (BRE), which is a risk score derived from the multiplication of two factors: Probability of Failure (PoF) and Consequence of Failure (CoF). This method of calculating risk adheres to asset management guidelines set forth in several international standards including the International Infrastructure Management Manual (IIMM); the British Standards Institution's Publicly Available Specification for asset management (PAS 55); and the International Organization for Standardization's guidelines for asset management (ISO 55000).

Below is a description of PoF, CoF, and total BRE score.

Probability of Failure (PoF)
PoF indicates the condition of an asset and how close an asset is to failure. Scores range from 1 to 5, as shown below:

1 - Excellent
2 - Minor Defects Only
3 - Maintenance Required
4 - Major Renewal Required
5 - Unserviceable or Failed

PoF scores are dynamic because asset condition continuously changes. PoF scores are updated periodically as routine condition assessments are completed, and as conditions change over time. The District assesses water utility asset condition every two years and inspects most creek reaches owned by the District annually. A formal condition monitoring program for District administration buildings and grounds assets is currently being developed. Though no formal condition monitoring program has been developed through the asset management program for fleet and IT assets, staff

routinely monitors these assets for failures or degrading conditions. The District's Equipment Management Unit ensures fleet and heavy equipment assets are routinely maintained, repaired and replaced based on age, mileage, and vehicle condition. The District's Information Technology Unit ensures IT equipment maintenance agreements are current, and equipment is replaced at set intervals.

Consequence of Failure (CoF)
CoF measures the impacts of asset failure. To calculate CoF, staff subject matter experts evaluate the asset's impact of failure on service delivery, community property, the environment, public safety, finances, and the District's reputation using the matrix, shown in Attachment 2. The CoF matrix is based on standards from the International Infrastructure Management Manual, and was customized for District use in 2013. Using the matrix, an asset is scored from 0 to 5 in each of the six categories. The total CoF score is the sum of the six scores, and can range from 0 to 30.

CoF scores do not vary significantly over time, unless external conditions change, such as an area becoming more populated or increased demand on a system. The Asset Management Unit updates CoF scores if needed as part of developing asset management plans (AMPs). The Asset Management Unit prepares a detailed facility AMP for one water utility facility and one creek per year, and performs a thorough analysis of CoF scores as part of these plans. In addition, all CoF scores are reviewed every five years as part of updating the Districtwide AMP, though this review is less detailed than the analysis done during individual facility AMPs.

Redundancy

Most asset management standards recommend including redundancy in risk calculations to account for back-up assets or extra capacity within a system. The District does not currently include a separate factor for redundancy in the BRE calculation, but rather accounts for redundancy in the CoF score. For example, a pump with two back-up pumps has a lower CoF score than a single pump with no back-up. The consequence of one of three pumps failing is low, while the consequence of a single pump failing is higher. The asset management program is evaluating whether to incorporate a separate redundancy factor into the BRE score.

Total Business Risk Exposure (BRE) Score
The total BRE score is the product of PoF and CoF, and is an index number that can range from 0 to 150. Total BRE scores are updated when PoF or CoF components change. As described above, PoF scores change more frequently than CoF scores.

The District uses the total BRE score to categorize assets as critical, moderate, or low risk. The District manages asset risk based on what risk category the asset resides. The asset management program sets thresholds for critical, moderate, and low risk BRE scores. The thresholds were developed by comparing BRE scores to actual maintenance practices. The critical risk BRE score threshold was set at the point where the District has typically initiated an asset replacement or rehabilitation project. The moderate risk threshold was set at the point where the District has typically initiated more frequent condition monitoring of an asset. The BRE thresholds for water utility assets are provided below in section 2.

2. Water Utility Risk Management

The District takes actions to manage water utility asset risk depending on the asset's risk category. This section includes a discussion of how water utility asset risk is managed for critical, moderate, and low risk assets. Information on watershed and administration risk management will be presented at a future Board meeting.

For each risk category, the BRE score range, and a description and examples of how the District manages water utility asset risk is provided. In addition, Attachment 3 provides a summary of current water utility asset risk scores, and a list of the current highest risk water utility assets with an associated risk mitigation strategy.

Critical Risk

BRE Score Range: 61-150

How critical risk water utility assets are managed:

1. Asset rehabilitation or replacement is accelerated in the Five-Year Maintenance Work Plan

One strategy to manage a critical risk asset is expedite its planned rehabilitation or replacement. In the Water Utility, this is done as part of the maintenance work planning process, which was presented to the Board on March 28, 2017. Each year, the Water Utility develops a Five-Year Maintenance Work Plan (MWP) that identifies the asset rehabilitation and replacement projects required for the upcoming five fiscal years. The MWP is a rolling five-year plan and is updated annually. In annual updates, staff reviews water utility asset risk scores and identifies any critical risk assets that need to be added to the MWP for rehabilitation or replacement, or that need to be accelerated. After rehabilitation or replacement, the asset's PoF score returns to 1, the total BRE score is reduced, and the asset is no longer considered to be a critical risk.

Example: Coyote Pumping Plant Adjustable Speed Drives (PoF = 4, CoF = 18, BRE = 72)

The pump motor adjustable speed drives (ASDs) for the six pumps at Coyote Pumping Plant were recommended for replacement in the FY 2017-2021 MWP. The MWP recommended a Capital Improvement Project to replace the ASDs due to the large scope of the project. A capital project, Coyote Pumping Plant ASD Replacement, was scheduled to begin in FY 2019 in the FY 2017 - 2021 Capital Improvement Plan (CIP). Since then, the condition of the ASDs has continued to degrade, and spare parts have become obsolete and are not readily available to make repairs. Consequently, the asset's PoF and BRE increased, and the project was accelerated to begin in FY 2018 in the FY 2018 - 2022 CIP.

2. Asset is rehabilitated or replaced as corrective maintenance (CM)

If an asset has a high consequence of failure or has already failed, it may be rehabilitated or replaced

immediately rather than scheduled in the MWP. In these cases, staff initiates a corrective maintenance (CM) work order to rehabilitate or replace the asset.

Example: PWTP Ammonia System Piping (PoF=4, CoF = 23, BRE = 92)

The ammonia system piping at PWTP is plastic (PVC) and was degrading quickly due to sun exposure. Ammonia can cause injury or death if inhaled, and is also critical to the water treatment process. When the cracked piping was found, a corrective maintenance work order was initiated and the piping was replaced.

3. Operations are modified

In some cases, the Water Utility can modify operations to mitigate critical risk. This may include operating at lower pressures or capacities, limiting system operational changes, changing supply sources, or changing treatment processes. This strategy reduces risk by reducing the PoF. Operations are modified so that the asset is less likely to fail.

Example: Anderson Dam (PoF = 4, CoF = 30, Total BRE = 120)

Anderson reservoir is operated at restricted levels, per Division of Safety of Dams requirements, in order to reduce risk of dam failure in a seismic event. The dam has seismic stability deficiencies that will be resolved with dam structural improvements. Until the structural improvements are constructed, the reservoir is operated at restricted levels to reduce risk.

Moderate Risk

BRE Score Range: 51-60

How moderate risk water utility assets are managed:

1. Routine preventive maintenance is increased

Preventive maintenance (PM) was described in the March 28, 2017 Board update on Water Utility Asset Management and Maintenance Programs. PM activities occur weekly, monthly, quarterly, semi-annually, or annually, depending on the activity. For a moderate risk asset, the Water Utility may increase the frequency of the asset's PM activities. This strategy prevents an asset from further or accelerated degradation.

Example: PWTP Transformers LC2, LC3, and LC4 (PoF = 3, CoF = 19, Total BRE = 57)

The condition of water utility electrical equipment is tested every two years. The most recent electrical testing at PWTP indicated that the condition of three large transformers is degrading, and they will be in need of rehabilitation sometime in the next few years. In order to slow the rate of degradation, electrical engineering and maintenance staff agreed to increase preventive maintenance from annually to every six months. The increased maintenance helps ensure the

transformers will continue to function as needed until the next electrical test in two years.

2. Condition is monitored more frequently

Another option for managing moderate risk assets is to monitor condition more frequently. The Water Utility typically assesses asset condition every two years, but can increase frequency to annually, every six months, or even daily for moderate risk assets. This strategy ensures that staff is aware if the asset moves into the critical risk category, and requires a critical risk management strategy as discussed above.

Example: Various treatment plant and pump station assets

Many water treatment plant assets that are critical to providing continuous potable water service such as booster pumps, chemical systems, and electrical equipment are visually inspected daily by operations and maintenance staff to ensure that any degrading conditions are caught and quickly repaired in order to avoid or minimize service disruptions.

Low Risk

BRE Score Range: 0-50

How low risk water utility assets are managed:

For assets falling into the low risk category, the Water Utility continues the assets' planned routine maintenance (PM) program, as described above under Moderate Risk. The water utility completes approximately 14,000 PM work orders each year.

3. Next Steps

Through its asset management program, the District will continue to track and monitor asset risk, and plans to implement the following improvements:

1. Develop risk maps: The District is working on developing color coded risk maps for its facilities, where red is critical, yellow is moderate, and green is low risk. Draft pipeline risk maps have been developed, and will be refined based on expert input, further data analysis, and condition and failure data from similar pipe from other water utilities. Creek risk maps are in development. The District intends to develop risk maps for its water treatment plants and pump stations, in which risk will be displayed on plant schematics.

2. Validate existing risk scores and develop risk scores for remaining assets: The District will continue to develop risk scores for assets that have not been evaluated, and to validate existing risk scores through asset management plans.

3. Monitor and update BRE thresholds: The District will continue to monitor BRE scores and resulting maintenance activities, and will update thresholds for critical, moderate, and low risk categories as needed. The thresholds will be adjusted over time as more asset failure data is gathered and analyzed, particularly for the moderate risk category, which is currently a narrow range.

In addition, a future Board update will provide more information on risk management for watershed and administration assets.

FINANCIAL IMPACT:
There is no financial impact associated with this item.

CEQA:
The recommended action is a ministerial action and thus is not subject to the requirements of CEQA.

ATTACHMENTS:
Attachment 1: 10-Step Asset Management Planning Model
Attachment 2: Consequence of Failure Matrix
Attachment 3: Water Utility Asset Risk Information
*Attachment 4: PowerPoint
*Handout 5.3-A, K. Irvin

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