Memorandum

July 12, 2017

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Subject: **NapaSan Asset Management Plan – Technical Summary**

Napa Sanitation District (NapaSan) owns and operates critical infrastructure serving the City of Napa and surrounding areas of Napa County with wastewater conveyance, treatment, water reuse and discharge services. NapaSan manages this infrastructure in alignment with its Strategic Plan goals, which includes as the first goal: *Build, maintain and operate a cost-effective and reliable wastewater treatment system for the NapaSan service area.* Developing an asset management program is a stated objective for Strategic Plan Goal One.

This Asset Management Plan provides a gap assessment of current asset management practices at NapaSan against accepted industry standards and provides a roadmap for implementing new or updated practices that, over the next 5 to 10 years, will become the foundation of a full asset management program in accordance with the Strategic Plan.
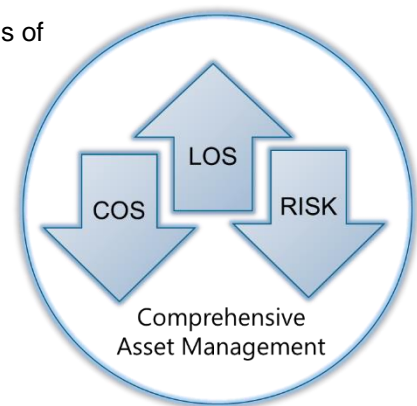
Asset Management Best Practices Review

Asset management (AM) is a management approach that balances levels of service (LOS) with cost of service (COS) at an acceptable level of risk. Levels of service are dynamic and evolve with the adoption of new regulatory requirements and in response to shifting economic and social priorities within the service area. Best practices for NapaSan are unique to this agency and the adopted asset management program needs to be fit for purpose and flexible.

Ultimately, the asset management program seeks to answer the following five questions on a continual basis:

1. What is the current state of my assets?

2. What is my required level of service?

3. Which assets are critical to sustained performance?

4. What are my best operation and maintenance and capital project investment strategies?

5. What is my long term funding strategy?

Implementing an asset management program is an investment in leading practices that over time will allow NapaSan to prioritize its maintenance and capital project needs. Without the asset management

program, spending decisions are based on available information that is not always complete or verified. Asset management doesn't save money per se, it provides tools and procedures that are necessary for NapaSan to make informed decisions that balance levels of service with risk and cost.

Gap Assessment

The International Organization for Standardization (ISO) 55001 standard defines the requirements for an asset management program. It applies to any industry in any country and is not specific to the water and wastewater agencies in California or the United States. This standard provides a template with which to assess NapaSan's current practices relating to asset management. Table 1 provides a summary of the assessment categories and their key elements used in the gap assessment.

Table 1 – Asset Management Assessment Categories (based on ISO 55001)

Category	Key Elements
100 - Setting Direction	Integrating asset management into agency policies and strategic plans, defining and updating levels of service, and setting and communicating asset management objectives and performance measures.
200 – Programming	Formal system for assessing asset value and remaining life, process for determining life cycle costs, formal procedure for business case evaluations of proposed capital projects, and engaging stakeholders in strategic planning process.
300 – Preparation	Formal maintenance planning and prioritization procedures based on criticality, condition, remaining life, and replacement cost of the assets. Preparation of Tactical Asset Management plans for the treatment plant, collection system, and recycled water and biosolids assets.
400 – Implementation	Development of standard operating procedures, business continuity plans, and emergency response plans; tracking and responding to customer complaints; maintaining CMMS database; formal contracting and asset commissioning and decommissioning standards and procedures; development of maintenance manuals and tracking maintenance costs; development of formal processes for work prioritization and predictive resource planning.
500 - Asset Monitoring	Formal asset condition assessment procedures (which assets, how often and when, how and what to monitor) and process for determining corrective action response; formal incident response, solution and documentation process that leads to continual improvements.
600 – Management System review	Implementation of an asset management program, development of formal risk management framework (business and asset risks), formal process for continuous improvements, and communication of and accessibility to relevant legal requirements and regulations governing the business.
700 - People & Organization	Commitment by Board, organizational alignment to support asset management program, on-boarding and training staff, change management, staffing levels, succession planning, and formal communication plan.

Category	Key Elements
800 – Data & Information	Establish asset hierarchy structures and data standards for asset attributes, establish a centralized and consolidated Knowledge Management Plan (data ownership, quality and integrity), development of data processes for timely reporting on key information, and data security and archiving.
900- Technology	CMMS, GIS, DSS and related databases that support the asset management program.

Based on detailed interviews and workshops with NapaSan staff and using a scoring scale of 0 ("innocent") to 100 ("excelling"), where a score of 52 is considered "competent" according to the ISO 55001 standard, NapaSan scored a 33 for its current practices relating to asset management. US water and wastewater agencies in the early stages of implementing formal asset management programs score similarly to NapaSan. This Asset Management Plan, when implemented, will move NapaSan towards a competent score as it relates to the ISO 55001 asset management standard. However, this score is an approximate benchmark and NapaSan will implement only the AM practices that help meet Strategic Plan Goal One, *Build, maintain and operate a cost-effective and reliable wastewater treatment system for the NapaSan service area,* regardless of the resulting score.

Asset Management Framework

Asset management is a framework, which is a way of managing an enterprise focused on seeking the lowest total lifecycle cost of ownership for infrastructure assets, while delivering services at a level customers and stakeholders require and are willing to pay for, at an acceptable level of risk to the community. This strategic-level framework integrates with the core functions of an organization. Achievement of optimal results occurs when applying the asset management framework throughout the organization on a day-to-day basis at the individual asset level, and this in turn informs investments in resources, maintenance, and capital improvements. Figure 1 illustrates the core functions of an organization expressed within an asset management framework.
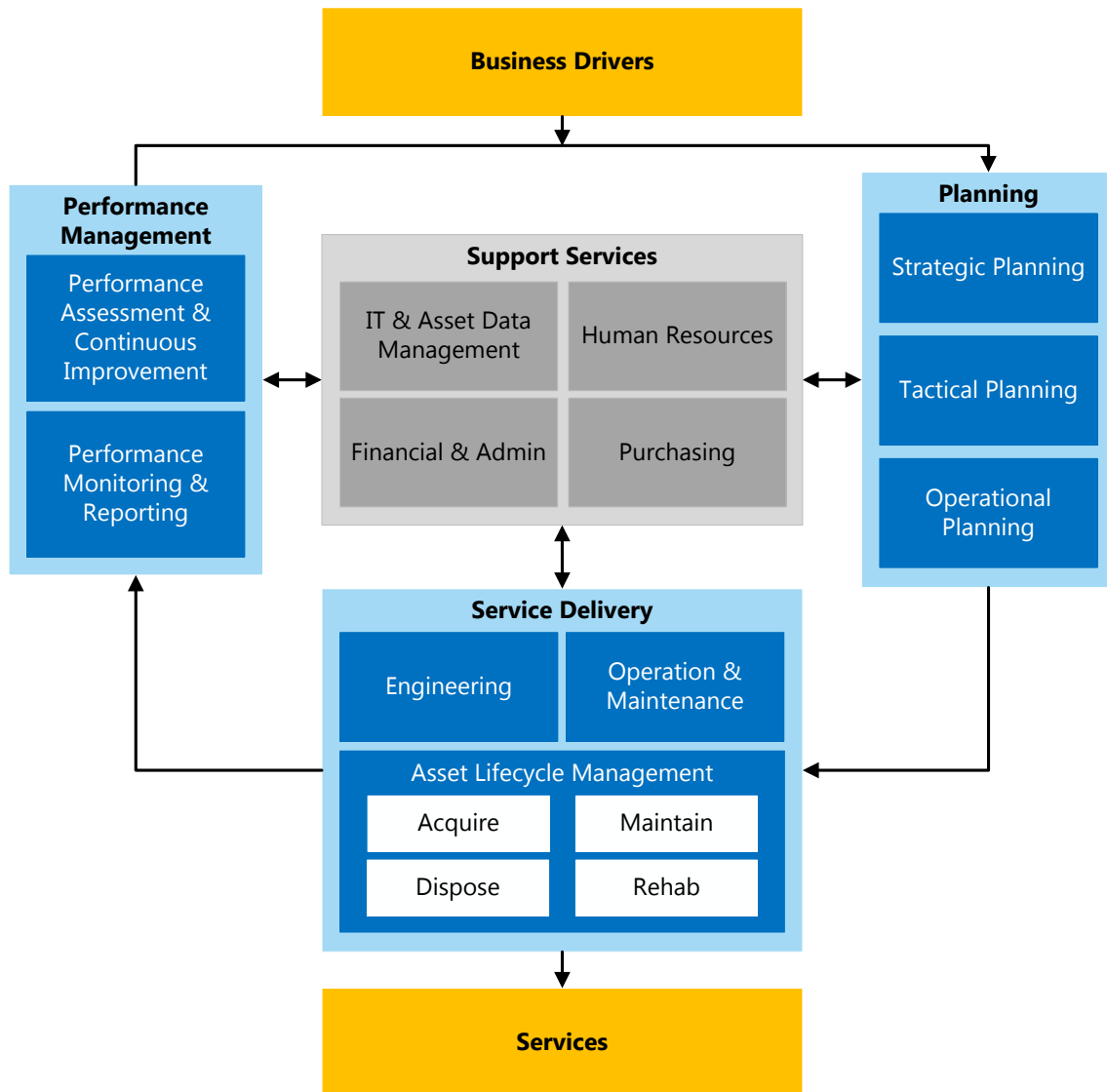
Figure 1 – Core Organization Functions Within an Asset Management Framework

Based on findings from the gap assessment, 14 improvement initiatives are identified that progress NapaSan's asset management program towards meeting Strategic Plan Goal One of Infrastructure Reliability. Table 2 summarizes these improvement initiatives by core function: planning, service delivery, performance management, and support services. The last initiative relates to implementing the asset management program itself and is outside of the core functions, having a timeframe equal to the time it takes to implement the other initiatives.

Table 2 – AM Improvement Initiatives by Core Function of Organization

Core Function	Initiative	Description of Improvements
Planning	P1	Monitor and report on AM implementation progress quarterly, and update the AM Policy and implementation plan annually as needed to align with NapaSan's Strategic Plan and budget.
	P2	Develop and pilot Consequence of Failure (CoF) and Probability of Failure (PoF) tables for a group of treatment plant assets and a group of collection system assets; modify tables as appropriate. Develop Tactical Asset Management Plans (TAMPs) for treatment plant, collection system, and recycled water/biosolids facilities. TAMPs include asset registers, maintenance strategies, risk profiles and rehabilitation/replacement strategies. Update plans over time to improve maintenance procedures as needed based on experience.
	P3	Develop standard procedures for prioritizing capital improvement projects including incorporating Business Case Evaluations (BCEs) as part of the chartering process. The improved chartering and BCE process will define the CIP prioritization process and include a life-cycle cost tool, risk reduction tool, cost/benefit tool, and BCE "Light" process for smaller projects.
Core Service Delivery	CS1	Develop standard procedures and associated forms for entering new assets into CMMS, updating asset information, and asset renewal/replacement or disposal. Identify staff responsibilities for updating asset registers for treatment plant, collection system and recycled water/biosolids. Refine procedures as appropriate to improve workflows after gaining experience with the new procedures.
	CS2	Implement the maintenance strategies described in the TAMPs at the asset level. Monitor and report out on maintenance activities including Work Requests, Work Order Backlogs, PM Compliance, Schedule Compliance, Percent Proactive Work, and Percent Predictive Work.
	CS3	Develop standard procedures and associated forms for completing condition assessments of treatment plant, collection system, and recycled water/biosolids assets. Identify responsible staff for completing each of three levels of condition assessment (desktop, visual and advanced). Include procedures for capturing condition assessments in CMMS.
Performance Management	PM1	Develop Levels of Service (LOS) framework and associated performance measures for the treatment plant, collection system and recycled water/biosolids assets.
	PM2	Develop standard procedures for root cause analysis and failure investigations, and standard failure modes and codes for entry into CMMS. Prepare a workflow chart identifying the steps for failure investigations and subsequent training and modifications to operation and maintenance procedures to incorporate lessons learned and improve performance. Identify responsible staff for conducting investigations and coding failure modes.

Core Function	Initiative	Description of Improvements
	PM3	Update reported performance measures to include performance against LOS for treatment plant, collection system and recycled water/biosolids assets. Participate in external benchmarking activities and adjust LOS as appropriate over time.
Support Services	SS1	Assess staff experience and skills and develop succession plans for knowledge transfer throughout the organization. Develop and implement training programs for implementing each of the AM initiatives and the asset management program as a whole.
Support Services	SS2	Review and update asset register content and format to support AM initiatives as necessary. Review and update asset hierarchy, unique identifiers, asset description/names and Maintenance Strategy Groups (MSGs) and update to support AM initiatives as necessary. Review and update (if necessary) data security and backup procedures to maintain integrity of data over time.
Support Services	SS3	Develop an interim solution for Hansen/GIS interface for the collection system. Evaluate, select and implement a new CMMS to replace Hansen and MP2 platforms. Develop an AM Information System plan to support the asset management plan and identify any gaps in the current system.
Support Services	SS4	Evaluate, select and implement an integrated capital and maintenance planning system (Decision Support System, or DSS) to inform the budgeting process, including predictive models for asset failure, life-cycle costs, and LOS, COS and risk.
AM Program Implementation	AMPI1	Appoint a dedicated AM staff person to oversee the implementation of the asset management program. Assign resources as needed in all departments to support implementation of AM initiatives, and contract for outside resources as appropriate to achieve Strategic Plan Goal #1.

Implementation Plan

A phased approach allows NapaSan to implement the AM improvement initiatives at a pace that optimizes uptake of new tools and procedures, and that spreads resource needs out over time. To the extent possible, NapaSan intends to implement the initiatives with in-house resources and limit outside consultants to facilitation and coaching as needed. Accelerating the implementation schedule requires more outside resources since NapaSan staff in each department has to perform their daily duties in addition to implementing AM initiatives, but the benefits of the program are realized sooner with an accelerated schedule. Two of the initiatives, developing TAMPs and installing a new CMMS, do require significant levels of outside resources regardless of the implementation timeline. For illustrative purposes, Table 3 provides a comparison of estimated internal and external resource needs for three possible implementation timelines.

Table 3 – AM Implementation Plan Resource Needs for Three Timelines

No.	Initiative Description	4-Year Implementation Plan				7-Year Implementation Plan				10-Year Implementation Plan			
		Internal	External	Software	Total	Internal	External	Software	Total	Internal	External	Software	Total
P1	Monitor and update AM implementation plan	$22,080	$0	$0	**$22,080**	$38,640	$0	$0	**$38,640**	$55,200	$0	$0	**$55,200**
P2	Develop and pilot TAMPs	$248,400	$675,000	$0	**$923,400**	$248,400	$675,000	$0	**$923,400**	$248,400	$675,000	$0	**$923,400**
P3	Capital project chartering and BCEs	$82,800	$100,000	$0	**$182,800**	$92,000	$75,000	$0	**$167,000**	$101,200	$50,000	$0	**$151,200**
CS1	Asset data management and upkeep	$82,800	$40,000	$0	**$122,800**	$87,400	$30,000	$0	**$117,400**	$92,000	$20,000	$0	**$112,000**
CS2	Implement maintenance strategies	$165,600	$100,000	$0	**$265,600**	$174,800	$75,000	$0	**$249,800**	$184,000	$50,000	$0	**$234,000**
CS3	Asset condition assessments	$124,200	$90,000	$0	**$214,200**	$133,400	$65,000	$0	**$198,400**	$142,600	$40,000	$0	**$182,600**
PM1	LOS and performance measures	$82,800	$70,000	$0	**$152,800**	$92,000	$50,000	$0	**$142,000**	$101,200	$30,000	$0	**$131,200**
PM2	Failure investigations and improvements	$124,200	$50,000	$0	**$174,200**	$128,800	$40,000	$0	**$168,800**	$133,400	$30,000	$0	**$163,400**
PM3	Performance reporting and improvements	$82,800	$30,000	$0	**$112,800**	$87,400	$20,000	$0	**$107,400**	$92,000	$10,000	$0	**$102,000**
SS1	Staff assessment and training	$165,600	$75,000	$0	**$240,600**	$172,500	$60,000	$0	**$232,500**	$179,400	$45,000	$0	**$224,400**
SS2	Asset register formatting and data security	$248,400	$185,000	$0	**$433,400**	$262,200	$150,000	$0	**$412,200**	$276,000	$115,000	$0	**$391,000**
SS3	CMMS and IS improvements	$248,400	$375,000	$300,000	**$923,400**	$248,400	$375,000	$300,000	**$923,400**	$248,400	$375,000	$300,000	**$923,400**
SS4	Select and implement DSS	$248,400	$50,000	$100,000	**$398,400**	$248,400	$50,000	$100,000	**$398,400**	$248,400	$50,000	$100,000	**$398,400**
AMPI	Ongoing support of AM implementation	n.a.	n.a.	n.a		n.a.	n.a.	n.a		n.a.	n.a.	n.a	
Total Resource Needs					**$4,166,480**				**$4,079,340**				**$3,992,200**
Average Annual Cost					**$1,041,620**				**$582,763**				**$399,220**

*Table is in 2017 dollars

Implementation of the recommended AM improvement initiatives in four phases allows NapaSan to pace the investments at a rate that fits within budget constraints, and allows time to assess the benefits of each phase before deciding on whether or not to implement subsequent phases. The time required to complete each phase is dependent on staff and budget availability, and would typically be 12 to 24 months per phase. Table 4 provides a breakdown of how the AM improvement initiatives are completed across the four phases, with some initiatives completed over more than one phase.

Table 4 – Implementation of AM Improvement Initiatives Over Four Phases

No.	Initiative Description	Phase 1	Phase 2	Phase 3	Phase 4
P1	Monitor and update AM implementation plan	▬	▬	▬	▬
P2	Develop and pilot TAMPs	▬	▬		
P3	Capital project chartering and BCEs	▬		▬	
CS1	Asset data management and upkeep		▬		
CS2	Implement maintenance strategies			▬	
CS3	Asset condition assessments	▬	▬		
PM1	LOS and performance measures	▬	▬		
PM2	Failure investigations and improvements		▬		
PM3	Performance reporting and improvements				▬
SS1	Staff assessment and training		▬		
SS2	Asset register formatting and data security	▬	▬		
SS3	CMMS and IS improvements	▬			
SS4	Select and implement DSS			▬	
AMPI	Ongoing support of AM implementation	▬	▬	▬	▬

Phase 1 initiatives are core to achieving Strategic Plan Goal One and are necessary regardless of implementing subsequent phases of the asset management program. Key objectives of the Phase 1 improvements include:

- Develop tools and procedures for assessing business risk exposure for groups of assets;

- Update the project chartering process to create a comprehensive and transparent method for prioritizing capital projects;

- Develop tools and procedures for assessing condition of assets, and identify staff responsible;

- Create a Levels of Service framework with example performance measures;

- Update asset register format and content including asset hierarchy, unique identifiers, asset descriptions/names, and Management Strategy Groups; and

- Replace the current Hansen and MP2 software with a new CMMS platform that suits vertical and horizontal assets. Create an interim solution for interfacing Hansen with GIS for collection system management.

Table 5 provides a breakdown of the recommended Phase 1 tasks and resource needs implemented over two fiscal years, which aligns with an overall program implementation timeline of 7 years. Phase 1 will be further broken down into three sub-tasks; Phase 1A includes necessary improvement tasks (P1, CS3, SS2 & SS3), Phase 1B includes CMMS implementation (SS3) and Phase 1C includes planning tasks and Phase 2 preparation tasks (P1, P2 & P3) whereby Phase 1B and Phase 1C will overlap. Attachment 1 presents task descriptions for the Phase 1 AM improvement initiatives.

Table 5 – Phase 1 Initiatives and Resource Needs

No.	Initiative Description	FY 17/18 (Phase 1A)				FY18/19 (Phase 1B & Phase 1C)			
		Internal	External	Software	Total	Internal	External	Software	Total
P1	Monitor and update AM implementation plan	$5,520	$0	$0	**$5,520**	$5,520	$0	$0	**$5,520**
P2	Develop and pilot TAMPs	$0	$0	$0	**$0**	$18,400	$25,000	$0	**$43,400**
P3	Capital project chartering and BCEs	$0	$0	$0	**$0**	$3,680	$20,000	$0	**$23,680**
CS3	Asset condition assessments	$9,200	$15,000	$0	**$24,200**	$0	$0	$0	**$0**
PM1	LOS and performance measures	$0	$0	$0	**$0**	$7,360	$20,000	$0	**$27,360**
SS2	Asset register formatting and data security	$18,400	$30,000	$0	**$48,400**	$0	$0	$0	**$0**
SS3	CMMS and IS improvements	$92,000	$100,000	$300,000	**$492,000**	$92,000	$275,000	$0	**$367,000**
	Total Resource Needs				**$570,120**				**$466,960**

Attachment 1 Phase 1 Task Descriptions

P1 - Monitor and Update AM Implementation Plan

Initiate projects and retain consultants as necessary to complete the Phase 1 improvements. Monitor progress and provide status reports to the NapaSan Board quarterly. Update the AM Policy and implementation plan annually as appropriate. This initiative is independent of the other Phase 1 initiatives.

Phase 1 Deliverables:

- Consultant contracts
- Board presentations

Phase 1 Resource Needs:

- Internal: 60 hours annually
- External: none

P2 – Develop and Pilot TAMPs

Tactical Asset Management Plans (TAMPs) are comprehensive documents that detail the levels of service and performance measures, the state of the assets, business risk exposure, and management strategies for all infrastructure assets. Separate TAMPs are prepared for the treatment plant and collection system; the recycled water and biosolids facilities can have an independent TAMP or they can be included in the treatment plant TAMP. The TAMPs provide the basis for prioritizing maintenance, renewal/replacement and capital improvement spending at the asset level. Updating the TAMPs periodically (every 5 to 10 years) addresses the changing state of the assets over time and accounts for completed projects.

Phase 1 does not include preparation of the TAMPs. The Phase 1 tasks for this initiative include piloting the methodology for evaluating Business Risk Exposure for a group of treatment plant assets and a group of collection system assets. This includes the following tasks:

1. Select the asset groups for piloting (e.g. solids process for the treatment plant, and Pine Street from Collier to Seymour for the collection system);

2. Develop separate Consequence of Failure (CoF) tables for treatment plant assets and for collection system assets;

3. Use the CoF tables to assign consequence of failure scores to each asset in the two groups;

4. Using the best available asset information, assign Probability of Failure (PoF) scores to the assets in the two groups;

5. Plot the results on a Business Risk Exposure (BRE) chart and evaluate how mitigation measures impact the overall BRE score; and

6. Update the CoF tables as appropriate after piloting is completed.

Begin this AM initiative after completing the Levels of Service framework under initiative PM1.

Phase 1 Deliverables:

- CoF tables for treatment plant and collection system assets
- Work flow chart and examples for evaluating Business Risk Exposure
- Technical memorandum summarizing BRE process

Phase 1 Resource Needs:
- Internal: 200 hours
- External: $25,000

P3 – Capital Project Chartering and BCEs

The purpose of this improvement is to establish a thorough and transparent process for initiating and prioritizing capital projects. The process includes a Business Case Evaluation to evaluate the cost and benefits of alternatives for each capital project, including the "no project" alternative. Project chartering tools include life-cycle cost analysis, risk reduction, and cost/benefit tools. A separate "BCE Light" process provides a streamlined evaluation method for smaller projects.

The Phase 1 initiative includes a review of NapaSan's current capital project initiation and prioritization process and development of a new project chartering process, and is independent of the other Phase 1 initiatives. However if staffing or funding resources become limited this task can be moved to Phase 2. Development of the tools are not included in Phase 1.

Phase 1 Deliverables:
- Capital project chartering process
- Technical memorandum summarizing project chartering process

Phase 1 Resource Needs:
- Internal: 40 hours
- External: $20,000

CS3 – Asset Condition Assessments

Asset condition assessments are necessary to answer the question "What is the state of my assets?" The asset condition scores form the basis of Probability of Failure scores, which in turn form the basis for Business Risk Exposure. Business Risk Exposure is the basis for prioritizing maintenance and renewal/replacement spending. The condition assessment protocol (CAP) includes a Level 1 Assessment (desktop), a Level 2 Assessment (visual inspection), and a Level 3 Assessment (physical measurement). Asset condition information logged in the CMMS is an important attribute displayed in the asset register.

Phase 1 tasks include establishing a condition assessment protocol for treatment plant assets and a separate protocol for collection system assets. (The recycled water and biosolids facilities would use the same protocol as the treatment plant.) Actual asset condition assessments will be included in Phase 2.

Phase 1 Deliverables:
- Treatment plant Condition Assessment Protocol
- Collection system Condition Assessment Protocol

- Technical memorandum summarizing CAPs

Phase 1 Resource Needs:

- Internal: 100 hours
- External: $15,000

PM1 – Levels of Service and Performance Measures

Levels of Service (LOS) define stakeholder expectations for performance. Stakeholders include customers, NapaSan's Board of Directors, agencies responsible for enforcing regulations, and NapaSan staff. This AM improvement initiative defines LOS and associated performance measures in alignment with Strategic Plan Goal #1.

Phase 1 tasks includes establishing preliminary LOS and performance measures for treatment plant and collection system assets. Additional refinement of the performance measures occur during subsequent phases of the asset management program, during the development of the TAMPs.

Phase 1 Deliverables:

- LOS and Performance Measures for the treatment plant
- LOS and Performance Measures for the collection system
- Technical memorandum summarizing LOS and performance measures

Phase 1 Resource Needs:

- Internal: 80 hours
- External: $20,000

SS2 – Asset Register Formatting and Data Security

A complete and up-to-date asset register is essential to a successful asset management program. The asset register organizes assets and defines their attributes. The information is entered and retrieved through the CMMS and is the fundamental data from which asset management decisions are made and spending is prioritized. This AM initiative develops the asset hierarchy, unique identifiers, asset descriptions/names, and Maintenance Strategy Groups (MSGs) for the new CMMS selected under initiative SS3. This initiative also includes reviewing and updating (if necessary) data security and backup procedures to maintain the integrity of the asset register over time.

Phase 1 tasks include a review of the existing asset register and development of a recommended format and content for the asset register set up with the new CMMS under initiative SS3.

Phase 1 Deliverables:

- Recommended asset register format and content
- Technical memorandum summarizing recommended asset register format and content

Phase 1 Resource Needs:

- Internal: 200 hours
- External: $30,000

SS3 – CMMS and IS Improvements

NapaSan currently uses MP2 as the CMMS for the treatment plant assets, and Hansen for the collection system assets. The two platforms are separate, and the Hansen software does not interface with the GIS system that capturing some of the asset data for the collection system. This AM improvement initiative has three objectives:

1. Create an interim solution creating an interface between Hansen and GIS;

2. Replace Hansen with a new CMMS and evaluate options for replacing Hansen and MP2 with a single CMMS platform; and

3. Developing an Information System (IS) Plan that identifies gaps and needs for supporting the full asset management program.

Phase 1 tasks address the first two objectives and require significant external resources including consultants and new software.

Creating an interface for the GIS and Hansen platforms requires establishing a single, external database where NapaSan staff manage asset information for the collection system. The external database populates the data in both GIS and Hansen, so both platforms have consistent data. Mapping existing data fields from GIS and Hansen to the new external database avoids the loss of information. Comparison of the current data from GIS and Hansen identifies discrepancies to be reconciled. Some field verification is likely required where discrepancies are noted.

Selection of a new CMMS includes evaluating alternative packages, preparing a specification and RFP for software vendors, selecting the preferred CMMS, and then overseeing the vendor's implementation of the new system and populating the database. Selecting and installing a new CMMS will take two years and this work should begin immediately.

Phase 1 Deliverables:
- Interim GIS/Hansen interface
- Technical memorandum describing the GIS/Hansen interface
- CMMS Specification and RFP to solicit bids from software vendors
- CMMS software, formatted for AM program, and populated with current data
- CMMS User Manual

Phase 1 Resource Needs:
- Internal: 2000 hours
- External: $300,000 for CMMS software and $375,000 for vendor support and consultant