



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

**ERDC**  
INNOVATIVE SOLUTIONS  
for a safer, better world

## **Asset Management and Facility Equipment Maintenance Nexus: Maintenance Effectiveness**

Stuart D. Foltz, Carlos B. Bislip-Morales, and  
E. Allen Hammack

September 2013



**The US Army Engineer Research and Development Center (ERDC)** solves the nation's toughest engineering and environmental challenges. ERDC develops innovative solutions in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, the Department of Defense, civilian agencies, and our nation's public good. Find out more at [www.erdcenter.usace.army.mil](http://www.erdcenter.usace.army.mil).

To search for other technical reports published by ERDC, visit the ERDC online library at <http://acwc.sdp.sirsi.net/client/default>.

# **Asset Management and Facility Equipment Maintenance Nexus: Maintenance Effectiveness**

Stuart D. Foltz

*Construction Engineering Research Laboratory  
U.S. Army Engineer Research and Development Center  
2902 Newmark Drive  
Champaign, IL 61822*

Carlos B. Bislip-Morales and E. Allen Hammack

*Coastal and Hydraulics Laboratory  
U.S. Army Engineer Research and Development Center  
3909 Halls Ferry Rd.  
Vicksburg, MS 39180*

Final report

Approved for public release; distribution is unlimited.

Prepared for **Headquarters**  
U.S. Army Corps of Engineers  
441 G Street NW  
Washington, DC 20314-1000

Under **Project #371013, "Linking FEM and Asset Management"**

## Abstract

The US Army Corps of Engineers (USACE) has constructed a wide variety of civil works structures. Many of these structures have surpassed their design life and deteriorated to a point that better tools and more extensive analysis are needed to identify the most critical maintenance and repair (M&R) needs. The work documented in this report analyzes how data collected in Facility Equipment Maintenance (FEM) can be used to evaluate the effectiveness of maintenance to improve the condition of lock infrastructure components. This includes analyzing how data already being collected in FEM can be used to evaluate maintenance effectiveness and also what additional data could be collected. In the process of addressing these objectives, numerous limitations in how FEM and Operational Condition Assessment (OCA) could be used to address this question were discovered, and they are documented in this report. The report also discusses numerous ways FEM could be used more effectively to address this question and the general benefit of USACE. A pilot Maintenance Effectiveness Review (MER) was held at a USACE lock and dam project.

**DISCLAIMER:** The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. All product names and trademarks cited are the property of their respective owners. The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

**DESTROY THIS REPORT WHEN NO LONGER NEEDED. DO NOT RETURN IT TO THE ORIGINATOR.**

## Executive Summary

The authors of this report were given approximately five calendar months to investigate USACE data pertaining to how maintenance affects the condition of navigation infrastructure. The focus was intended to be on a comparison of maintenance, based on records in FEM, and condition, using the Operational Condition Assessment (OCA) ratings. The scope of this basic question is immense.

Further instruction narrowed the scope for this initial study to five more specific concerns:

1. Examine OCA Inland Navigation data and FEM database for correlation of assets/components.
2. Develop and test data queries of those correlated assets/components as needed for differing USACE locations—most likely Portland (NWP), Great Lakes and Ohio River (LRD), Mississippi Valley (MVD), and North Atlantic (NAD).
3. Using queries from step #2, pull maintenance data from FEM that relates to a condition rating in the Inland Navigation OCA.
4. Examine the data subset from step #3 for certain fields that would likely correspond to condition: failure data, installation date, and frequency of Preventive or Corrective Maintenance (PM or CM).
5. At some point, question subject matter experts (SMEs—perhaps external to USACE) to learn what other data fields may correspond to condition that could be queried under step #4.

Work was initiated, but difficulties arose almost immediately:

- FEM has no universal list of components or naming conventions. There are standardized classifications available for use, but they are for assets at a relatively high level of the infrastructure hierarchy.
- Many different types of maintenance are applied to various components and subcomponents of these classified items. OCA ratings are also for components and subcomponents of these classified items.

- Each USACE Division, District, and project is left to determine independently what they want to list in FEM as assets and how they name each one.
- As for OCA, multiple lists of OCA components were obtained, and at least two different lists had someone defend it as the correct and complete list.
- Because there is no uniform identification of assets within FEM, it was not possible to develop queries by using them.
- Additionally, there was little or no maintenance data for FEM assets that could be meaningfully queried. What is available primarily consists of job plans, of varying detail, clarity, and accuracy. The job plans are implemented based on a preventative maintenance schedule, and completion is recorded when applicable.

Some job plans were reviewed, and this review is discussed further in Chapter 2. FEM includes some data fields which might provide a more accurate picture of maintenance effectiveness, but current usage of these data fields is too limited for making meaningful queries. Two comprehensive approaches to analyze maintenance effectiveness are addressed in Sections 4.1 and 4.3. One approach is to use failure rates of each specific grouping of components as an indicator of maintenance effectiveness. The second method is to look at the ratio of routine to non-routine maintenance. Each approach has its strengths and weaknesses. A number of more targeted approaches are proposed in 4.4.

Whether maintenance management information of various types is currently being entered into FEM, could be entered but is not, or can't currently be recorded in FEM, there still needs to be a well-developed plan for how this information is going to be used, how it will benefit the Corps, how to ensure it is entered, and how it will be reviewed for accuracy.

Only a small part of FEM's capabilities are being used now, and there is much more that could be done with minimal or no additional effort to benefit the project directly and to provide more information for understanding USACE maintenance practices.

The following items currently in FEM should be reviewed and revised by the asset owners:

- Job plans

- Asset hierarchies
- Classifications

The following items can currently be entered in FEM, but generally are not entered. There should be additional guidance to increase uniformity within and across projects:

- Labor
- Materials and costs
- Inventory

The following are items that can be entered in FEM but some have no standardized input to ensure uniformity. They should be reviewed and revised at the national level. There is a need to not only ensure uniformity and consistency, but also to determine what data will best meet needs at local and national levels:

- Classifications
- Attributes
- Failure reporting
- Downtime reporting
- Condition monitoring
- Asset prioritization
- Work order prioritization

A Maintenance Effectiveness Review (MER) was held at New Cumberland Lock and Dam. Because USACE is not applying maintenance according to uniform standards throughout its inventory, nor is it collecting the types of maintenance data that might be used to make estimates of reliability (as would be typical for an organization with a mature maintenance management program), the MER had a somewhat different focus than it might otherwise have had.

The primary activity was to review and improve the text of the job plans. Prioritization capabilities within FEM were also reviewed, and an attempt was made to apply them to assets and job plans. Many useful results came out of the MER. For example, the authors gained a much better understanding of the operation of a navigation lock and the maintenance that is performed. However, some unforeseen issues greatly affecting the mainte-

nance practices and priorities of the lock personnel were discovered. These include:

- An expectation of never being able to replace items deemed non-critical or only being able to with expenditure of excessive time justifying, purchasing, and (as applicable) installing. This results in what may be an excessive effort to avoid the breakdown, failure, or wear-out of any piece of equipment regardless of cost-effectiveness of these maintenance actions.
- The sense of ownership, responsibility, and pride in the project held by the personnel. Clearly there is value to USACE in supporting that desire of the maintenance staff to make the project the best they can.
- A risk-aversion to making changes from the standard operating procedure due to no expectation of reward if it works and an expectation of punishment if it doesn't.

The results of the MER led to questions regarding the relationship between tasks in a MER and in the AM Maintenance Management Implementation Plan (MMIP) being piloted in each USACE division. A pilot implementation was attended by this study's authors, and it appears that the relationship between these two activities is mostly synergistic, with little or no overlap. At this time, however, details of the MMIP are not completely understood due to the pending release of some draft reports. It also appears that the MMIP objective of identifying project maintenance needs is being accomplished generically for the types of infrastructure present at the project rather than for the specific components and operational environment. By contrast, the process completed during the pilot MER for this work focused on the specific components and operational environment at that project.

Each approach has its benefits and drawbacks. Application of the same generic maintenance cost model to all projects within the MMIP does not properly account for specific circumstances at each project. If the model estimates are very good, the model will be generally correct on a network level. It will not, however, properly reflect the maintenance needs at any one project accurately. The focus on job plans and tasks done within the MER captures exactly what the local experts think needs to be done, but it does not account for varying expectations from project to project and does not align maintenance needs equitably across the network. See Uzarski

(2009) for further discussion of network and project-level application of maintenance management.

Using OCA rating data, a comparison was made between condition and age. The results suggest that there is minimal correlation between an asset's age and condition. This comparison is very preliminary, however, and not conclusive due to limitations of the data. These limitations include the use of a project service date rather than specific component ages and multiple reasons to be suspicious of the applicability of the OCA ratings. The primary reason for the suspicions regarding using OCA ratings is that most ratings were "B," but there also are concerns about what the OCA is rating (as described in the next paragraph).

At the start of this project, it was requested that OCA ratings be used as the measure of component condition. OCA ratings also are being used as one input for estimating user impacts. While no literature is known to verify the effectiveness for that objective, a review of the criteria for assigning these ratings suggests that OCA ratings do not provide a meaningful measure of condition as it would relate to maintenance. OCA ratings include numerous factors unrelated to maintenance (e.g., violates law, life safety concern, capacity, design flaw) and the measures of condition related to maintenance (e.g., normal wear) and potentially related to maintenance (e.g., imminent failure, recent service loss, known deficiency) not only are not continuous, but also the discrete ratings are based on yes/no measures that provide minimal information regarding deterioration or indication of maintenance effectiveness.

The primary objective of this project was not met. Early in the project it was learned that the maintenance records in FEM lacked the detail and specificity to complete the primary tasks. It was also determined that the OCA ratings did not capture appropriate information for assessing maintenance effectiveness. Nonetheless, this project resulted in many valuable findings that can be applied within USACE Civil Works O&M maintenance management to improve effectiveness.

One of the major findings was that a focus of prioritizing repairs based on risk of unscheduled outage results in conflicting priorities with standard maintenance management practices focused on minimizing overall maintenance costs. This conflict likely reduces overall system condition. It is unlikely that maintenance can be optimized directly, based on the pri-

ority of individual work packages. Instead, it is reached by a properly balanced application of preventive and corrective maintenance.

# Contents

Abstract .....	ii
Executive Summary .....	iii
Contents .....	ix
Figures and Tables .....	xii
Preface.....	xiv
Abbreviations.....	xv
Unit Conversion Factors .....	xvi
<b>1 Introduction .....</b>	<b>1</b>
1.1 Background .....	1
1.2 Objective .....	1
1.3 Approach.....	1
<b>2 FEM Maintenance Data.....</b>	<b>3</b>
2.1 Introduction .....	3
2.2 Assets .....	3
2.3 Asset classification .....	6
2.4 Attributes.....	8
2.5 Comparison of OCA critical components to FEM assets at individual locks .....	8
2.6 Job plans .....	12
2.6.1 Job plan tasks.....	12
2.6.2 Labor, materials, tools, and remarks .....	14
2.7 Preventative maintenance records .....	14
2.8 Inventory.....	14
2.9 Job plan relevance to operation and condition.....	14
2.10 Work orders .....	15
2.11 Labor reporting .....	15
2.12 Failure reporting.....	16
2.13 Downtime reporting.....	18

2.14	Condition monitoring .....	20
2.15	Asset prioritization .....	20
2.16	Work order prioritization.....	21
2.17	Standing work history .....	22
<b>3</b>	<b>Maintenance Effectiveness Review .....</b>	<b>24</b>
3.1	MER pilot.....	24
3.2	Critical and non-critical maintenance .....	26
3.2.1	Examples .....	26
3.2.2	Discussion.....	27
3.3	Prioritization .....	29
3.3.1	Considerations for prioritization.....	30
3.4	MMIP pilot.....	32
<b>4</b>	<b>Approaches to Minimizing Maintenance Cost.....</b>	<b>34</b>
4.1	Metrics for maintenance effectiveness.....	35
4.2	Failure recording .....	35
4.2.1	Recording date of installation.....	35
4.2.2	Failure modes.....	36
4.2.3	Condition vs maintenance.....	36
4.3	Corrective versus preventative maintenance ratio .....	37
4.4	Miscellaneous approaches to optimize various aspects of routine maintenance .....	38
4.4.1	Hidden failure data.....	38
4.4.2	Time-directed preventive maintenance.....	39
4.4.3	Condition-directed or corrective maintenance.....	39
4.4.4	Usage-based maintenance.....	39
4.4.5	Waiver of maintenance .....	39
4.4.6	Tracking work order costs.....	40
4.4.7	Other reporting metrics.....	40
4.5	Management practices for optimizing routine maintenance .....	40
<b>5</b>	<b>Other Topics.....</b>	<b>42</b>
5.1	Age to condition comparison .....	42
5.2	Lock closure causes.....	48
5.3	Operations and Maintenance Business Information Link lock closure data.....	48
5.4	Measuring condition .....	56

5.4.1	<i>Condition data and condition categories</i> .....	56
5.4.2	<i>Condition category inaccuracies</i> .....	58
5.4.3	<i>Applying condition ratings to asset hierarchical levels</i> .....	59
5.5	Operational condition assessment .....	60
<b>6</b>	<b>Summary</b> .....	<b>63</b>
6.1	Conclusion .....	63
6.1.1	<i>Maintenance Effectiveness Review</i> .....	63
6.1.2	<i>Condition rating</i> .....	63
6.1.3	<i>FEM</i> .....	64
6.2	Recommendations.....	64
6.2.1	<i>Facility Equipment Maintenance</i> .....	64
6.2.2	<i>Condition rating</i> .....	66
	References .....	<b>68</b>
	Appendix A: FEM Component Classifications.....	<b>69</b>
	Appendix B: FEM Component Hierarchy Examples .....	<b>75</b>
B.1.	Wilson Lock and Dam .....	76
B.2.	Lower Monumental Lock and Dam.....	81
	Appendix C: OCA and FEM Component Comparisons .....	<b>84</b>
C.1.	Wilson Lock and Dam .....	85
C.2.	Lower Monumental Lock and Dam.....	131
	Appendix D: FEM Job Plans.....	<b>177</b>
D.1.	Bayou Sorrel.....	178
D.2.	Lower Monumental Lock and Dam.....	202
D.3.	New Cumberland Lock and Dam.....	220

## Report Documentation Page

# Figures and Tables

## Figures

Figure 1. FEM asset classification page with little component detail. ....	7
Figure 2. FEM’s navigation lock asset classification, showing additional classification detail. ....	8
Figure 3. Lock & Dam No. 14, complete FEM hierarchy.....	11
Figure 4. FEM labor reporting example. ....	16
Figure 5. Example of FEM failure report.....	17
Figure 6. FEM downtime reporting selection. ....	19
Figure 7. FEM downtime (details) reporting selection. ....	19
Figure 8. FEM condition monitoring selection. ....	20
Figure 9. FEM input options to prioritize assets. ....	21
Figure 10. FEM input options for work order prioritization.....	22
Figure 11. Standing work history selection in FEM, showing the “Details” field where most of the information is recorded.....	23
Figure 12. Example of optimization of total maintenance cost minimization. ....	37
Figure 13. Foundation System, 1970s to present – negative slope. ....	44
Figure 14. Quoin Blocks (on gate) – positive slope.....	44
Figure 15. Pintle Ball – negative slope. ....	45
Figure 16. Foundation System for expanded time period.....	46
Figure 17. Quoin Blocks (on gate) – negative slope.....	46
Figure 18. Pintle Ball – positive slope.....	47
Figure 19. OMBIL website with numbers added to show order of selection during task. ....	50
Figure 20. Graphical user interface to query database for desired variables.....	51
Figure 21. Field/variable selection.....	52
Figure 22. Initial display of data.....	52
Figure 23. Adjusted display of data.....	53
Figure 24. Category unscheduled unavailability versus total unavailable. ....	54
Figure 25. Category unavailability versus total unavailable.....	54

Figure 26. 3 Category unscheduled unavailability and all other unscheduled versus total unavailable.....	55
Figure 27. 3 Category scheduled unavailability and all other scheduled versus total unavailable.....	55
Figure 28. OCA navigation condition rating flowchart (USACE n.p.).....	62

## Tables

Table 1. Geographical location hierarchy.....	4
Table 2. Functional asset hierarchy.....	5
Table 3. Partial OCA/FEM comparison for Wilson Lock.....	10
Table 4. Example job plan.....	13
Table 5. Comparison of AM viewer and export data fields.....	43
Table 6. Conversion of OCA ratings to numerical values.....	43
Table 7. Individual component condition categories.....	57
Table 8 - Generic condition rating scale. ....	58
Table 9. Expected performance categories.....	59

## **Preface**

This study was conducted for Headquarters, US Army Corps of Engineers (USACE) under Project #371013, “Linking FEM and Asset Management.” The technical monitor was William J. Lillycrop, Technical Director for Navigation.

The work was performed under the direction of the Materials and Structures Branch (CF-M) of the Facilities Division (CF), U.S. Army Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL). At the time of publication, Vicki VanBlaricum was Chief, CEERD-CF-M and Michael Golish was Chief, CEERD-CF. Martin J. Savoie was the Technical Director for Installations. The Deputy Director of ERDC-CERL was Dr. Kirankumar Topudurti, and the Director was Dr. Ilker Adiguzel.

COL Jeffrey R. Eckstein was the Commander of ERDC, and Dr. Jeffery P. Holland was the Director.

## Abbreviations

Term	Spellout
AM	Asset Management
APPMS	Automated Personal Property Management System
CERL	Construction Engineering Research Laboratory
CM	corrective maintenance
CW	Civil Works
ERDC	Engineer Research and Development Center
FEM	Facility Equipment Maintenance
GUI	graphical user interface
HQ	headquarters
LRD	Great Lakes and Ohio River District
M&R	maintenance and repair
MER	Maintenance Effectiveness Review
MMIP	Maintenance Management Implementation Plan
MVD	Mississippi Valley District
NAD	North Atlantic District
NAVSEA	Naval Sea Systems Command
NWP	Portland District
OCA	Operational Condition Assessment
OMBIL	Operations and Maintenance Business Information Link
PM	preventive maintenance
REMIS	Real Estate Management Information System
SME	subject matter expert
SWH	standing work history
USACE	US Army Corps of Engineers

## Unit Conversion Factors

Multiply	By	To Obtain
miles (U.S. statute)	1,609.347	meters

# **1 Introduction**

## **1.1 Background**

The US Army Corps of Engineers (USACE) has constructed a wide variety of civil works structures. Many of these structures have surpassed their design life and deteriorated to a point that better tools and more extensive analysis is needed to identify the most critical maintenance and repair (M&R) needs. Asset Management (AM) is working to develop many of these capabilities. One concern is the impact of M&R on the condition and the reliability of the infrastructure. Maintenance is currently applied based on a combination of continuing maintenance practices that have been done in the past and repair decision making based on the expertise of the managers, engineers, and mechanics. In most cases this has resulted in facilities in good condition for their age but it provides limited capability to analyze past performance to determine what works best and how to improve.

## **1.2 Objective**

The intended objective of the research project being documented in this report is to analyze how data collected in Facility Equipment Maintenance (FEM) can be used to evaluate the effectiveness of maintenance to improve the condition of lock infrastructure components. This includes analyzing how data already being collected in FEM can be used to evaluate maintenance effectiveness and also what data could be collected. The second part can be further broken down into data FEM is already designed to collect and data that FEM is not currently designed to collect.

Ideally, prioritization of M&R expenditures should be based on minimization of risk (event probabilities and event consequences). This requires an understanding of how infrastructure performs given the usage, environment, and maintenance histories and an ability to measure and quantify them independently to understand the role of each on reliability. This is a difficult and complicated question that this report only begins to address.

## **1.3 Approach**

The focus of this research was intended to be on a comparison of maintenance based on records in FEM and condition using the Operational Con-

dition Assessment (OCA) ratings. Further instruction narrowed the scope for this initial study down to five more specific concerns:

1. Examine OCA Inland Navigation data and FEM database for correlation of assets/components.
2. Develop and test data queries of those correlated assets/components as needed at differing locations, most likely Portland District (NWP), Great Lakes and Ohio River District (LRD), Mississippi (MVD), and North Atlantic District (NAD).
3. Using those queries, pull maintenance data from FEM that relates to a condition rating in the Inland Navigation OCA.
4. Examine the data subset from step #3 for certain fields that we think correspond to condition: failure data, installation date, and frequency of Preventive or Corrective Maintenance (PM or CM).
5. At some point, question subject matter experts (SMEs—perhaps external to USACE) to learn what other data fields may correspond to condition that we could possibly query under step #4.

As work progressed, these tasks were modified and additional tasks were added. The biggest of the additional tasks was a review of the capabilities of FEM and completion of a pilot Maintenance Effectiveness Review (MER). Each of these tasks was useful in better understanding how FEM could be used to collect data on maintenance practices.

## **2 FEM Maintenance Data**

### **2.1 Introduction**

While FEM can collect various maintenance-related information and help manage day-to-day maintenance activities, it provides little or no programmed capabilities to analyze information or make statistical comparisons. That said, there are many benefits which can be gained through intelligent use of the tool. If these benefits are to be gained, however, the data must be entered using organization-wide, uniform methods that are specifically designed for the intended types of analyses.

Currently, most of the data that could be collected in FEM is not being collected, and much of the data that is entered uses free-text fields and other non-uniform methods that are not conducive to searches and statistical analysis. FEM currently includes data fields to collect some of this data more systematically. FEM could be set up to allow standardized collection of even more information that would be useful for analysis and optimization of maintenance practices. This chapter is only an introductory discussion of issues regarding the use of FEM.

### **2.2 Assets<sup>1</sup>**

In FEM, assets are anything that work is managed against. Assets can be real property (facilities), personal property, or components. Components are defined as a part or feature of an asset (or another component) that will be maintained, repaired, or replaced. For example, a roof, exterior building envelope, and HVAC system can be components of a building (real property) asset, a fan can be a component of an HVAC system (another component of an asset), and an engine can be a component of a backhoe (personal property) asset.

FEM is an asset-based work management system in which every work order must be associated with an asset. Although FEM will allow work orders to be written against locations, this is not a good business practice since work activities and their associated costs should be connected to an

---

<sup>1</sup> Portions of this section were provided by John Beshears at USACE Walla Walla District (NWW).

asset. Typically, FEM users attach their work orders to assets, but there is no USACE policy on how work orders are managed. Furthermore, inconsistencies in the levels of asset hierarchy that are chosen can make analysis of maintenance practices more difficult.

FEM provides numerous ways to organize assets and their components. The FEM *Locations* module provides an organizational umbrella for assets. Although you can create an asset without a location, it is not recommended. Locations provide a macro-level organization of assets. The module allows users to assign “parent-child” relationships to locations, and the relationships created can be used to organize locations and their associated assets into functional or geographical *hierarchies*. The most common type of location hierarchy is geographical. An example is shown in Table 1).

Table 1. Geographical location hierarchy.

Pine Flat Project Top Level
Dam and Restricted Area
Headquarters Area
North Lake Area
Deer Creek Recreation Area
Island Park Recreation Area
Trimmer Recreation Area
Sycamore Creek WMA
East Lake Area
Kirch Flat Campground

The FEM *Asset* module also allows users to assign parent-child relationships to assets, and those relationships can be used to organize assets into functional or geographical *hierarchies*. Both functional and geographical hierarchies of assets can be incorporated into the overall asset organizational scheme. Hierarchies allow a manager to organize an asset inventory in a way that makes sense and is easily accessible. A well-designed hierarchy matches the way the users think about and manage assets in the hierarchy. A sample functional asset hierarchy is shown in Table 2.

Table 2. Functional asset hierarchy.

<b>Visitor Center</b>
<i>HVAC</i>
Furnace/Forced Air Unit
Air Conditioner Compressor
Air Conditioner Evaporator
<i>Plumbing</i>
Piping (hot & cold water)
Water Heater
Fixtures
<i>Exterior Envelope</i>
Siding
Paint
Windows
Doors
Roof

Note that a list of assets within a FEM site should be referred to as an *asset inventory*. The parent-child relationships of the assets within the asset inventory are known as the *asset hierarchy*. Sometimes you will hear the term “hierarchy” mistakenly used in the context of the term “inventory;” it is important to remember that the terms do not mean the same thing.

Asset inventories and their associated hierarchies can be relatively simple or extremely complex, depending on the importance and/or criticality of the asset and the level of maintenance management it requires. As an example, the asset/component hierarchy of a recreational site located at a multipurpose project might only include the top-level asset, “recreational facility” and its associated buildings, while the asset/component hierarchy of a hydroelectric turbine and generator may contain hundreds or even thousands of components. The OCA process may eventually be used in the FEM asset inventory/hierarchy for some assets such as locks where the goal is to have a one-to-one match between the OCA model and the FEM inventory/hierarchy. This one-to-one match does not currently exist. (See Section 2.5 for further details.)

The development of FEM asset inventories and their associated hierarchies should be a joint effort between the project’s management staff and the project’s maintenance and operations staff, with input from the USACE district. Some districts require specific smart-numbering systems,

or they may require a standard inventory and hierarchy be created to a certain level. Project maps, printouts from REMIS (Real Estate Management Information System) and APPMS Automated Personal Property Management System), organization charts, and other project information should be available for reference during the process. Users should consider tools like OCA, RecBest, and others when developing their inventories.

The development of a good location list and hierarchy plus a well-thought-out, top-level asset inventory/hierarchy will facilitate easy future expansion and revision.

### 2.3 Asset classification<sup>2</sup>

*Asset classifications* are a function of FEM/Maximo<sup>3</sup> that allows the development of an asset taxonomy. The FEM classification screen is shown in Figure 1. A precise taxonomy of assets allows searching the database across the enterprise without regard to asset numbering and naming schemes or asset hierarchies. Classifications are a very powerful tool for identifying assets within an enterprise database like FEM; they are critical to statistical analysis of maintenance effectiveness.

Imagine that the Corps decided to track all pickup trucks in FEM, and HQ made a call to the field to ensure every pickup truck was included in a FEM asset inventory/hierarchy. Once the field complied, however, all this data would be of little value on either a division or national level because some people might use “PU,” some might use “P/U” while others might even use model names such as “F-150” and “Silverado” to describe their pickup truck assets instead of the word “pickup.” Some people might suggest that a universal asset numbering system adequately identifying pickups would solve this issue, but there could still be transposed characters and other problems due to human error. The best way to solve the problem is to direct the field to select the asset classification, “20-02-07, Trucks, Pickup, Group F” for each pickup truck asset of this type. Selecting the classification in this way (from a predetermined pull-down list) ensures there is no chance of misspelling or transposing characters. Now it is easy to search all pickup data across the entire database.

---

<sup>2</sup> Portions of this section were provided by John Beshears at USACE Walla Walla District (NWW)

<sup>3</sup> Maximo is a commercially available software program that USACE had customized and this customization resulted in FEM.

The current system of asset classifications in FEM is based on ER 37-1-30, “Financial Administration - Accounting and Reporting,” which contains an appendix “Authorized Purposes for Multi Purpose Hydropower Projects” (USACE 2002). The classification structure and classified lock components are reproduced in this report as Appendix A: FEM Component Classifications. The current classification system is appropriate for classifying real property facilities and major items of personal property, but it includes only higher levels of detail for component hierarchy (Figure 1). The more detailed classification options for locks are shown in Figure 2.

Where the current system *does* address components at a somewhat lower level, such as an elevator, the system exhibits some problem areas with singularity. Ultimately, the Corps will likely expand classifications to the component level by using UNIFORMAT II, Unified Facilities Guide Specifications (UFGS), OCA, or other input as an organizational guide. In the interim, users are advised to classify their assets in accordance with any guidance offered by each USACE business line.

Figure 1. FEM asset classification page with little component detail.

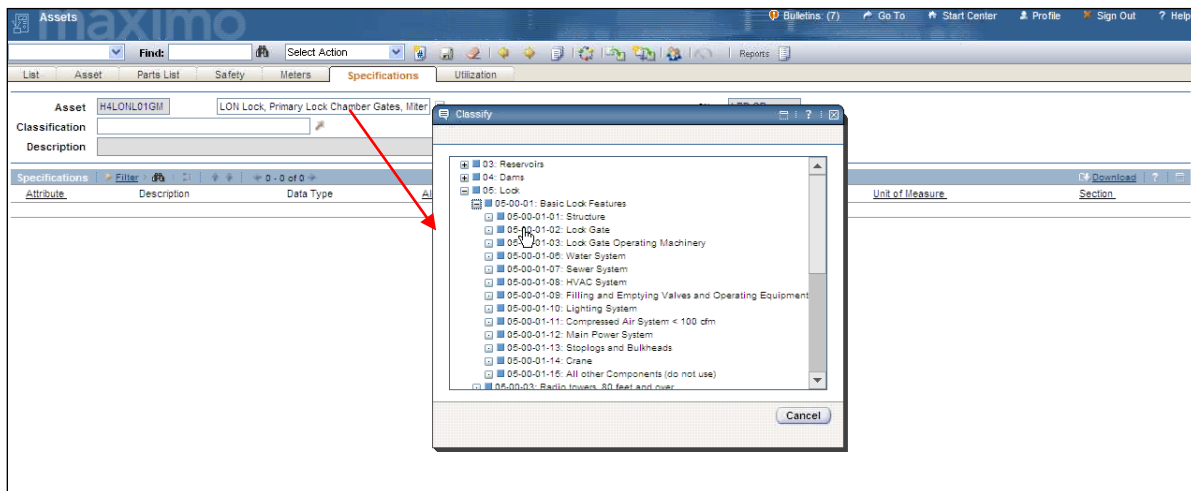
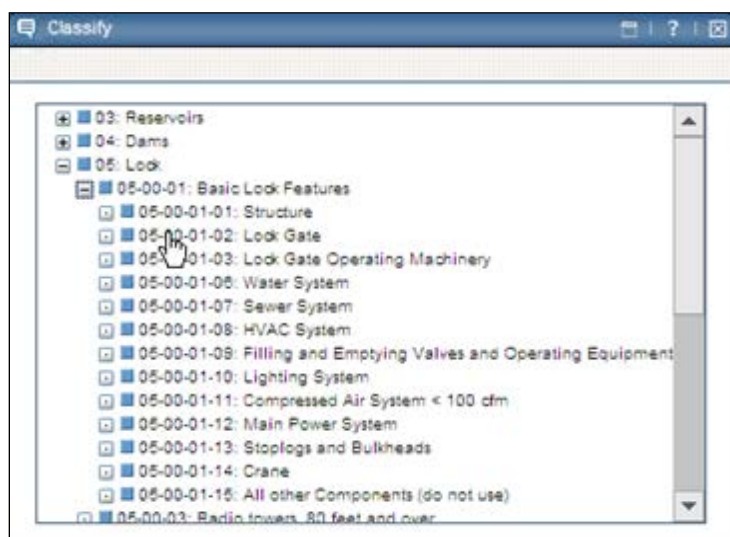


Figure 2. FEM's navigation lock asset classification, showing additional classification detail.



## 2.4 Attributes

Once a classification is established in FEM, the program supports a list of *attributes* associated with a particular classification. Attributes provide additional information about the asset related to its classification. In the previous pickup truck example (Section 2.3), some of the attributes established are engine size, number of cylinders, air conditioning (yes/no), color, etc. Currently, attributes have been developed in FEM for floating plant and some vehicular classification. The hydropower business line is in the process of identifying attributes, and attributes are also being developed to help support dredged material disposal area management. Determining what attribute information should be collected and then collecting this data is critical to tracking maintenance effectiveness and being able to retrieve meaningful information for particular assets. Attributes and classifications are critical for sorting infrastructure assets for many types of analysis, including maintenance effectiveness.

## 2.5 Comparison of OCA critical components to FEM assets at individual locks

In order to evaluate how well the FEM database entries have been populated by project personnel, the existing FEM hierarchies were compared to those in the AM OCA ratings database. By analyzing the FEM hierarchies of multiple projects from different USACE districts, an understanding of how infrastructure components are currently identified in FEM throughout USACE can be inferred. The goal of the comparisons is to determine

how closely the FEM hierarchical components correspond to the OCA components. The OCA component list should include all the vital components of a navigation project. Therefore, all components listed in the FEM hierarchies should also be listed in the OCA database. By comparing the OCA and FEM databases, the FEM database can be evaluated for completeness.

Three navigation projects were chosen for the OCA/FEM database comparison:

- Wilson Lock and Dam (Nashville District)
- Lower Monumental Lock and Dam (Walla Walla District)
- Lock and Dam No. 14 (Rock Island District)

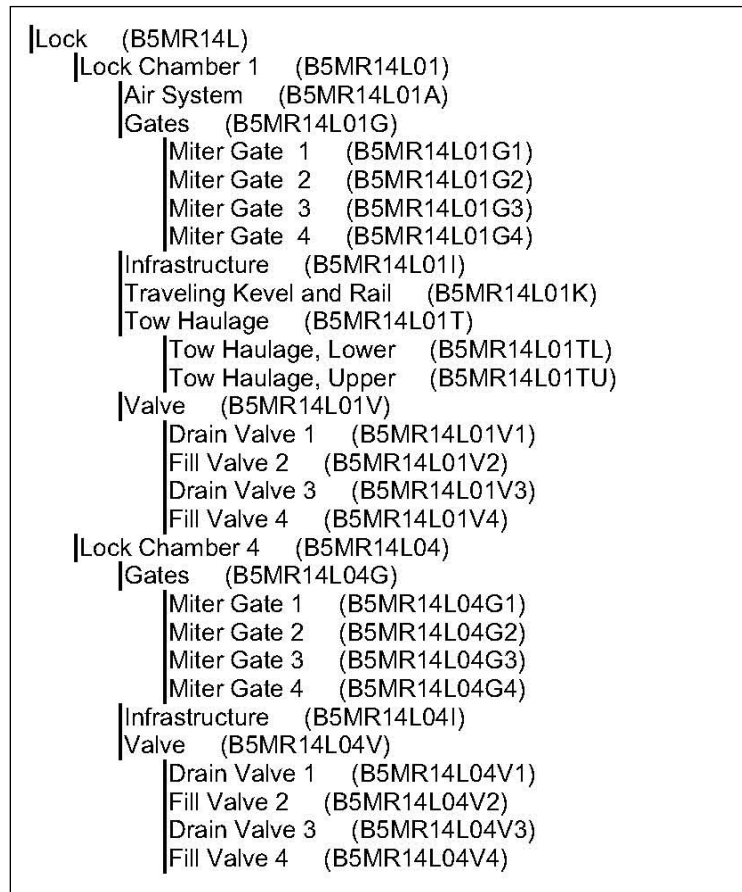
Results of the comparison showed the level of detail in the FEM database varied greatly among these three projects. For both Wilson Lock and Dam and Lower Monumental Lock and Dam, a sufficient amount of detail was included in the database for comparison with the OCA component list. The listed components ranged from lock gates and lock culvert valves to elevators, lighting, and fence lines. (For reference, the FEM hierarchies for Wilson Lock and Lower Monumental Lock used in the OCA/FEM comparisons are listed in Appendix B: FEM Component Hierarchy Examples.) By contrast, for Lock and Dam No. 14, the level of detail within the FEM database was much lower. Only the largest navigation lock components, such as the gates were included (see Figure 3). A section of the OCA/FEM comparison for Wilson Lock is shown in Table 3. (For reference, the complete OCA/FEM comparisons for Wilson Lock and Dam and for Lower Monumental Lock and Dam are in Appendix C: OCA and FEM Component Comparisons).

In Table 3, the second column is very sparse for multiple reasons. First, the OCA component list includes many types of components not present at these locks. The lock also has infrastructure not deemed critical by OCA, so it is not listed as an OCA component. These reasons are acceptable. The problem stems from much of the infrastructure at the locks not being identified in the same way in both the FEM and OCA component lists.

Table 3. Partial OCA/FEM comparison for Wilson Lock.

OCA Component List	FEM Hierarchy
1. Lock	Structures
2. Lock Structure	Primary Chamber
3. Lock Walls & Other Lock Structures	Lock Walls
4. Landside Wall	Land Wall
5. Stability	
5. Structural	
5. Deterioration	
4. Middle/Intermediate Wall	
5. Stability	
5. Structural	
5. Deterioration	
4. Riverside Wall	River Wall
5. Stability	
5. Structural	
5. Deterioration	
4. Guide Wall	Lower Guide Wall
5. Stability	
5. Structural	
5. Deterioration	
4. Guard Wall	Upper Guide Wall
5. Stability	
5. Structural	
5. Deterioration	
4. Pier Wall	
5. Stability	
5. Deterioration	
4. Nose Pier	
5. Stability	
5. Structural	
5. Deterioration	
4. Gate Sill	Guard Sill, Downstream
	Guard Sill, Upstream
	Miter Sill, Downstream
	Miter Sill, Upstream

Figure 3. Lock &amp; Dam No. 14, complete FEM hierarchy.



The FEM hierarchy for Wilson Lock contained a major component – an air bubbler system – that was not included in the OCA database. Such an omission is a concern, and the OCA database should be evaluated to determine if any other components are also missing.

Inspection of the FEM hierarchies revealed that the terminology used to describe lock components varies among navigation projects. For instance, a component may be referred to as a “culvert valve” at one project but as a “reverse tainter gate” at another project. While neither description is technically incorrect, the difference in description (and level of detail) significantly hinders efforts to compare the components at different projects. Implementing a project component naming convention would greatly reduce the problems associated with the level of detail in component descriptions within the FEM database.

Another common problem found in the FEM database entries was widespread typographical and spelling mistakes. These seemingly minor errors

cause significant problems with automated searches of the database. Such problems can be avoided by limiting data entry in the FEM database to existing component lists. These component lists would be generated for all USACE projects to create an all-inclusive list of components (to a certain level of detail) at all projects. For instance, when creating an entry in the FEM database for the upstream miter gate at a lock, the data entry employee would not have to manually type “miter gate,” but would just have to select “miter gate” from a pull-down list in the FEM database.

## **2.6 Job plans**

FEM job plans record details for a particular maintenance activity that can be repeated on a routine or non-routine basis. Most job plans are for routine activities, but a non-routine job plan is a good way to document how to complete a recurring non-routine activity. This documentation might be especially important for a complicated job with difficult-to-remember steps or a job with critical safety concerns. Job plans primarily consist of tasks, labor (including crafts and crews), materials (including inventory), tools, and remarks.

### **2.6.1 Job plan tasks**

Well-written, detailed, job plan tasks provide an important record of what maintenance is planned. While there are other ways that completed maintenance can be recorded in FEM, a record of completed job plan tasks is best. High-quality job plan task descriptions also allow comparisons from project to project, and they are especially useful to maintenance personnel new to the project. See Table 4 for an example of a job plan with tasks, after it was edited during the MER. Job plans for Bayou Sorrel, Lower Monumental, and New Cumberland are provided in Appendix D: FEM Job Plans. These examples illustrate the range of detail for job plans typical within USACE.

Most projects include minimal detail for routine maintenance tasks within FEM. The reasons for this lack of detail include those listed below.

- Initial job plans were primarily cut and pasted from maintenance manuals.
- Tasks were copied to remarks field instead of to separate task fields.
- Personnel haven't had time to update and edit their job plans.
- Personnel “know” what needs to be done.

- Some of the specifics are documented elsewhere.
- Almost certainly for various other reasons, good and bad.

Table 4. Example job plan.

<b>ASSET:</b> H4LONL - LON Lock	
<b>PM:</b> H4LON8465	<b>DESCRIPTION:</b> Rack & Sector Gears, Operating Levers, Rollers & Guides-Q
<b>JOB:</b> H4LON25323	<b>CREW:</b> H4LON-MC
<b>FREQUENCY:</b> 3 months	
<b>Elapsed Time:</b> 16 hr	<b>Total Manhours:</b> 32 m/h
<b>Personnel:</b> 2 mc	
<b>Task Description:</b> Lubricate 1200-ft and 600-ft Chamber Miter Gates Rack & Sector Gears, Operating Levers, Rollers & Guides	
<ol style="list-style-type: none"> <li>1. Review AHA for this procedure.</li> <li>2. Review MSDS for precautions with grease and solvents used in this procedure.</li> <li>3. Gather tools required to complete maintenance.</li> <li>4. Ensure all personnel informed of activity.</li> <li>5. Remove grating to access machinery.</li> <li>6. Inspect and lubricate rollers and guides with 630AA.</li> <li>7. Inspect and lubricate rack and sector gears with MPG 2.</li> <li>8. Inspect and lubricate operating levers and linkage assemblies with MPG 2.</li> <li>9. Visually check anchorage for cracks and overall condition.</li> <li>10. Operate miter gates to ensure proper operation and distribution of lubrication.</li> <li>11. Check all components for looseness, wear and proper operation and adequate lubrication.</li> <li>12. Listen for abnormal noises coming from machinery.</li> <li>13. Restore equipment to readiness condition.</li> <li>14. Report completion in FEM.</li> </ol>	
<b>Safety Precautions:</b> Follow EM-385-1-1 general safety precautions when performing maintenance. Follow all posted safety precautions in the area of operation.	
<b>Tools, Parts, Consumables:</b> 630AA lubricant, MPG-2 lubricant, Grating hooks, air compressor, air compressor, grease guns, putty knife, rags, buckets, absorbent wipes.	
<b>Remarks:</b> This job is done more frequently at many other locks – perhaps they can reduce the frequency.	

## **2.6.2 Labor, materials, tools, and remarks**

Estimates of the required labor, materials, and tools can be entered in the job plan. This information not only helps in preparation for a particular work order (application of a job order according to a PM record) but also, the plans can also be used to compare available resources over a time period (e.g., month, year) to the resources at hand. Unfortunately, the “Remarks” field often becomes a catch-all for information that could be entered in other fields intended for that particular information.

## **2.7 Preventative maintenance records**

PM records can include one or more job plans on the same or different schedules. When multiple job plans are included, it is often done to apply light maintenance on a frequent schedule (e.g., monthly) and heavier maintenance on a less frequent basis (e.g., annually).

## **2.8 Inventory**

Materials and tools can be inventoried so that when a work order is generated, a request for these items can be placed and availability verified. (The benefits of this capability are outside the scope of this report.)

## **2.9 Job plan relevance to operation and condition**

The relationship between a job plan and a component’s operation varies depending on the component and the type of maintenance within the job plan. It is unlikely that any amount of data would allow a meaningful statistical evaluation of the maintenance benefit without a consideration of how the maintenance impacts the infrastructure. For example, lubrication of components can have one or more benefits of varying types:

- The component can break or freeze.
- Wear of the component can increase, shortening its life.
- Load on other components can increase, causing those components to break.
- Wear of the other components can increase, shortening their life.
- Performance of the component can be reduced, slowing lock operations or requiring additional manual labor to keep operations moving.

The above list of benefits may be imperfect or incomplete, but it should be clear that maintenance effectiveness is not as simple as comparing a job

plan's maintenance tasks to the condition of the applicable component. This lack of direct comparison is further complicated by job plans that apply various maintenance to multiple components and by components that have multiple maintenance actions applied to them, so that there is no one-to-one correlation between a job plan and a component's condition.

## **2.10 Work orders**

Work orders can be automatically generated based on job plans and a PM record, or they can be generated manually. Manually generated work orders might be for an operational failure or to initiate further investigation of a concern. Work orders can be reported as completed, and many projects do this. As previously mentioned, job plan tasks can also be reported as completed. This is not typically part of the current USACE business practice, however. Reporting work order (and job plan tasks) completion is useful from a day-to-day operational standpoint, but it provides only a bare minimum of useful information for more rigorous analysis of maintenance practices. Labor reporting is very useful for numerous reasons, as discussed in Section 2.11. Recording of other maintenance results such as use of consumables, repair parts, and costs provides valuable information for analyzing maintenance practices. Recording such details is the best method for understanding how maintenance funds are used and the total cost for maintenance.

## **2.11 Labor reporting**

FEM is configured to record labor information (Figure 4). In Figure 4, the frame is set up to include the person, hours, dates, work order, CEFMS work unit, and additional information. FEM labor reporting can be modified as needed.

As of this writing, there are two USACE districts recording labor in FEM and using this information in their payroll process. Many other districts are waiting for FEM and CEFMS to be linked before they use FEM to record labor. While efficiencies will be gained when FEM and CEFMS labor is linked, there are numerous reasons to consider recording labor in FEM now. First, the level of effort is similar to filling out a timesheet, something that has to be done regardless. There are also many advantages. It creates a record of how much time is actually spent on each work order. This allows comparison of the job plan estimates to the actual hours and is critical for determining the total cost of maintenance. Additionally, job plans

can be updated to show a more accurate estimate, anomalies in the time it takes to complete a job order can be investigated to better understand the maintenance requirements, time spent in non-maintenance activities (e.g., training) can be tracked, and costs for routine and non-routine maintenance can be compared. While this list of advantages is not exhaustive, it indicates significant value from tracking labor in FEM.

Figure 4. FEM labor reporting example.

The screenshot shows the 'Labor Reporting' application window. On the left is a navigation pane with various record types like 'CURPPHART', 'D-LADOU', 'G2DUNAPPROVED', etc. The main area displays a table of labor records for 'OHNSTAD, JAMES E'. The table has columns for Name, WO #, Start Date, Labor Type, Reg Hrs, PP Hrs, CEFMS Labor Code, Env / Haz Code, Special Rate Code, and Appr?. The records show various work orders (e.g., 12-18443, 12-18442, 12-18441) with dates ranging from 08/21/2012 to 09/03/2012. Labor types include LH, LS, and RF. Hours are listed in 'Reg Hrs' and 'PP Hrs' columns. The interface includes a search bar, a 'View Total Hours' button, and a 'New Row' button at the bottom right.

Name	WO #	Start Date	Labor Type	Reg Hrs	PP Hrs	CEFMS Labor Code	Env / Haz Code	Special Rate Code	Appr?
%OHNSTAD%									
OHNSTAD, JAMES E		09/03/2012	LH	10.00	0.00				
OHNSTAD, JAMES E		08/30/2012	LS	5.00	0.00				<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/30/2012	RF	5.00	0.00	1508DE			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/29/2012	RF	8.00	0.00	1508DE			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18442	08/29/2012	RF	2.00	0.00	18A84C			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/28/2012	RF	8.00	0.00	1508DE			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18441	08/28/2012	RF	2.00	0.00	151B9B			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18440	08/27/2012	RF	2.00	0.00	14E1C2			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/27/2012	RF	8.00	0.00	1508DE			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/23/2012	RF	8.00	0.00	1508DE			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18442	08/23/2012	RF	2.00	0.00	18A84C			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18442	08/22/2012	RF	2.00	0.00	18A84C			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/22/2012	RF	8.00	0.00	1508DE			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18441	08/21/2012	RF	2.00	0.00	151B9B			<input checked="" type="checkbox"/>
OHNSTAD, JAMES E	12-18443	08/21/2012	RF	8.00	0.00	1508DE			<input checked="" type="checkbox"/>

## 2.12 Failure reporting

Failure reporting is important for a number of reasons but it basically comes down to understanding what fails, how often, why, in what conditions, and with what consequences. FEM includes a work order page for recording the failure class, problem, cause, and remedy (Figure 5).

At first glance, failure reporting seems to be quite simple. It is not. Each of the questions in the previous paragraph needs to be approached in a direct and explicit fashion to capture the desired information.

**What has failed?** — Identifying what has failed must be done in a consistent way. That means using classifications to identify the component and attributes to identify details such as the manufacturer, size, etc.

**How often?** — This is the best basis for estimating failure rates. It may also help identify systemic problems. The occurrence of a failure needs to be precisely defined. Is it based on a repair, subcomponent replacement, overhaul, total replacement, another basis, or some combination of these? The answer will determine how the data can be used.

**Why?** — The most valuable data is identification of the failure mode. It makes a difference whether electric motor failures are from bearings that have been inadequately lubricated or from a short in the motor windings that can't be maintained but might indicate a manufacturer defect.

**What conditions?** — If every USACE lock were constructed with a similar design, size, usage, operating environment, etc., determining failure rates could be done more accurately. There are a number of ways to capture these operating conditions but it will require extensive forethought to most effectively account for these variables.

**Suspensions?** — How are replacements before failure to be recorded?

**What consequences?** — Should a failure be reported based on a stall, stoppage, non-routine application of maintenance, or other criteria?

Figure 5. Example of FEM failure report.

The screenshot shows a web-based interface for 'Work Order Tracking'. The main content area displays a failure report for Work Order 12-96942, titled 'Power Back Generator (Monthly)' at site LRP-OD. The failure details include a Failure Class of 'GEAR' and a Failure Code of 'Gears, Any Open Or Enclosed'. The Remarks field contains 'dummy failure'. Below this, a table of Failure Codes is shown, with columns for Type, Failure Code, and Description. The table lists three entries: PROBLEM (CRACK - Crack In Structure Or Surface), CAUSE (CRACKED - Cracked Component), and REMEDY (REPAIR - Repaired - Incl. Cleaned). A 'Select Failure Codes' button is located at the bottom right of the table.

Type	Failure Code	Description
PROBLEM	CRACK	Crack In Structure Or Surface
CAUSE	CRACKED	Cracked Component
REMEDY	REPAIR	Repaired - Incl. Cleaned

With adequate data points and detail, failure data can assist in many ways. First, it can allow a statistical calculation of past failure rates. This is important for verifying estimates used in risk analysis. Failure data can also help identify common causes of failures, maintenance deficiencies, manufacturing defects, design flaws, and other system faults.

While failure data information is useful, it likely needs to be supplemented with additional information. Useful supplementation includes (a) information that can be collected in FEM such as age; (b) information that should be collected as standardized attributes such as the manufacturer, model, size, etc.; and (c) information such as condition as it relates to the specific failure mode. While this last piece of information (condition) could be accomplished by extensive data collection, there are possible alternatives such as post-failure estimates and automated condition monitoring.

### **2.13 Downtime reporting**

Currently, FEM makes no direct connection between downtime reporting and failure reporting, although both must be tied to a work order. Downtime reporting differs from failure reporting in that it is primarily concerned with recording what asset is unavailable and the duration. Figure 6 and Figure 7 show entry of this information into FEM. Note that downtime reporting is based on what is occurring during the downtime and does not include information on what led to the downtime. It also does not specifically distinguish between scheduled and unscheduled downtime. Currently there are five choices for types of downtime, as shown in Figure 7. Note that the list does not include any type of weather-related downtime, nor does it allow recording a boat accident, personnel injury, or other causes not listed in FEM. Although it is possible to record lock stoppages and shutdowns within the downtime reporting, there is no obvious best way to do that and currently no guidance on how it should be done. As a result, if a project started using FEM to record shutdowns, it is likely those shutdowns would be recorded in different ways across USACE and thus, would not allow easy compilation of the history of shutdowns and their causes.

While there is no direct link in FEM between downtime reporting and failure reporting, because both are tied to a work order, a link is established, and both can be matched up within the database. But that link is weak within the user interface because failure reporting is located on a work order tab and downtime reporting is on a pull-down menu. It would be better if the user interface included a stronger link between the two. One option that would be a rather weak but useful link is to prompt the user to enter a downtime report when exiting failure reporting and provide a similar prompt when exiting the downtime report.

Figure 6. FEM downtime reporting selection.

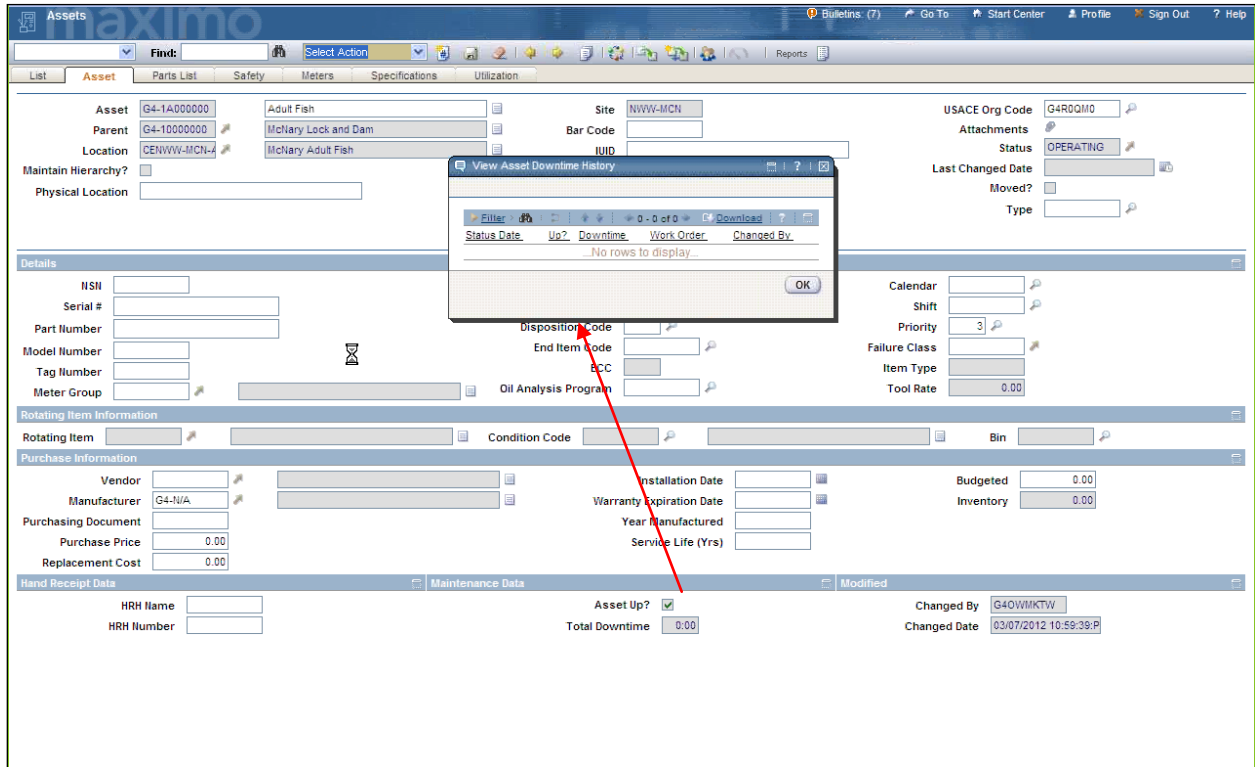
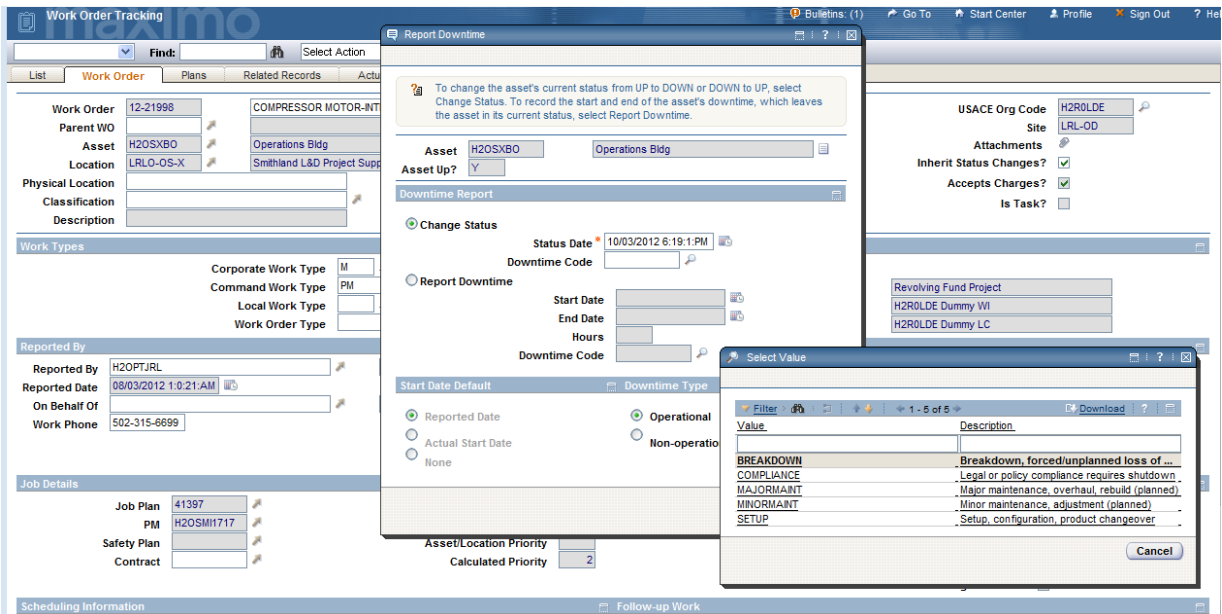


Figure 7. FEM downtime (details) reporting selection.



## 2.14 Condition monitoring

FEM includes pages for collection of condition monitoring data. USACE does not use the FEM “Condition Monitoring” capability, except in a few instances where individual projects are monitoring some gauge and characteristic markers (e.g., fuel levels, oil quality) as shown in Figure 8. Currently there are three condition types: “Continuous” (e.g., odometer), “Gauge” (e.g., pressure) and “Characteristic” (e.g., OCA rating). There is no preset, generic set of categories for Characteristic meters. Instead, these categories would be set up for a particular asset by using picklists. Potentially, this capability could be used to capture OCA data for the infrastructure or other condition data more closely linked to maintenance effectiveness.

Figure 8. FEM condition monitoring selection.

The screenshot displays the 'Condition Monitoring' interface for an asset named '500 kw, 4160-volt Emergency Generator'. The interface is divided into several sections:

- Asset Information:** Point: DIESEL REFILL, Asset: G4-SXAPSG00, Meter: DIESELLEVG. Attachments include USACE Org Code (G4R0PLO), Site (NWW-LGR), Meter Type (GAUGE), and Unit of Measure (GALLON).
- Limits:** Upper Warning Limit (2,100.000), Upper Action Limit (2,300.000), Lower Warning Limit (1,800.000), and Lower Action Limit (1,000.000). Job plans for both upper and lower limits are set to 'ORDER DIESEL FUEL'.
- Measurements:** A table showing historical data with columns for Measurement Date, Measurement, and Observation.
 

Measurement Date	Measurement	Observation
04/01/2012 12:00:AM	2,028.000	
03/08/2012 12:00:AM	1,799.000	
02/29/2012 12:00:AM	1,810.000	
01/11/2012 12:00:AM	2,530.000	
12/03/2011 12:00:AM	2,028.000	
11/13/2011 12:00:AM	1,829.000	
- History:** A section for Work Order history, currently showing no rows.
- Record Modification Data:** Changed By: G40ELJMW, Changed Date: 03/01/2012 5:26:11 PM.

## 2.15 Asset prioritization

USACE does not use FEM’s “Asset Prioritization” capability. The first step toward usage would be to determine how this capability would be used. Among other possibilities, it could potentially be used in conjunction with work order prioritization to help focus maintenance on more critical components, but USACE does not have any guidance for applying such a prior-

itization. Figure 9 shows the FEM input options for asset prioritization. These choices can be revised as needed. As part of a MER at New Cumberland Lock and Dam, an attempt was made to prioritize assets. This attempt is further discussed in 3.3.

Figure 9. FEM input options to prioritize assets.

The screenshot displays the Maximo Assets application interface. A 'Select Value' dialog box is open, showing a list of priority levels for asset prioritization:

Value	Description
1	Ancillary, low priority
2	Basic, not essential/critical
3	Essential for product delivery
4	Critical for product delivery

The main form shows the following details for the asset 'H4LM3LVT':

- Asset: H4LM3LVT
- Parent: H4LM3LV
- Location: LRPW-LM3-L
- Physical Location: 05-03-01
- Site: LRP-OD
- USACE Org Code: H4R08B0
- Status: OPERATING
- Priority: 2
- Failure Class: [Empty]
- Item Type: [Empty]
- Tool Rate: [Empty]
- Installation Date: [Empty]
- Warranty Expiration Date: [Empty]
- Year Manufactured: [Empty]
- Service Life (Yrs): [Empty]
- Asset Up?
- Total Downtime: 0:00
- Changed By: H4OPLBBX
- Changed Date: 04/15/2011 2:27:17 PM

## 2.16 Work order prioritization

USACE does not use FEM's "Work Order Prioritization" capability. The first step toward usage would be to determine how it would be used. It could potentially be used to help focus maintenance on more critical components, but USACE does not have any guidance for applying such a prioritization. Figure 10 shows the FEM input options for work order prioritization. These choices can be revised as needed. As part of a MER done at New Cumberland Lock and Dam, an attempt was made to prioritize work orders. This attempt is further discussed in Section 3.3.

Figure 10. FEM input options for work order prioritization.

The screenshot displays the 'Work Order Tracking' application interface. A 'Select Value' dialog box is open, showing a list of prioritization options:

Value	Description
1	Deferrable, low priority
2	Normal-for effective operation
3	Urgent-stop eventual loss
4	Critical-stop immediate loss

The background form shows the following details:

- Work Order:** 12-107050
- Parent WO:** [Empty]
- Asset:** H4LM3LVT
- Location:** LRP11-LM3-L
- Physical Location:** 05-03-01
- Classification:** [Empty]
- Description:** [Empty]
- Work Types:** Corporate Work Type (0), Command Work Type (PM), Local Work Type ([Empty]), Work Order Type ([Empty])
- Reported By:** H4ORWJAK
- Reported Date:** 09/04/2012 4:14:AM
- On Behalf Of:** [Empty]
- Work Phone:** 304-277-2240
- Job Details:** Job Plan (H4LM3017), PM (H4LM310539), Safety Plan, Contract
- Priority:** WO Priority (2), WO Priority Justification, Asset/Location Priority (2), Calculated Priority (4)
- Scheduling Information:** Target Start (09/04/2012 12:00:AM), Target Finish (09/04/2012 12:30:AM), Scheduled Start, Scheduled Finish, Duration (0:30), Time Remaining

## 2.17 Standing work history

Standing work history (SWH) is a FEM option that was added for LRD, although it is available for all users. SWHs are work orders that stay open and are used to record various information on individual components or equipment, including almost anything except routine maintenance tasks. The objective was to record information that would have been kept on handwritten maintenance cards. Figure 11 shows a SWH with the “Details” field where most of the information is recorded. This information includes most non-routine maintenance, fuel deliveries, new equipment, parts replacements, etc. FEM has other data fields for recording most of this information, but the SWH allows the personnel to transition from past practice with the least amount of change. When information on unscheduled maintenance is recorded in SWHs, this creates an obstacle to statistical searches related to maintenance effectiveness. One option for a more standardized recording of some of this information (e.g., measurements, meter readings) is to use the condition monitoring capability discussed in Section 2.14).

Figure 11. Standing work history selection in FEM, showing the “Details” field where most of the information is recorded.

The screenshot displays the MAXIMO Work Order Tracking interface in a Windows Internet Explorer browser. The main content area shows a table of work logs for work order H4LON10-5270. The table has columns for Record, Class, Created By, Created Date, Remark Date, Type, Summary, and Viewable?. The selected record (H4LON10-5270) is expanded to show a 'Details' panel. This panel contains a 'Summary' field with the text 'Inspected Brakes and Gear Box' and a 'Details' field with the text 'Spring 6 1/2" 352 ft. lbs.', 'Air Gap 1/8"', and 'Brake Lining 1/2"'. A 'Viewable?' checkbox is also present and is currently unchecked.

Record	Class	Created By	Created Date	Remark Date	Type	Summary	Viewable?
H4LON10-5270	WORKORDER	H4OPLBWR	08/29/2012 3:25:11 PM	08/29/2012 3:22:18 PM	CLIENTNOTE	Inspected Brakes and Gear Box	N
H4LON10-5270	WORKORDER	H4OPLBWR	08/29/2012 3:22:18 PM	08/29/2012 3:22:18 PM	WORK	Installed corking	N
H4LON10-5270	WORKORDER	H4OPLBWR	02/10/2012 7:8:38 PM	02/10/2012 7:8:38 PM	WORK	Pre-Inspection Tainter Gate #1	N
H4LON10-5270	WORKORDER	H4ORXDP3	12/08/2011 3:52:17 PM	12/08/2011 3:52:17 PM	WORK	Inspected Brakes and Gear Box	N
H4LON10-5270	WORKORDER	H4ORXDP3	10/05/2010 8:51:11 PM	10/05/2010 6:51:11 PM	CLIENTNOTE	Inspected Brakes and Gear Box	N

**Details Panel:**

- Record: H4LON10-5270
- Class: WORKORDER
- Created By: H4ORXDP3
- Created Date: 12/08/2011 3:52:17 PM
- Remark Date: 12/08/2011 3:52:17 PM
- Changed By: H4ORXDP3
- Changed Date: 12/08/2011 3:53:48 PM
- Type: WORK
- Viewable?:

**Summary:** Inspected Brakes and Gear Box

**Details:** Spring 6 1/2" 352 ft. lbs.  
Air Gap 1/8"  
Brake Lining 1/2"

### 3 Maintenance Effectiveness Review

Once an organization has a maintenance management system implemented and is using it to manage and collect data on maintenance and repair, a MER can be used to verify the job plan's applicability and effectiveness. Basic questions include: (a) whether there is degradation to the asset that is affected by maintenance, (b) maintenance task needed and type needed, (c) consequence of functional failure, and (d) current maintenance cost effectiveness and how it might be improved. If data has been collected about the application of job plans, this can also be used to justify task, frequency, or cost modifications. A MER also provides a good opportunity for engineers and designers to interface with maintenance mechanics.

For an organization that applies maintenance per manufacturer recommendations or possibly applies maintenance even more extensively, savings can often be achieved by reviewing maintenance effectiveness. Naval Sea Systems Command (NAVSEA) reports the MERs for various ships and infrastructure result in an average reduction in routine maintenance of 40%.<sup>4</sup> In cases where routine maintenance is minimal, the MER may result in increased routine maintenance.

#### 3.1 MER pilot

In consultation with the team responsible for the Civil Works (CW) MMIP, it was decided that a MER pilot should be held. The MER pilot would serve multiple purposes to include: (1) help the research team become more familiar with routine maintenance practices at a lock, (2) provide information to the MMIP team to be used in developing and implementing the MMIP, (3) help the project maintenance personnel improve their job plans and their routine maintenance practices, and (4) help all three groups better understand how to use FEM in the USACE business process.

Given that USACE had never performed anything like a MER prior to this pilot, the specific activities and results were not completely certain. USACE participants were not familiar with the process, and the specifics

---

<sup>4</sup> Oral communication by authors with NAVSEA contractor who trains Navy users of MER process.

would also depend on the quality of the job plans for the site and how the project was using FEM in their maintenance process.

A MER was held at New Cumberland Lock and Dam. Because USACE is not applying maintenance according to uniform standards throughout its inventory nor is it collecting the types of maintenance data that might allow estimates of reliability that would be typical for an organization with a mature maintenance management program, the MER had a somewhat different focus than it might otherwise have had. In this case, the primary activity was to review and improve the text of job plans. Prioritization capabilities within FEM were also reviewed, and an attempt was made to apply them to assets and job plans. Many useful results came out of the MER. The authors gained a much better understanding of the operation of a navigation lock and the maintenance that is performed on it.

Only a small part of FEM's capabilities are being used, so there is a lot more that could be done with minimal or no additional effort to benefit the project directly and also to provide more information for understanding USACE maintenance practices.

Some unforeseen issues affecting the maintenance practices and priorities of the lock personnel were discovered; these issues are outlined below.

- An expectation by personnel of never being able to replace items deemed noncritical, or only being able to do so with expenditure of excessive time justifying, purchasing, and (as applicable) installing. This results in what may be excessive efforts to avoid the breakdown, failure, or wear-out of any piece of equipment regardless of the cost-effectiveness of these maintenance efforts.
- The sense of ownership, responsibility, and pride in the project held by the personnel. Clearly there is value to USACE in supporting that desire to make the project the best they can.
- A risk-aversion by personnel for making changes from the standard operating procedure due to their having no expectation of reward if it works and an expectation of punishment if it doesn't.

The results were moderately different than expected, but it still proved to be a useful experience. Many of the lessons learned were unexpected. (The results and lessons learned are discussed in Section 3.2.2.)

## 3.2 Critical and non-critical maintenance

### 3.2.1 Examples

#### *Routine maintenance at New Cumberland*

Service bridge elevator and crane – Typically this elevator is used infrequently, and there is a ladder which can be used as an alternative; however, the elevator becomes more critical when personnel need to pass ice in order to lock tows through. Under these conditions, personnel need to be able to operate the bulkhead, and that requires use of the elevator to access and operate the crane on the service bridge. Under these conditions, the crane becomes critical and the elevator can be, too. In addition, these same conditions often result in an icy ladder that is a safety hazard to use in the absence of an elevator.

Lawn tractor – Besides being used to mow grass, this device is used to plow snow on the lock walls. Without it, it would not be possible to use the carts in snowy conditions to get to controls at each end of the locks, and walking to the controls would be difficult or potentially dangerous with snow melting and refreezing. In addition, this tractor is used to extend the cable to pull a split tow through the auxiliary lock because this lock has no rabbit for accomplishing that task.

Electric carts and chariots – These devices are not mission critical, but their loss is an unacceptable condition. Walking would delay lockage and increased staffing would be very costly relative to the cost of providing and maintaining the carts.

Power washer – This device is used for many tasks including cleanup of some other equipment; however, the use most closely related to USACE mission may be for clean up after flood. Flooding of the lock wall is infrequent, and cleanup can be mostly accomplished using a pump and small fire hose. Flooding of the galleries is more frequent. While it doesn't happen every year, some years it can occur multiple times. The power washer is the most cost-effective option for this task. If funds for replacement were certain, it might be cost effective to not maintain power washers and replace them upon failure.

*“Big M” crane maintenance at Wilson Locks*

While this example of maintenance was not part of the MER, it is relevant to the issue of M&R for critical and non-critical components, so it is addressed here. Personnel reported that these cranes are frequently used for critical maintenance, but they are old and frequently break down. Personnel also reported spending significant maintenance hours repairing cranes that are beyond their serviceable life. This need for frequent repair means not only a potentially costly life cycle for the cranes, but it also reduces availability of labor hours to work on equipment considered more critical. This need can result in conflict because there are a limited number of hours available for maintenance, but these cranes have to be made operational first because other maintenance and repair can't be completed without them. However, it should be noted that because these cranes are not used to lock tows, they are not considered “critical” within the current AM framework.

### **3.2.2 Discussion**

With the possible exception of the service bridge elevator, the equipment at New Cumberland in these examples is performing adequately and does not need to be replaced. A question that was common throughout the MER is whether maintenance should be applied intensively, moderately, or not at all (i.e., run to fail) for particular equipment. This is a complex and situationally dependent question, and some aspects are addressed further in this discussion.

The pieces of equipment listed in Section 3.2.1 were specifically chosen as examples because they may not be considered “critical” to most people not working at a lock. There is a Headquarters (HQ) USACE-level effort to focus maintenance and repair on critical components. However, this focus may not be optimal, because it has some faults. For example, it ignores or minimizes various aspects of maintenance effectiveness. The crane example discussed above shows where non-critical equipment can be a requirement for maintenance of critical equipment. Also, other equipment that is typically not critical can be critical to operation under certain circumstances or critical to efficient operation. While the cranes at Wilson L&D are not directly used in locking navigation traffic, and therefore not deemed critical within AM, lock personnel see these pieces of equipment as critical to performing their mission. They report that frequent breakdowns and labor spent repairing these cranes interfere with performing

their other duties, including maintaining the mission-critical equipment. The annual costs for crane operation may also be higher than optimal (compared to replacement).

Another area of potential disagreement involves smaller pieces of equipment. Hypothetically, maintenance on tractors could be cut in half (or even less) with minimal impact on expected life. In another hypothetical example, if preventative maintenance on a power washer costs \$300/year and a replacement costs \$600, it might be cost effective to run to failure. However, lock personnel see it quite differently. This type of equipment is used frequently and needed for safe and effective operation of the locks. Even if these types of equipment are not used in lockages, there are at least two reasons that lock personnel do not see reduced (or eliminated) preventative maintenance as a viable option:

1. They have no expectation of ever being able to replace equipment if it should break. This is especially true for items such as carts, tractors, and power washers. For this reason alone, run to failure is not an option.
2. Most lock personnel take great pride in their facilities and in their efforts to maintain the condition of the equipment. Requiring them to forego maintenance would impact morale and likely result in an undesirable reduction in productivity.

Additionally, lock personnel note that there is also a substantial labor and administrative cost to replacing equipment.

Minimizing total maintenance cost is important. That said, the impact of reduced preventative maintenance such as run-to-failure may have adverse impacts on personnel morale and productivity. It can also lead to loss of equipment with limited ability to replace. Likewise, a focus on critical maintenance may ignore the benefits of potential savings from minimizing the total maintenance cost. In either case, budget restrictions further complicate the decision process and may make it difficult or impossible to avoid making less-effective maintenance decisions.

Reaching an optimal answer is difficult, and a focus on critical infrastructure avoids at least one difficulty. If a facility needs two cranes, three electric carts and a tractor, they are likely to want three cranes, five carts, and two tractors. Developing a uniform process to identify the facility's true

needs would be difficult. That difficulty does not imply “noncritical” equipment is not needed, but optimizing the equipment and its maintenance, especially if done systematically, can be very complex.

Optimal maintenance should at minimum consider, and possibly be primarily based on, minimizing the maintenance cost (see 2.15 and 2.16 for further discussion of prioritization capabilities of FEM). If CM is expensive, or the failure consequences are high, and either of those situations can be reduced by additional PM, then the level of PM should be high. Likewise, if PM is more expensive than CM (or replacement), then it is worth considering a lower level of maintenance. See Figure 12 (in Section 4.3) for an illustration of the tradeoffs between more or less maintenance.

The MER and additional discussions as part of this research project indicate that routine maintenance and repair that extends or restores the service life of an asset in a cost-effective manner should be a high priority, regardless of whether the component is considered critical and regardless of its impact on the risk of lock shutdown. As mentioned previously, there are some reasons other than cost-benefit calculations to apply a greater level of maintenance. Inefficiencies will result if there is a surplus or shortage of available maintenance labor, but the targeted goal should still be to match maintenance resources to the level of maintenance.

The priorities for repairs and major rehabilitation were not a focus of the MER. Those two priorities may be somewhat different, especially for repairs that are primarily focused on reducing the risk of lock shutdown. Nonetheless, applying optimal maintenance to noncritical components can free up resources (funds and labor) for “critical” maintenance and repair.

### **3.3 Prioritization**

During the MER pilot, it was decided that an attempt should be made to prioritize the job plans. The primary objective of this exercise was to better understand the priorities from the lock personnel’s viewpoint. There was no prior preparation for this part of the exercise, and no expectation that this would result in meaningful priority ratings or a usable product.

The prioritization exercise was divided into two parts based on the first two bullets below. Each part of the exercise was scored on a 1–10 scale. Afterward, we reviewed the ratings from highest to lowest. Some were revised based on their score relative to the other job plans. It was noted that

scoring was more difficult in the absence of guidance on how the priority should be reflected in the scores. The importance of the mission was not evaluated in this exercise, but the following points were considered.

- Importance of the maintenance to the component reliability
- Importance of the component reliability to the mission
- Importance of the mission itself

### **3.3.1 Considerations for prioritization**

The job plan prioritization exercise was valuable for a number of other reasons besides learning the lock personnel's viewpoint. It was clear that a common basis was needed for assigning priority. Priority could be based on many different concerns, and it was not clear how much weight should be given to the various reasons for performing maintenance, the potential benefits of the maintenance, or other factors. Numerous parameters are mentioned and briefly discussed below. In order to arrive at meaningful priorities, criteria would be needed to explicitly consider these issues in the prioritization process.

#### *Frequency of application*

Frequency of application is one consideration, and the following are some questions to be considered:

- Should the priority be tied to missing one application of the tasks?
- Should the priority be tied to missing 50% of the applications?
- Should the priority be tied to never doing the maintenance?

#### *Scope of job plan*

A robust job plan could potentially be pared down to include only the tasks deemed most critical. This may or may not have a significant impact on the outcome (maintenance effectiveness), but there is an open question regarding how this is to be considered when assigning a priority.

#### *Variety of benefits accrued*

The variety of benefits accrued from different maintenance activities makes it hard to evaluate and compare effectiveness. The following list gives some reasons why:

- Not completing some lubrication job plans can have a very quick impact on smooth operation and can lead to the need for corrective maintenance in the short term.
- Some job plans have minimal impact in the short term but can significantly shorten the expected life.
- The impact of not inspecting for hidden safety deficiencies (e.g., fuel spill cleanup kit deterioration) is significantly different than maintenance of active systems.
- Some job plans are required by law, such as elevator inspections.
- Some inspections are required by USACE regulation, such as those for furnace, boilers and hammer valve, air receivers, Environmental Compliance Assessment (ERGO), Failure Modes and Effects Analysis (FMEA), high stress steel inspections (HSS), and Periodic Inspection.

#### *Failure-mode ratio*

The failure-mode ratio is the percentage of failures attributable to a particular failure mode. While this ratio was not specifically addressed in the prioritization process, personnel were considering the failure modes that the routine maintenance was addressing.

Personnel were also considering the availability impact which is the impact of not having a particular component available all the time. The impact can be considered by gathering the following data:

- Percentage of mission cycles that the system is used.
- Percentage of mission cycles the system is critical.

Note that some equipment does not have a direct tie to mission cycles such as emergency safety equipment, maintenance equipment, or flood cleanup equipment.

Other equipment has a varying relationship to mission, and likewise, the failure modes may have different relationships to the missions. Reviewing a history of failures for the tractor used for grass, snow, and line hauling provides an example, as given here:

- Tractor failed to start.
- Tractor failed to start cold.
- Tractor failed to start cold in winter (snow plow more critical than grass cutting).
- Tractor failed to operate successfully.

- Mower deck failed to operate.

#### *Past reliability*

Past reliability based on the current routine maintenance practices could be considered in evaluating the maintenance priority. Unfortunately, it doesn't give a clear indication of the impact of a reduced maintenance regimen.

#### *Mitigation or replacement*

Mitigation of component failure can occur in a number of different ways or none. How should this be considered in priority of the routine maintenance?

- Maintenance crew repair
- Manual labor to replace the components' function
- Contracted services
- Reserve component

Similarly, if the component must be replaced, the impact to the mission can vary:

- Backup system not immediately available
- Backup results in delay
- Backup system not readily available

This section includes far more detail than is likely to be used within a job plan prioritization scheme. That said, it should be recognized that any less-detailed scheme is still likely to include implicit consideration of these various factors. It is possible that explicit consideration of most or all of these factors could be avoided by focusing on maintenance approaches that minimize overall maintenance cost. This approach is discussed further in section 4.

### **3.4 MMIP pilot**

The results of the MER resulted in questions regarding the relationship between tasks in a MER and in the AM MMIP that was being piloted in each USACE division. A pilot implementation was attended, and it appears that the relationship between these two activities is mostly synergistic, with little or no overlap. At this time, details of the MMIP are incompletely understood, pending release of the draft reports. It appears that the MMIP

objective of identifying project maintenance needs is being accomplished generically for the types of infrastructure present at the project rather than for the specific components and operational environment. On the other hand, the process completed during the pilot MER focused on the specific components and operational environment at that project. Each approach has its benefits and drawbacks. Application of the same generic maintenance cost model to all projects within the MMIP does not properly account for specific circumstances at each project. If the model estimates are very good, it will be generally correct on a network level, but it will not accurately reflect the maintenance needs at any one project. The focus on job plans and tasks done within the MER captures exactly what the local experts think needs to be done, but it does not capture varying expectations from project to project and does not align maintenance needs equitably across the network. See Uzarski (2009) for further discussion of network and project-level application of maintenance management.

## 4 Approaches to Minimizing Maintenance Cost

The project documented in this report was a preliminary look at a few aspects of optimizing the planning and execution of maintenance to get the very best maintenance from each dollar spent and to optimize the total maintenance expenditure. There are many factors that contribute to reaching this objective. For example, USACE has historically relied on the expertise of personnel at the locks. This can work well for an individual site if the budget is sufficient. As budgets shrink, however, there is more concern about having adequate funds and a greater need to ensure one project is not overfunded at the expense of another being underfunded. Information systems such as FEM present the opportunity to analyze the most effective maintenance practices and optimize the frequency of their use. Whenever the needs exceed the funding, a results-oriented approach can be taken to prioritize maintenance and ensure the most effective maintenance is continued.

To optimize maintenance within USACE, an analysis process is needed that is based on data. However, USACE does not collect the engineering data necessary for making such an analysis. Further, determining what data is needed and how it should be used is undoubtedly a complicated issue, for which a baseball story provides an illustrative example. Baseball is a game known for a wealth of statistics. Baseball experts have always had an expectation that they knew what statistics were important and how to rate the contribution of players. The story *Moneyball* indicates that they did not. In this true story, the Oakland Athletics focused on a different set of statistics in their player selection, and they were very successful until other teams also started using these alternative selection methods. Given that USACE doesn't even collect most of the relevant maintenance statistics, one can hardly expect that it has determined what statistics are important to judging maintenance effectiveness. Even if USACE does start collecting more maintenance-related statistics, it might be a long and difficult road to optimal use of this information.

To begin understanding the difficulty, one must realize there are many metrics that can help evaluate maintenance effectiveness, starting with simple things like tracking the hours spent for each maintenance task or

the total time spent on each asset. The uniqueness of the projects, however, can make it difficult to carry these types of comparisons across projects. There are at least two other approaches that may provide greater insight into maintenance effectiveness and they are discussed below in Sections 4.1 and 4.3.

## **4.1 Metrics for maintenance effectiveness**

As initially envisioned, the primary objective of this research project was to make a statistical comparison of the level of maintenance using FEM data to the OCA ratings of components. This objective was described in Section 1.3 and tasks #3–4 are restated below.

3. Pull maintenance data from FEM that relates to a condition rating in the Inland Navigation OCA.
4. Examine the data subset from step #3 for certain fields that we think correspond to condition: failure data, installation date, and frequency of Preventive or Corrective Maintenance (PM or CM).

It was quickly learned that the installation date for nearly all components is not being recorded in FEM (if it is even known); even when captured, the date is more likely to be in a remark field that cannot be queried by date and is not easily searched by any method. Failure data for lock components also is not being captured except occasionally in remarks.

As for frequency of maintenance, this is typically being captured in FEM. Maintenance is described using job plans and is planned by preventative maintenance schedules that generate work orders which most users will record as closed when they have been completed. What is less clear is what maintenance is being performed and how it relates to an OCA rating.

## **4.2 Failure recording**

### **4.2.1 Recording date of installation**

Recording the installation date would seem relatively easy and straightforward, but it is not. The primary complication is determining whether a rehabilitated component is new when a portion of its parts have been repaired or replaced. Criteria for judging this can be created, but it will take a significant effort to do the job well. This work would require an initial effort to develop guidance that can be consistently applied across the in-

ventory to identify the metrics for replaced (new) versus simply being repaired. There are at least two ways to minimize the ambiguity of repair versus replace: (1) focus on the smallest components possible, and (2) focus on failure modes.

#### **4.2.2 Failure modes**

Recording failures unambiguously also requires a focus on failure modes, and Weibull models are only applicable to failure data collected at this level. Because USACE operates locks of unique designs, loadings, and usage with diverse components of varying size and manufacture in diverse environments, good failure data also requires more information to understand the contribution of each failure mode to the observed failures. The question is how this information should be captured. Demand versus capacity is important, but it seems reasonable to ignore this for most USACE lock infrastructure which is usually designed for much higher loads than typically seen. Usage or loading cycles are very important. Age may also be useful as a crude approximation of many age-related contributors to failure, but age does not account for the uniqueness of each USACE structure. One way to capture the uniqueness is by condition ratings that focus on each failure mode. Thus, a failure rate relationship can be developed based on usage and condition.

#### **4.2.3 Condition vs maintenance**

The relationship between condition and maintenance probably is not nearly as simple as looking at the maintenance frequency. First, there is a need to account for the uniqueness of each site. The condition measures must also be aligned with distresses that are associated with the type(s) of maintenance being applied. If this isn't difficult enough, there is also a matter of the different levels of maintenance that are applied at different frequencies (which may be changed over the years) for different failure modes, and the failure being prevented may be years or decades into the future. A rough approximation of the maintenance level may prove useful but it may take some thought and expertise to develop.

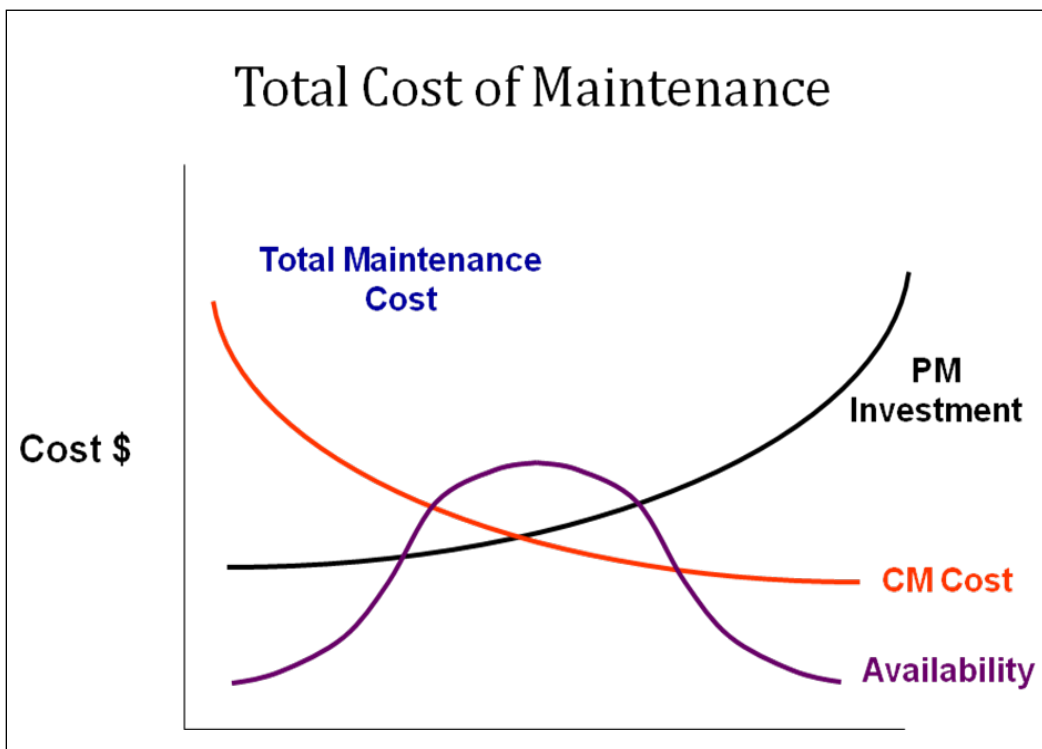
The relationship between condition and corrective maintenance is likely to be the most difficult to measure meaningfully. One factor is ensuring the conditions being measured and the deficiencies being corrected are appropriately aligned to each other. As with preventative maintenance, the deficiencies and failures being corrected may occur at very wide intervals. If

the corrective maintenance is done during scheduled dewaterings, the corrective maintenance may be more highly correlated with opportunity than the current need for repair.

### 4.3 Corrective versus preventative maintenance ratio

Theoretically, one of the simplest measures of maintenance effectiveness is to compare the PM cost to the CM cost and loss of service. An illustration is shown in Figure 12.

Figure 12. Example of optimization of total maintenance cost minimization.



The goal of maintenance cost control is to optimize the PM and CM to maximize availability of an asset or component. Figure 12 suggests that the optimal expenditure might be equal parts PM and CM, but this graph is only illustrative and should not be read to indicate that. The actual slopes could be much different, and the availability curve may be shifted significantly one way or the other. Optimization would require capturing information on the maintenance (PM and CM) applied at each project and for each asset, as well as recording failures, failure modes, and availability impacts. While improvements could be made, information can already be collected in FEM for PM, failure reporting, and availability. However, a

method for collecting CM information is not defined and is not a current capability of FEM. Completion of some PM and much of the CM for the most critical lock components occurs during lock dewatering. Because much of the cost is associated with the dewatering itself and not the actual maintenance and repair, there would need to be a clearly defined process for assigning costs to PM versus CM and to individual assets within the lock structure. Additionally, the costs of an actual dewatering are a significant added maintenance effort that must be accounted for.

While looking at the ratio of PM versus CM could provide some very valuable insights, it leaves one big question unanswered—is the specific PM or CM that is being applied considered to be the most effective use of PM or CM dollars, respectively? While having good maintenance personnel with authority to make the decision of whether the maintenance is needed partially addresses this question, most likely it brings the analysis back to looking at maintenance by a method based on one or more of the metrics reviewed in Section 4.1.

#### **4.4 Miscellaneous approaches to optimize various aspects of routine maintenance**

Sections 4.1 and 4.3 have presented two alternatives for high-level analysis of maintenance effectiveness. In addition, there are many other ways that key aspects of maintenance effectiveness can be targeted and improved on a more targeted basis. Most of these methods require more data than is currently being collected in FEM in order to implement them effectively and/or verify their success. A discussion of other ways to achieve maintenance effectiveness includes:

##### **4.4.1 Hidden failure data**

Hidden failures occur on components and equipment not used continuously. The longer the dormancy, the more likely it is to have a hidden failure or to fail upon startup. Inspection and testing is needed to find these failures. Inspection may be too frequent or not frequent enough and too extensive or too limited in scope. Data could be recorded regarding how often the problem being inspected is found, how easily it can be identified by inspection, how much effort the inspection requires, the potential for damage resulting from the inspection, and how important it is to find it.

#### **4.4.2 Time-directed preventive maintenance**

Time-directed PM can be cost effective where the need is known to be regular, the condition is difficult to assess, or damage can occur prior to the condition deficiency being apparent. The difficulty can be in determining the optimal frequency. For example, a standard rule of changing the oil every 3,000 miles is very conservative. If the cost is reasonable compared to potential consequences, this may be acceptable. Another approach would be to perform oil analysis to determine if the viscosity and dirt level are acceptable. This would be condition-directed but could be used for a short time to determine the optimal time-directed frequency. Without analysis of the time-directed tasks, inappropriate maintenance levels can be perpetuated, wasting resources.

#### **4.4.3 Condition-directed or corrective maintenance**

For infrastructure that is relatively cheap to replace compared to the cost of performing PM, it may be advantageous to only apply condition-directed and corrective maintenance. Condition-directed maintenance can also be optimal for assets that are very expensive to apply a maintenance cycle. Condition directed tasks may provide a less expensive option if the condition can be determined much more cheaply. Condition directed maintenance adds a step to the maintenance process (verification of condition) so data is needed to verify this additional effort is cost effective.

#### **4.4.4 Usage-based maintenance**

Manufacturers often recommend time-based maintenance based on frequent or continuous usage. USACE will often use equipment on a less frequent basis. Revising PM schedules based on usage can reduce maintenance requirements.

#### **4.4.5 Waiver of maintenance**

Time-based maintenance is often conservatively applied. Cost reductions can be as simple as changing frequency of lubrication from 2 weeks to 3 weeks and inspecting at 2 weeks. There is always the potential that reduced maintenance will be insufficient. One approach is to approve a waiver for test of a maintenance reduction at one site or even for one component.

#### **4.4.6 Tracking work order costs**

As mentioned in 2.6.2 and 2.11, detailed planning and estimating costs of tools, materials and labor as well as recording actual usage and expenditure for completion of work orders supports maintenance management in various ways.

#### **4.4.7 Other reporting metrics**

Condition reporting, failure reporting, and downtime reporting all provide valuable information for assessing the effectiveness of maintenance practices. In order to use these effectively, USACE needs to develop standard guidance for how and what needs to be recorded.

### **4.5 Management practices for optimizing routine maintenance**

USACE has no maintenance management program. There is no formal process for determining what maintenance should be performed. There is no process for personnel at a lock to get approval for changes to their routine maintenance practices. Maintenance is planned and performed on an ad hoc basis based on individual experience and past practices. If maintenance effectiveness is to be analyzed for determining how to improve practices, there needs to be a formal process for determining and revising job plans.

There is no process for standardization across Districts, Divisions, or USACE. While the lock infrastructure at each project is mostly unique to that site, there are some components that are common to multiple sites. Some lock components and most on-lock equipment is similar enough at multiple sites so that the same job plans could be used. If many of the job plans and PM schedules were shared by many projects, this would create more opportunity for measuring and analyzing maintenance effectiveness.

Some project managers and personnel are inclined to implement intensive maintenance. In many circumstances, this tendency is good. It prevents costly shutdowns and reduces replacement costs by extending asset life. Project personnel typically have a pride in their projects that is valuable because it leads to a good work ethic. This should not be minimized. There are a number of factors that drive decision making that may not be optimal. In some circumstances, particularly for equipment that can be replaced readily and cheaply, a very high level of maintenance may not be

cost effective. Their pride in the project also leads them to want to perform the highest level of maintenance, regardless of whether it is cost effective. There is also an uncertainty about whether they will be able to replace failed equipment not absolutely critical to day-to-day lockage. This can also lead to excessive maintenance. This effort to avoid any failure (no matter how important to lock operation) is not inherently bad, but should be an explicit consideration in any review of maintenance effectiveness.

## 5 Other Topics

### 5.1 Age to condition comparison

Asset management uses age (and variations of age such as usage) as a measure of reliability. Weibull analysis can be used to estimate reliability based on age. Because the OCA ratings are used as an indicator of reliability by adjusting the age-based Weibull curve for a particular component, it was deemed worthwhile to look at how the condition of components compared to their age.

It was known from the beginning that this comparison would be negatively impacted by at least two sources of error. First, the age data that is available with the OCA ratings is for the project, not the components. Data indicating which components might have been replaced since original construction was not available. Second, it is unclear why so many of the ratings were B (with a few higher). Possibilities include the successful completion of repairs to address most deficiencies in condition, condition rating criteria that is skewed (appropriate or not) to result in mostly B ratings, other unidentified causes, or some combination of these causes.

The list of all components assigned an OCA rating was downloaded from the AM website's OCA viewer.<sup>5</sup> This data, containing over 160,000 entries, was exported to a Microsoft® Excel™ file. The viewer and export data fields are listed in Table 5. This list was then reduced to about 1,000 unique entries, and some key components were selected for further investigation. In order to more easily compare the condition and age of the components, the OCA ratings (initially letter grades with pluses and minuses) were translated to a point system for sorting and filtering (Table 6).

---

<sup>5</sup> <https://assetmanagement.usace.army.mil/FRM/AnalyticsDev/>

Table 5. Comparison of AM viewer and export data fields.

AM Analytics viewer fields	AM Analytics export fields
Division	Not included
District	Not included
Project Component Type	Not included
Subcomponent Rating (Letter Grade)	Group
Date in service (PROJECT date in service)	Component
Not included	Rating
Not included	Date in service
Not included	Project ID
Not included	Component ID
Not included	Comment
Not included	Group Comment
Not included	Group ID

Table 6. Conversion of OCA ratings to numerical values.

A	+	A+	15
A		A	14
A	-	A-	13
B	+	B+	12
B		B	11
B	-	B-	10
C	+	C+	9
C		C	8
C	-	C-	7
D	+	D+	6
D		D	5
D	-	D-	4
F	+	F+	3
F		F	2
F	-	F-	1
COMPLETE FAILURE		COMPLETE	0

OCA ratings of B- or less indicate reduced functionality or non-compliance with operational requirements. Only these ratings were used to create age versus condition plots. Linear trend lines were added to the charts and standard deviations were calculated. Afterward, in order to look at infrastructure with fewer replacements, a reduction in the selection of “Years in

Service” was made from the entire range dating back to 1916 to more recent data of only the last 40 years. Additional charts were developed for the same components (Figure 13, Figure 14, and Figure 15). By comparing charts for identical components, changes in trend lines and standard deviations of the select data were observed.

Figure 13. Foundation System, 1970s to present – negative slope.

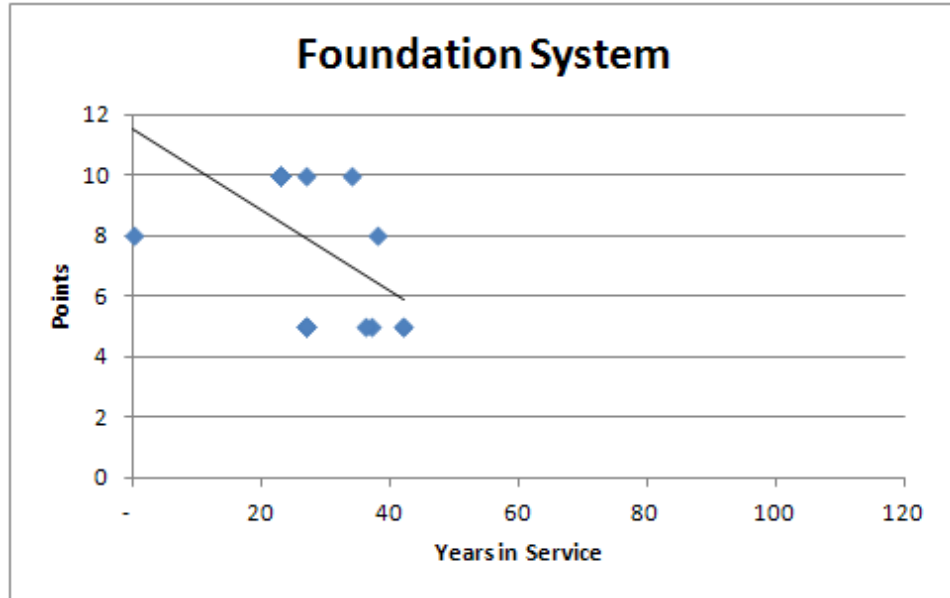


Figure 14. Quoin Blocks (on gate) – positive slope.

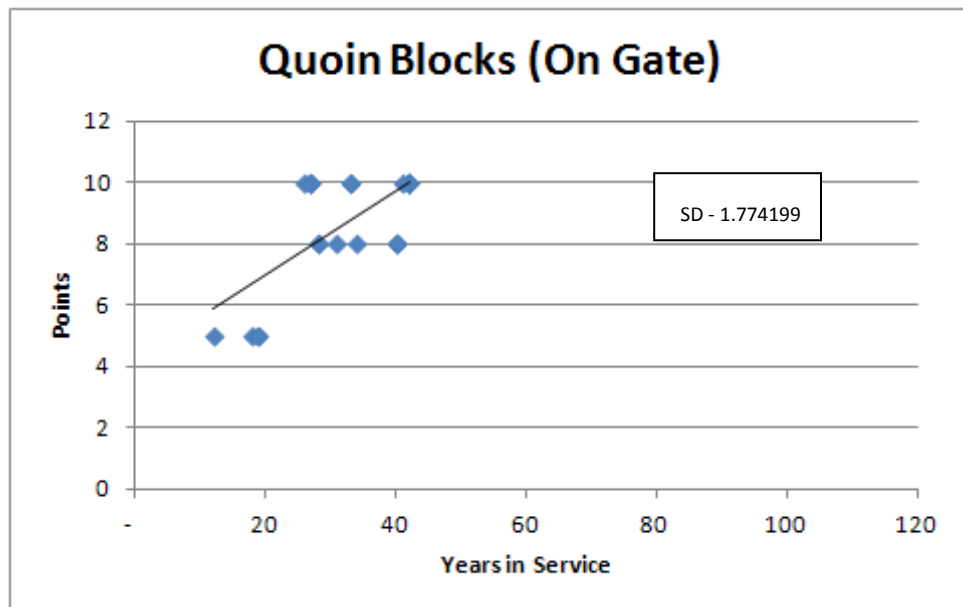
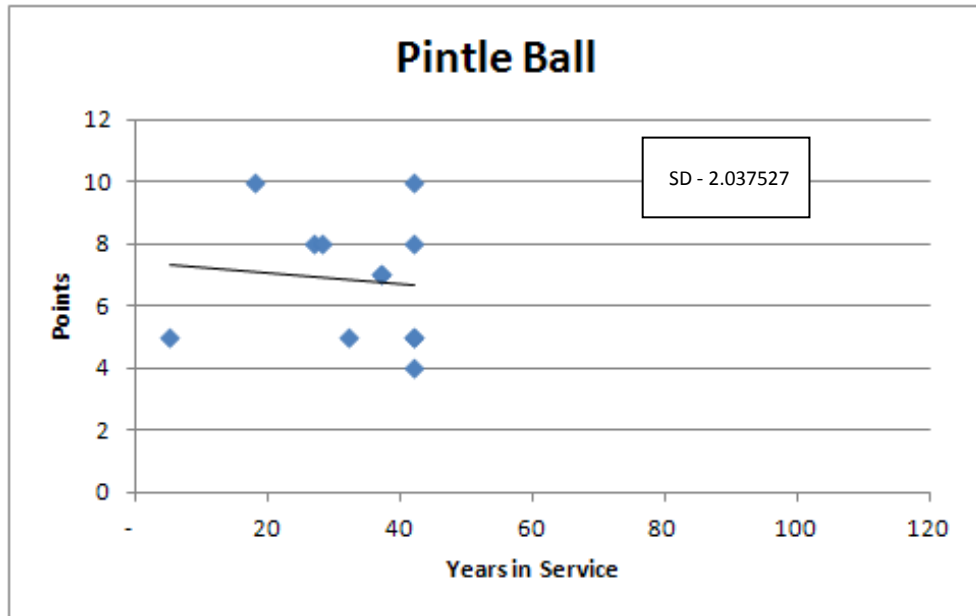


Figure 15. Pintle Ball – negative slope.



When the reduced amount of years was used, various components' trend lines showed various changes in slope direction (i.e., positive to negative and vice versa). In most cases, the data had a larger concentration with older projects, causing the angle of the components' trend lines to shift as the range of years was increased. This behavior can be observed when comparing Figure 13 and Figure 16.

Three typical changes were observed when selecting more recent projects. When comparing Figure 13 and Figure 16, we can observe how the trend line, initially strongly negative, became less negative. Another observed behavior was seen when comparing Figure 14 and Figure 17, where a sharp difference in slope direction and magnitude occurred. This behavior was observed, yet in the other direction when comparing Figure 15 and Figure 18. Standard deviations were reduced when the selection was reduced. While this reduction may not be statistically significant, it might be expected since older projects are more likely to have replaced components and therefore a lower correlation of project age and component condition.

Figure 16. Foundation System for expanded time period.

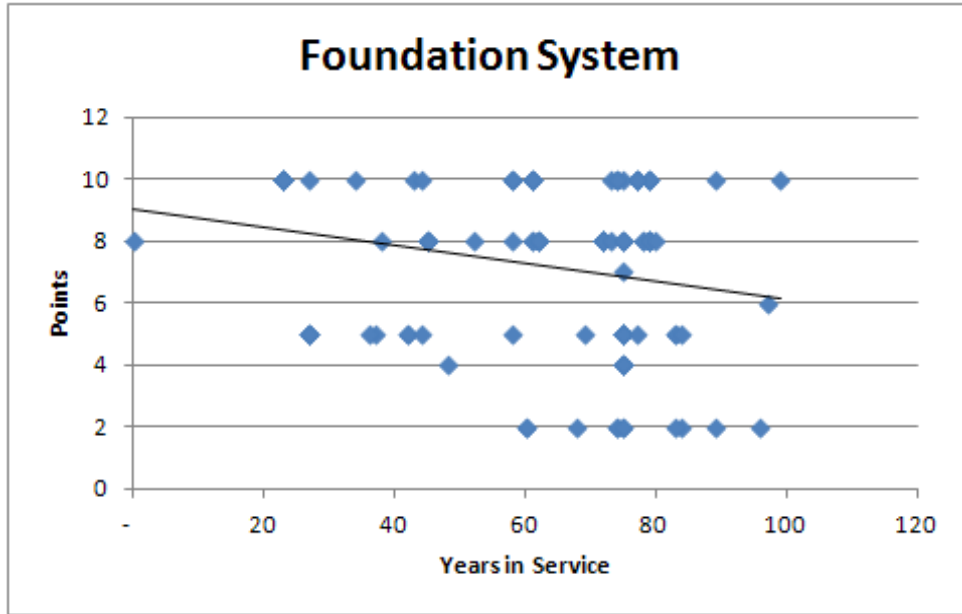


Figure 17. Quoin Blocks (on gate) – negative slope.

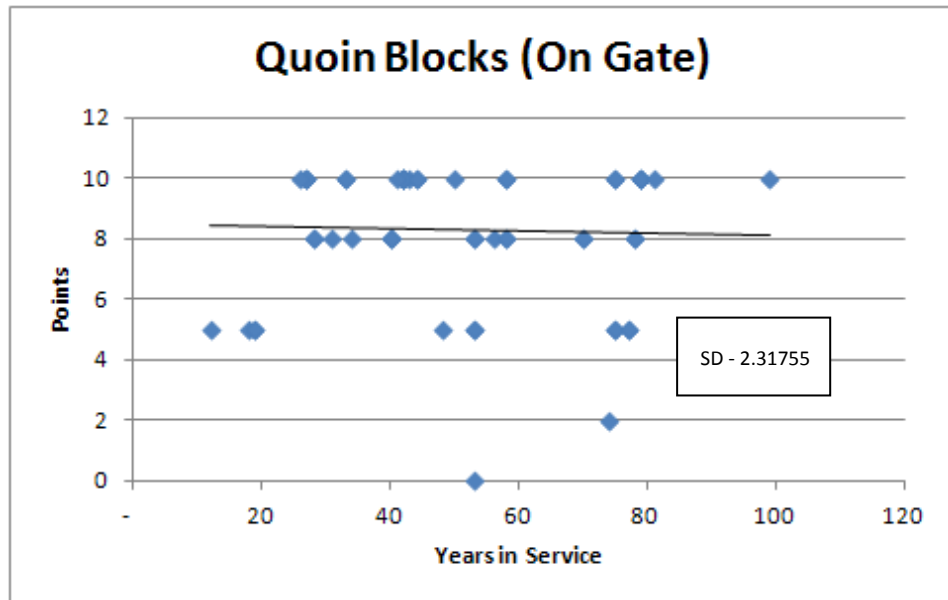
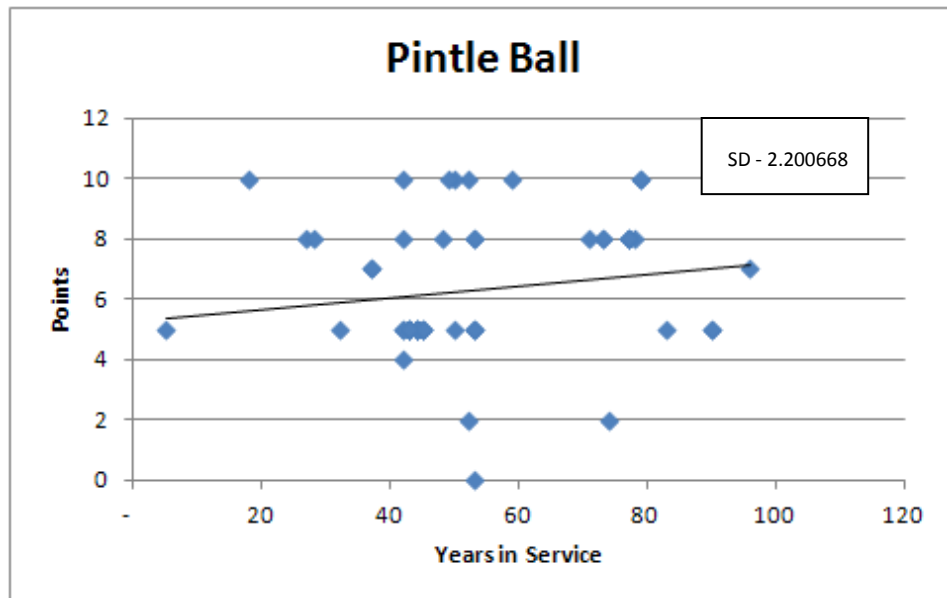


Figure 18. Pintle Ball – positive slope.



The handling of the data and observation from the charts prompted certain concerns and suggestions, as listed below.

- Project Date in Service is used, where component date in service should also be recorded.
- Time is currently used to relate the ratings of all components. This metric might not necessarily be the most appropriate for all components, e.g. usage or an alternate measurable parameter
- Frequency of components' repairs and replacements is not recorded.
- The OCA rating system is used to determine a component's condition. However, without any historical record this presents the issue of how close these ratings are to the actual "condition" they represent. Additional factors that could assist in addressing this issue are below.
  - Physical deterioration
  - Remaining life
  - Current reliability
  - Degraded service
  - Maintenance requirement
  - Subcomponent weighting
- Over 90% of components have a "B" rating. As projects age, components are replaced, repaired, and maintained at this rating.
  - How often would they receive a lower rating?
  - How often do these repairs and replacements occur?

- How costly are these repairs and replacements?
- What information is missing from a “B” ratings?
- How long does a component maintain a “B” rating?

In general, the data show a large majority of “B” ratings, suggesting relative reliability and functionality of the components and subsequently, systems and each project as a whole. This majority, together with all available data, was weighted heavily towards projects with increased age. Since the data was ordered by “Project Date in Service,” without additional information this could indicate a large probability of increased maintenance as age increases in order to maintain the minimum allowable condition rating. As a result, though age and condition should be correlated, the available data is not adequate to support the hypothesis.

## **5.2 Lock closure causes**

Lock closures hinder traffic through the waterways. As a result, acquisition and analysis of available data should be done in an effort to better understand the nature of and minimize lock closures. To this end, an emphasis should be made on identifying the cause and occurrence of the closures. In order to increase effectiveness and efficiency, lock closures caused by repairs, maintenance and malfunctions are of interest. With an ageing navigation infrastructure, these types of closures (either scheduled or unscheduled) have the potential to increase in occurrence, length, and cost.

While neither FEM nor Operations and Maintenance Business Information Link (OMBIL) are currently used to record specific engineering related details of a lock shutdown such as the specific components that fail, failure mode, age, usage, environmental exposure, condition, etc., OMBIL does record scheduled and unscheduled lock shutdowns. This data is analyzed further in Section 5.3.

## **5.3 Operations and Maintenance Business Information Link lock closure data**

Lock closure data is accessible through the OMBIL website (Figure 19). As this website queries a very large database, constraints are required to better locate the desired information. For the user to constrain the data, a new window opens (Figure 20), displaying the available graphical user interface (GUI) to view and query the database.

With the data available in this database, focus was on lock closures caused by repairs, maintenance, and malfunctions. In order to retrieve this data in a manageable manner, a series of variables had to be selected within the desired fields. With the display shown in Figure 21, selected fields with relevant variables were:

- USACE Hierarchy
  - All USACE
- Measure
  - Scheduled Unavailability
  - Unscheduled Unavailability
  - Total Unavailability
- Time
  - Calendar Years
- Unavailability Codes (29 distinct categories)
  - EE - Repairing lock or lock hardware
  - R - Lock hardware or equipment malfunction
  - T - Maintaining lock or lock equipment
  - All Unavailability Codes

Once the desired variables are selected, a table is displayed presenting the queried data (Figure 22). This table can be adjusted to display the data in various ways, as seen by comparing data displayed in Figure 22 and

Figure 23. This data can then be exported to an Excel file for further analysis.

Figure 19. OMBIL website with numbers added to show order of selection during task.

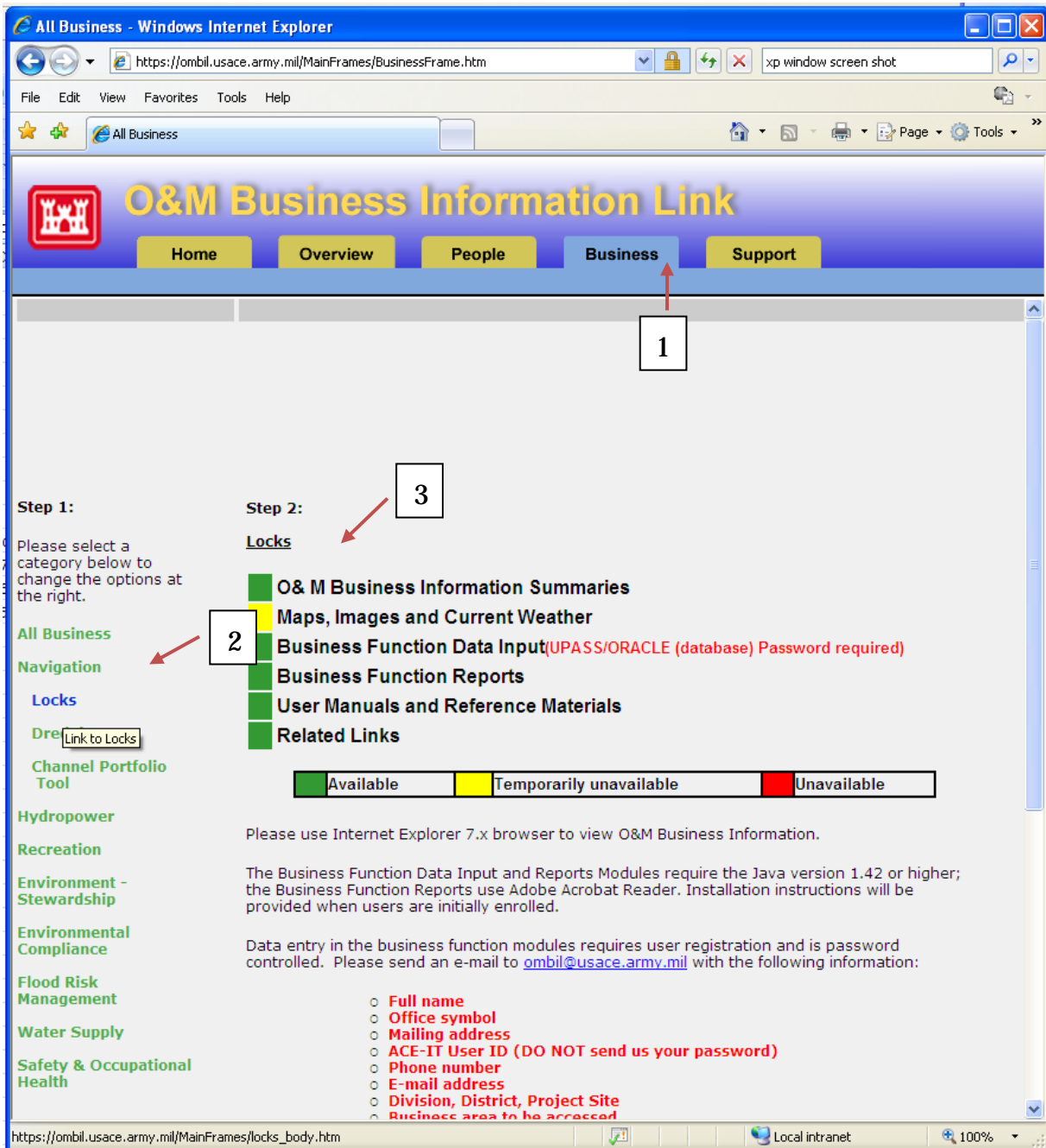


Figure 20. Graphical user interface to query database for desired variables.

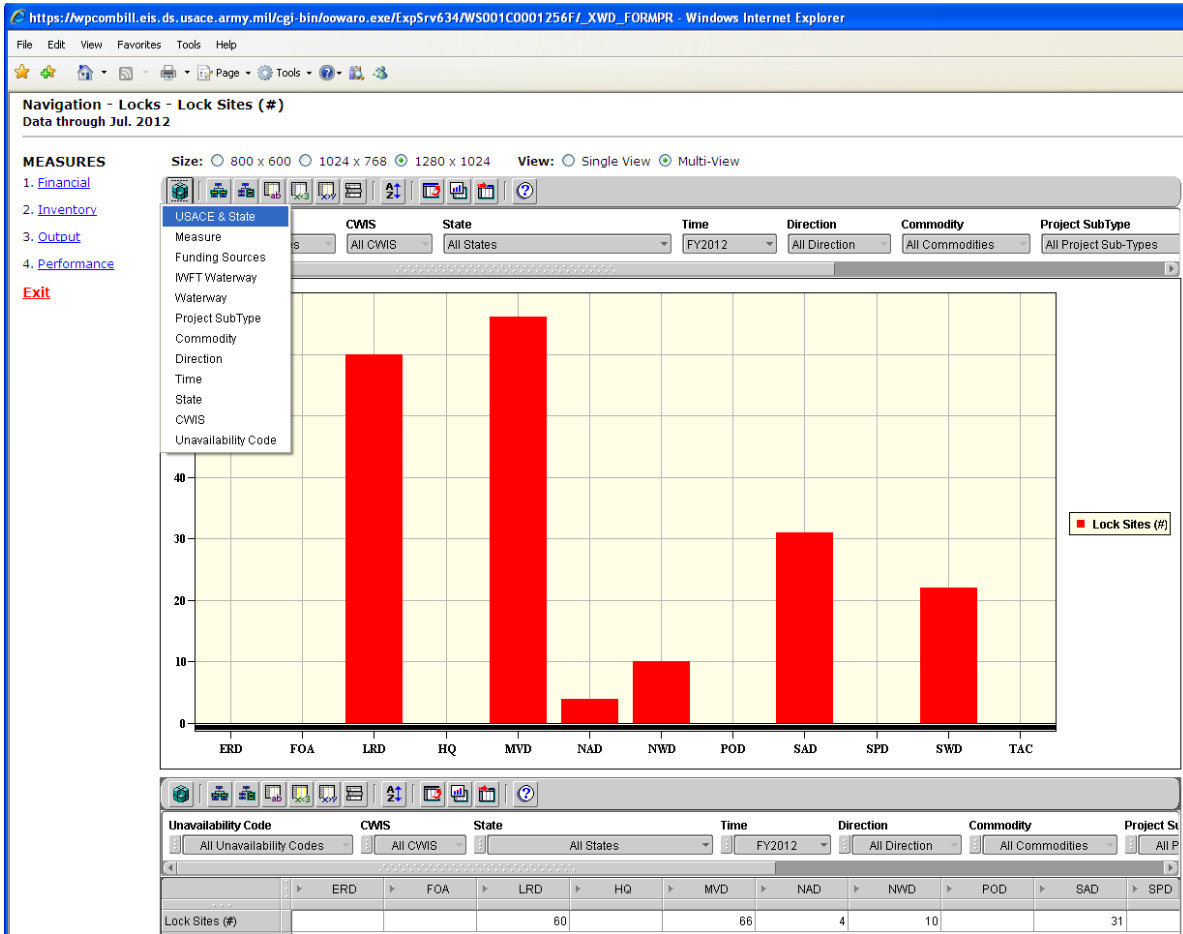


Figure 21. Field/variable selection.

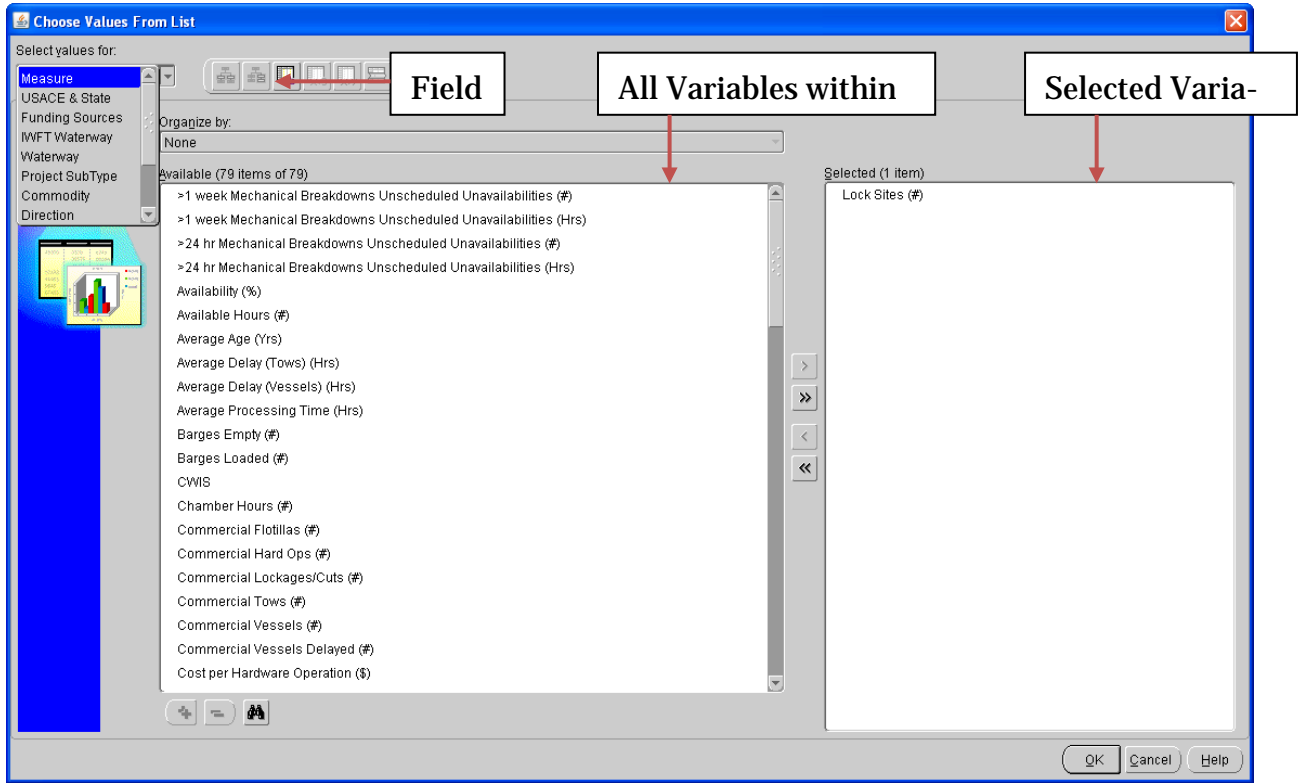


Figure 22. Initial display of data.

Unavailability Code	CWIS		State	Direction	Commodity		Project SubType		W	
EE - Repairing lock or lock hardware	All CWIS	All States	All Direction	All Commodities	All Project Sub-Types					
	CY1992	CY1993	CY1994	CY1995	CY1996	CY1997	CY1998	CY1999	CY2000	CY2...
	All USACE	All USACE	All USACE	All USACE	All USACE	All USACE	All USACE	All USACE	All USACE	All ...
Availability (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.72	
Available Hours (#)	518,880.00	2,084,880.00	2,084,880.00	2,084,880.00	2,090,592.00	2,084,880.00	2,084,880.00	2,084,880.00	2,084,797.12	2,069,
Scheduled ...									130	
Scheduled ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	
Scheduled ...									4,577.68	10,
Unavailabilities (#)	0	0	0	0	0	0	0	0	295	
Unavailability (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	
Unavailable Time ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5,794.88	14,
Unscheduled ...									165	
Unscheduled ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	
Unscheduled ...									1,217.20	4,

Figure 23. Adjusted display of data.

All USACE										
Availability (%)										
	CY1992	CY1993	CY1994	CY1995	CY1996	CY1997	CY1998	CY1999	CY2000	CY2...
EE - Repairing ...	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.72	
R - Lock ...	99.93	99.94	99.87	99.95	99.79	99.94	99.90	99.87	99.89	
T - Maintaining ...	98.64	98.76	98.57	98.00	98.62	98.49	98.45	98.41	99.46	

For the years selected, total scheduled unavailable time was 59.1% of total unavailable time among all USACE locks per year, of which 40.9% was unscheduled. The three categories of interest (repairs, maintenance and malfunctions) represent a total of 28.5% of total unavailable time. For the same three categories of interest, 15.0% of unavailable time was scheduled and 13.5% was unscheduled.

The individual percentages for these categories are shown in Figure 24, presenting the unscheduled unavailable time as a percentage of total unavailable time. These yearly percentages range from 1%-14%, and when combined they represent 4%-21% of total unavailable time during the years. Total unavailability for each category, followed by the three categories combined is shown in Figure 25. This chart shows how much of the unavailable time (on average 13.9%) was mostly, due to repairing the lock or lock hardware (category EE), 10.7% to maintaining the lock or lock equipment (category T), and 3.9% to lock hardware or equipment malfunction (category R). When these three categories' unscheduled unavailability is compared to that of the other 26 categories, 33% of all unscheduled unavailability is due to these three categories and 67% to the other 26 categories. Figure 26 presents how the unscheduled unavailability of these three categories compares to the all other unscheduled unavailability each year. Scheduled unavailability for these categories is 25.3% of all scheduled unavailability, whereas all other categories comprise 74.7%. Figure 27 presents how the scheduled unavailability of these three categories compares to the all other scheduled unavailability each year.

Figure 24. Category unscheduled unavailability versus total unavailable.

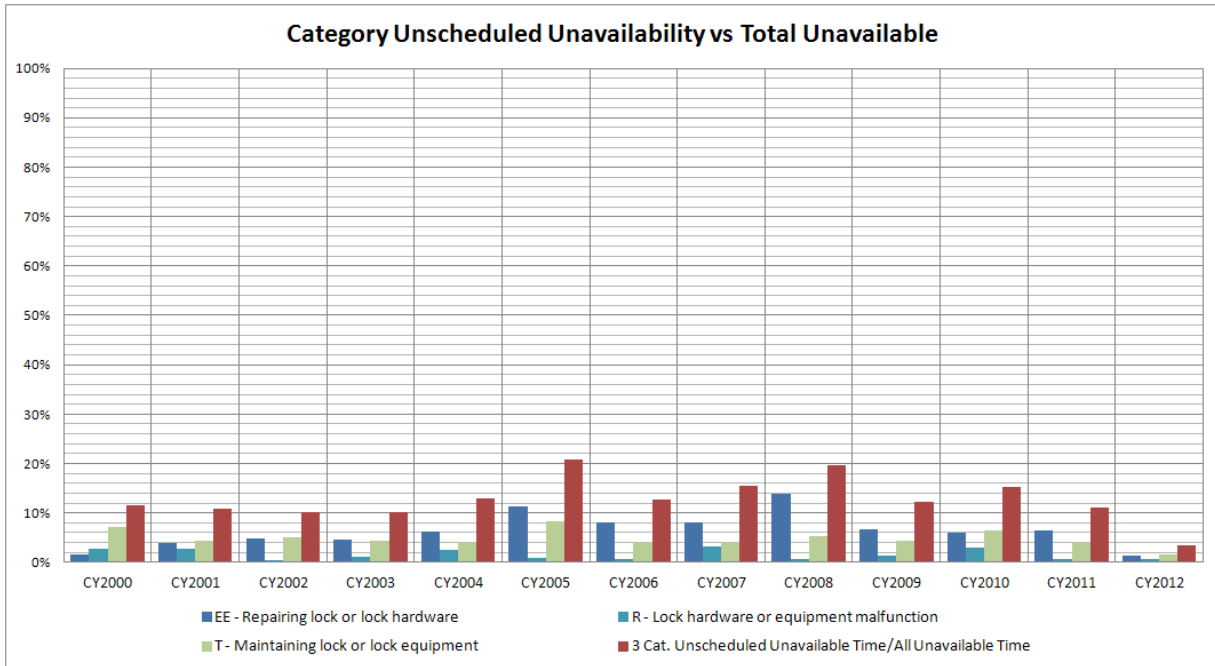


Figure 25. Category unavailability versus total unavailable.

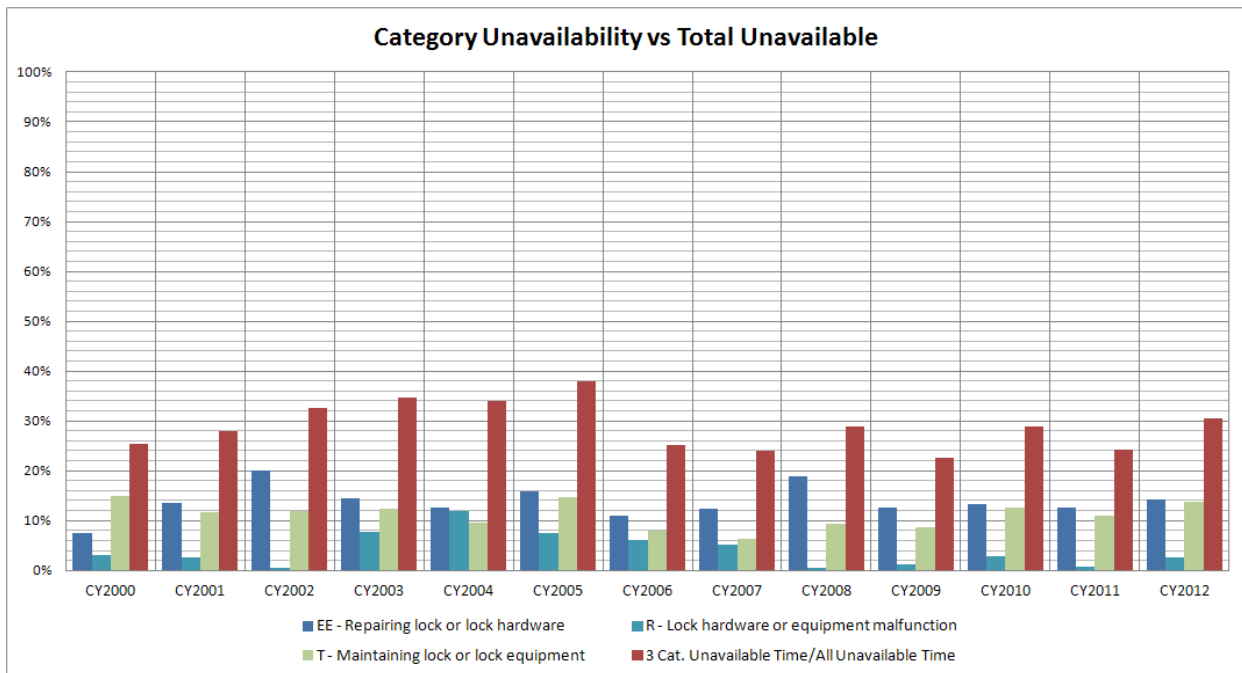


Figure 26. 3 Category unscheduled unavailability and all other unscheduled versus total unavailable.

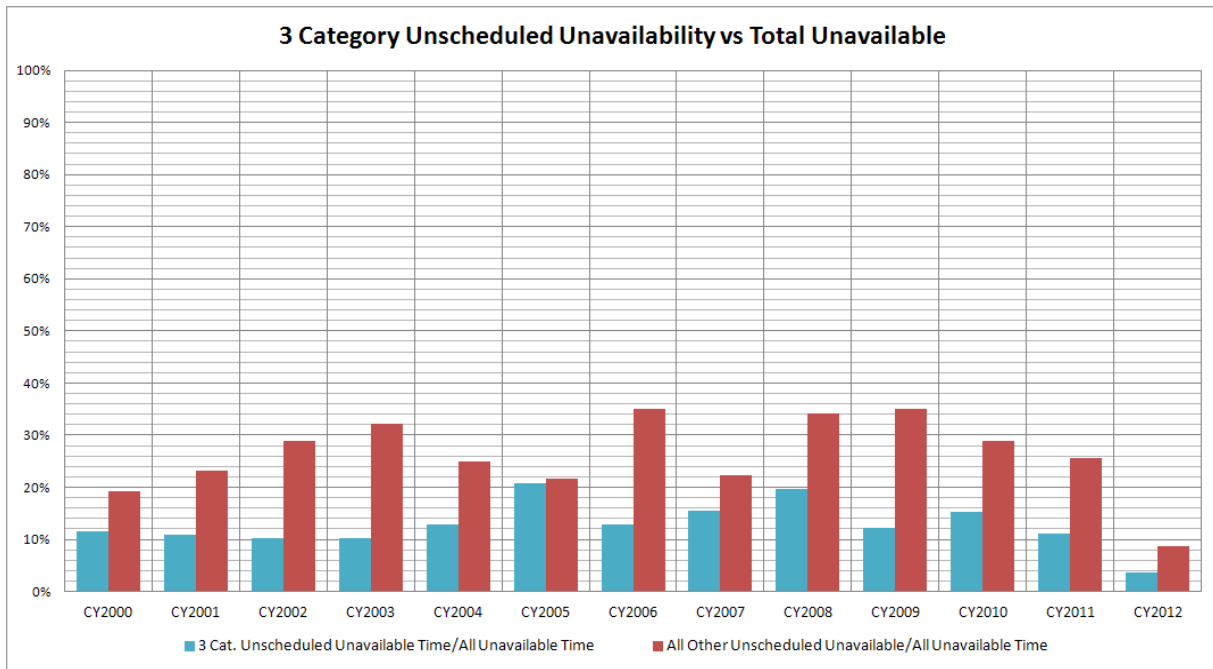
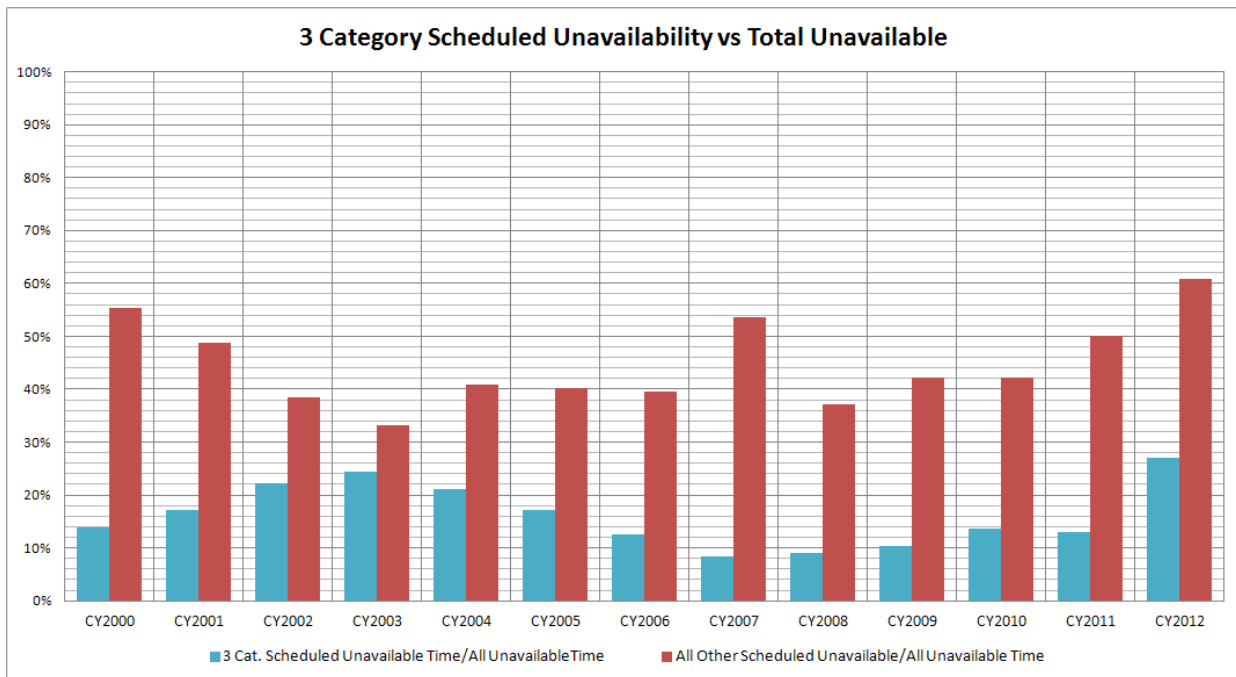


Figure 27. 3 Category scheduled unavailability and all other scheduled versus total unavailable.



Lock closures can be expensive to industry and to the government. Un-scheduled closures caused by repairs or maintenance can increase delays and queues, especially if they occur frequently. In order to reduce the amount and length of lock closures, certain closure categories should be studied further. From the data acquired, the three categories of interest comprised a total of 28.5% of unavailable time throughout USACE locks during 2000- Sept. 27, 2012, where 15% of the unavailable time was scheduled and 13.5% was unscheduled. It is therefore recommended to further study the causes of the closures, especially unscheduled as this impacts industry more severely. Unfortunately, detailed information about these closures is unavailable through OMBIL and is not currently available in FEM either.

## **5.4 Measuring condition**

Before discussing how to measure condition, a definition of condition should first be stated. Condition is a state of appearance, quality, or working order. In regards to infrastructure, it typically refers to wear, corrosion, and other forms of deterioration, but the term is also frequently used to refer to various facets of functional readiness.

The two most important considerations affecting the integrity of condition data are the quality of the data that is collected and the degree to which the data is appropriate for the intended use. Because there is no perfect measurement of condition, there are many variables to be considered when trying to quantify the condition of a given piece of infrastructure.

- What kind of data is available or might be collected
- Is a measure of condition, function, or some other metric needed
- Is the condition being used to make strategic (network level) or tactical (project level) decisions.
- Is a measure needed for a failure mode, subcomponent, component, or system
- How accurate must the condition rating be in order to meet the given need for a condition measure
- What is the cost-benefit of creating the condition rating

### **5.4.1 Condition data and condition categories**

The following four categories illustrate different levels of detail for information within a condition rating system. They are listed from most de-

tailed to least. This loss of detail has to be weighed against the cost of more detail and the impact to the end objective of using the condition measurement. Note that greater detail allows more accuracy, but it does not guarantee accuracy. That is determined by the specifics of the rating method.

**1. Measurement** – Direct measurement is the least subjective and the most repeatable. While measurement values can vary, they are least likely to vary from person to person. Some distresses such as corrosion can be difficult to measure. Others such as noise or vibration are rarely measured. While the correlation may not be directly one to one, measurements are the most likely condition rating to inform about a failure mode.

Examples of measurements are: thickness, length, viscosity, amperage, force, section loss, missing bolts/rivets, leakage rate, piezometric level, number of pits, volume loss, displacement, temperature, etc.

**2. Measurement category** – Categories might be similar to the actual measurements but measured or recorded within a range. In many cases this would allow the measurement to be “eyeballed” instead of actually measured.

Examples of measurement categories are: within specification, less than 10%, very fine <0.01, fine >0.01 and <0.04, medium >0.04 and <0.08, wide >0.08, less than 2-in. loss, loss exposing rebar.

**3. Individualized condition category** – While the categories may not include physical measurements, the description of each category is specific to the item and helps create a shared mental image of the types and severity of distresses for the rated item but still more subjective than measurements. Condition category ratings are shown in Table 7.

**Table 7. Individual component condition categories.**

1	Machinery has failed/ broken teeth or misaligned teeth cause failure.
2	Teeth are worn, gears have backlash and vibrate, lubrication is low.
3	Gears show pitting and oil discolored
4	Minor pitting on gear teeth, but unit functions properly.
5	Machine is in good condition and no misalignment is occurring.

**4. Generic condition category** – Whether the categories are defined (e.g., excellent, good, fair, poor, failed), or the categories include more explana-

tion, the same categories are applied to all rated items. It is likely that people will have varying images of both the types and the severity of the distresses present. Examples of generic condition categories are shown in Table 8.

Table 8 - Generic condition rating scale.

Zone	Condition Index	Condition Description
1	85 to 100	<b>Excellent:</b> No noticeable defects. Some aging or wear may be visible.
	70 to 84	<b>Good:</b> Only minor deterioration or defects are evident.
2	55 to 69	<b>Fair:</b> Some deterioration or defects are evident, but function is not significantly affected.
	40 to 54	<b>Marginal:</b> Moderate deterioration. Function is still adequate.
3	25 to 39	<b>Poor:</b> Serious deterioration in at least some portions of the structure. Function is inadequate.
	10 to 24	<b>Very poor:</b> Extensive deterioration. Barely functional.
	0 to 9	<b>Failed:</b> No longer functions. General failure or complete failure or a major structural component.

#### 5.4.2 Condition category inaccuracies

Categories also introduce another problem to data quality beside the loss of detail. They often capture information lacking either the appropriate accuracy or applicability to the question or decision to be addressed.

##### *Ambiguous categories*

Categories can also be ambiguous if they contain multiple conditions. Referring to the individualized condition categories of Table 7, we note that the categories contain multiple distresses or deficiencies. In both of these examples, the specific condition present is unknown. Teeth wear, lubrication level, and vibration may be related but all can occur separately or in any combination. These condition descriptions also lack an indication of severity.

- “Teeth are worn, gears have backlash and vibrate, lubrication is low”
  - Wear, backlash, vibration, and lubrication are all correlated but each can occur independently.
  - How worn? How much vibration and backlash? How low?

- “Serious deterioration in at least some portions of the structure. Function is inadequate.”
  - Deterioration and function are correlated but are more likely to be independent for most of the life cycle.
  - How serious? Which portion?

#### *Non-condition categories*

“Condition” tends to be a catchall for many things that aren’t strictly condition. There is nothing wrong with this as long as there is a shared understanding of what is meant. While Table 8 is primarily a generic condition rating scale, it is ambiguous because it includes functionality as part of the condition category description. Another example of non-condition condition rate categories is shown in Table 9. These categories are based on judgment of confidence in future performance. They are reliability or dependability ratings. Note that it is unclear how moderate and high level of confidence should be defined. While condition often indicates wear, usage, or deterioration, reliability ratings might show low ratings for new items of poor quality or for items that frequently break down for reasons other than condition such as overload. If these reliability ratings are used where condition information is really needed, results are likely to be poor.

**Table 9. Expected performance categories**

1	Judged to have high likelihood of failure when needed with high level of confidence.
2	Judged to not likely perform satisfactorily when needed with a moderate level of confidence.
3	Moderate rating.
4	Judged to likely perform satisfactorily when needed with a moderate level of confidence.
5	Judged to perform well when needed with a high level of confidence.

#### **5.4.3 Applying condition ratings to asset hierarchical levels**

Condition ratings may also have different benefits depending on whether the rating is for a failure mode, a system, or some hierarchical level between. Using a condition rating made at one level for a decision at a different level of the asset hierarchy typically results in a poor outcome.

Condition ratings at different levels and the type of inspection needed are given below:

- Condition rating of the system (visual or performance)
- Condition rating of the component (visual)
- Condition rating of the component (visual, measurement, and performance)
- Condition rating of the subcomponent (visual, measurement, and performance)
- Condition rating of the failure mode (visual, measurement, and performance)

The value of the condition rating data may vary depending on whether it is based on visual observation, measurements, or performance. Performance ratings are often referred to as functional ratings.

## 5.5 Operational condition assessment

At the start of this project, it was requested that OCA ratings be used as the measure of condition. As previously discussed, condition ratings can capture different aspects of condition with varying degrees of accuracy. The primary use of navigation OCA ratings is to assess the probability of an unscheduled lock shutdown due to infrastructure unavailability. This does not necessarily align with the condition as it relates to maintenance effectiveness so it is reasonable to analyze whether the condition measures are appropriate for assessing maintenance effectiveness.

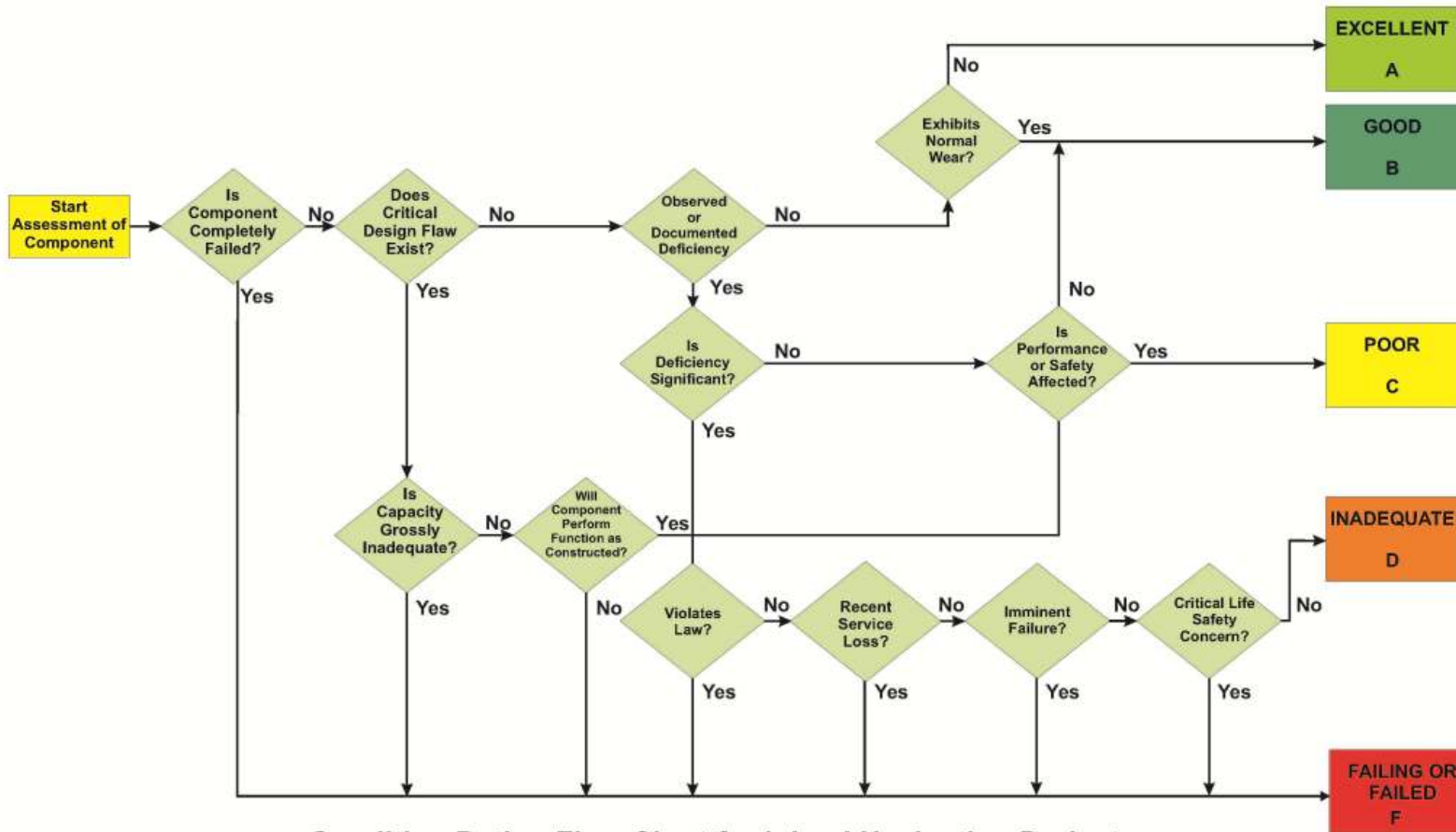
The OCA navigation condition rating flowchart in Figure 28 shows the rating methodology. It is based on a series of yes/no questions resulting in five possible ratings. A review of the criteria for assigning these OCA ratings suggests, however, that they do not provide a meaningful measure of condition as it would relate to maintenance. Reasons for the lack of meaningful measure are given below.

- The OCA questions include numerous factors unrelated to maintenance (e.g., violates law, life safety concern, capacity, design flaw), and the measures of condition related to maintenance (normal wear) and potentially related to maintenance (e.g., imminent failure, recent service loss, known deficiency).
- The ratings are not only noncontinuous, but the discrete ratings also are based on yes/no measures that provide only a minimal number of

gradations. These yes/no questions do not provide sufficient detail to relate the condition to maintenance practices.

- The ratings are applied at a component or sub-system level. Information for judging maintenance effectiveness is more useful at the subcomponent of failure mode level.

Figure 28. OCA navigation condition rating flowchart (USACE n.p.).



Condition Rating Flow Chart for Inland Navigation Projects

## **6 Summary**

### **6.1 Conclusion**

The primary objective of this project was not met. Early in the project, it was learned that the maintenance records in FEM lacked the detail and specificity to complete the primary tasks assigned to this work. It was also clear that the OCA ratings did not capture appropriate information for assessing maintenance effectiveness. Nonetheless, this project resulted in many valuable findings that can be applied to improve effectiveness within USACE Civil Works O&M maintenance management.

One of the major findings was that a focus on prioritizing repairs based on risk of unscheduled outage results in conflicting priorities, with standard maintenance management practices focused on minimizing overall maintenance costs and as a result, likely reducing overall system condition. It is unlikely that asset availability can be optimized directly, based on the priority of individual work packages. Instead, it is reached by a properly balanced application of preventive and corrective maintenance.

#### **6.1.1 Maintenance Effectiveness Review**

A MER was held at New Cumberland Lock and Dam. Based on a preliminary review of job plans for a number of projects, the in-depth revision of the job plans at New Cumberland confirms the benefits of creating accurate job plans and PM schedules. Such revisions come with a significant cost if applied Corps-wide, however; this cost needs to be considered in conjunction with the overall AM objectives and the reasons for using FEM.

#### **6.1.2 Condition rating**

At the start of this project, it was requested that OCA ratings be used as the measure of component condition. OCA ratings also are being used as one input for estimating user impacts. While no literature is known to verify the effectiveness for the second use, a review of the criteria for assigning these ratings suggests that OCA ratings do not provide a meaningful measure of condition as it would relate to maintenance. OCA ratings include numerous factors unrelated to maintenance (e.g., violates law, life safety concern, capacity, design flaw) and the measures of condition related to maintenance (e.g., normal wear) and potentially related to mainte-

nance (e.g., imminent failure, recent service loss, known deficiency) not only are noncontinuous, but also the discrete ratings are based on yes/no measures that provide minimal information regarding deterioration or indication of maintenance effectiveness.

### **6.1.3 FEM**

Currently FEM records contain inventory information of varying detail, job plans, PM schedules, and records of completed scheduled maintenance. Some USACE districts and projects use FEM for additional records such as standing work orders, gauge monitoring, labor reporting, and inventory, but these uses are limited. In these capacities, FEM is primarily being used as a glorified calendar and spreadsheet. Far more thought and development needs to be applied to FEM if USACE is to capture more than a small fraction of this maintenance system's potential benefits.

## **6.2 Recommendations**

In order to judge the effectiveness of maintenance applied to USACE navigation locks, as well as other USACE infrastructure, there is a need for substantial additional capabilities. These capabilities are mostly or entirely inherent in use of FEM at a level that captures most of the tools benefits. In other words, if USACE intends to continue using FEM, these are capabilities that should be implemented and used.

In addition to the suggestions for collection of data in FEM listed in the subsequent sub-section, there is also an opportunity to collect data on preventative and corrective maintenance in order to better understand how this ration relates to failures and downtime as discussed in Section 4.3. It would be a substantial effort to develop this capability and collect the data.

### **6.2.1 Facility Equipment Maintenance**

Whether maintenance management information of various types is currently being entered into FEM, could be entered but is not, or can't currently be recorded in FEM, there needs to be a well-developed plan for how this information is going to be used, how it will benefit the Corps, how it is going to be ensured that the information is entered, and how it will be reviewed for accuracy.

The following items currently in FEM that the owners should review and revise:

- Job plans
- Asset hierarchies
- Classifications

USACE currently has job plans in FEM for most scheduled maintenance. The job plan tasks need to be more completely documented and revised for clarity.

The following items can currently be entered in FEM but are generally not entered. There should be additional guidance developed at the national level to increase uniformity within and across projects and also to determine what data will best meet needs at local and national levels:

- Labor
- Materials and costs
- Inventory

Significant resistance to labor reporting within FEM was noted during the work documented in this report. It is unclear why such resistance is present as it could be accomplished with little or no additional effort. It is primarily a matter of changing a business practice. The benefits of accurately reporting labor within FEM to evaluating maintenance practices are significant.

Assessing the benefits of using inventory capabilities within FEM is beyond the scope of this report but it should be explicitly considered at the USACE level.

The following items that can be entered in FEM but some have no standardized input to ensure uniformity. They should be reviewed and revised at the national level. There is a need to not only ensure uniformity and consistency, but also to determine what data will best meet needs at local and national levels:

- Classifications
- Attributes
- Failure reporting

- Downtime reporting
- Condition monitoring
- Asset prioritization
- Work order prioritization

Asset classification capabilities currently implemented within FEM are inadequate for effective use of the data collected on maintenance practices. Insufficient asset classification is an obstacle to effective searches of the collected information.

Attributes also need to be established within FEM for many of the same reasons as classifications. Attributes enhance the capabilities provided by a robust classification system.

USACE capabilities for estimating risk associated with infrastructure availability are severely limited by a lack of data useful in estimating probabilities of adverse conditions. Only minimal improvements can be made unless the right data is systematically collected on component failures, operational failures, and other causes of infrastructure unavailability. Useful data collection can only be accomplished through a very careful consideration of what data will be most likely to predict probabilities of failures and downtime.

Reporting of condition monitoring data in FEM can provide multiple benefits but one in particular is as supporting data for understanding the causes of failures and estimating failures.

Work order and asset prioritization may provide benefits to AM beyond assessing maintenance effectiveness, and their value and usage should be investigated further. While it may currently be too early in the development of the USACE AM program, these tools should be considered within an overall plan and not ignored until the program matures.

### **6.2.2 Condition rating**

If the original objective of this project—using condition as a measure of maintenance effectiveness—remains attractive, it can only be accomplished by using condition ratings at a sub-component or failure mode level. In the development of these ratings, one step should be to assess the desirability of developing ratings at each of those two levels.

Whether OCA is a useful tool for asset management generally, and more specifically for budget prioritization, is a question that was not addressed in this report but appears to be worth further investigation.

## References

- USACE. n.d. FEM Production Database. Washington, DC: Department of the Army, USACE Headquarters. Accessed online: <https://maximo.eis.ds.usace.army.mil/maximo/webclient/login/login.jsp?sc=1353013456622>.
- USACE. 2002. "Financial Reporting and Accounting Treatment for Multiple Purpose Projects" Chapter 14, Appendix A in *Financial Administration: Accounting and Reporting*. ER 37-1-30, as revised 2003–2012. Washington, DC: Department of the Army, USACE Headquarters, CERM-F. Accessed online: [http://publications.usace.army.mil/publications/eng-regs/ER\\_37-1-30\\_pfl/toc.htm](http://publications.usace.army.mil/publications/eng-regs/ER_37-1-30_pfl/toc.htm).
- USACE. 2010. Operational Condition Assessment Process for Inland Navigation, Instruction Manual & Software User Guides, Version 1.2. Washington, DC: Department of the Army, USACE Headquarters (n.p.).
- USACE, Great Lakes and Ohio Rivers Division. 2010. Program Management Plan for Facilities Equipment and Maintenance System (FEM), Cincinnati, OH: USACE Great Lakes and Ohio Rivers Division.
- USACE, Pittsburg District. n.d. "FEM Reports." Pittsburg, PA: USACE Pittsburg District. Accessed online: <https://w3.www.usace.army.mil/apps/fem/femreports>.
- USACE, Pittsburg District. 1985. *New Cumberland Locks and Dam Ohio River, Ohio Operations and Maintenance Manual*. Pittsburg, PA: USACE Pittsburg District.
- Uzarski, Donald R., David T. McKay, and Stuart D. Foltz. 2009. *Role of Inspection and Condition Assessment in U.S. Army Corps of Engineers Civil Works Infrastructure Management: Current Practices and Opportunities for the Future*. ERDC/CERL TR-09-4. Champaign, IL: Engineer Research and Development Center—Construction Engineering Research Laboratory. Available online: <http://acwc.sdp.sirsi.net/client/search/asset/1002620>.

## **Appendix A: FEM Component Classifications**

The first page is the first-level classification structure, and the subsequent four pages comprise the lock components classification.

<b>FEM Classification Structure</b>		
		<b>ER 37-1-30 Chp 14 App A</b>
01	Not Used	Lands and Damages
02	Not Used	Relocators
03	Reservoirs	Reservoirs
04	Dam	Dam
05	Lock	Lock
06	Fish and Wildlife Facility	Fish and Wildlife Facility
07	Power Plant	Power Plant
08	Roads, Railroads, and Bridges	Roads, Railroads, and Bridges
09	Channels and Canals	Channels and Canals
10	Breakwaters and Seawalls	Breakwaters and Seawalls
11	Levees and Floodwalls	Levees and Floodwalls
12	Coastal Navigation Ports and Harbors	Coastal Navigation Ports and Harbors
13	Pumping Plants	Pumping Plants
14	Recreational Facilities	Recreational Area
15	Floodway Control and Diversion Structures	Floodway Control and Diversion Structures
16	Bank Stabilization	Bank Stabilization
17	Not Used	Beach Replenishment
18	Not Used	Cultural Resources
19	Buildings, Grounds and Utilities	Buildings, Grounds and Utilities
20	Permanent Operating Equipment (Fleet)	Permanent Operating Equipment (Fleet)
		* Blue Sections not included in current ER but are included in "Real Property Cost Feature Definitions"

ER 37-1-30			Asset Classification				Notes
05 LOCKS			05			Lock	
	1. Basic Lock Features			05-00-01		Lock, Basic Lock Features	
		<i>a. Structure, excluding Timber Structures</i>			05-00-01-01	Lock, Basic Lock Features, Structure	
						Lock, Basic Lock Features, Structures, Lock Walls	
						Lock Sills and Floors	
						Lock Cutoff Walls	
						Lock Embankments	
						Lock Erosion Protection	
						Lock Other Structural Systems	
		<i>b. Gates</i>			05-00-01-02	Lock, Basic Lock Features, Lock Gate	Attributes: miter, lift, sector, tainter, roller
		<i>c. Machinery, Gate Operating</i>			05-00-01-03	Lock, Basic Lock Features, Lock Gate Operating Machinery	
		<i>d. Control House, separate from Lock Structure</i>					Not Used, recommending 19 - Buildings and Utilities
		<i>e. Operating Building, Concrete</i>					Not Used, recommending 19 - Buildings and Utilities
		<i>f. Water System</i>			05-00-01-06	Lock, Basic Lock Features, Water System	
		<i>g. Sewer System</i>			05-00-01-07	Lock, Basic Lock Features, Sewer System	
		<i>h. Heating and/or Ventilating System</i>			05-00-01-08	Lock, Basic Lock Features, HVAC System	
		<i>i. Filling and Emptying Valves and Operating Equipment</i>			05-00-01-09	Lock, Basic Lock Features, Filling and Emptying Valves and Operating Equipment	
		<i>j. Lighting System, excluding Lighting Board and Attached Accessory Equipment</i>			05-00-01-10	Lock, Basic Lock Features, Lighting System	

		<i>l. Main Power System, excluding Power Boards and Engine Generator Sets 100-kw and over</i>			05-00-01-12	Lock, Basic Lock Features, Main Power System	
		<i>m. Stoplogs and Bulkheads</i>			05-00-01-13	Lock, Basic Lock Features, Stoplogs and Bulkheads	
		<i>n. Crane, Complete (excluding Mobile and Crawler type)</i>			05-00-01-14	Lock, Basic Lock Features, Crane	* Suggested addition to 20
		<i>o. All Components not listed elsewhere</i>			05-00-01-15	Lock, Basic Lock Features, All other Components	
	2. Operating Buildings, other than Concrete, not part of Lock Structure, excluding Control Houses.						Not Used, recommending 19 - Buildings and Utilities
	3. Radio towers, 80 feet and over				05-00-03	Lock, Radio towers, 80 feet and over	
	4. Elevator, complete, with Operating Mechanism, excluding embedded parts				05-00-04	Lock, Elevator	
	5. 055 Engine Generator Set, 100-kw and over				05-00-05	Lock, Engine Generator Set > 100kW	

	6. 056 Main Power, Lighting and Control Boards, complete with attached accessories			05-00-06		Lock, Power, Lighting, and Control Boards	
	7. Air Compressors, complete, 100 cfm and over			05-00-07		Lock, Air Compressors > 100 cfm	
	8. Moorage and Lock Approach Structures Guide Walls, Dolphins and other Guide Structures, timber			05-00-08		Lock, Moorage and Lock Approach Structures	
		<i>a. Mooring Dolphins and other Facilities for Temporary Moorage Water-borne Traffic</i>			05-00-08-01	Lock, Moorage and Lock Approach Structures, Mooring Dolphins & Other Facilities for Temporary Moorage	
		<i>b. Bulkheads and retaining Walls</i>			05-00-08-02	Lock, Moorage and Lock Approach Structures, Bulkheads and Retaining Walls	
	9. Roof Coverings, 3,000 sq. ft. and over per building						Not Used

10. Radio communicatio ns equipment location including transmitter, receiver power supplies, auxiliary generators, batteries, cables, and antennas, but excluding land and improvements, buildings, and tower 80 feet and over						Not Used, Recommend adding to 20
--	--	--	--	--	--	-------------------------------------

## **Appendix B: FEM Component Hierarchy Examples**

This Appendix includes the hierarchies entered into FEM for Wilson Lock and Dam (H3WILL) and Lower Monumental Locks and Dam (G4-3N).

## B.1. Wilson Lock and Dam

- |WIL Lock (H3WILL)
  - |WIL Lock, Primary Lock Chamber 01 (H3WILL01)
    - |WIL Lock, Primary Lock Chamber Gates (H3WILL01G)
      - |WIL Lock, Primary Lock Chamber Gates, Lift (H3WILL01GL)
      - |WIL Lock, Gates, Lift, Upstream, Primary Chamber (H3WILL01GLU)
      - |WIL Lock, Primary Lock Chamber Gates, Miter (H3WILL01GM)
        - |WIL Lock, Gates, Miter, Downstream, Primary Chamber (H3WILL01GMD)
      - |WIL Lock, Gates, Other Items, Air Bubbler System, Primary Chamber (H3WILL01GOB)
      - |WIL Lock, Gates, Other Items, Embedded Metals, Primary Chamber (H3WILL01GOM)
      - |WIL Lock, Gates, Other Items, Seals, Primary Chamber (H3WILL01GOS)
      - |WIL Lock, Gates, Operating Equip & Mach, Downstream, Primary Chamber (H3WILL01GQD)
      - |WIL Lock, Gates, Operating Equip & Mach, Upstream, Primary Chamber (H3WILL01GQU)
    - |WIL Lock, Primary Lock Chamber Structure (H3WILL01S)
      - |WIL Lock, Structures, Erosion Protection, Downstream Approach, Primary Chamber (H3WILL01SEPD)
      - |WIL Lock, Structures, Erosion Protection, Upstream Approach, Primary Chamber (H3WILL01SEPU)
      - |WIL Lock, Structures, Floor System, Primary Chamber (H3WILL01SFF)
      - |WIL Lock, Structures, Guard Sill, Downstream, Primary Chamber (H3WILL01SFGD)
      - |WIL Lock, Structures, Guard Sill, Upstream, Primary Chamber (H3WILL01SFGU)
      - |WIL Lock, Structures, Miter Sill, Downstream, Primary Chamber (H3WILL01SFMD)
      - |WIL Lock, Structures, Miter Sill, Upstream, Primary Chamber (H3WILL01SFMU)
      - |WIL Lock, Structures, Navigation Aides, Floating Mooring Bits, Primary Chamber (H3WILL01SNF)
      - |WIL Lock, Structures, Navigation Aides, Tow Haulage Systems, Primary Chamber (H3WILL01SNT)
      - |WIL Lock, Primary Lock Chamber Structures, Lock Walls (H3WILL01SW)
        - |WIL Lock, Structures, Lock Walls, Lower Guide Wall, Primary Chamber (H3WILL01SWDD)
        - |WIL Lock, Structures, Lock Walls, Land Wall, Primary Chamber (H3WILL01SWL)
        - |WIL Lock, Structures, Lock Walls, River Wall, Primary Chamber (H3WILL01SWR)
        - |WIL Lock, Structures, Lock Walls, Upper Guide Wall, Primary Chamber (H3WILL01SWUD)
    - |WIL Lock, Primary Lock Chamber Valves (H3WILL01V)
      - |WIL Lock, Primary Lock Chamber Valves, Operating Machinery (H3WILL01VM)
        - |WIL Lock, Valves, Operating Machinery, Emptying Valve, Land Wall, Primary Chamber (H3WILL01VMEL)
        - |WIL Lock, Valves, Operating Machinery, Emptying Valve, River Wall, Primary Chamber (H3WILL01VMER)
        - |WIL Lock, Valves, Operating Machinery, Filling Valve, Land Wall, Primary Chamber (H3WILL01VMFL)
        - |WIL Lock, Valves, Operating Machinery, Filling Valve, River Wall, Primary Chamber (H3WILL01VMFR)
        - |WIL Lock, Valves, Operating Machinery, Supplemental Emptying Valve, Land Wall, Primary Chamber (H3WILL01VMSEL)
      - |WIL Lock, Primary Lock Chamber Valves, Other Items (H3WILL01VO)
        - |WIL Lock, Valves, Other Items, Debris Guards, Intakes, Primary Chamber (H3WILL01VOIG)
        - |WIL Lock, Valves, Other Items, Embedded Metals, Emptying Valves, Land Wall, Primary Chamber (H3WILL01VOMEL)
        - |WIL Lock, Valves, Other Items, Embedded Metals, Emptying Valves, River Wall, Primary Chamber (H3WILL01VOMER)
        - |WIL Lock, Valves, Other Items, Embedded Metals, Filling Valves, Land Wall, Primary Chamber (H3WILL01VOMFL)
        - |WIL Lock, Valves, Other Items, Embedded Metals, Filling Valves, River Wall, Primary Chamber (H3WILL01VOMFR)

- WIL Lock, Valves, Other Items, Seals, Emptying Valves, Land Wall, Primary Chamber (H3WILL01VOSEL)
- WIL Lock, Valves, Other Items, Seals, Emptying Valves, River Wall, Primary Chamber (H3WILL01VOSER)
- WIL Lock, Valves, Other Items, Seals, Filling Valves, River Wall, Primary Chamber (H3WILL01VOSFR)
- WIL Lock, Auxiliary Lock Chamber 02 (H3WILL02)
  - WIL Lock, Auxiliary Lock Chamber Gates (H3WILL02G)
    - WIL Lock, Auxiliary Lock Chamber Gates, Lift (H3WILL02GL)
    - WIL Lock, Gates, Lift, Upstream, Auxiliary Chamber (H3WILL02GLU)
    - WIL Lock, Auxiliary Lock Chamber Gates, Miter (H3WILL02GM)
    - WIL Lock, Gates, Miter, Downstream, Auxiliary Chamber (H3WILL02GMD)
    - WIL Lock, Gates, Miter, Middle, Auxiliary Chamber (H3WILL02GMM)
    - WIL Lock, Gates, Other Items, Air Bubbler System, Auxiliary Chamber (H3WILL02GOB)
    - WIL Lock, Gates, Other Items, Embedded Metals, Auxiliary Chamber (H3WILL02GOM)
    - WIL Lock, Gates, Other Items, Seals, Auxiliary Chamber (H3WILL02GOS)
    - WIL Lock, Gates, Operating Equip & Mach, Downstream, Auxiliary Chamber (H3WILL02GQD)
    - WIL Lock, Gates, Operating Equip & Mach, Middle, Auxiliary Chamber (H3WILL02GQM)
    - WIL Lock, Gates, Operating Equip & Mach, Upstream, Auxiliary Chamber (H3WILL02GQU)
  - WIL Lock, Auxiliary Lock Chamber Structure (H3WILL02S)
    - WIL Lock, Structures, Erosion Protection, Downstream Approach, Auxiliary Chamber (H3WILL02SEPD)
    - WIL Lock, Structures, Erosion Protection, Upstream Approach, Auxiliary Chamber (H3WILL02SEPU)
    - WIL Lock, Structures, Floor System, Auxiliary Chamber (H3WILL02SFF)
    - WIL Lock, Structures, Guard Sill, Downstream, Auxiliary Chamber (H3WILL02SFGD)
    - WIL Lock, Structures, Guard Sill, Middle, Auxiliary Chamber (H3WILL02SFGM)
    - WIL Lock, Structures, Guard Sill, Upstream, Auxiliary Chamber (H3WILL02SFGU)
    - WIL Lock, Structures, Miter Sill, Downstream, Auxiliary Chamber (H3WILL02SFMD)
    - WIL Lock, Structures, Miter Sill, Middle, Auxiliary Chamber (H3WILL02SFMM)
    - WIL Lock, Structures, Miter Sill, Upstream, Auxiliary Chamber (H3WILL02SFMU)
    - WIL Lock, Structures, Navigation Aides, Floating Mooring Bits, Auxiliary Chamber (H3WILL02SNF)
    - WIL Lock, Structures, Navigation Aides, Tow Haulage Systems, Auxiliary Chamber (H3WILL02SNT)
    - WIL Lock, Auxiliary Lock Chamber Structures, Lock Walls (H3WILL02SW)
      - WIL Lock, Structures, Lock Walls, Lower Guard Wall, Auxiliary Chamber (H3WILL02SWDR)
      - WIL Lock, Structures, Lock Walls, Land Wall, Auxiliary Chamber (H3WILL02SWL)
      - WIL Lock, Structures, Lock Walls, River Wall, Auxiliary Chamber (H3WILL02SWR)
      - WIL Lock, Structures, Lock Walls, Upper Guard Wall, Auxiliary Chamber (H3WILL02SWUR)
  - WIL Lock, Auxiliary Lock Chamber Valves (H3WILL02V)
    - WIL Lock, Auxiliary Lock Chamber Valves, Operating Machinery (H3WILL02VM)
      - WIL Lock, Valves, Operating Machinery, Emptying Valve, Land Wall, Auxiliary Chamber (H3WILL02VMEL)
      - WIL Lock, Valves, Operating Machinery, Emptying Valve, River Wall, Auxiliary Chamber, Lower (H3WILL02VMERL)
      - WIL Lock, Valves, Operating Machinery, Emptying Valve, River Wall, Auxiliary Chamber, Upper (H3WILL02VMERU)
      - WIL Lock, Valves, Operating Machinery, Filling Valve, Land Wall, Auxiliary Chamber, Upper (H3WILL02VMFLU)
      - WIL Lock, Valves, Operating Machinery, Filling Valve, River Wall, Auxiliary Chamber, Upper (H3WILL02VMFRU)

- WIL Lock, Auxiliary Lock Chamber Valves, Other Items (H3WILL02VO)
  - WIL Lock, Valves, Other Items, Debris Guards, Intakes, Auxiliary Chamber (H3WILL02VOIG)
  - WIL Lock, Valves, Other Items, Embedded Metals, Emptying Valves, Land Wall, Auxiliary Chamber (H3WILL02VOMEL)
  - WIL Lock, Valves, Other Items, Embedded Metals, Emptying Valves, River Wall, Auxiliary Chamber (H3WILL02VOMER)
  - WIL Lock, Valves, Other Items, Embedded Metals, Filling Valves, Land Wall, Auxiliary Chamber (H3WILL02VOMFL)
  - WIL Lock, Valves, Other Items, Embedded Metals, Filling Valves, River Wall, Auxiliary Chamber (H3WILL02VOMFR)
  - WIL Lock, Valves, Other Items, Seals, Emptying Valves, Land Wall, Auxiliary Chamber (H3WILL02VOSEL)
  - WIL Lock, Valves, Other Items, Seals, Emptying Valves, River Wall, Auxiliary Chamber (H3WILL02VOSER)
  - WIL Lock, Valves, Other Items, Seals, Filling Valves, River Wall, Auxiliary Chamber (H3WILL02VOSFR)
- WIL Lock, Electronic Security System (H3WILLESS)
- WIL Lock, Gates (H3WILLG)
  - WIL Lock, Gates, Lift (H3WILLGL)
  - WIL Lock, Gates, Miter (H3WILLGM)
  - WIL Lock, Gates, Other Items (H3WILLGO)
  - WIL Lock, Gates, Operating Equipment & Machinery (H3WILLGQ)
- WIL Lock, Instrumentation (H3WILLI)
  - WIL Lock, Instrumentation, Communication & Warning Systems (H3WILLIC)
  - WIL Lock, Instrumentation, Concrete Strain Gages (H3WILLICS)
  - WIL Lock, Instrumentation, Data Management Systems (H3WILLID)
  - WIL Lock, Instrumentation, Inclinometers (H3WILLII)
  - WIL Lock, Instrumentation, Data Loggers (H3WILLIL)
  - WIL Lock, Instrumentation, Alignment Monuments (H3WILLIM)
  - WIL Lock, Instrumentation, Piezometers (H3WILLIP)
  - WIL Lock, Instrumentation, PLCs (H3WILLIPLC)
  - WIL Lock, Instrumentation, Steel Strain Gages (H3WILLISS)
  - WIL Lock, Instrumentation, VFDs (H3WILLIV)
- WIL Lock, Miscellaneous Systems (H3WILLMS)
  - WIL Lock, Miscellaneous Systems, Elevator (H3WILLMSE)
    - WIL Lock, Miscellaneous Systems, Elevator, Cars And Equipment (H3WILLMSECE)
    - WIL Lock, Miscellaneous Systems, Elevator, Power And Controls (H3WILLMSEPC)
- WIL Lock, Other Structures (H3WILLO)
  - WIL Lock, Other Structures, Bridges (H3WILLOB)
    - WIL Lock, Other Structures, Bridges, Service, Superstructure (H3WILLOBSS)
    - WIL Lock, Other Structures, Bridges, Service, Piers, Supports & Foundations (H3WILLOBSU)
  - WIL Lock, Other Structures, Control Buildings (H3WILLOC)
    - WIL Lock, Other Structures, Control Buildings, Land Wall, Primary Chamber (H3WILL01OCBL)
    - WIL Lock, Other Structures, Control Buildings, River Wall, Primary Chamber (H3WILL01OCBR)
    - WIL Lock, Other Structures, Control Buildings, Land Wall, Auxiliary Chamber (H3WILL02OCBL)
    - WIL Lock, Other Structures, Control Buildings, River Wall, Auxiliary Chamber (H3WILL02OCBR)
- WIL Lock, Structures (H3WILLS)
  - WIL Lock, Structures, Embankments (H3WILLSE)
    - WIL Lock, Structures, Embankments, Downstream Approach (H3WILLSED)
    - WIL Lock, Structures, Embankments, Upstream Approach (H3WILLSEU)
  - WIL Lock, Structures, Erosion Protection (H3WILLSEP)
    - WIL Lock, Structures, Erosion Protection, Downstream, Landside Embankment (H3WILLSEPDLE)
    - WIL Lock, Structures, Erosion Protection, Downstream, River Wall (H3WILLSEPDR)
    - WIL Lock, Structures, Erosion Protection, Upstream, Landside Embankment (H3WILLSEPULE)
  - WIL Lock, Structures, Sills & Floors (H3WILLSF)

- WIL Lock, Structures, Navigation Aides (H3WILLSN)
- WIL Lock, Structures, Other Structural Systems (H3WILLSO)
  - WIL Lock, Structures, Other Structural Systems, Retaining Walls (H3WILLSOR)
- WIL Lock, Structures, Lock Walls (H3WILLSW)
- WIL Lock, Utility Systems (H3WILLU)
  - WIL Lock, Utility Systems, Air System (H3WILLUA)
    - WIL Lock, Utility Systems, Air System, Controls (H3WILLUAAC)
    - WIL Lock, Utility Systems, Air System, Distribution System (H3WILLUAAD)
    - WIL Lock, Utility Systems, Air System, Pumps, Valves & Receivers (H3WILLUAAP)
  - WIL Lock, Utility Systems, Electrical Power & Controls (H3WILLUE)
    - WIL Lock, Utility Systems, Electrical Power & Controls, Control Systems (H3WILLUECS)
    - WIL Lock, Utility Systems, Electrical Power & Controls, Distribution Systems (H3WILLUED)
    - WIL Lock, Utility Systems, Electrical Power & Controls, Switch Gear/Motor Control Center (H3WILLUEGM)
    - WIL Lock, Utility Systems, Electrical Power & Controls, Lightning Protection System (H3WILLUELPS)
    - WIL Lock, Utility Systems, Electrical Power & Controls, Lighting Systems (H3WILLUELS)
  - WIL Lock, Utility Systems, Hydraulic System (H3WILLUH)
    - WIL Lock, Utility Systems, Hydraulic System, Distribution System (H3WILLUHHD)
    - WIL Lock, Utility Systems, Hydraulic System, Pumps, Backup (H3WILLUHHBP)
    - WIL Lock, Utility Systems, Hydraulic System, Pumps, Primary (H3WILLUHHPP)
    - WIL Lock, Utility Systems, Hydraulic System, Valves And Controls (H3WILLUHHVC)
  - WIL Lock, Utility Systems, Combined Service/Potable Water System (H3WILLUSPW)
    - WIL Lock, Utility Systems, Combined Service/Potable Water System, Pumps & Controls (H3WILLUSPWWC)
    - WIL Lock, Utility Systems, Combined Service/Potable Water System, Distribution System (H3WILLUSPWWD)
  - WIL Lock, Utility Systems, Service Water (Only) System (H3WILLUSW)
    - WIL Lock, Utility Systems, Service Water (Only) System, Pumps & Controls (H3WILLUSWWC)
    - WIL Lock, Utility Systems, Service Water (Only) System, Distribution System (H3WILLUSWWD)
- WIL Lock, Valves (H3WILLV)
  - WIL Lock, Primary Lock Chamber Valves, Tainter (H3WILL01VT)
    - WIL Lock, Valves, Tainter, Emptying, Land Wall, Primary Chamber (H3WILL01VTEL)
    - WIL Lock, Valves, Tainter, Emptying, River Wall, Primary Chamber (H3WILL01VTER)
    - WIL Lock, Valves, Tainter, Filling, Land Wall, Primary Chamber (H3WILL01VTFL)
    - WIL Lock, Valves, Tainter, Filling, River Wall, Primary Chamber (H3WILL01VTFR)
    - WIL Lock, Valves, Tainter, Supplemental Emptying, Land Wall, Primary Chamber (H3WILL01VTSEL)
    - WIL Lock, Valves, Tainter, Supplemental Emptying, River Wall, Primary Chamber (H3WILL01VTSER)
  - WIL Lock, Auxiliary Lock Chamber Valves, Tainter (H3WILL02VT)
    - WIL Lock, Valves, Tainter, Emptying, Land Wall, Auxiliary Chamber, Upper (H3WILL02VTELU)
    - WIL Lock, Valves, Tainter, Emptying, River Wall, Auxiliary Chamber, Lower (H3WILL02VTERL)
    - WIL Lock, Valves, Tainter, Emptying, River Wall, Auxiliary Chamber, Upper (H3WILL02VTERU)
    - WIL Lock, Valves, Tainter, Filling, Land Wall, Auxiliary Chamber, Upper (H3WILL02VTFLU)
    - WIL Lock, Valves, Tainter, Filling, River Wall, Auxiliary Chamber, Upper (H3WILL02VTFRU)
- WIL Lock, Valves, Operating Machinery (H3WILLVM)

- |WIL Lock, Valves, Other Items (H3WILLVO)
- |WIL Lock, Valves, Tainter (H3WILLVT)
- |WIL Lock, Closure Systems (H3WILLX)
  - |WIL Lock, Closure Systems, Maintenance (H3WILLXM)
    - |WIL Lock, Closure Systems, Maintenance, Bulkheads (H3WILLXMB)
    - |WIL Lock, Closure Systems, Maintenance, Lifting Frames (H3WILLXMF)
    - |WIL Lock, Closure Systems, Maintenance, Hoisting Equipment (H3WILLXMH)
    - |WIL Lock, Closure Systems, Maintenance, Stop Logs (H3WILLXMS)

## B.2. Lower Monumental Lock and Dam

- | NAVIGATION LOCK (G4-3N000000)
  - | BULKHEADS (G4-3NB00000)
    - | STOPLOGS (G4-3NBBZ000)
      - | FLOATING BULKHEADS (G4-3NBF000)
        - | FLOATING BULKHEADS UNWATERING PUMPS (G4-3NBFUP00)
          - | FLOATING BULKHEADS UNWATERING PUMP #1 (G4-3NBFUP10)
            - | MOTOR CONTROLLER (G4-3NBFUP1C)
          - | FLOATING BULKHEADS UNWATERING PUMP #2 (G4-3NBFUP20)
            - | MOTOR CONTROLLER (G4-3NBFUP2C)
          - | FLOATING BULKHEADS UNWATERING PUMP #3 (G4-3NBFUP30)
            - | MOTOR CONTROLLER (G4-3NBFUP3C)
          - | FLOATING BULKHEADS UNWATERING PUMP #4 (G4-3NBFUP40)
            - | MOTOR CONTROLLER (G4-3NBFUP4C)
        - | UNWATERING SUMP SLUCE GATE (G4-3NBUWSSG)
        - | FILL/EMPTYING VALVE BULKHEADS (G4-3NBVB000)
          - | LOCK EMPTYING VALVE BULKHEAD (G4-3NBVE000)
            - | LOCK EMPTYING VALVE BULKHEAD V2 (G4-3NBEV200)
            - | LOCK EMPTYING VALVE BULKHEAD V1 (G4-3NBEV100)
          - | LOCK FILL VALVE BULKHEAD (G4-3NBVF000)
            - | LOCK FILL VALVE BULKHEAD V3 (G4-3NBFV300)
            - | LOCK FILL VALVE BULKHEAD V4 (G4-3NBFV400)
  - | CONTROL STANDS (G4-3NECS000)
    - | DOWN STREAM CONTROL STAND (G4-3NECS0DS)
      - | CONTROL CONSEL (G4-3NECC100)
        - | HVAC (G4-3NEHVAC1)
    - | UP STREAM CONTROL STAND (G4-3NECS0US)
      - | CONTROL CONSEL (G4-3NECC200)
        - | HVAC (G4-3NEHVAC2)
  - | GATES (G4-3NGATE00)
    - | DOWNSTREAM GATE #1 (G4-3NGDN000)
      - | GATE STRUCTURE (G4-3NGDN0GS)
        - | HOISTING EQUIPMENT DOWNSTREAM GATE 1 (G4-3NGDN0HE)
          - | BEARINGS (G4-3NGDN0BS)
          - | CABLE DRUM (G4-3NGDN0CD)
          - | ELECTRICAL SYSTEM (G4-3NGDN0ES)
            - | LIFT GATE CONTROLS (G4-3NGDN0LG)
            - | MOTOR CONTROL CENTER (G4-3NGDN0MC)
          - | GEAR REDUCERS (G4-3NGDN0GR)
          - | CABLES (G4-3NGDN0HC)
          - | HYDRAULIC SYSTEM (G4-3NGDN0HS)
      - | UPSTREAM GATE #2 (G4-3NGUP000)
        - | GATE STRUCTURE (G4-3NGUP0GS)
          - | HOISTING EQUIPMENT UPSTREAM GATE 2 (G4-3NGUP0HE)
            - | BEARINGS (G4-3NGUP0BS)
            - | CABLE DRUM (G4-3NGUP0CD)
            - | ELECTRICAL SYSTEM (G4-3NGUP0ES)
              - | GEAR REDUCER (G4-3NGUP0GR)
            - | CABLES (G4-3NGUP0HC)
            - | HYDRAULIC SYSTEM (G4-3NGUP0HS)
      - | INFRASTRUCTURE (G4-3NI00000)
        - | BUILDINGS (G4-3NIBU000)
        - | DIFFUSERS (G4-3NIDF000)
        - | FLOATING GUIDEWALL (G4-3NIFGW00)
        - | GUIDEWALLS (G4-3NIGW000)
        - | LOCK CHAMBER (G4-3NILC000)
        - | LOCK STRUCTURE (G4-3NILS000)
        - | NAVLOCK LIGHTING (G4-3NILT000)
        - | MOORING BITS (G4-3NIMB000)
        - | ROADWAYS (G4-3NIRO000)
        - | WEATHER STATION (G4-3NIWS000)
      - | MISCELLANEOUS (G4-3NM00000)
        - | STATION SERVICE (G4-3NS00000)
          - | 4160 LOAD CENTER (G4-3NSLP000)
            - | LSP1 4160 VOLT SWITCHGEAR (G4-3NSLSP100)
            - | LSP2 4160 VOLT SWITCHGEAR (G4-3NSLSP200)
          - | 480 LOAD CENTER (G4-3NSLQ000)
            - | LQ-3 480 Volt Distribution Panel (G4-3NPLQ300)
            - | LCQ-1 480 Volt Control Center (G4-3NSLCQ10)

- LCQ-2 480 Volt Control Center (G4-3NSLCQ20)
- LCQ-3 480 Volt Control Center (G4-3NSLCQ30)
- LCQ-4 480 Volt Control Center (G4-3NSLCQ40)
- LQ-1 480 Volt Distribution Panel (G4-3NSLQ100)
- LQ-4 480 Volt Distribution Panel (G4-3NSLQ400)
- LQ-5 480 Volt Distribution Panel (G4-3NSLQ500)
- LSQ-1 480-volt switchgear (G4-3NSLSQ10)
- LSQ-2 480 Volt Switchgear (G4-3NSLSQ20)
- |120 VOLT LOAD CENTER (G4-3NSLR000)
  - LR-3 SWITCHGEAR (G4-3NPLR300)
  - LR-5 SWITCHGEAR (G4-3NPLR500)
  - LRS-2 SWITCHGEAR (G4-3NPLRS20)
  - LR-1 SWITCHGEAR (G4-3NSLR100)
  - LR-2 SWITCHGEAR (G4-3NSLR200)
  - LR-4 SWITCHGEAR (G4-3NSLR400)
  - LRS-1 SWITCHGEAR (G4-3NSLRS10)
- |TAINTER VALVES (G4-3NV00000)
  - |DRAIN VALVES (G4-3NVDZ000)
    - |DRAIN VALVE #1 (G4-3NVDV100)
      - HYDRAULIC CYL (G4-3NVDV1HC)
      - TAINTER VALVE #1 (G4-3NVDV1TV)
      - AUTO LUBE SYS (G4-3NVDVLS1)
      - HYDRAULIC UNIT (G4-3NVDZ0HD)
    - |DRAIN VALVE #2 (G4-3NVDV200)
      - HYDRUALIC CYL (G4-3NVDV2HC)
      - HYDRUALIC UNIT (G4-3NVDV2HU)
      - TAINTER VALVE #2 (G4-3NVDV2TV)
      - AUTO LUBE SYS (G4-3NVDVLS2)
    - |DRAIN VALVE CONTROLS (G4-3NVDVC00)
  - |FILL VALVES #3 & 4 (G4-3NVFZ000)
    - |FILL VALVLE #3 (G4-3NVFV300)
      - HYDRAULIC CYL (G4-3NVFV3HC)
      - HYDRAULIC UNIT (G4-3NVFV3HU)
      - TAINTER VALVE #3 (G4-3NVFV3TV)
      - AUTO LUBE SYSTEM (G4-3NVFVLS3)
    - |FILL VALVE #4 (G4-3NVFV400)
      - HYDRAULIC CYL (G4-3NVFV4HC)
      - HYDRAULIC UNIT (G4-3NVFV4HU)
      - TAINTER VALVE #4 (G4-3NVFV4TV)
      - AUTO LUBE SYS (G4-3NVFVLS4)
    - |FILL VALVE CONTROLS (G4-3NVFVC00)
- |DRAINAGE & UNWATERING SYSTEM (G4-3NW00000)
  - |PUMPS (G4-3NWP000)
    - |UNWATERING PUMP #1 (G4-3NWP1000)
      - MOTOR CONTROLLER (G4-3NWP1MC0)
    - |UNWATERING PUMP #2 (G4-3NWP2000)
      - MOTOR CONTROLLER (G4-3NWP2MC0)
    - |UNWATERING PUMP #3 (G4-3NWP3000)
      - MOTOR CONTROLLER (G4-3NWP3MC0)
    - |TAINTER VALVE UW PUMP #4 (G4-3NWP4000)
      - MOTOR CONTROLLER (G4-3NWP4MC0)
    - |TAINTER VALVE UW PUMP #5 (G4-3NWP5000)
      - MOTOR CONTROLLER (G4-3NWP5MC0)
  - |COMPRESSED AIR SYSTEM (G4-3NX00000)
    - |#1 NAV LOCK COMPRESSOR (G4-3NAC1000)
      - MOTOR CONTROLLER (G4-3NXAC1MC)
    - |#2 NAV LOCK COMPRESSOR (G4-3NAC2000)
      - MOTOR CONTROLLER (G4-3NXAC2MC)
    - |#3 NAV LOCK COMPRESSOR (G4-3NAC3000)
      - MOTOR CONTROLLER (G4-3NXAC3MC)
    - INTERCOM (G4-3NEIC000)
    - BUBBLERS (G4-3NXBU000)
    - NORTH ELEVATOR (G4-3NXEL000)
    - SOUTH ELEVATOR (G4-3NXELS00)
  - |FIRE SYSTEMS (G4-3NXFS000)
    - WATER CONON D/S (G4-3NFSWCDS)
    - WATER CONON U/S (G4-3NFSWCUS)
    - FIRE PUMP #1 (G4-3NXFSP10)

|MOTOR CONTROLLER (G4-3NFSP1C)  
|FIRE PUMP #2 (G4-3NXFSP20)  
|MOTOR CONTROLLER (G4-3NFSP2C)

## **Appendix C: OCA and FEM Component Comparisons**

The OCA critical components are compared to components listed in FEM for Wilson Lock and Dam and Lower Monumental Lock and Dam.

## C.1. Wilson Lock and Dam

**KEY:** 1. Feature 2. System 3. Sub-System 4. Component 5. Sub-Component

<ul style="list-style-type: none"><li>1. Lock</li><li>2. Lock Filling and Emptying Systems</li><li>3. F/E Operating Machinery<ul style="list-style-type: none"><li>4. Direct Acting Cylinder (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Hosing - Flexible</li></ul></li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Linkage</li><li>4. Bellcrank Assembly (Hydraulic or Electric)<ul style="list-style-type: none"><li>5. Bell Crank</li><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder – Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Motor (Fixed)</li><li>5. Hydraulic Motor (Variable)</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"> <li>5. Hydraulic Piping - Carbon Steel</li> <li>5. Hydraulic Piping - Stainless Steel</li> <li>5. Linkage</li> <li>5. Strut Arm Pin</li> <li>5. Strut Arm, Rigid</li> <li>5. Strut Arm Spring</li> <li>4. Electric Operating Equipment F/E Valves <ul style="list-style-type: none"> <li>5. Brake - Electric Elements</li> <li>5. Electric Motor</li> <li>5. Motor Starter (Full Voltage)</li> <li>5. Motor Starter (Reduced Voltage)</li> <li>5. Motor Starter (Variable Frequency)</li> <li>5. Power Cable - Flex/Cable Trays</li> <li>5. Power Cable - Submerged/Conduit</li> </ul> </li> </ul>	
---	--

**4. Gear Drive Assembly (Electric)****5. Bevel Gear****5. Brake - Mechanical Pads & Springs****5. Connecting Shaft - Rotating****5. Flexible Coupling****5. Gear Reducer/Parallel Gears****5. Helical Gear****5. Hydraulic Motor (Fixed)****5. Hydraulic Motor (Variable)****5. Linkage****5. Rack****5. Right Angle Gear****5. Rigid Coupling****5. Sector Gear**

<ul style="list-style-type: none"><li>5. Spur/Pinion Gear</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>5. Torque Tube</li><li>4. Gear Drive Assembly (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Linkage</li><li>5. Rack</li><li>5. Rack Rollers</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Sector Gear</li><li>5. Stem</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>5. Torque Tube</li><li>4. Rope Hoist Mechanism (Electric)<ul style="list-style-type: none"><li>5. Bevel Gear</li><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connecting Shaft - Rotating</li><li>5. Flexible Coupling</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Helical Gear</li><li>5. Right Angle Gear</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Rigid Coupling</li><li>5. Rope Other Material (Define)</li><li>5. Rope Sockets</li><li>5. Spur/Pinnion Gear</li><li>5. Strut Arm Pin</li><li>5. Strut Arm Spring</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Rope Hoist Mechanism (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Linkage</li><li>5. Rope Other Material (Define)</li><li>5. Rope Sockets</li><li>5. Sheave Guide Assembly</li><li>5. Strut Arm Pin</li><li>5. Strut Arm Spring</li><li>5. Wire Rope Attachment Casting</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Round Valve (Hydraulic or Electric)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Electric Actuator</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. Hydraulic Piping - Carbon Steel</li> <li>5. Hydraulic Piping - Stainless Steel</li> <li>5. Rack</li> <li>5. Rack Rollers</li> <li>5. Sector Gear</li> <li>5. Stem</li> <li>3. F/E Valve Anchorages &amp; Supports <ul style="list-style-type: none"> <li>4. Valve Anchorage <ul style="list-style-type: none"> <li>5. Corrosion</li> <li>5. Fatigue</li> </ul> </li> </ul> </li> <li>3. F/E Valves <ul style="list-style-type: none"> <li>4. Butterfly Valve (Horizontal Pivot) <ul style="list-style-type: none"> <li>5. Corrosion</li> <li>5. Fatigue</li> </ul> </li> </ul> </li> </ul>	
--	--

<p>4. Butterfly Valve (Vertical Pivot)</p> <p>5. Corrosion</p> <p>5. Fatigue</p> <p>4. Cylindrical Plunger Valve</p> <p>5. Corrosion</p> <p>5. Fatigue</p> <p>4. Multiple Round Valve System</p> <p>5. Round Valve Fatigue</p> <p>4. Reverse Tainter Valve</p>	<p>Valves, Tainter, Emptying, Land Wall, Primary Chamber</p> <p>Valves, Tainter, Emptying, River Wall, Primary Chamber</p> <p>Valves, Tainter, Filling, Land Wall, Primary Chamber</p> <p>Valves, Tainter, Filling, River Wall, Primary Chamber</p> <p>Valves, Tainter, Supplemental Emptying, Land Wall, Primary Chamber</p> <p>Valves, Tainter, Supplemental Emptying, River Wall,</p>
--	--



<p>4. Miter Gate Anchorage</p> <ul style="list-style-type: none"> <li>5. Anchorage Bar (Parallel) - Fatigue</li> <li>5. Anchorage Bar (Perpendicular) - Fatigue</li> <li>5. Anchorage Pin/Wedge Pin - Fatigue</li> <li>5. Embedded Anchorage Assembly - Fatigue</li> <li>5. Gudgeon Pin</li> <li>5. Link Pin - Fatigue</li> </ul> <p>4. Roller Gate Anchorage</p> <ul style="list-style-type: none"> <li>5. Embedded Anchorage Assembly - Fatigue</li> <li>5. Embedded Frame/Guide Assembly - Corrosion</li> </ul> <p>4. Sector Gate Anchorage</p> <ul style="list-style-type: none"> <li>5. Embedded Hinge/Anchorage Assembly - Fatigue</li> <li>5. Hinge Pin - Fatigue</li> <li>5. Hinge/Bracket Support - Corrosion</li> </ul>	
---	--

<ul style="list-style-type: none"><li>5. Hinge/Bracket Support - Fatigue</li><li>4. Tainter Gate Anchorage<ul style="list-style-type: none"><li>5. Embedded Trunnion Assembly - Fatigue</li><li>5. Yoke Assembly - Corrosion</li><li>5. Yoke Assembly - Fatigue</li></ul></li><li>3. Lock Gate Operating Equipment<ul style="list-style-type: none"><li>4. Automatic Lubrication System (AIS)<ul style="list-style-type: none"><li>5. Feed and Supply Lines</li><li>5. Injectors</li><li>5. Metering Device</li><li>5. Operating Mechanism</li><li>5. Pump</li><li>5. Reservoir</li><li>5. Timer</li></ul></li></ul></li></ul>	
--	--

**4. Chain Hoist Mechanism (Electric)****5. Brake - Mechanical Pads & Springs****5. Chain Coupling (Shackle & Pin)****5. Chain Roller Type****5. Chain - Link Type****5. Connecting Shaft - Rotating****5. Counterweights****5. Flexible Coupling****5. Gear Reducer/Parallel Gears****5. Hydraulic Motor (Fixed)****5. Hydraulic Motor (Variable)****5. Right Angle Gear****5. Rigid Coupling****5. Sector Gear**

<ul style="list-style-type: none"><li>5. Slip Clutch</li><li>5. Sprocket</li><li>5. Spur/Pinnion Gear</li><li>4. Direct Acting Hydraulic Cylinder<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Hosing - Flexible</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li></ul></li></ul>	
--	--

**4. Electrical Operating Equipment (Lock Gates)****5. Brake - Electric Elements****5. Electric Motor****5. Motor Starter (Full Voltage)****5. Motor Starter (Reduced Voltage)****5. Motor Starter (Variable Frequency)****5. Power Cable - Flex/Cable Trays****5. Power Cable - Submerged/Conduit****4. Ohio River Type Assembly (Electric)****5. Bevel Gear****5. Brake - Mechanical Pads & Springs****5. Connection Pin****5. Gear Reducer/Parallel Gears****5. Gudgeon Pin**

<ul style="list-style-type: none"><li>5. Helical Gear</li><li>5. Rack</li><li>5. Rack Rollers</li><li>5. Right Angle Gear</li><li>5. Sector Arm</li><li>5. Sector Gear</li><li>5. Sector Pin</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Ohio River Type Assembly (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Gudgeon Pin</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Rack</li><li>5. Rack Rollers</li><li>5. Sector Arm</li><li>5. Sector Gear</li><li>5. Sector Pin</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Packaged Direct Connected Hydraulic Cylinder Assembly</li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. Check Valve</li> <li>5. Connection Pin</li> <li>5. Hydraulic Cylinder Support</li> <li>5. Hydraulic Cylinder - Ceramic</li> <li>5. Hydraulic Cylinder - Chrome/Stainless</li> <li>5. Hydraulic Hosing - Flexible</li> <li>5. Hydraulic Piping - Carbon Steel</li> <li>5. Hydraulic Piping - Stainless Steel</li> <li>5. Integrated HPU</li> <li>4. Panama Type Assembly (Electric) <ul style="list-style-type: none"> <li>5. Bevel Gear</li> <li>5. Brake - Mechanical Pads &amp; Springs</li> <li>5. Connection Pin</li> <li>5. Gear Reducer/Parallel Gears</li> </ul> </li> </ul>	
---	--

<ul style="list-style-type: none"><li>5. Gudgeon Pin</li><li>5. Helical Gear</li><li>5. Rack</li><li>5. Rack Rollers</li><li>5. Right Angle Gear</li><li>5. Sector Arm</li><li>5. Sector Gear</li><li>5. Sector Pin</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Rope Hoist Mechanism (Electric)<ul style="list-style-type: none"><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connecting Shaft - Rotating</li></ul></li></ul>	
--	--

5. Counterweights

5. Drum

5. Flexible Coupling

5. Gear Reducer/Parallel Gears

5. Geared Sheave

5. Hydraulic Motor (Fixed)

5. Multipart Sheave

5. Plain Sheave

5. Right Angle Gear

5. Rigid Coupling

5. Spur/Pinion Gear

5. Wire Rope Coupling

5. Wire Rope - Carbon Steel

5. Wire Rope - Stainless Steel

**4. Rope Hoist Mechanism (Hydraulic)****5. Check Valve****5. Counterweights****5. Crosshead****5. Crosshead Guide****5. Geared Sheave****5. Hydraulic Cylinder Support****5. Hydraulic Cylinder - Ceramic****5. Hydraulic Cylinder - Chrome/Stainless****5. Hydraulic Piping - Carbon Steel****5. Hydraulic Piping - Stainless Steel****5. Multipart Sheave****5. Plain Sheave****5. Rope Other Material (Define)**

<ul style="list-style-type: none"><li>5. Sheave Guide Assembly</li><li>5. Wire Rope Attachment Casting</li><li>5. Wire Rope Coupling</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Wire Rope Cable (Horizontal Pull) Assembly<ul style="list-style-type: none"><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connecting Shaft - Rotating</li><li>5. Drum</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Geared Sheave</li><li>5. Multipart Sheave</li><li>5. Plain Sheave</li><li>5. Right Angle Gear</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. Rope Other Material (Define)</li> <li>5. Spur/Pinion Gear</li> <li>5. Wire Rope Coupling</li> <li>5. Wire Rope - Carbon Steel</li> <li>5. Wire Rope - Stainless Steel</li> <li>3. Lock Gate Structures</li> <li>4. Miter Type Gate <ul style="list-style-type: none"> <li>5. Diagonals - Corrosion</li> <li>5. Diagonals - Fatigue</li> <li>5. Horizontal Girders - Corrosion</li> <li>5. Horizontal Girders - Fatigue</li> <li>5. Skin Plate Assembly - Corrosion</li> <li>5. Vertical Girders - Corrosion</li> <li>5. Vertical Girders - Fatigue</li> </ul> </li> </ul>	<p>Primary Lock Chamber Gates</p> <p>Gates, Miter, Downstream, Primary Chamber</p>
---	--

**4. Roller Type Gate****5. Horizontal Girders - Corrosion****5. Horizontal Girders - Fatigue****5. Skin Plate Assembly - Corrosion****5. Vertical Girders - Corrosion****5. Vertical Girders - Fatigue****4. Sector Type Gate****5. Bracing/Diagonals - Corrosion****5. Bracing/Diagonals - Fatigue****5. Center Post - Corrosion****5. Center Post - Fatigue****5. Hinge Assembly - Corrosion****5. Hinge Assembly - Fatigue****5. Horizontal Trusses - Corrosion**

<ul style="list-style-type: none"><li>5. Horizontal Trusses - Fatigue</li><li>5. Skin Plate Assembly - Corrosion</li></ul> <p>4. Tainter Type Gate</p> <ul style="list-style-type: none"><li>5. Horizontal Girders - Corrosion</li><li>5. Horizontal Girders - Fatigue</li><li>5. Left End Frame - Corrosion</li><li>5. Left End Frame - Fatigue</li><li>5. Left Hub Assembly - Corrosion</li><li>5. Left Hub Assembly - Fatigue</li><li>5. Right End Frame - Corrosion</li><li>5. Right End Frame - Fatigue</li><li>5. Right Hub Assembly - Corrosion</li><li>5. Right Hub Assembly - Fatigue</li><li>5. Skin Plate Assembly - Corrosion</li></ul>	
---	--

<ul style="list-style-type: none"> <li>5. Vertical Girders - Corrosion</li> <li>5. Vertical Girders - Fatigue</li> <li>4. Vertical Lift Type Gate</li> <li>5. Horizontal Trusses - Corrosion</li> <li>5. Horizontal Trusses - Fatigue</li> <li>5. Roller/Truck Assemblies - Fatigue</li> <li>5. Roller/Truck Assemblies - Corrosion</li> <li>5. Skin Plate Assembly - Corrosion</li> <li>5. Vertical Panel - Corrosion</li> <li>5. Vertical Panel - Fatigue</li> <li>3. Misc Lock Gate Features <ul style="list-style-type: none"> <li>4. Gate Fire Suppression System <ul style="list-style-type: none"> <li>5. Gate Fire Protection System</li> </ul> </li> </ul> </li> <li>4. Gate Latching Devices</li> </ul>	<p>Gates, Lift, Upstream, Primary Chamber</p>
---	---

<ul style="list-style-type: none"> <li>5. Electric Driven Operator</li> <li>5. Gate Latching Device</li> <li>5. Hydraulic Driven Operator</li> <li>5. Manual Operator</li> <li>4. Gate Seals <ul style="list-style-type: none"> <li>5. Seal Heater System</li> <li>5. Seals</li> <li>5. Seals, Other Material (Define)</li> <li>5. Seals, Rubber</li> <li>5. Seals, Timber</li> </ul> </li> <li>4. Lock Gate Cathodic Protection <ul style="list-style-type: none"> <li>5. Impressed Current System</li> <li>5. Sacrificial Anodes</li> </ul> </li> <li>4. Lock Gate Fenders</li> </ul>	<p>Gates, Other Items, Seals, Primary Chamber</p>
---	---

<ul style="list-style-type: none"><li>5. Fender Supports</li><li>5. Fenders Other Materials (Define)</li><li>5. Steel Fenders</li><li>5. Timber Fenders</li><li>5. Uhmw Fenders</li><li>4. Miter Guide<ul style="list-style-type: none"><li>5. Guide Bracket</li><li>5. Miter Device</li><li>5. Roller(s)</li></ul></li><li>4. Pintles<ul style="list-style-type: none"><li>5. Pintle</li><li>5. Pintle Ball</li><li>5. Pintle Base &amp; Anchorage</li><li>5. Pintle Casting (On Gate)</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"> <li>4. Quoin Blocks &amp; Other Load Blocks</li> <li>5. Contact Blocks</li> <li>5. Embedded Quoin Section</li> <li>5. Quoin Blocks (On Gate)</li> <li>2. Lock Structure</li> <li>3. Lock Walls &amp; Other Lock Structures</li> <li>4. Bulkhead Sill</li> <li>5. Deterioration</li> <li>5. Stability</li> <li>5. Structural</li> <li>4. Chamber Floor</li> <li>5. Deterioration</li> <li>5. Foundation Drainage System</li> <li>5. Foundation Pressure Relief System</li> </ul>	<p>Structures, Floor System, Primary Chamber</p>
--	--

<p>5. Seepage Cutoff System</p> <p>5. Stability</p> <p>5. Structural</p> <p>4. Filling/Emptying Culverts</p> <p>5. Deterioration</p> <p>5. Structural</p> <p>4. Gate Sill</p> <p>5. Deterioration</p> <p>5. Foundation Drainage System</p> <p>5. Foundation Pressure Relief System</p> <p>5. Foundation System</p> <p>5. Seepage Cutoff System</p> <p>5. Stability</p> <p>5. Structural</p>	<p>Structures, Miter Sill, Downstream, Primary Chamber Structures, Miter Sill, Upstream, Primary Chamber</p>
---	--

<p>4. Guard Sill</p> <p>5. Deterioration</p> <p>5. Stability</p> <p>5. Structural</p>	<p>Structures, Guard Sill, Downstream, Primary Chamber</p> <p>Structures, Guard Sill, Upstream, Primary Chamber</p>
<p>4. Guard Wall</p> <p>5. Deterioration</p> <p>5. Foundation Drainage System</p> <p>5. Foundation Pressure Relief System</p> <p>5. Foundation System</p> <p>5. Seepage Cutoff System</p> <p>5. Stability</p> <p>5. Structural</p>	<p>Structures, Lock Walls, Lower Guide Wall, Primary Chamber</p>
<p>4. Guide Wall</p> <p>5. Deterioration</p>	<p>Structures, Lock Walls, Upper Guide Wall, Primary Chamber</p>

<ul style="list-style-type: none"> <li>5. Foundation Drainage System</li> <li>5. Foundation Pressure Relief System</li> <li>5. Foundation System</li> <li>5. Seepage Cutoff System</li> <li>5. Stability</li> <li>5. Structural</li> <li>4. Landside Wall</li> <li>5. Deterioration</li> <li>5. Foundation Drainage System</li> <li>5. Foundation Pressure Relief System</li> <li>5. Foundation System</li> <li>5. Seepage Cutoff System</li> <li>5. Stability</li> <li>5. Structural</li> </ul>	<p style="text-align: center;">Structures, Lock Walls, Land Wall, Primary Chamber</p>
--	---

<ul style="list-style-type: none"> <li>4. Middle/Intermediate Wall <ul style="list-style-type: none"> <li>5. Deterioration</li> <li>5. Foundation Drainage System</li> <li>5. Foundation Pressure Relief System</li> <li>5. Foundation System</li> <li>5. Seepage Cutoff System</li> <li>5. Stability</li> <li>5. Structural</li> </ul> </li> <li>4. Miscellaneous Paving <ul style="list-style-type: none"> <li>5. Curbs</li> <li>5. Esplanade Paving</li> <li>5. Exterior Plaza Areas</li> <li>5. Heliport Pads</li> <li>5. Retaining Walls</li> </ul> </li> </ul>	<p>Structures, Other Structural Systems, Retaining Walls</p>
--	--

<ul style="list-style-type: none"><li>5. Sidewalks</li><li>5. Slope Paving</li><li>4. Nose Pier</li><li>5. Deterioration</li><li>5. Foundation System</li><li>5. Stability</li><li>5. Structural</li><li>4. Pier Wall</li><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. Structural</li> <li>4. Riverside Wall <ul style="list-style-type: none"> <li>5. Deterioration</li> <li>5. Foundation Drainage System</li> <li>5. Foundation Pressure Relief System</li> <li>5. Foundation System</li> <li>5. Seepage Cutoff System</li> <li>5. Stability</li> <li>5. Structural</li> </ul> </li> <li>3. Misc Lock Features <ul style="list-style-type: none"> <li>4. Docks, Wharfs and Lock Mooring Facilities <ul style="list-style-type: none"> <li>5. Fixed Dock</li> <li>5. Floating Dock</li> <li>5. Mooring Features</li> </ul> </li> </ul> </li> </ul>	<p>Structures, Lock Walls, River Wall, Primary Chamber</p>
---	--

<ul style="list-style-type: none"> <li>5. Paved Boat Ramp</li> <li>5. Safe Harbors</li> <li>5. Unpaved Boat Ramp</li> <li>5. Wharfs &amp; Bulkheads</li> <li>4. Elevator <ul style="list-style-type: none"> <li>5. Elevator Car &amp; Structure</li> <li>5. Elevator Controls</li> <li>5. Elevator Hoisting Equipment</li> </ul> </li> <li>4. Fish &amp; Wildlife Protection Features <ul style="list-style-type: none"> <li>5. Fish Barriers</li> <li>5. Fish Deterrent Systems</li> <li>5. Fish Diversion Structures</li> <li>5. Fish Ladders</li> <li>5. Manatee Barriers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Miscellaneous Systems, Elevator</li> <li>Miscellaneous Systems, Elevator, Cars And Equipment</li> <li>Miscellaneous Systems, Elevator, Power And Controls</li> </ul>
---	---

<ul style="list-style-type: none"> <li>5. Other Wildlife Barriers</li> <li>4. Guide Rail, Roads, and Parking Areas <ul style="list-style-type: none"> <li>5. Guide Rail, Parking Areas</li> <li>5. Guide Rail, Roadways</li> </ul> </li> <li>4. Jib Cranes, Davits &amp; Light Hoists <ul style="list-style-type: none"> <li>5. Davit</li> <li>5. Jib Crane</li> <li>5. Light Hoist</li> </ul> </li> <li>4. Lock Access Road <ul style="list-style-type: none"> <li>5. Drainage Systems</li> <li>5. Embankment</li> </ul> </li> <li>5. Guide Rail, Parking Areas</li> <li>5. Guide Rail, Roadways</li> </ul>	<p>Structures, Embankments, Downstream Approach Structures, Embankments, Upstream Approach</p>
--	--

<ul style="list-style-type: none"><li>5. Paving</li><li>4. Lock Approach Clearance<ul style="list-style-type: none"><li>5. Obstructions</li><li>5. Shoaling</li></ul></li><li>4. Lock Chamber Clearance<ul style="list-style-type: none"><li>5. Debris Accumulation</li><li>5. Obstructions</li></ul></li><li>4. Lock Parking Area<ul style="list-style-type: none"><li>5. Drainage Systems</li><li>5. Embankment</li><li>5. Paving</li></ul></li><li>4. Saltwater Control Systems<ul style="list-style-type: none"><li>5. Air System Features</li><li>5. Barriers and Gates</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. By-Pass (Diversion) Conduits</li> <li>5. Circulation Conduits</li> <li>5. Electric Power</li> <li>5. Hydraulic Power</li> <li>5. Machinery</li> <li>5. Machinery Houses</li> <li>5. Operating Controls</li> <li>5. Pump &amp; Machinery Controls</li> <li>5. Pumps</li> <li>4. Shoreline Erosion Protection</li> <li>5. Armor Stone</li> </ul>	<ul style="list-style-type: none"> <li>Structures, Erosion Protection, Downstream Approach, Primary Chamber</li> <li>Structures, Erosion Protection, Upstream Approach, Primary Chamber</li> <li>Structures, Erosion Protection, Downstream, Landside Embankment</li> <li>Structures, Erosion Protection, Downstream, River Wall</li> <li>Structures, Erosion Protection, Upstream, Landside Embankment</li> </ul>
--	--

<ul style="list-style-type: none"><li>5. Bedding &amp; Fill Layers<ul style="list-style-type: none"><li>5. Filter Layer</li></ul></li><li>4. Stairs, Walkways &amp; Work Platforms<ul style="list-style-type: none"><li>5. Paved Walkways</li><li>5. Stairways, Concrete</li><li>5. Stairways, Steel</li><li>5. Work Platforms</li></ul></li><li>3. Misc Lock Wall Features<ul style="list-style-type: none"><li>4. Bulkhead Slot Fillers<ul style="list-style-type: none"><li>5. Corrosion/Deterioration</li><li>5. Damage/Loss</li></ul></li><li>4. Debris Screens, Culvert Ports<ul style="list-style-type: none"><li>5. Damage/Loss</li></ul></li><li>4. Emergency Gate Screens/Slot Fillers/Protectors</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Corrosion/Deterioration</li><li>5. Damage/Loss</li><li>4. Grating/Cover Plates<ul style="list-style-type: none"><li>5. Aluminum Cover Plates</li><li>5. Aluminum Grating</li><li>5. Concrete Cover Plates</li><li>5. Steel Cover Plates</li><li>5. Steel Grating</li></ul></li><li>4. Handrailing &amp; Safety Rail<ul style="list-style-type: none"><li>5. Aluminum Pipe Post &amp; Rail</li><li>5. Steel Pipe Post &amp; Rail</li><li>5. Wire Rope with Post</li></ul></li><li>4. Ladders<ul style="list-style-type: none"><li>5. Aluminum Ladder</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. Steel Ladder</li> <li>5. Steel Rungs in Recess</li> <li>4. Trash Racks, Culvert Intakes</li> <li>5. Damage/Loss</li> <li>4. Utility Crossovers/Tunnels</li> <li>5. Infiltration</li> <li>4. Wall Armor/Fenders</li> <li>5. Corrosion/Deterioration</li> <li>5. Damage/Loss</li> <li>2. Navigational Aids &amp; Auxiliary Facilities</li> <li>3. Mooring Facilities</li> <li>4. Mooring Facilities</li> <li>5. Mooring Buoy No. 01</li> <li>5. Mooring Dolphin/Mooring Pier No. 01</li> </ul>	
--	--

<p>5. Mooring Buoy No. 2</p> <p>5. Mooring Buoy No. 3</p> <p>5. Mooring Buoy No. 4</p> <p>5. Mooring Buoy No. 5</p> <p>5. Mooring Cell No. 01</p> <p>5. Mooring Cell No. 2</p> <p>5. Mooring Cell No. 3</p> <p>5. Mooring Cell No. 4</p> <p>5. Mooring Cell No. 5</p> <p>5. Mooring Dolphin/Mooring Pier No. 2</p> <p>5. Mooring Dolphin/Mooring Pier No. 3</p> <p>5. Mooring Dolphin/Mooring Pier No. 4</p> <p>5. Mooring Dolphin/Mooring Pier No. 5</p> <p>3. Navigation Aides</p>	
--	--

<ul style="list-style-type: none"><li>4. Flow Control Features<ul style="list-style-type: none"><li>5. Exposed Training Dikes</li><li>5. Other Flow Control Aides</li><li>5. Shuttered Guard Walls</li><li>5. Submerged Training Dikes</li><li>5. Wing Dams</li></ul></li><li>4. Navigation Aides<ul style="list-style-type: none"><li>5. Air Horns/Audible Signal System</li><li>5. Air Tuggers</li><li>5. Bollards &amp; Deadmen</li><li>5. Capstans</li><li>5. Check Posts</li><li>5. Fender Collision Boom (Incl. Equipment)</li><li>5. Floating Mooring Bits</li></ul></li></ul>	<p>Structures, Navigation Aides, Floating Mooring Bits, Primary Chamber</p>
---	---

<p>5. Tow Haulage System</p> <p>5. Traffic Signal System</p>	<p>Structures, Navigation Aides, Tow Haulage Systems, Primary Chamber</p>
--	---

## C.2. Lower Monumental Lock and Dam

<ul style="list-style-type: none"><li>1. Lock</li><li>2. Lock Filling and Emptying Systems</li><li>3. F/E Operating Machinery<ul style="list-style-type: none"><li>4. Direct Acting Cylinder (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Hosing - Flexible</li></ul></li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Linkage</li><li>4. Bellcrank Assembly (Hydraulic or Electric)<ul style="list-style-type: none"><li>5. Bell Crank</li><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Motor (Fixed)</li><li>5. Hydraulic Motor (Variable)</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Linkage</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Electric Operating Equipment F/E Valves<ul style="list-style-type: none"><li>5. Brake - Electric Elements</li><li>5. Electric Motor</li><li>5. Motor Starter (Full Voltage)</li><li>5. Motor Starter (Reduced Voltage)</li><li>5. Motor Starter (Variable Frequency)</li><li>5. Power Cable - Flex/Cable Trays</li><li>5. Power Cable - Submerged/Conduit</li></ul></li></ul>	
---	--

**4. Gear Drive Assembly (Electric)****5. Bevel Gear****5. Brake - Mechanical Pads & Springs****5. Connecting Shaft - Rotating****5. Flexible Coupling****5. Gear Reducer/Parallel Gears****5. Helical Gear****5. Hydraulic Motor (Fixed)****5. Hydraulic Motor (Variable)****5. Linkage****5. Rack****5. Right Angle Gear****5. Rigid Coupling****5. Sector Gear**

<ul style="list-style-type: none"><li>5. Spur/Pinion Gear</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>5. Torque Tube</li><li>4. Gear Drive Assembly (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Linkage</li><li>5. Rack</li><li>5. Rack Rollers</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Sector Gear</li><li>5. Stem</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>5. Torque Tube</li><li>4. Rope Hoist Mechanism (Electric)<ul style="list-style-type: none"><li>5. Bevel Gear</li><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connecting Shaft - Rotating</li><li>5. Flexible Coupling</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Helical Gear</li><li>5. Right Angle Gear</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Rigid Coupling</li><li>5. Rope Other Material (Define)</li><li>5. Rope Sockets</li><li>5. Spur/Pinnion Gear</li><li>5. Strut Arm Pin</li><li>5. Strut Arm Spring</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Rope Hoist Mechanism (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Linkage</li><li>5. Rope Other Material (Define)</li><li>5. Rope Sockets</li><li>5. Sheave Guide Assembly</li><li>5. Strut Arm Pin</li><li>5. Strut Arm Spring</li><li>5. Wire Rope Attachment Casting</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Round Valve (Hydraulic or Electric)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Electric Actuator</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Rack</li><li>5. Rack Rollers</li><li>5. Sector Gear</li><li>5. Stem</li><li>3. F/E Valve Anchorages &amp; Supports<ul style="list-style-type: none"><li>4. Valve Anchorage<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li></ul></li><li>3. F/E Valves<ul style="list-style-type: none"><li>4. Butterfly Valve (Horizontal Pivot)<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>4. Butterfly Valve (Vertical Pivot)<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li><li>4. Cylindrical Plunger Valve<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li><li>4. Multiple Round Valve System<ul style="list-style-type: none"><li>5. Round Valve Fatigue</li></ul></li><li>4. Reverse Tainter Valve<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li><li>4. Slide Gate Valve<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>4. Stoney Gate Valve<ul style="list-style-type: none"><li>5. Corrosion</li><li>5. Fatigue</li></ul></li><li>2. Lock Gates &amp; Operating Machinery</li><li>3. Lock Gate Anchorages &amp; Support Features<ul style="list-style-type: none"><li>4. Lift Gate Anchorage<ul style="list-style-type: none"><li>5. Embedded Anchorage Assembly - Fatigue</li><li>5. Embedded Guides Corrosion</li></ul></li><li>4. Miter Gate Anchorage<ul style="list-style-type: none"><li>5. Anchorage Bar (Parallel) - Fatigue</li><li>5. Anchorage Bar (Perpendicular) - Fatigue</li><li>5. Anchorage Pin/Wedge Pin - Fatigue</li><li>5. Embedded Anchorage Assembly - Fatigue</li><li>5. Gudgeon Pin</li></ul></li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Link Pin - Fatigue</li><li>4. Roller Gate Anchorage<ul style="list-style-type: none"><li>5. Embedded Anchorage Assembly - Fatigue</li><li>5. Embedded Frame/Guide Assembly - Corrosion</li></ul></li><li>4. Sector Gate Anchorage<ul style="list-style-type: none"><li>5. Embedded Hinge/Anchorage Assembly - Fatigue</li><li>5. Hinge Pin - Fatigue</li><li>5. Hinge/Bracket Support - Corrosion</li><li>5. Hinge/Bracket Support - Fatigue</li></ul></li><li>4. Tainter Gate Anchorage<ul style="list-style-type: none"><li>5. Embedded Trunnion Assembly - Fatigue</li><li>5. Yoke Assembly - Corrosion</li><li>5. Yoke Assembly - Fatigue</li></ul></li><li>3. Lock Gate Operating Equipment</li></ul>	
---	--

**4. Automatic Lubrication System (AIS)****5. Feed and Supply Lines****5. Injectors****5. Metering Device****5. Operating Mechanism****5. Pump****5. Reservoir****5. Timer****4. Chain Hoist Mechanism (Electric)****5. Brake - Mechanical Pads & Springs****5. Chain Coupling (Shackle & Pin)****5. Chain Roller Type****5. Chain - Link Type****5. Connecting Shaft - Rotating**

<ul style="list-style-type: none"><li>5. Counterweights</li><li>5. Flexible Coupling</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Hydraulic Motor (Fixed)</li><li>5. Hydraulic Motor (Variable)</li><li>5. Right Angle Gear</li><li>5. Rigid Coupling</li><li>5. Sector Gear</li><li>5. Slip Clutch</li><li>5. Sprocket</li><li>5. Spur/Pinnion Gear</li><li>4. Direct Acting Hydraulic Cylinder<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Hosing - Flexible</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>4. Electrical Operating Equipment (Lock Gates)<ul style="list-style-type: none"><li>5. Brake - Electric Elements</li><li>5. Electric Motor</li><li>5. Motor Starter (Full Voltage)</li><li>5. Motor Starter (Reduced Voltage)</li><li>5. Motor Starter (Variable Frequency)</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Power Cable - Flex/Cable Trays</li><li>5. Power Cable - Submerged/Conduit</li><li>4. Ohio River Type Assembly (Electric)<ul style="list-style-type: none"><li>5. Bevel Gear</li><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connection Pin</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Gudgeon Pin</li><li>5. Helical Gear</li><li>5. Rack</li><li>5. Rack Rollers</li><li>5. Right Angle Gear</li><li>5. Sector Arm</li><li>5. Sector Gear</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Sector Pin</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Ohio River Type Assembly (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Gudgeon Pin</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Rack</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Rack Rollers</li><li>5. Sector Arm</li><li>5. Sector Gear</li><li>5. Sector Pin</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Packaged Direct Connected Hydraulic Cylinder Assembly<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Connection Pin</li><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Hosing - Flexible</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Integrated HPU</li><li>4. Panama Type Assembly (Electric)<ul style="list-style-type: none"><li>5. Bevel Gear</li><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connection Pin</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Gudgeon Pin</li><li>5. Helical Gear</li><li>5. Rack</li><li>5. Rack Rollers</li><li>5. Right Angle Gear</li><li>5. Sector Arm</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Sector Gear</li><li>5. Sector Pin</li><li>5. Strut Arm Pin</li><li>5. Strut Arm, Rigid</li><li>5. Strut Arm Spring</li><li>4. Rope Hoist Mechanism (Electric)<ul style="list-style-type: none"><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connecting Shaft - Rotating</li><li>5. Counterweights</li><li>5. Drum</li><li>5. Flexible Coupling</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Geared Sheave</li><li>5. Hydraulic Motor (Fixed)</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Multipart Sheave</li><li>5. Plain Sheave</li><li>5. Right Angle Gear</li><li>5. Rigid Coupling</li><li>5. Spur/Pinion Gear</li><li>5. Wire Rope Coupling</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Rope Hoist Mechanism (Hydraulic)<ul style="list-style-type: none"><li>5. Check Valve</li><li>5. Counterweights</li><li>5. Crosshead</li><li>5. Crosshead Guide</li><li>5. Geared Sheave</li></ul></li></ul>	
---	--

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>5. Hydraulic Cylinder Support</li><li>5. Hydraulic Cylinder - Ceramic</li><li>5. Hydraulic Cylinder - Chrome/Stainless</li><li>5. Hydraulic Piping - Carbon Steel</li><li>5. Hydraulic Piping - Stainless Steel</li><li>5. Multipart Sheave</li><li>5. Plain Sheave</li><li>5. Rope Other Material (Define)</li><li>5. Sheave Guide Assembly</li><li>5. Wire Rope Attachment Casting</li><li>5. Wire Rope Coupling</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li><li>4. Wire Rope Cable (Horizontal Pull) Assembly</li></ul> |  |
|---|--|

<ul style="list-style-type: none"><li>5. Brake - Mechanical Pads &amp; Springs</li><li>5. Connecting Shaft - Rotating</li><li>5. Drum</li><li>5. Gear Reducer/Parallel Gears</li><li>5. Geared Sheave</li><li>5. Multipart Sheave</li><li>5. Plain Sheave</li><li>5. Right Angle Gear</li><li>5. Rope Other Material (Define)</li><li>5. Spur/Pinnion Gear</li><li>5. Wire Rope Coupling</li><li>5. Wire Rope - Carbon Steel</li><li>5. Wire Rope - Stainless Steel</li></ul> <p>3. Lock Gate Structures</p>	
--	--

<p>4. Miter Type Gate</p> <ul style="list-style-type: none"><li>5. Diagonals - Corrosion</li><li>5. Diagonals - Fatigue</li><li>5. Horizontal Girders - Corrosion</li><li>5. Horizontal Girders - Fatigue</li><li>5. Skin Plate Assembly - Corrosion</li><li>5. Vertical Girders - Corrosion</li><li>5. Vertical Girders - Fatigue</li></ul> <p>4. Roller Type Gate</p> <ul style="list-style-type: none"><li>5. Horizontal Girders - Corrosion</li><li>5. Horizontal Girders - Fatigue</li><li>5. Skin Plate Assembly - Corrosion</li><li>5. Vertical Girders - Corrosion</li><li>5. Vertical Girders - Fatigue</li></ul>	
--	--

**4. Sector Type Gate****5. Bracing/Diagonals - Corrosion****5. Bracing/Diagonals - Fatigue****5. Center Post - Corrosion****5. Center Post - Fatigue****5. Hinge Assembly - Corrosion****5. Hinge Assembly - Fatigue****5. Horizontal Trusses - Corrosion****5. Horizontal Trusses - Fatigue****5. Skin Plate Assembly - Corrosion****4. Tainter Type Gate****5. Horizontal Girders - Corrosion****5. Horizontal Girders - Fatigue****5. Left End Frame - Corrosion**

<ul style="list-style-type: none"><li>5. Left End Frame - Fatigue</li><li>5. Left Hub Assembly - Corrosion</li><li>5. Left Hub Assembly - Fatigue</li><li>5. Right End Frame - Corrosion</li><li>5. Right End Frame - Fatigue</li><li>5. Right Hub Assembly - Corrosion</li><li>5. Right Hub Assembly - Fatigue</li><li>5. Skin Plate Assembly - Corrosion</li><li>5. Vertical Girders - Corrosion</li><li>5. Vertical Girders - Fatigue</li><li>4. Vertical Lift Type Gate<ul style="list-style-type: none"><li>5. Horizontal Trusses - Corrosion</li><li>5. Horizontal Trusses - Fatigue</li><li>5. Roller/Truck Assemblies - Fatigue</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Roller/Truck Assemblies - Corrosion</li><li>5. Skin Plate Assembly - Corrosion</li><li>5. Vertical Panel - Corrosion</li><li>5. Vertical Panel - Fatigue</li><li>3. Misc Lock Gate Features<ul style="list-style-type: none"><li>4. Gate Fire Suppression System<ul style="list-style-type: none"><li>5. Gate Fire Protection System</li></ul></li><li>4. Gate Latching Devices<ul style="list-style-type: none"><li>5. Electric Driven Operator</li><li>5. Gate Latching Device</li><li>5. Hydraulic Driven Operator</li><li>5. Manual Operator</li></ul></li><li>4. Gate Seals<ul style="list-style-type: none"><li>5. Seal Heater System</li></ul></li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Seals</li><li>5. Seals, Other Material (Define)</li><li>5. Seals, Rubber</li><li>5. Seals, Timber</li><li>4. Lock Gate Cathodic Protection<ul style="list-style-type: none"><li>5. Impressed Current System</li><li>5. Sacrificial Anodes</li></ul></li><li>4. Lock Gate Fenders<ul style="list-style-type: none"><li>5. Fender Supports</li><li>5. Fenders Other Materials (Define)</li><li>5. Steel Fenders</li><li>5. Timber Fenders</li><li>5. Uhmw Fenders</li></ul></li><li>4. Miter Guide</li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Guide Bracket</li><li>5. Miter Device</li><li>5. Roller(s)</li><li>4. Pintles<ul style="list-style-type: none"><li>5. Pintle</li><li>5. Pintle Ball</li><li>5. Pintle Base &amp; Anchorage</li><li>5. Pintle Casting (On Gate)</li></ul></li><li>4. Quoin Blocks &amp; Other Load Blocks<ul style="list-style-type: none"><li>5. Contact Blocks</li><li>5. Embedded Quoin Section</li><li>5. Quoin Blocks (On Gate)</li></ul></li><li>2. Lock Structure</li><li>3. Lock Walls &amp; Other Lock Structures</li></ul>	
--	--

<ul style="list-style-type: none"><li>4. Bulkhead Sill<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Stability</li><li>5. Structural</li></ul></li><li>4. Chamber Floor<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li><li>5. Structural</li></ul></li><li>4. Filling/Emptying Culverts<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Structural</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>4. Gate Sill<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li><li>5. Structural</li></ul></li><li>4. Guard Sill<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Stability</li><li>5. Structural</li></ul></li><li>4. Guard Wall<ul style="list-style-type: none"><li>5. Deterioration</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li><li>5. Structural</li></ul> <p>4. Guide Wall</p> <ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li><li>5. Structural</li></ul>	
---	--

<ul style="list-style-type: none"><li>4. Landside Wall<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li><li>5. Structural</li></ul></li><li>4. Middle/Intermediate Wall<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Stability</li><li>5. Structural</li><li>4. Miscellaneous Paving<ul style="list-style-type: none"><li>5. Curbs</li><li>5. Esplanade Paving</li><li>5. Exterior Plaza Areas</li><li>5. Heliport Pads</li><li>5. Retaining Walls</li><li>5. Sidewalks</li><li>5. Slope Paving</li></ul></li><li>4. Nose Pier<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation System</li><li>5. Stability</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"><li>5. Structural</li> <li>4. Pier Wall<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li><li>5. Seepage Cutoff System</li><li>5. Stability</li><li>5. Structural</li></ul></li> <li>4. Riverside Wall<ul style="list-style-type: none"><li>5. Deterioration</li><li>5. Foundation Drainage System</li><li>5. Foundation Pressure Relief System</li><li>5. Foundation System</li></ul></li></ul>	
--	--

5. Seepage Cutoff System	
5. Stability	
5. Structural	
3. Misc Lock Features	
4. Docks, Wharfs and Lock Mooring Facilities	
5. Fixed Dock	
5. Floating Dock	
5. Mooring Features	
5. Paved Boat Ramp	
5. Safe Harbors	
5. Unpaved Boat Ramp	
5. Wharfs & Bulkheads	
4. Elevator	
5. Elevator Car & Structure	

<ul style="list-style-type: none"><li>5. Elevator Controls</li><li>5. Elevator Hoisting Equipment</li><li>4. Fish &amp; Wildlife Protection Features<ul style="list-style-type: none"><li>5. Fish Barriers</li><li>5. Fish Deterrent Systems</li><li>5. Fish Diversion Structures</li><li>5. Fish Ladders</li><li>5. Manatee Barriers</li><li>5. Other Wildlife Barriers</li></ul></li><li>4. Guide Rail, Roads, and Parking Areas<ul style="list-style-type: none"><li>5. Guide Rail, Parking Areas</li><li>5. Guide Rail, Roadways</li></ul></li><li>4. Jib Cranes, Davits &amp; Light Hoists<ul style="list-style-type: none"><li>5. Davit</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Jib Crane</li><li>5. Light Hoist</li><li>4. Lock Access Road<ul style="list-style-type: none"><li>5. Drainage Systems</li><li>5. Embankment</li><li>5. Guide Rail, Parking Areas</li><li>5. Guide Rail, Roadways</li><li>5. Paving</li></ul></li><li>4. Lock Approach Clearance<ul style="list-style-type: none"><li>5. Obstructions</li><li>5. Shoaling</li></ul></li><li>4. Lock Chamber Clearance<ul style="list-style-type: none"><li>5. Debris Accumulation</li><li>5. Obstructions</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"><li>4. Lock Parking Area<ul style="list-style-type: none"><li>5. Drainage Systems</li><li>5. Embankment</li><li>5. Paving</li></ul></li><li>4. Saltwater Control Systems<ul style="list-style-type: none"><li>5. Air System Features</li><li>5. Barriers and Gates</li><li>5. By-Pass (Diversion) Conduits</li><li>5. Circulation Conduits</li><li>5. Electric Power</li><li>5. Hydraulic Power</li><li>5. Machinery</li><li>5. Machinery Houses</li><li>5. Operating Controls</li></ul></li></ul>	
--	--

<ul style="list-style-type: none"> <li>5. Pump &amp; Machinery Controls</li> <li>5. Pumps</li> <li>4. Shoreline Erosion Protection <ul style="list-style-type: none"> <li>5. Armor Stone</li> <li>5. Bedding &amp; Fill Layers</li> <li>5. Filter Layer</li> </ul> </li> <li>4. Stairs, Walkways &amp; Work Platforms <ul style="list-style-type: none"> <li>5. Paved Walkways</li> <li>5. Stairways, Concrete</li> <li>5. Stairways, Steel</li> <li>5. Work Platforms</li> </ul> </li> <li>3. Misc Lock Wall Features <ul style="list-style-type: none"> <li>4. Bulkhead Slot Fillers</li> </ul> </li> </ul>	<p>FLOATING BULKHEADS UNWATERING PUMP #1</p> <p>MOTOR CONTROLLER</p>
---	--

FLOATING BULKHEADS UNWATERING PUMP #2

MOTOR CONTROLLER

FLOATING BULKHEADS UNWATERING PUMP #3

MOTOR CONTROLLER

FLOATING BULKHEADS UNWATERING PUMP #4

MOTOR CONTROLLER

FILL/EMPTYING VALVE BULKHEADS

LOCK EMPTYING VALVE BULKHEAD

LOCK EMPTYING VALVE BULKHEAD V2

LOCK EMPTYING VALVE BULKHEAD V1

LOCK FILL VALVE BULKHEAD

LOCK FILL VALVE BULKHEAD V3

LOCK FILL VALVE BULKHEAD V4

5. Corrosion/Deterioration

<ul style="list-style-type: none"><li>5. Damage/Loss</li><li>4. Debris Screens, Culvert Ports<ul style="list-style-type: none"><li>5. Damage/Loss</li></ul></li><li>4. Emergency Gate Screens/Slot Fillers/Protectors<ul style="list-style-type: none"><li>5. Corrosion/Deterioration</li><li>5. Damage/Loss</li></ul></li><li>4. Grating/Cover Plates<ul style="list-style-type: none"><li>5. Aluminum Cover Plates</li><li>5. Aluminum Grating</li><li>5. Concrete Cover Plates</li><li>5. Steel Cover Plates</li><li>5. Steel Grating</li></ul></li><li>4. Handrailing &amp; Safety Rail<ul style="list-style-type: none"><li>5. Aluminum Pipe Post &amp; Rail</li></ul></li></ul>	
---	--

<ul style="list-style-type: none"> <li>5. Steel Pipe Post &amp; Rail</li> <li>5. Wire Rope with Post</li> <li>4. Ladders <ul style="list-style-type: none"> <li>5. Aluminum Ladder</li> <li>5. Steel Ladder</li> <li>5. Steel Rungs in Recess</li> </ul> </li> <li>4. Trash Racks, Culvert Intakes <ul style="list-style-type: none"> <li>5. Damage/Loss</li> </ul> </li> <li>4. Utility Crossovers/Tunnels <ul style="list-style-type: none"> <li>5. Infiltration</li> </ul> </li> <li>4. Wall Armor/Fenders <ul style="list-style-type: none"> <li>5. Corrosion/Deterioration</li> <li>5. Damage/Loss</li> </ul> </li> <li>2. Navigational Aids &amp; Auxiliary Facilities</li> </ul>	
---	--

**3. Mooring Facilities**

**4. Mooring Facilities**

5. Mooring Buoy No. 01

5. Mooring Dolphin/Mooring Pier No. 01

5. Mooring Buoy No. 2

5. Mooring Buoy No. 3

5. Mooring Buoy No. 4

5. Mooring Buoy No. 5

5. Mooring Cell No. 01

5. Mooring Cell No. 2

5. Mooring Cell No. 3

5. Mooring Cell No. 4

5. Mooring Cell No. 5

5. Mooring Dolphin/Mooring Pier No. 2

<ul style="list-style-type: none"><li>5. Mooring Dolphin/Mooring Pier No. 3</li><li>5. Mooring Dolphin/Mooring Pier No. 4</li><li>5. Mooring Dolphin/Mooring Pier No. 5</li></ul> <p>3. Navigation Aides</p> <p>4. Flow Control Features</p> <ul style="list-style-type: none"><li>5. Exposed Training Dikes</li><li>5. Other Flow Control Aides</li><li>5. Shuttered Guard Walls</li><li>5. Submerged Training Dikes</li><li>5. Wing Dams</li></ul> <p>4. Navigation Aides</p> <ul style="list-style-type: none"><li>5. Air Horns/Audible Signal System</li><li>5. Air Tuggers</li><li>5. Bollards &amp; Deadmen</li></ul>	
---	--

<ul style="list-style-type: none"><li>5. Capstans</li><li>5. Check Posts</li><li>5. Fender Collision Boom (Incl. Equipment)</li><li>5. Floating Mooring Bits</li><li>5. Tow Haulage System</li><li>5. Traffic Signal System</li></ul>	
---	--

## **Appendix D: FEM Job Plans**

Job plans for Bayou Sorrel, Lower Mountain Lock and Dam, and New Cumberland Lock and Dam are given in this appendix.

## D.1. Bayou Sorrel

### PM & Jobplan Listing by Asset

Site = MVN-A

See the last page  
for field explanations

ASSET	PM	JOB PLAN	iptask	Org Code	CREW	FREQUENCY	SEQUENCE
				<b>B2R0022</b>			
<b>B2AS</b>	<b>Bayou Sorrel Lock Top Level</b>						
No PMs for B2AS							
<b>B2ASL</b>	<b>Lock</b>						
	BSL-2398	WEEKLY SHIFT 1 LOCK OPERATORS			B2AS-LO	2 WEEKS	
	Next 6/18/12		Next Job BSL-15105	Use Target Start:	Y		
1	Date BSL-15105	WEEKLY SHIFT 1 LOCK OPERATORS DUTIES				1	
		10	COMMUNICATE WITH TOWS				
		20	OPERATE GATES & CHECK GUIDEWALLS				
		30	INPUT DATA INTO LPMS & EDIT MONTHLY REPORTS				
		40	SHIFT 1 CONTROL HOUSE & OTHER DUTIES				
2	BSL-2402	WEEKLY SHIFT 2 LOCK OPERATORS			B2AS-LO	2 WEEKS	
	Next 6/18/12		Next Job BSL-15111	Use Target Start:	Y		
	Date BSL-15111	WEEKLY SHIFT 2 LOCK OPERATORS DUTIES				1	
		10	COMMUNICATE WITH TOWS				
		20	OPERATE GATES & CHECK GUIDEWALLS				
		30	INPUT DATA INTO LPMS & EDIT MONTHLY REPORTS				
		40	SHIFT 2 CONTROL HOUSE & OTHER DUTIES				
3	BSL-2403	WEEKLY SHIFT 1 LOCK OPERATORS			B2AS-LO	2 WEEKS	
	Next 6/17/12		Next Job BSL-15110	Use Target Start:	Y		
	Date BSL-15110	WEEKLY SHIFT 1 LOCK OPERATORS DUTIES				1	
		10	COMMUNICATE WITH TOWS				
		20	OPERATE GATES & CHECK GUIDEWALLS				
		30	INPUT DATA INTO LPMS & EDIT MONTHLY REPORTS				
		40	SHIFT 1 CONTROL HOUSE & OTHER DUTIES				
4	BSL-2404	WEEKLY SHIFT 2 LOCK OPERATORS			B2AS-LO	2 WEEKS	
	Next 6/17/12		Next Job BSL-15108	Use Target Start:	Y		
	Date BSL-15108	WEEKLY SHIFT 2 LOCK OPERATORS DUTIES				1	
		10	COMMUNICATE WITH TOWS				
		20	OPERATE GATES & CHECK GUIDEWALLS				
		30	INPUT DATA INTO LPMS & EDIT MONTHLY REPORTS				
		40	SHIFT 2 CONTROL HOUSE & OTHER DUTIES				
5	BSL-2420	WEEKLY ADMINISTRATIVE WORK			B2AS-AD	1 WEEKS	
	Next 6/11/12		Next Job BSL-15160	Use Target Start:	Y		
	Date BSL-15160	WEEKLY ADMINISTRATIVE WORK				1	
		10	CHECK GW DAILY				
		20	ENTER TIME INTO CEFMS				
		30	DO REPORTS				
		40	POST MAIL				
		50	SEND OVERTIME REQUEST				
		60	HANDLE ROUTINE CORRESPONDENCE				
		70	HANDLE ROUTINE COMMUNICATIONS BY PHONE				
6	BSL-2421	WEEKLY MECHANIC'S PAPERWORK			B2AS-MA	1 WEEKS	
	Next 6/17/12		Next Job BSL-15162	Use Target Start:	Y		
	Date BSL-15162	WEEKLY MECHANIC'S PAPERWORK				1	
		10	UPDATE MAXIMO WEEKLY				
		20	KEEP UP INDIVIDUAL LOGS FOR EQUIP.				
		30	ORDER SUPPLIES AND PARTS AS NEEDED				
		40	UPDATE PROGRAMS AS NEEDED.				
		50	GENERAL OFFICE DUTIES				
7	BSL-2422	WEEKLY SAFETY MEETING			B2AS-AD	1 WEEKS	
	Next 6/17/12		Next Job BSL-15164	Use Target Start:	Y		
	Date BSL-15164	WEEKLY SAFETY MEETING				1	

		10 HOLD SAFETY MEETING 20 PARTICIPATORY MANAGEMENT 30 SAFETY FILM 40 SAFETT MANUAL - REVIEW				
8	BSL-2423	END OF MONTH REPORTS		B2AS-AD	1 MONTHS	
	Next 6/28/12		Next Job BSL-15167	Use Target Start: Y		
	Date BSL-15167	END OF MONTH REPORTS			1	
9	BSL-2424	10 END OF MONTH REPORTS FOR FOLLOWING MONTHLY MAN OVERBOARD & FIRE DRILL		B2AS-AD	1 MONTHS	
	Next 7/5/12		Next Job BSL-15170	Use Target Start: Y		
	Date BSL-15170	MONTHLY MAN OVERBOARD & FIRE DRILL			1	
10	BSL-2425	10 HOLD MAN OVERBOARD DRILL 20 HOLD FIRE DRILL MONTHLY FIRE ALARM CHECKS		B2AS-MA	1 MONTHS	
	Next 6/21/12		Next Job BSL-15173	Use Target Start: Y		
	Date BSL-15173	MONTHLY FIRE ALARM CHECKS			1	
11	BSL-2426	10 TEST FIRE ALARMS 20 CHANGE BATTERY WHEN TIME CHANGES MONTHLY FIRE EXTINGUISHER CHECKS		B2AS-MA	1 MONTHS	
	Next 7/8/12		Next Job BSL-15174	Use Target Start: Y		
	Date BSL-15174	MONTHLY FIRE EXTINGUISHER INSP.			1	
12	BSL-2428	10 INSPECT MONTHLY 20 CHECK FOR FULL CHARGE 30 CHECK HOSE AND PINS 40 RECHARGE & REPLACE AS NEEDED 50 MARK MONTHLY TAG YEARLY FIRE STATIONS MAINT. & INSP.		B2AS-MA	1 YEARS	
	Next 11/13/12		Next Job BSL-15177	Use Target Start: Y		
	Date BSL-15177	YEARLY FIRE STATIONS MAINT. & INSP.			1	
13	BSL-2429	10 CHECK HOSE PRESSURE 20 CHECK NOZZLES 30 CHECK HOSE CONDITION & REPLACE AS NEEDED 40 CLEAN/PAINT STATIONS AS NEEDED 50 REPAIR HOSE REELS AS NEEDED YEARLY LIFE RING BUOY MAINT. & INSP.		B2AS-MA	0 DAYS	
	Next		Next Job BSL-15179	Use Target Start: Y		
	Date BSL-15179	YEARLY LIFE RING BUOYS MAINT. & INSP.			1	
14	BSL-2431	10 CHECK LINES 20 CHECK PHYSICAL CONDITION 30 REPAIR/REPLACE AS NEEDED 40 PAINT PREPARED AREAS MONTHLY EYE WASH STATION MAINT. & INSP.		B2AS-MA	1 MONTHS	
	Next 6/21/12		Next Job BSL-15181	Use Target Start: Y		
	Date BSL-15181	MONTHLY EYE WASH STATION MAINT. & INSP.			1	
		10 CHECK FOR LEAKS 20 CLEAN 30 RUN WATER THRU STATION				
						End of Asset B2ASL
	<b>B2ASLG</b>	<b>Gates</b>				
15	BSL-1715	WEEKLY LOCK GATE INSPECTIONS		B2AS-MA	1 WEEKS	
	Next 6/17/12		Next Job BSL-14268	Use Target Start: Y		
	Date BSL-14268	WEEKLY LOCK GATE INSPECTIONS			1	
		10 DAILY INSPECTION OF LOCK GATES				
	BSL-1719	WEEKLY LOCK GATE MACHINERY CHECKS		B2AS-MA	2 WEEKS	
	Next 6/18/12		Next Job BSL-14270	Use Target Start: Y		
	Date BSL-14270	WEEKLY LOCK GATE MACHINERY CHECKS			1	
16		10 CHECK GATE MACHINERY WHILE IN OPERATION 20 CHECK FOR HYDRAULIC LEAKS AND REPAIR AS NEEDED 30 WIPE UP ANY SPILLED OR LEAKED HYDRAULIC FLUID 40 CLEAN DRIP PANS AND PUT NEW OIL PADS AROUND ENGINE MACHINERY 50 MAKE ANY AND ALL ADJUSTMENTS TO MACHINERY AS NEEDED.				

17	BSL-1721	60 TIGHEN UP ALL LOOSE HYDRAULIC HOSES. 70 CHECK SETTING ON BRAKE AND ADJUST IF NEEDED. 80 MAKE OVERALL INSPECTION OF MACHINERY AND MAKE REPAIRS AS NEEDED	WEEKLY BULL GEAR MAINT. & INSP.	B2AS-MA	1 WEEKS
	Next Date: 6/11/12 BSL-14271	Next Job: BSL-14271	WEEKLY BULL GEAR MAINT. & INSP.	Use Target Start: Y	1
18	BSL-2386	10 GREASE EXPOSED BULL GEAR WITH HIGH GEAR 20/20. 20 CLEAN UP ANY GREASE ON FLOOR OF ENGINE BED. 30 CHECK FIT OF BULL GEAR INTO GATE RACK 40 GREASE GATE RACK AS NEEDED 50 MAKE REPAIRS AS NEEDED	MONTHLY INSP. OF DRIER CRYSTALS	B2AS-MA	1 MONTHS
	Next Date: 6/22/12 BSL-15092	Next Job: BSL-15092	MONTHLY INSP. OF DRIER CRYSTALS	Use Target Start: Y	1
19	BSL-2387	10 INSPECT DRIER CRYSTALS AND CHANGE AS NEEDED	HYDRAULIC OIL SAMPLING	B2AS-MA	6 MONTHS
	Next Date: 6/17/12 BSL-15093	Next Job: BSL-15093	HYDRAULIC OIL SAMPLING	Use Target Start: Y	1
20	BSL-2395	10 PULL SAMPLES FROM 3 POINTS ON EACH GATE 20 SEND SAMPLES IN FOR ANALYSIS	YEARLY GATE HINGE MAINT. & INSP.	B2AS-MA	1 YEARS
	Next Date: 7/10/12 BSL-15100	Next Job: BSL-15100	YEARLY GATE HINGE MAINT. & INSP.	Use Target Start: Y	1

- End of Asset B2ASLG
- B2ASLG1 Gate1**  
No PMs for B2ASLG1
  - B2ASLG1EM Electric Motor**  
No PMs for B2ASLG1EM
  - B2ASLG1HG Hydraulic Group**  
No PMs for B2ASLG1HG
  - B2ASLG1HGF Hydraulic Filters**  
No PMs for B2ASLG1HGF
  - B2ASLG1HGF1 Primary Filter**  
No PMs for B2ASLG1HGF1
  - B2ASLG1HGF2 Secondary Filter**  
No PMs for B2ASLG1HGF2
  - B2ASLG1HGH Hydraulic Hoses**  
No PMs for B2ASLG1HGH
  - B2ASLG1HGI Hydraulic Reservoir Isolator**  
No PMs for B2ASLG1HGI
  - B2ASLG1HGM Hydraulic Manifold**  
No PMs for B2ASLG1HGM
  - B2ASLG1HGV Proportional Directional Valve**  
No PMs for B2ASLG1HGV
  - B2ASLG1HM Hydraulic Bull Gear Motor**  
No PMs for B2ASLG1HM
  - B2ASLG1HP Hydraulic Pump**  
No PMs for B2ASLG1HP

<b>B2ASLG2</b>	<b>Gate 2</b>	No PMs for B2ASLG2
<b>B2ASLG2EM</b>	<b>Electric Motor</b>	No PMs for B2ASLG2EM
<b>B2ASLG2HG</b>	<b>Hydraulic Group</b>	No PMs for B2ASLG2HG
<b>B2ASLG2HGF</b>	<b>Hydraulic Filters</b>	No PMs for B2ASLG2HGF
<b>B2ASLG2HGFI</b>	<b>Primary Filter</b>	No PMs for B2ASLG2HGFI
<b>B2ASLG2HGFS</b>	<b>Secondary Filter</b>	No PMs for B2ASLG2HGFS
<b>B2ASLG2HGH</b>	<b>Hydraulic Hoses</b>	No PMs for B2ASLG2HGH
<b>B2ASLG2HGI</b>	<b>Hydraulic Reservoir Isolator</b>	No PMs for B2ASLG2HGI
<b>B2ASLG2HGM</b>	<b>Hydraulic Manifold</b>	No PMs for B2ASLG2HGM
<b>B2ASLG2HGV</b>	<b>Proportional Directional Valve</b>	No PMs for B2ASLG2HGV
<b>B2ASLG2HM</b>	<b>Hydraulic Bull Gear Motor</b>	No PMs for B2ASLG2HM
<b>B2ASLG2HP</b>	<b>Hydraulic Pump</b>	No PMs for B2ASLG2HP
<b>B2ASLG3</b>	<b>Gate 3</b>	No PMs for B2ASLG3
<b>B2ASLG3EM</b>	<b>Electric Motor</b>	No PMs for B2ASLG3EM
<b>B2ASLG3HG</b>	<b>Hydraulic Group</b>	No PMs for B2ASLG3HG
<b>B2ASLG3HGF</b>	<b>Hydraulic Filters</b>	No PMs for B2ASLG3HGF
<b>B2ASLG3HGFI</b>	<b>Primary Filter</b>	No PMs for B2ASLG3HGFI
<b>B2ASLG3HGFS</b>	<b>Secondary Filter</b>	No PMs for B2ASLG3HGFS
<b>B2ASLG3HGH</b>	<b>Hydraulic Hoses</b>	No PMs for B2ASLG3HGH
<b>B2ASLG3HGI</b>	<b>Hydraulic Reservoir Isolator</b>	No PMs for B2ASLG3HGI
<b>B2ASLG3HGM</b>	<b>Hydraulic Manifold</b>	No PMs for B2ASLG3HGM
<b>B2ASLG3HGV</b>	<b>Proportional Directional Valve</b>	No PMs for B2ASLG3HGV
<b>B2ASLG3HM</b>	<b>Hydraulic Bull Gear Motor</b>	No PMs for B2ASLG3HM
<b>B2ASLG3HP</b>	<b>Hydraulic Pump</b>	No PMs for B2ASLG3HP

			No PMs for B2ASLG3HP		
<b>B2ASLG4</b>	<b>Gate 4</b>				
			No PMs for B2ASLG4		
<b>B2ASLG4EM</b>	<b>Electric Motor</b>				
			No PMs for B2ASLG4EM		
<b>B2ASLG4HG</b>	<b>Hydraulic Group</b>				
			No PMs for B2ASLG4HG		
<b>B2ASLG4HGF</b>	<b>Hydraulic Filters</b>				
			No PMs for B2ASLG4HGF		
<b>B2ASLG4HGFI</b>	<b>Primary Filter</b>				
			No PMs for B2ASLG4HGFI		
<b>B2ASLG4HGFS</b>	<b>Secondary Filter</b>				
			No PMs for B2ASLG4HGFS		
<b>B2ASLG4HGH</b>	<b>Hydraulic Hoses</b>				
			No PMs for B2ASLG4HGH		
<b>B2ASLG4HGI</b>	<b>Hydraulic Reservoir Isolator</b>				
			No PMs for B2ASLG4HGI		
<b>B2ASLG4HGM</b>	<b>Hydraulic Manifold</b>				
			No PMs for B2ASLG4HGM		
<b>B2ASLG4HGV</b>	<b>Proportional Directional Valve</b>				
			No PMs for B2ASLG4HGV		
<b>B2ASLG4HM</b>	<b>Hydraulic Bull Gear Motor</b>				
			No PMs for B2ASLG4HM		
<b>B2ASLG4HP</b>	<b>Hydraulic Pump</b>				
			No PMs for B2ASLG4HP		
<b>B2ASLGS</b>	<b>Spare Gate Parts</b>				
			No PMs for B2ASLGS		
<b>B2ASLGSDV</b>	<b>Proportional Directional Valve</b>				
			No PMs for B2ASLGSDV		
<b>B2ASLGSEM</b>	<b>Electric Motors</b>				
			No PMs for B2ASLGSEM		
<b>B2ASLGSHP</b>	<b>Hydraulic Pumps</b>				
			No PMs for B2ASLGSHP		
<b>B2ASLGSHP1</b>	<b>Denison Hydraulic Pump #1</b>				
			No PMs for B2ASLGSHP1		
<b>B2ASLGSHP2</b>	<b>Denison Hydraulic Pump #2</b>				
			No PMs for B2ASLGSHP2		
<b>B2ASLI</b>	<b>Infrastructure</b>				
21	BSL-2397	YEARLY SHEET PILES & DOLPHIN INSP.		B2AS-MA	1 YEARS
	Next 6/13/12		Next Job BSL-15103	Use Target Start: Y	
	Date BSL-15103	YEARLY SHEET PILES & DOLPHIN INSP.			1
		10 CHECK FOR BREAKS			
		20 CHECK FOR RUST			
		30 CHIP AND PRIME AS REQUIRED			
		40 PAINT AS NEEDED			
		50 REPAIR AS NEEDED			
		60 WASH AS NECESSARY			
			End of Asset B2ASLI		
<b>B2ASLICD</b>	<b>Concrete Dolphin</b>				

No PMs for B2ASLICD

**B2ASLICW Chamber Walls**

22	BSL-1399	MONTHLY LOCK CHAMBER & LIGHTING MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13669	Use Target Start: Y	
	BSL-13669	MONTHLY LOCK CHAMBER & LIGHTING MAINT. & INSP.	1	
		10 CHECK LOCK CHAMBER GUIDEWALLS FOR UNKNOWN DAMAGE		
		20 CHECK WALKWAYS FOR ROTTEN OR MISSING BOARDS		
		30 CHECK LIGHTS		
		40 CHECK LIGHTING CONNECTIONS		
		50 CLEAN CONTACTS AND LENS		
		60 CHANGE BULBS AS NEEDED		

End of Asset B2ASLICW

**B2ASLIGW Guide Wall**

No PMs for B2ASLIGW

**B2ASLIGWL Guidewall Lighting**

23	BSL-1401	MONTHLY GUIDEWALL LIGHTING MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13673	Use Target Start: Y	
	BSL-13673	MONTHLY GUIDEWALL LIGHTING MAINT. & INSP.	1	
		10 CHECK LIGHTS		
		20 CHECK CONNECTIONS		
		30 CLEAN CONTACTS & LENS		
		40 CHANGE BULBS AS NEEDED		

End of Asset B2ASLIGWL

**B2ASLIHR Handrails**

24	BSL-2430	YEARLY HANDRAILS & STEEL PILES MAINT. & INSP.	B2AS-MA	1 YEARS
	Next 10/19/12	Next Job BSL-15180	Use Target Start: Y	
	BSL-15180	YEARLY HANDRAIL & STEEL PILES MAINT. & INSP.	1	
		10 CHECK FOR BREAKS		
		20 CHECK FOR RUST		
		30 CHIP AND PRIME AS REQUIRED		
		40 WASH AND PAINT		
		50 REPAIR AS NEEDED		

End of Asset B2ASLIHR

**B2ASLISC Staircases**

No PMs for B2ASLISC

**B2ASLIWW Walkways**

25	BSL-2396	WEEKLY GUIDEWALL WALKWAYS INSP.	B2AS-MA	1 WEEKS
	Next 6/17/12	Next Job BSL-15101	Use Target Start: Y	
	BSL-15101	WEEKLY GUIDEWALL WALKWAYS INSP.	1	
		10 CHECK NAVIGATION LIGHT AT END OF WALLS		
		20 CHECK GUIDEWALL FOR UNKNOWN DAMAGE		
		30 CHECK FOR ROTTEN OR MISSING BOARDS		
		40 CHECK GUIDEWALL LIGHTING		
		50 CLEAN LENS & CHANGE BULBS AS NEEDED		

End of Asset B2ASLIWW

**B2ASLL Leave**

No PMs for B2ASLL

**B2ASLLA Annual Leave**

No PMs for B2ASLLA

**B2ASLLAD Administrative Leave**

No PMs for B2ASLLAD

**B2ASLLF Family Sick Leave**

No PMs for B2ASLLF

**B2ASLLS Sick Leave**

No PMs for B2ASLLS

<b>B2ASLT</b>		<b>Trip For Official Business</b>					
				No PMs for B2ASLT			
<b>B2ASLTR</b>		<b>Training/Travel</b>					
				No PMs for B2ASLTR			
<b>B2ASX</b>		<b>Project Support</b>					
26	BSL-2407	YEARLY TIER TWO REPORTS		B2AS-MA	1 YEARS		
	Next Date	1/8/13	Next Job	BSL-15114	Use Target Start:	Y	
	BSL-15114	YEARLY TIER TWO REPORTS					1
		10 DUE TIER TWO REPORT					
		20 SENT COPY OF TIER TWO					
		30 WEB ADDRESS: www.dps.state.la.us/lcnweb.nsf					
		40 CHECK OLD REPORTS IN FILE CABINET					
27	BSL-2408	YEARLY OMBIL - INTERNAL & EXTERNAL ASSESSMENTS		B2AS-AD	1 YEARS		
	Next Date	1/8/13	Next Job	BSL-15116	Use Target Start:	Y	
	BSL-15116	YEARLY OMBIL - INTERNAL & EXTERNAL ASSESSMENTS					1
		10 NAVIGATING TO OMBIL					
				End of Asset B2ASX			
<b>B2ASXB</b>		<b>Buildings and Grounds</b>					
28	BSL-1099	MONTHLY A/C UNITS MAINT. & INSP.		B2AS-MA	1 MONTHS		
	Next Date	7/9/12	Next Job	BSL-12891	Use Target Start:	Y	
	BSL-12891	MONTHLY A/C UNITS MAINT. & INSP.					1
		10 Check AC filters / Change when needed					
		20 Check and clean coils when needed					
		30 Pour bleach in drain pipe on A/C Units before using during summer months					
29	BSL-1110	WEEKLY POWER HOUSE INSPECTION		B2AS-MA	1 WEEKS		
	Next Date	6/23/09	Next Job	BSL-15098	Use Target Start:	Y	
	BSL-15098	WEEKLY POWERHOUSE INSP.					1
		10 CHECK DOORS					
		20 CHECK WINDOWS					
		30 CHECK LIGHTS					
		40 CHECK HOUSEKEEPING					
		50 GENERAL INSPECTION					
30	BSL-1113	ANNUAL HURRICAN SHUTTER INSPECTION		B2AS-MA	1 YEARS		
	Next Date	6/9/13	Next Job	BSL-12931	Use Target Start:	Y	
	BSL-12931	ANNUAL HURRICANE SHUTTER INSPECTION					1
		10 Annual Hurricane Shutter Inspection					
31	BSL-1377	MONTHLY ROADS & GROUNDS MAINT. & INSPECTION		B2AS-MA	1 MONTHS		
	Next Date	7/9/12	Next Job	BSL-13575	Use Target Start:	Y	
	BSL-13575	MONTHLY ROADS & GROUNDS MAINT. & INSPECTION					1
		10 PICK UP TRASH & DEBRIS.					
		20 GRADE ROADS AS NEEDED					
		30 REPAIR POT HOLES IN ROADS					
		40 SPRAY FENCE LINE & RIF RAF					
		50 CLEAN & TRIM AROUND DITCHES AND CULVERTS					
32	BSL-1379	YEARLY FLOWER BEDS & TREES MAINT. & INSP.		B2AS-MA	1 YEARS		
	Next Date	10/30/12	Next Job	BSL-13585	Use Target Start:	Y	
	BSL-13585	YEARLY FLOWER BEDS & TREES MAINT. & INSP.					1
		10 WEED BEDS AS NEEDED					
		20 TRIM SHRUBS AND TREES					
		30 CHANGE OUT FLOWERS AS NEEDED					
		40 WATER & FERTILIZE					
		50 MAKE GENERAL OVERALL INSPECTION					
33	BSL-1385	WEEKLY FRIDAY WORK SCHEDULE		B2AS-MA	1 WEEKS		
	Next Date	6/17/12	Next Job	BSL-13615	Use Target Start:	Y	
	BSL-13615	WEEKLY FRIDAY WORK SCHEDULE					1
		10 WASH VEHICLES					
		20 EMPTY GARBAGE CANS AND BRING TO DUMPSTER					
		30 CLEAN UP IN MECHANIC'S OFFICE, POWER HOUSE, TRACTOR SHED AND TOOL					
		40 CHECK GAS CANS AND FILL AS NEEDED					
		50 CHECK SUPPLIES AND MAKE LIST IF NEEDED					

34	BSL-1395	MONTHLY HAZARD WASTE STORAGE MAINT.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13629	Use Target Start: Y	
	Date BSL-13629	MONTHLY HAZARD WASTE STORAGE MAINT.		1
		10 CHECK FOR LEAKS		
		20 OIL PADLOCK		
		30 CLEAN AS NEEDED		
		End of Asset B2ASXB		
	<b>B2ASXBBD</b>	<b>Boat Dock</b>		
		No PMs for B2ASXBBD		
	<b>B2ASXBCH</b>	<b>Control Houses</b>		
		No PMs for B2ASXBCH		
	<b>B2ASXBCH1</b>	<b>Control House #1</b>		
35	BSL-2391	WEEKLY NORTH CONTROL HOUSE INSP.	B2AS-MA	1 WEEKS
	Next 6/17/12	Next Job BSL-15096	Use Target Start: Y	
	Date BSL-15096	WEEKLY NORTH CONTROL HOUSE INSP.		1
		10 CHECK LIGHTS		
		20 CHECK DOORS		
		30 CHECK WINDOWS		
		40 CHECK HOUSEKEEPING		
		50 GENERAL INSPECTION		
36	BSL-2413	YEARLY NORTH END CONTROL HOUSE INSP.	B2AS-MA	1 YEARS
	Next 11/10/12	Next Job BSL-15144	Use Target Start: Y	
	Date BSL-15144	YEARLY NORTH END CONTROL HOUSE INSP.		1
		10 CHECK DOORS		
		20 CHECK WINDOWS		
		30 WASH EXTERIOR		
		40 MAKE NEEDED REPAIRS AS REQUIRED		
		50 PAINT AS REQUIRED		
		End of Asset B2ASXBCH1		
	<b>B2ASXBCH2</b>	<b>Control House #2</b>		
37	BSL-2392	WEEKLY SOUTH CONTROL HOUSE INSP.	B2AS-MA	1 WEEKS
	Next 6/17/12	Next Job BSL-15097	Use Target Start: Y	
	Date BSL-15097	WEEKLY SOUTH CONTROL HOUSE INSP.		1
		10 CHECK LIGHTS		
		20 CHECK DOORS		
		30 CHECK WINDOWS		
		40 CHECK HOUSEKEEPING		
		50 GENERAL INSPECTION		
38	BSL-2414	YEARLY SOUTH END CONTROL HOUSE INSP.	B2AS-MA	1 YEARS
	Next 11/10/12	Next Job BSL-15147	Use Target Start: Y	
	Date BSL-15147	YEARLY SOUTH END CONTROL HOUSE INSP.		1
		10 CHECK DOORS		
		20 CHECK WINDOWS		
		30 WASH EXTERIOR		
		40 MAKE REPAIRS AS NEEDED		
		50 PAINT AS REQUIRED		
		End of Asset B2ASXBCH2		
	<b>B2ASXBDR</b>	<b>Southend Dayroom</b>		
39	BSL-1111	YEARLY SOUTHEND DAYROOM MAINT. & INSP.	B2AS-MA	1 YEARS
	Next 6/9/13	Next Job BSL-12930	Use Target Start: Y	
	Date BSL-12930	YEARLY SOUTHEND DAYROOM MAINT. & INSP.		1
		10 Yearly Southend Dayroom - Maint. & Inspection		
40	BSL-1391	MONTHLY SEWAGE TREATMENT PLANT MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-14522	Use Target Start: Y	
	Date BSL-14522	MONTHLY SEWAGE TREATMENT PLANT MAINT. & INSP.		1
		10 GENERAL INSPECTION		
		20 CHECK FOR LEAKS		
		30 CHECK WIRING		
		40 CHECK CHLORINE TABLETS AND ADD AS NEEDED		

- 50 CHECK ENZYNES AND ADD AS NEEDED
- 60 CHECK SEWAGE PLANT IN OPERATION
- 70 CLEAN AND PAINT AS NEEDED

End of Asset B2ASXBDR

**B2ASXBE1 Ergo Building-Corrosives**

No PMs for B2ASXBE1

**B2ASXBE2 Ergo Building- Paint/Gas/Oil**

41	BSL-1000	YEARLY FLAMMABLE STORAGE BUILDING INSP.			B2AS-MA	1 YEARS
	Next 9/25/12		Next Job BSL-12894	Use Target Start: Y		
	BSL-12894	YEARLY FLAMMABLE STORAGE BUILDING INSP.				1
		10 Check Doors				
		20 Check Windows				
		30 Wash Exterior				
		40 Repair as needed				
		50 Paint as required				

End of Asset B2ASXBE2

**B2ASXBG Grounds Proper**

42	BSL-1380	180 DAY SIGN MAINT. & INSP.			B2AS-MA	180 DAYS
	Next 9/18/12		Next Job BSL-13586	Use Target Start: Y		
	BSL-13586	180 DAY SIGN MAINT. & INSP.MVN				1
		10 GENERAL INSPECTION OF ALL SIGNS				
		20 CLEAN AS NEEDED				
		30 WEEDEAT AROUND SIGN POST				
	BSL-1400	MONTHLY RESERVATION LIGHTING MAINT. & INSP.			B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13671	Use Target Start: Y		
43	BSL-13671	MONTHLY RESERVATION LIGHTING MAINT. & INSP.				1
		10 CHECK LIGHTS				
		20 CHECK CONNECTIONS				
		30 CLEAN CONTACTS & LENS				
		40 CHANGE BULBS AS NEEDED				

End of Asset B2ASXBG

**B2ASXBNL New Lock Office**

44	BSL-1102	YEARLY OFFICE BUILDING INSPECTION			B2AS-MA	1 YEARS
	Next 12/4/12		Next Job BSL-12896	Use Target Start: Y		
	BSL-12896	YEARLY OFFICE BUILDING INSPECTION				1
		10 Check Doors				
		20 Check windows				
		30 Wash exterior				
		40 Repair as needed				
		50 Paint as required				

End of Asset B2ASXBNL

**B2ASXBOL Old Lock Office/ North End Dayroom**

45	BSL-1103	YEARLY OLD LOCK OFFICE BUILDING MAINT. & INSP.			B2AS-MA	1 YEARS
	Next 12/1/12		Next Job BSL-12900	Use Target Start: Y		
	BSL-12900	YEARLY OLD LOCK OFFICE BUILDING MAINT. & INSP.				1
		10 Check Doors				
		20 Check Windows				
		30 Wash Exterior				
		40 Repair as needed				
		50 Paint as required				

End of Asset B2ASXBOL

**B2ASXBPG Powerhouse/Generator Room**

46	BSL-1109	YEARLY POWER HOUSE MAINT. & INSP.			B2AS-MA	1 YEARS
	Next 6/9/13		Next Job BSL12920	Use Target Start: Y		
	BSL12920	YEARLY POWER HOUSE MAINT. & INSP.				1
		10 Yearly Power House Maintenance & Inspection				
47	BSL-2393	WEEKLY POWERHOUSE INSP.			B2AS-MA	1 WEEKS
	Next 6/11/12		Next Job BSL-15098	Use Target Start: Y		

	BSL-15098	WEEKLY POWERHOUSE INSP.			1
		10 CHECK DOORS			
		20 CHECK WINDOWS			
		30 CHECK LIGHTS			
		40 CHECK HOUSEKEEPING			
		50 GENERAL INSPECTION			
		End of Asset B2ASXBPG			
	<b>B2ASXBPL</b>	<b>Parking Lots</b>			
		No PMs for B2ASXBPL			
	<b>B2ASXBPLE</b>	<b>Parking Lot, East</b>			
		No PMs for B2ASXBPLE			
	<b>B2ASXBPLW</b>	<b>Parking Lot, West</b>			
		No PMs for B2ASXBPLW			
	<b>B2ASXBSB</b>	<b>Storage Building</b>			
		No PMs for B2ASXBSB			
	<b>B2ASXBTB</b>	<b>Tool/Parts Building</b>			
48	BSL-1114	YEARLY TOOLS AND PARTS BUILDING MAINT. & INSP.	B2AS-MA		1 YEARS
	Next 6/9/13		Use Target Start: Y		
	BSL-12932	YEARLY TOOLS AND PARTS BUILDING MAINT. & INSP.			1
		10 Yearly Tool and Parts Building			
		End of Asset B2ASXBTB			
	<b>B2ASXBTS</b>	<b>Tractor Shed/ Shop Building</b>			
49	BSL-1115	YEARLY TRACTOR SHED MAINT. & INSP.	B2AS-MA		1 YEARS
	Next 6/9/13		Use Target Start: Y		
	BSL-12933	YEARLY TRACTOR SHED MAINT. & INSP.			1
		10 Yearly Tractor Shed Inspection			
50	BSL-1375	ANNUAL TRACTOR SHED INSPECTION	B2AS-MA		1 YEARS
	Next 6/23/12		Use Target Start: Y		
	BSL-13572	ANNUAL TRACTOR SHED INSPECTION			1
		10 INSPECT BUILDING EXTERIOR			
		20 WASH BUILDING			
		30 CHECK DOORS			
		40 CHECK CLEANLINESS			
		End of Asset B2ASXBTS			
	<b>B2ASXC</b>	<b>Communications</b>			
		No PMs for B2ASXC			
	<b>B2ASXCC</b>	<b>Cellular Telephones</b>			
		No PMs for B2ASXCC			
	<b>B2ASXCS</b>	<b>Cisco Telephone System</b>			
		No PMs for B2ASXCS			
	<b>B2ASXCST</b>	<b>Telephones</b>			
		No PMs for B2ASXCST			
	<b>B2ASXE</b>	<b>Electrical Systems</b>			
51	BSL-1398	WEEKLY ELECTRICAL CONDUIT INSPECTION	B2AS-MA		1 WEEKS
	Next 6/17/12		Use Target Start: Y		
	BSL-13668	WEEKLY ELECTRICAL CONDUIT TRUNKS INSPECTION			1
		10 CHECK CONDUIT FOR WATER			
		20 PUMP AS REQUIRED			
		30 MAINTAIN 7 CONDUITS FOR OLD AND NEW WRING			
		End of Asset B2ASXE			
	<b>B2ASXEC</b>	<b>Control Systems</b>			
52	BSL-1108	180 DAY PLC SYSTEM AND INSPECTION	B2AS-MA		180 DAYS
	Next 11/20/12		Use Target Start: Y		
		Next Job BSL-12912			

	BSL-12912	180 DAY PLC SYSTEM AND INSPECTION			1
		10 PLC GATE OPERATION			
		20 PLC WATER GAUGE			
		30 GATE LASERS			
		End of Asset B2ASXEC			
	<b>B2ASXECAT</b>	<b>Automatic Transfer System</b>			
		No PMs for B2ASXECAT			
	<b>B2ASXECDS</b>	<b>Disconnect Starter Panel</b>			
		No PMs for B2ASXECDS			
	<b>B2ASXECHC</b>	<b>Hydraulic Control Curcuit (4)</b>			
		No PMs for B2ASXECHC			
	<b>B2ASXECTP</b>	<b>Three Phase Disconnect</b>			
		No PMs for B2ASXECTP			
	<b>B2ASXECTR</b>	<b>408- Three Phase/ 208 Transformer</b>			
		No PMs for B2ASXECTR			
	<b>B2ASXEG</b>	<b>Emergency Generator</b>			
53	BSL-1402	WEEKLY DIESEL GENERATOR MAINT. & INSP.		B2AS-MA	1 WEEKS
	Next 6/17/12		Next Job BSL-13674	Use Target Start: Y	
	BSL-13674	WEEKLY DIESEL GENERATOR MAINT. & INSP.			1
		10 CHECK OIL			
		20 CHECK RADIATOR			
		30 CHECK DAY FUEL TANK			
		40 CHECK HOSES			
		50 CHECK BELTS			
		60 CHECK BATTERY & CABLES			
		70 CHECK FOR EXHAUST LEAKS			
		80 CHECK ELECTRICAL CONNECTIONS			
		90 GENERAL INSPECTION OF UNIT			
		100 CLEAN AS REQUIRED			
		110 RUN GENERATOR FOR 30 MINS. EVERY WEEK			
54	BSL-1403	MONTHLY EMERGENCY PORTABLE DIESEL GENERATOR MAINT. & INSP.		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13676	Use Target Start: Y	
	BSL-13676	MONTHLY EMERGENCY PORTABLE DIESEL GENERATOR MAINT. & INSP.			1
		10 CHECK FUEL			
		20 CHECK OIL AND ADD IF NEEDED			
		30 START AND RUN FOR 15 MINUTES			
		End of Asset B2ASXEG			
	<b>B2ASXEGDT</b>	<b>500 Gallon Diesel Tank</b>			
55	BSL-1392	YEARLY DIESEL FUEL TANK MAINT. & INSP.		B2AS-MA	1 YEARS
	Next 11/12/12		Next Job BSL-13627	Use Target Start: Y	
	BSL-13627	YEARLY DIESEL STORAGE TANK MAINT. & INSP.			1
		10 CHECK TANK FOR LEAKS			
		20 CHECK DIESEL PUMP			
		30 CHECK CONTAINMENT AREA FOR LEAKS			
		40 CHECK PUMP HOSE AND REPLACE AS NEEDED			
		50 CLEAN TANK AND CONTAINMENT AREA			
		60 PAINT AS NEEDED			
		End of Asset B2ASXEGDT			
	<b>B2ASXEGEG</b>	<b>Generac 155KW Emergency Generator</b>			
		No PMs for B2ASXEGEG			
	<b>B2ASXF</b>	<b>Floating Plant</b>			
		No PMs for B2ASXF			
	<b>B2ASXFB</b>	<b>Boats</b>			
		No PMs for B2ASXFB			

**B2ASXFBAS 14' Aluminum Skiff w/ 25 HP Mercury**

56	BSL-1406	MONTHLY 14' BOAT AND MOTOR MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13679	Use Target Start: Y	
	BSL-13679	MONTHLY 14' BOAT & MOTOR MAINT. & INSP.		1
		10 CHECK FLOATION		
		20 INSPECT LINES		
		30 CHECK FUEL AND OIL		
		40 CLEAN AND PAINT AS REQUIRED		
		50 CHECK FIRE EXTINGUISHER		
		60 START MOTOR		
		70 CHECK PROP		

End of Asset B2ASXFBAS

**B2ASXFBBT 22' Back Track Trailer**

57	BSL-2350	YEARLY 22' BOAT TRAILER MAINT. & INSP.	B2AS-MA	1 YEARS
	Next 6/29/12	Next Job BSL-15046	Use Target Start: Y	
	BSL-15046	YEARLY 22' BOAT TRAILER MAINT. & INSP.		1
		10 CHECK LIGHTS		
		20 CHECK HITCH		
		30 CHECK TIRES		
		40 CHECK BEARINGS		
		50 CHECK ROLLERS		
		60 CHECK ELECTRICAL WRING & HOOK UP		
		70 GENERAL INSPECTION		

58	BSL-2352	MONTHLY 22' BOAT TRAILER MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 6/22/12	Next Job BSL-15048	Use Target Start: Y	
	BSL-15048	MONTHLY 22' BOAT TRAILER MAINT. & INSP.		1
		10 CHECK HITCH		
		20 CHECK SAFETY CHAINS		
		30 CHECK WINCH & CABLE		
		40 CHECK TIE DOWN STRAPS		
		50 CHECK ROLLERS		
		60 CHECK SUSPENSION		
		70 CHECK FRAME FOR CRACKS		
		80 CHECK TRAILER LIGHTS		
		90 CHECK WHEEL BEARINGS & BEARING BUDDY		
		100 CHECK REFLECTORS		
		110 CHECK WIRING HARNESS		
		120 CHECK TIRES		

End of Asset B2ASXFBBT

**B2ASXFBEX 22' Express w/ 115 HP Yamaha**

59	BSL-1407	MONTHLY 22' BOAT AND MOTOR MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 6/22/12	Next Job BSL-13680	Use Target Start: Y	
	BSL-13680	MONTHLY 22' BOAT AND MOTOR MAINT. & INSP.		1
		10 CHECK FLOATION		
		20 INSPECT LINES		
		30 CHECK FUEL AND OIL		
		40 CLEAN AND PAINT AS NEEDED		
		50 CHECK FIRE EXTINGUISHER		
		60 CHECK AND START MOTOR		
		70 CHECK PROP		

End of Asset B2ASXFBEX

**B2ASXFBEZ 14' EZ Loader Boat Trailer**

60	BSL-2349	YEARLY 14' BOAT TRAILER MAINT. & INSP.	B2AS-MA	1 YEARS
	Next 6/9/13	Next Job BSL-15043	Use Target Start: Y	
	BSL-15043	YEARLY 14' BOAT TRAILER MAINT. & INSP.		1
		10 CHECK LIGHTS		
		20 CHECK HITCH		
		30 CHECK TIRES		
		40 CHECK BEARINGS		
		50 CHECK ROLLERS		
		60 CHECK ELECTRICAL WRING AND HOOK UP		
		70 GENERAL INSPECTIONS		

61	BSL-2351	MONTHLY 14' BOAT TRAILER MAINT. & INSP.		B2AS-MA	1 MONTHS
	Next 6/22/12		Next Job BSL-15047	Use Target Start: Y	
	BSL-15047	MONTHLY 14' BOAT TRAILER MAINT. & INSP.			1
		10 CHECK HITCH			
		20 CHECK SAFETY CHAINS			
		30 CHECK WINCH AND CABLE			
		40 CHECK TIE DOWN STRAPS			
		50 CHECK ROLLERS			
		60 CHECK SUSPENSION			
		70 CHECK FRAME FOR CRACKS			
		80 CHECK TRAILER LIGHTS			
		90 CHECK WHEEL BEARINGS AND BEARING BUDDYS			
		100 CHECK REFLECTORS			
		110 CHECK WIRING HARNESS			
		120 CHECK TIRES			

End of Asset B2ASXFBEZ

**B2ASXFO Barges**

62	BSL-1405	180 DAYS WORK BARGE MAINT. & INSP.		B2AS-MA	180 DAYS
	Next 12/3/12		Next Job BSL-13678	Use Target Start: Y	
	BSL-13678	180 DAY WORK BARGE MAINT. & INSP.			1
		10 CHECK FLOATION			
		20 CHECK MOORING LINES			
		30 CHECK FOR CRACKS AND LOOSE RIVETS			
		40 CHECK WELDS			
		50 CLEAN AND PAINT AS REQUIRED			
		60 MAKE REPAIRS AS NEEDED			

End of Asset B2ASXFO

**B2ASXM Mobile Equipment**

No PMs for B2ASXM

**B2ASXMH Heavy Equipment**

No PMs for B2ASXMH

**B2ASXMT Tractors**

No PMs for B2ASXMT

**B2ASXMTBB Box Blade (2)**

63	BSL-1422	GRADER BOX MAINTANENCE INSPECTION		B2AS-MA	1 YEARS
	Next 10/16/12		Next Job BSL-13699	Use Target Start: Y	
	BSL-13699	GRADER BOX MAINTANENCE INSPECTION			1
		10 CHECK BLADE FOR CRACKS			
		20 CHECK BOX FOR CRACKS			
		30 CHECK HITCH			
		40 CLEAN AS NECESSARY			

End of Asset B2ASXMTBB

**B2ASXMTBU Backhoe Unit**

64	BSL-1408	180 DAYS BACKHOE UNIT MAINT. & INSP.		B2AS-MA	180 DAYS
	Next 11/23/12		Next Job BSL-13681	Use Target Start: Y	
	BSL-13681	180 DAYS BACKHOE MAINT. & INSP.			1
		10 CHECK HYDRAULIC LINES REPLACE AS NEEDED			
		20 CHECK BOLTS ON UNIT			
		30 GREASE BEFORE USE			
		40 CLEAN AS NEEDED			
		50 INSPECT BUCKET TEETH			
		60 CHECK ALL CONTROL OPERATIONS BEFORE USE			
		70 OPERATE SLOWLY BEFORE PUTTING UNDER FULL LOAD			

End of Asset B2ASXMTBU

**B2ASXMTFE Front End Loader**

65	BSL-1409	180 DAYS FRONT END LOADER MAINT. & INSP.		B2AS-MA	180 DAYS
	Next 11/23/12		Next Job BSL-13682	Use Target Start: Y	
	BSL-13682	180 DAYS FRONT END LOADER MAINT. & INSP.			1
		10 CHECK HYDRAULIC LINES			

- 20 CHECK BOLTS
- 30 GREASE BEFORE USE
- 40 CLEAN AS NEEDED
- 50 CHECK ALL CONTROL OPERATIONS
- 60 OPERATE SLOWLY BEFORE PUTTING UNDER FULL LOAD

End of Asset B2ASXMTFE

**B2ASXMTJM 6' John Deere Mower**

No PMs for B2ASXMTJM

**B2ASXMTNH New Holland Tractor- 55HP**

66	BSL-2037	WEEKLY TRACTOR MAINT. & INSP.		B2AS-MA	1 WEEKS
	Next 6/11/12		Next Job BSL-14793	Use Target Start: Y	
	Date BSL-14793	WEEKLY TRACTOR MAINT. & INSP.			1
		10 WEEKLY CHECKS			
		20 CHECK ALL MOVING PARTS			
		30			
67	BSL-2038	180 DAYS TRACTOR MAINT. & INSP.		B2AS-MA	180 DAYS
	Next 11/23/12		Next Job BSL-14794	Use Target Start: Y	
	Date BSL-14794	180 DAYS TRACTOR MAINT. & INSP.			1
		10 LUBRICATE TRACTOR			
		20 CHECK COOLING SYSTEM			
		30 CHANGE OIL AND FILTERS AS NEEDED			
		40 CHECK BATTERY			
68	BSL-2040	YEARLY TRACTOR MAINT. & INSP.		B2AS-MA	1 YEARS
	Next 10/5/12		Next Job BSL-14795	Use Target Start: Y	
	Date BSL-14795	YEARLY TRACTOR MAINT. & INSP.			1
		10 DRAIN AND FLUSH COOLING SYSTEM			
		20 CHANGE HYDRAULIC OIL AND FILTER			
		30 CHANGE FUEL FILTER			

End of Asset B2ASXMTNH

**B2ASXMTSB Scraper Blade**

69	BSL-1419	YEARLY GRADER BLADE MAINT. & INSP.		B2AS-MA	1 YEARS
	Next 10/16/12		Next Job BSL-13697	Use Target Start: Y	
	Date BSL-13697	YEARLY GRADER BLADE MAINT. & INSP.			1
		10 CHECK BLADE FOR CRACKS			
		20 CHECK HITCH			
		30 CLEAN AS REQUIRED			
		40 CHECK BLADE PIVOTS			

End of Asset B2ASXMTSB

**B2ASXMOV Vehicles**

No PMs for B2ASXMOV

**B2ASXMVFP Chevrolet Pick Up Truck**

No PMs for B2ASXMVFP

**B2ASXMVJG John Deere Gator**

70	BSL-2353	WEEKLY JOHN DEERE GATOR CHECKS		B2AS-MA	0 WEEKS
	Next		Next Job BSL-15049	Use Target Start: Y	
	Date BSL-15049	WEEKLY JOHN DEERE GATOR CHECKS			1
		10 DAILY JOHN DEERE GATOR CHECKS			
71	BSL-2354	3 MONTH JOHN DEERE GATOR CHECKS		B2AS-MA	3 MONTHS
	Next 4/20/10		Next Job BSL-15050	Use Target Start: Y	
	Date BSL-15050	3 MONTHLY JOHN DEERE GATOR CHECKS			1
		10 CHECK AND TIGHTEN HARDWARE			
		20 CHECK DRIVE BELT CONDITION AND TENSION			
		30 CHECK BATTERY			
		40 CHECK WEAR PADS ON DRIVE CLUTCH			
		50 CHECK DRIVE TRAIN TENSION			
		60 CHECK RADIATOR SCREEN			
		70 CHECK AIR INTAKE TUBE			
		80 LUBRICATE FRONT KING PINS			
		90 LUBRICATE DRIVE CHAIN			

		100 LUBRICATE AXLE COUPLERS 110 CLEAN ENGINE COOLING FINS				
72	BSL-2355	6 MONTH JOHN DEERE GATOR CHECKS		B2AS-MA	6 MONTHS	
	Next 4/19/10		Next Job BSL-15051	Use Target Start: Y		
	Date BSL-15051	6 MONTH JOHN DEERE GATOR CHECKS			1	
		10 CHANGE ENGINE OIL AND FILTERS 20 CHECK TRANSAXLE LEVEL 30 CHECK AIR CLEANER DUST UNLOADING VALVE 40 CHECK AIR CLEANER ELEMENT AND CHANGE AS NEEDED 50 CHECK SPARK PLUG				
73	BSL-2356	9 MONTH JOHN DEERE GATOR CHECKS		B2AS-MA	9 MONTHS	
	Next 3/9/10		Next Job BSL-15052	Use Target Start: Y		
	Date BSL-15052	9 MONTH JOHN DEERE GATOR CHECKS			1	
		10 CHECK AND TIGHTEN BOLTS TO CORRECT TORQUE 20 CLEAN PRIMARY DRIVE CLUTCH 30 ADJUST ENGINE VALVE CLEARANCE				
74	BSL-2357	YEARLY JOHN DEERE GATOR CHECKS		B2AS-MA	1 YEARS	
	Next 4/19/10		Next Job BSL-15053	Use Target Start: Y		
	Date BSL-15053	YEARLY JOHN DEERE GATOR CHECKS			1	
		10 CHANGE FUEL FILTER 20 CHANGE ENGINE COOLANT				
		End of Asset B2ASXMVJG				
	<b>B2ASXMK2</b>	<b>Kawasaki Mule #2</b>				
75	BSL-2364	WEEKLY KAWASAKI MULE 3010 MAINT. & INSP.		B2AS-MA	1 WEEKS	
	Next 6/11/12		Next Job BSL-15060	Use Target Start: Y		
	Date BSL-15060	WEEKLY KAWASAKI MULE 3010 MAINT. & INSP.			1	
		10 WEEKLY INSPECTIONS				
76	BSL-2365	YEARLY KAWASAKI MULE 3010 MAINT. & INSP.		B2AS-MA	1 YEARS	
	Next 12/9/12		Next Job BSL-15061	Use Target Start: Y		
	Date BSL-15061	YEARLY KAWASAKI MULE 3010 MAINT. & INSP.			1	
		10 CHECK CONVERTER BELT 20 CLEAN AND GAP SPARK PLUG 30 CLEAN AIR CLEANER ELEMENT 40 ADJUST IDLE SPEED 50 CHECK SPARK ARRESTER 60 CLEAN RADIATOR 70 CHECK STEERING 80 CHECK STEERING AND DRIVE SHAFT DUST BOOTS 90 CHECK BRAKE PEDAL PLAY 100 CHECK BRAKE HOSE AND PIPE 110 CHECK BRAKE FLUID LEVEL 120 CHECK BRAKE WEAR 130 CHECK TIRES 140 CHECK BATTERY 150 LUBRICATE 160 GENERAL INSPECTION				
77	BSL-2367	3 MONTH KAWASAKI MULE 3010 MAINT.		B2AS-MA	3 MONTHS	
	Next 7/11/12		Next Job BSL-15062	Use Target Start: Y		
	Date BSL-15062	3 MONTH KAWASAKI MULE 3010 MAINT.			1	
		10 CHECK CONVERTER DRIVEN PULLEY SHOE 20 CHECK VALVE CLEARANCE 30 CHECK THROTTLE PLAY 40 CHECK FUEL SYSTEM CLEANLINESS 50 CHECK RADIATOR HOSE AND CONNECTION				
78	BSL-2369	YEARLY KAWASAKI MULE 3010 MAINT.		B2AS-MA	1 YEARS	
	Next 6/19/12		Next Job BSL-15063	Use Target Start: Y		
	Date BSL-15063	YEARLY KAWASAKI MULE 3010 MAINT.			1	
		10 CHANGE ENGINE OIL 20 CHECK RADIATOR HOSE AND CONNECTIONS 30 CHANGE OIL IN FRONT FINAL GEAR CASE 40 CHANGE OIL IN TRANSMISSION CASE				
79	BSL-2371	2 YEAR KAWASAKI MULE 3010 MAINT.		B2AS-MA	2 YEARS	

	Next Date	6/7/14	Next Job	BSL-15064	Use Target Start:	Y	
	BSL-15064	2 YEAR KAWASAKI MULE 3010 MAINT.					1
		10	CHANGE ENGINE COOLANT				
		20	CHANGE BRAKE FLUID				
		30	REPLACE MASTER BRAKE CYLINDER CUP AND DUST SEAL				
		40	REPLACE BRAKE WHEEL CYLINDER ASSEMBLY				
80	Next Date	6/7/16	Next Job	BSL-15066	Use Target Start:	Y	
	BSL-2373	4 YEAR KAWASAKI MULE 3010 MAINT.					4 YEARS
	BSL-15066	4 YEAR KAWASAKI MULE 3010 MAINT.					1
		10	REPLACE FUEL HOSE				
		20	REPLACE BRAKE HOSE				

End of Asset B2ASXMK2

**B2ASXMM1 Kawasaki Mule #1**

81	Next Date	6/17/12	Next Job	BSL-15054	Use Target Start:	Y	
	BSL-2358	WEEKLY KAWASAKI MULE 4010 MAINT. & INSP.					1 WEEKS
	BSL-15054	WEEKLY KAWASAKI MULE 4010 MAINT. & INSP.					1
		10	WEEKLY MULE INSPECTIONS				
82	Next Date	1/5/13	Next Job	BSL-15055	Use Target Start:	Y	
	BSL-2359	YEARLY KAWASAKI MULE 4010 MAINT. & INSP.					1 YEARS
	BSL-15055	YEARLY KAWASAKI MULE 4010 MAINT. & INSP.					1
		10	MONTHLY CHECKS				
83	Next Date	7/5/12	Next Job	BSL-15056	Use Target Start:	Y	
	BSL-2360	3 MONTH KAWASAKI MULE 4010 MAINT. & INSP.					3 MONTHS
	BSL-15056	3 MONTH KAWASAKI MULE 4010 MAINT. & INSP.					1
		10	CHECK CONVERTER DRIVEN PULLEY SHOE				
		20	CHECK VALVE CLEARANCE				
		30	CHECK THROTTLE PLAY				
		40	CHECK FUEL SYSTEM CLEANLINESS				
		50	CHECK RADIATOR HOSES AND CONNECTIONS				
84	Next Date	1/5/13	Next Job	BSL-15057	Use Target Start:	Y	
	BSL-2361	YEARLY KAWASAKI MULE 4010 MAINT. & INSP.					1 YEARS
	BSL-15057	YEARLY KAWASAKI MULE 4010 MAINT. & INSP.					1
		10	CHANGE ENGINE OIL AND FILTER				
		20	CHECK RADIATOR HOSES AND CONNECTIONS				
		30	CHANGE OIL IN FRONT FINAL GEAR CASE				
		40	CHANGE OIL IN TRANSMISSION CASE				
85	Next Date	1/5/14	Next Job	BSL-15058	Use Target Start:	Y	
	BSL-2362	2 YEAR KAWASAKI MULE 4010 MAINT.					2 YEARS
	BSL-15058	2 YEAR KAWASAKI MULE 4010 MAINT.					1
		10	CHANGE ENGINE COOLANT				
		20	CHANGE BRAKE FLUID				
		30	REPLACE MASTER BRAKE CYLINDER CUP AND DUST SEAL				
		40	REPLACE BRAKE WHEEL CYLINDER ASSEMBLY				
86	Next Date	1/5/14	Next Job	BSL-15059	Use Target Start:	Y	
	BSL-2363	4 YEAR KAWASAKI MULE 4010 MAINT.					4 YEARS
	BSL-15059	4 YEAR KAWASAKI MULE 4010 MAINT.					1
		10	REPLACE FUEL HOSE				
		20	REPLACE BRAKE HOSE				

End of Asset B2ASXMM1

**B2ASXQ Supporting Equipment**

87	Next Date	7/9/12	Next Job	BSL-13787	Use Target Start:	Y	
	BSL-1466	MONTHLY CHAIN SAW MAINT. & INSP.					1 MONTHS
	BSL-13787	MONTHLY CHAIN SAW MAINT. & INSP.					1
		10	RUN CHAIN SAW				
		20	CHECK OIL FOR CHAIN & ADD IF NEEDED				
		30	CHECK FOR LOOSE NUTS AND BOLTS				
		40	CHECK CHAIN FOR WEAR AND TEAR				
		50	CHECK CHAIN BAR FOR CRACKS OR BREAKS				
		60	REPLACE CHAIN AND CHAIN BAR AS NEEDED				
		70	CHANGE FILTERS AS NEEDED				

88	BSL-1505	180 DAY PORTABLE HEATER MAINT. & INSP.	B2AS-MA	180 DAYS
	Next 8/30/12	Next Job BSL-13914	Use Target Start: Y	
	BSL-13914	180 DAY PORTABLE HEATER MAINT. & INSP.		1
		10 CHECK WIRING		
		20 CHECK & CLEAN FAN BLADES		
		30 CHECK HEATING COIL		
		40 CHECK LEG SUPPORTS		
		50 CHECK SAFETY FEATURES		
		60 CLEAN UNIT		
		70 REPAIR AS NEEDED		
89	BSL-1687	180 -DAY SPACE HEATERS MAINTENANCE & INSPECTION	B2AS-MA	180 DAYS
	Next 11/4/12	Next Job BSL-14253	Use Target Start: Y	
	BSL-14253	180 DAY SPACE HEATERS MAINTENANCE & INSPECTION		1
		10 CHECK HEATER COILS		
		20 CHECK ELECTRIC CORDS		
		30 CHECK THERMOSTAT CONTROLS		
		40 CLEAN AS NEEDED		
90	BSL-1938	MONTHLY REFRIGERATOR MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 6/22/12	Next Job BSL-14538	Use Target Start: Y	
	BSL-14538	MONTHLY REFRIGERATOR MAINT. & INSP.		1
		10 CHECK WIRING AND MOTOR		
		20 DEFROST AS NEEDED		
		30 CLEAN		
		40 GENERAL INSPECTION		
91	BSL-1940	MONTHLY ELECTRIC STOVE MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-14541	Use Target Start: Y	
	BSL-14541	MONTHLY ELECTRIC STOVE MAINT. & INSP.		1
		10 CHECK WIRING		
		20 CLEAN OVEN AND COOK TOP		
		30 GENERAL INSPECTION		
92	BSL-1942	180 DAY SHOP VAC MAINT. & INSP.	B2AS-MA	180 DAYS
	Next 10/3/12	Next Job BSL-14548	Use Target Start: Y	
	BSL-14548	180 DAY SHOP VAC MAINT. & INSP.		1
		10 CHECK ELECTRICAL CORD		
		20 CHECK ATTACHMENTS		
		30 EMPTY AND CLEAN CONTAINER AS NEEDED		
		40 WASH FILTER		
		50 CLEAN OUTSIDE OF UNIT		
		End of Asset B2ASXQ		
	<b>B2ASXQ3P</b>	<b>3" Water Pump</b>		
93	BSL-1404	MONTHLY 3" DIESEL WATER PUMP MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13677	Use Target Start: Y	
	BSL-13677	MONTHLY 3" DIESEL WATER PUMP MAINT. & INSPECTION		1
		10 CHECK FUEL		
		20 CHECK OIL AND ADD IF NEEDED		
		30 CHECK SUCTION AND DISCHARGE HOSES		
		40 CLEAN AS NEEDED		
		50 START PUMP		
		60 MAKE REPAIRS AS NEEDED		
		End of Asset B2ASXQ3P		
	<b>B2ASXQAB</b>	<b>Air Blower</b>		
		No PMs for B2ASXQAB		
	<b>B2ASXQAC</b>	<b>30 Gal Air Compressor</b>		
94	BSL-1435	MONTHLY AIR COMPRESSOR (ELECTRICAL) MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13715	Use Target Start: Y	
	BSL-13715	MONTHLY AIR COMPRESSOR (ELECTRIC) MAINT. & INSP.		1
		10 CHECK OIL IN COMPRESSOR - CHANGE IF NEEDED		
		20 CHECK ELECTRICAL CONNECTIONS		
		30 CHECK COMPRESSOR BELTS		
		40 CHECK HOSES AND FITTINGS FOR LEAKS		

- 50 DRAIN WATER FROM AIR TANK
- 60 CHECK MOVING PARTS WHILE RUNNING
- 70 MAKE REPAIRS AS NEEDED

End of Asset B2ASXQAC

**B2ASXQAT Air Tools**

95	BSL-1488	MONTHLY AIR TOOLS MAINT. & INSP.		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13848	Use Target Start: Y	
	Date BSL-13848	MONTHLY AIR TOOLS MAINT. & INSP.			1
		10 MAINTENANCE AND INSPECTION			
		20 CHECK CONDITION OF TOOLS			
		30 CHECK FOR CRACKS OR BREAKS IN CASING			
		40 CHECK AIR HOSE FITTINGS			
		50 REPLACE OR REPAIR AS NEEDED			

End of Asset B2ASXQAT

**B2ASXQBC Battery Charger**

96	BSL-1439	MONTHLY BATTERY CHARGER MAINT. & INSP.		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13736	Use Target Start: Y	
	Date BSL-13736	MONTHLY BATTERY CHARGER MAINT. & INSP.			1
		10 CHECK ELECTRICAL CORD			
		20 CHECK CHARGING LEADS			
		30 CLEAN AND REPAIR AS NEEDED			
		40 CHECK OPERATION OF UNIT			

End of Asset B2ASXQBC

**B2ASXQBG Electric Bilge Pumps**

No PMs for B2ASXQBG

**B2ASXQBP Back Pack Sprayer**

97	BSL-1501	YEARLY BACK PACK SPRAYER MAINT. & INSP.		B2AS-MA	1 YEARS
	Next 12/9/12		Next Job BSL-13892	Use Target Start: Y	
	Date BSL-13892	YEARLY BACK PACK SPRAYER MAINT. & INSP.			1
		10 CHECK PUMP			
		20 CHECK TANK			
		30 CHECK HOSE			
		40 CHECK NOZZLE			
		50 CLEAN AFTER USE			

End of Asset B2ASXQBP

**B2ASXQBW Bobcat Welding Machine**

No PMs for B2ASXQBW

**B2ASXQET Electrical Tools**

98	BSL-1443	MONTHLY TABLE BANDSAW INSPECTION		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13738	Use Target Start: Y	
	Date BSL-13738	MONTHLY TABLE BANDSAW INSPECTION			1
		10 CHECK POWER CORD FOR DEFECTS			
		20 CHECK SAW BLADE FOR BROKEN TEETH			
		30 CHECK SAFETY GAURDS FOR PROPER PLACEMENT			
		40 CLEAN AS NEEDED			
		50			
99	BSL-1467	MONTHLY DRILL/MILLING MACHINE MAINT. & INSP.		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13790	Use Target Start: Y	
	Date BSL-13790	MONTHLY DRILL/MILLING MACHINE MAINT. & INSP.			1
		10 CHECK ELECTRICAL CORD			
		20 CHECK DRILL CHUCK			
		30 GREASE SHAFT			
		40 CHECK BELTS			
		50 CLEAN AS NEEDED			
100	BSL-1469	MONTHLY GRINDER/BUFFER MAINT. & INSP.		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13791	Use Target Start: Y	
	Date BSL-13791	MONTHLY GRINDER/BUFFER MAINT. & INSP.			1
		10 CHECK WIRING			
		20 CHECK GRINDING STONE FOR CRACKS			

101	BSL-1470	30 CHECK WIRE BRUSH 40 REPLACE GRINDING STONE AND WIRE BRUSH AS NEEDED 180 DAYS SHOP FAN MAINT. & INSP.	Next Job BSL-13793	Use Target Start: Y	B2AS-MA	180 DAYS
	Next 11/20/12 Date BSL-13793	180 DAYS SHOP FAN MAINT. & INSP,				1
102	BSL-1481	10 CHECK AND CLEAN FAN BLADES 20 CHECK MOTOR 30 CHECK ELECTRICAL CORD 40 MAKE GENERAL INSPECTION AND CLEAN IF NEEDED 50 REPAIR AS NEEDED MONTHLY ELECTRICAL TOOLS MAINT. & INSP.	Next Job BSL-13832	Use Target Start: Y	B2AS-MA	1 MONTHS
	Next 7/9/12 Date BSL-13832	MONTHLY ELECTRICAL TOOLS MAINT. & INSP.				1
103	BSL-1697	10 MAINTENANCE AND INSPECTION 20 INSPECT ELECTRIC CORDS 30 INSPECT FOR CRACKS OR BREAKS IN CASINGS 40 REPLACE AS NEEDED 50 CLEAN AFTER USE MONTHLY COMPOUND MITER SAW MAINT. & INSP.	Next Job BSL-14255	Use Target Start: Y	B2AS-MA	1 MONTHS
	Next 7/9/12 Date BSL-14255	MONTHLY COMPOUND MITER SAW MAINT. & INSP.				1
		10 CHECK BLADE FOR CRACKS OR DAMAGE 20 CHANGE BLADE AS NEEDED 30 CHECK ELECTRICAL CORD FOR BREAKS OR CRACKS 40 CHECK THAT SAFETY GUARDS ARE IN PLACE. 50 REPAIR AS NEEDED 60 CLEAN AFTER EACH USE				
		End of Asset B2ASXQET				
	<b>B2ASXQGG</b>	<b>Grease Gun</b>				
		No PMs for B2ASXQGG				
	<b>B2ASXQGN</b>	<b>Portable Generator</b>				
		No PMs for B2ASXQGN				
	<b>B2ASXQHT</b>	<b>Hand Tools</b>				
104	BSL-1472	MONTHLY HAND TOOLS MAINT. & INSP.	Next Job BSL-13810	Use Target Start: Y	B2AS-MA	1 MONTHS
	Next 7/9/12 Date BSL-13810	MONTHLY HAND TOOLS MAINT. & INSP.				1
105	BSL-1500	10 CHECK FOR CRACKS OR BREAKS 20 REPLACE OR REPAIR AS NEEDED 30 INSPECT GENERAL CONDITION YEARLY 2 GAL. SPRAYER MAINT. & INSP.	Next Job BSL-13886	Use Target Start: Y	B2AS-MA	1 YEARS
	Next 12/9/12 Date BSL-13886	YEARLY 2 GAL. SPRAYER MAINT. & INSP.				1
		10 CHECK PUMP 20 CHECK TANK 30 CHECK HOSE 40 CHECK NOZZLE 50 CLEAN TANK AFTER USE				
106	BSL-1690	YEARLY HOISTING EQUIPMENT MAINTENANCE & INSPECTION	Next Job BSL-14254	Use Target Start: Y	B2AS-MA	1 YEARS
	Next 12/3/12 Date BSL-14254	YEARLY HOISTING EQUIPMENT MAINTENANCE & INSPECTION				1
		10 CHECK TO MAKE SURE EQUIPMENT WORKS PROPERLY 20 OIL ALL MOVING PARTS 30				
107	BSL-1944	YEARLY BENCH VISE MAINT. & INSP.	Next Job BSL-14551	Use Target Start: Y	B2AS-MA	1 YEARS
	Next 11/13/12 Date BSL-14551	YEARLY BENCH VISE MAINT. & INSP.				1
		10 CHECK FOR CRACKS OR BREAKS 20 CHECK VISE SCREW FOR EASE OF MOVEMENT 30 CLEAN AND OIL AS REQUIRED				

End of Asset B2ASXQHT

**B2ASXQLC Large Cutting Unit**

108	BSL-1432	MONTHLY OXYGEN/ACETYLENE UNIT MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13711	Use Target Start: Y	
	BSL-13711	MONTHLY OXYGEN/ACETYLENE UNIT MAINT. & INSP.		1
		10 CHECK HOSES AND FITTINGS		
		20 CHECK PROPER SETTINGS ON GAUGES		
		30 REPLACE EMPTY BOTTLES		
		40 CHECK CUTTING TORCH		
		50 INSURE SAFETY EQUIPMENT IN ORDER		
		60 CHECK FIRE EXTINGUISHER		
		70 REPLACE ITEMS AS NEEDED		

End of Asset B2ASXQLC

**B2ASXQLS Portable Light Stands**

No PMs for B2ASXQLS

**B2ASXQMW Miller Wire Feed Welding Machine**

No PMs for B2ASXQMW

**B2ASXQNA Air Compressor, Control House**

109	BSL-1434	MONTHLY AIR COMPRESSOR - NORTH END CONTROL HOUSE	B2AS-MA	1 MONTHS
	Next 1/16/11	Next Job BSL-13714	Use Target Start: Y	
	BSL-13714	MONTHLY AIR COMPRESSOR - NORTH END CONTROL HOUSE		1
		10 CHECK ELECTRICAL CONNECTIONS		
		20 CHECK AIR HOSE		
		30 DRAIN WATER FROM TANK		
		40 CHECK OPERATION OF UNIT		

End of Asset B2ASXQNA

**B2ASXQPA Portable Air Compressor**

110	BSL-1436	MONTHLY AIR COMPRESSOR (PORTABLE) MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/9/12	Next Job BSL-13716	Use Target Start: Y	
	BSL-13716	MONTHLY AIR COMPRESSOR (PORTABLE) MAINT. & INSPECTION		1
		10 CHECK OIL IN COMPRESSOR		
		20 CHECK OIL IN ENGINE		
		30 CHECK GAS		
		40 CHECK AIR FILTER ON COMPRESSOR - CLEAN AS NEEDED		
		50 CHECK AIR FILTER ON ENGINE - CLEAN AS NEEDED		
		60 CHECK COMPRESSOR GUARD - TIGHTEN GUARD IF NEEDED		
		70 CHECK FOR OIL AND AIR LEAKS		
		80 CHECK ALL FITTINGS		
		90 CHECK HOSES		
		100 DRAIN WATER FROM AIR TANK		
		110 CHANGE OIL & FILTERS AS NEEDED		
111	BSL-1437	180 DAY AIR COMPRESSOR (PORTABLE) MAINT. & INSP.	B2AS-MA	180 DAYS
	Next 7/19/12	Next Job BSL-13844	Use Target Start: Y	
	BSL-13844	180 DAY PORTABLE AIR COMPRESSOR MAINT. & INSP.		1
		10 CHANGE ENGINE OIL		
		20 CLEAN GAS BOWL		
		30 CHECK AND CLEAN SPARK PLUG		
		40 CLEAN SPARK ARRESTOR		
112	BSL-1438	YEARLY AIR COMPRESSOR (PORTABLE) MAINT. & INSP.	B2AS-MA	1 YEARS
	Next 6/11/12	Next Job BSL-13720	Use Target Start: Y	
	BSL-13720	YEARLY AIR COMPRESSOR (PORTABLE) MAINT. & INSP.		1
		10 CLEAN FUEL TANK AND STRAINER		
		20 CHECK FUEL HOSE AND REPLACE IF NEEDED		

End of Asset B2ASXQPA

**B2ASXQPM Powermax Plasma Cutter**

No PMs for B2ASXQPM

**B2ASXQPR Pressure Washer**

113	BSL-1936	MONTHLY PRESSURE WASHER MAINT. & INSP.	B2AS-MA	1 MONTHS
-----	----------	--	---------	----------

Next 6/11/12 Next Job BSL-14534 Use Target Start: Y  
 Date BSL-14534 MONTHLY PRESSURE WASHER MAINT. & INSP. 1  
 10 CHECK OIL IN MOTOR AND PUMP  
 20 CHECK GAS  
 30 CHECK PULL CORD  
 40 CHECK HOSE AND FITTINGS  
 50 RUN WEEKLY  
 60 CLEAN AFTER EACH USE

End of Asset B2ASXQPR

**B2ASXQPS Portable Sandblaster**

No PMs for B2ASXQPS

**B2ASXQPT Power Tools**

114 BSL-1425 MONTHLY WEED EATER MAINTENANCE & INSPECTION B2AS-MA 1 MONTHS  
 Next 7/9/12 Next Job BSL-13700 Use Target Start: Y

Date BSL-13700 MONTHLY WEED EATER MAINTENANCE & INSPECTION 1  
 10 CHECK OIL  
 20 CHECK GAS  
 30 CHECK STRING  
 40 CHECK FOOTING FOR LOOSE OR BROKEN PARTS  
 50 RUN  
 60 CLEAN  
 70

115 BSL-1477 MONTHLY BATTERY OPERATED TOOLS MAINT. & INSP. B2AS-MA 1 MONTHS  
 Next 7/9/12 Next Job BSL-13831 Use Target Start: Y

Date BSL-13831 MONTHLY BATTERY OPERATED TOOLS MAINT. & INSP. 1  
 10 MAINTENANCE AND INSPECTIONS

116 BSL-1941 MONTHLY TABLE SAW MAINT. & INSP. B2AS-MA 1 MONTHS  
 Next 7/9/12 Next Job BSL-14544 Use Target Start: Y

Date BSL-14544 MONTHLY TABLE SAW MAINT. & INSP. 1  
 10 CHECK THAT SAFETY GUARDS IN PLACE.  
 20 CHECK BLADE FOR CRACKS OR BREAKS  
 30 CHECK ELECTRICAL CORD FOR CRACKS OR CUTS  
 40 WEAR SAFETY GLASSES WHEN USING  
 50 CHECK MOTOR MOUNTING BRACKET AND ADJUST AS NEEDED  
 60 CLEAN AFTER EACH USE

End of Asset B2ASXQPT

**B2ASXQPU Spray Paint Unit**

117 BSL-1935 180 DAY PAINT SPRAYER MAINT. & INSP. B2AS-MA 180 DAYS  
 Next 11/5/12 Next Job BSL-14529 Use Target Start: Y

Date BSL-14529 180 DAY PAINT SPRAYER MAINT. & INSP. 1  
 10 CHECK HOSE CONNECTIONS  
 20 CHECK HOSES FOR CRACKS OR CUTS - REPLACE AS NEEDED  
 30 CHECK GASKET ON SPRAY POT FOR GOOD SEAL  
 40 CHECK SPRAY GUN AND CLEAN AFTER EACH USE  
 50 CHECK THAT GAUGES IN GOOD WORKING ORDER  
 60 CLEAN POT AND GUN AFTER EACH USE.

End of Asset B2ASXQPU

**B2ASXQPW Pow Con Welding Machine**

No PMs for B2ASXQPW

**B2ASXQSC Small Cutting Unit**

118 BSL-1433 MONTHLY PORTABLE OXYGEN/ACETYLENE UNIT MAINT. & INSP. B2AS-MA 1 MONTHS

Next 7/9/12 Next Job BSL-13712 Use Target Start: Y  
 Date BSL-13712 MONTHLY PORTABLE OXYGEN/ACETYLENE UNIT MAINT. & INSP. 1  
 10 CHECK HOSES  
 20 CHECK BOTTLE CONNECTIONS  
 30 CHECK SETTINGS ON GAUGES  
 40 REPLACE EMPTY BOTTLES  
 50 CHECK TORCH IN GOOD OPERATING MANNER  
 60 CHECK SAFETY EQUIPMENT

70 REPLACE PARTS AS NEEDED

End of Asset B2ASXQSC

**B2ASXQSM Sump Pumps**

No PMs for B2ASXQSM

**B2ASXQST Spray Tank**

119	BSL-1937	MONTHLY 15 GAL. SPRAYER MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 6/24/12	Next Job BSL-14536	Use Target Start: Y	
	BSL-14536	MONTHLY 15 GAL. SPRAYER MAINT. & INSP.		1
		10 CHECK HITCH		
		20 CHECK PUMP		
		30 CHECK HOSES AND NOZZLE		
		40 CHECK ELECTRICAL CONNECTIONS		
		50 CLEAN AFTER EACH USE		

End of Asset B2ASXQST

**B2ASXQUT 20' Utility Trailer**

120	BSL-2384	MONTHLY 20' UTILITY TRAILER MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 6/20/12	Next Job BSL-15089	Use Target Start: Y	
	BSL-15089	MONTHLY 20' UTILITY TRAILER MAINT. & INSP.		1
		10 CHECK LIGHTS		
		20 CHECK HITCH		
		30 CHECK TIRES		
		40 CHECK WHEEL BEARINGS		
		50 CHECK WIRING HARNESS		
		60 GENERAL INSPECTION		

121	BSL-2385	YEARLY 20' UTILITY TRAILER INSP.	B2AS-MA	1 YEARS
	Next 10/26/12	Next Job BSL-15091	Use Target Start: Y	
	BSL-15091	YEARLY 20' UTILITY TRAILER INSP.		1
		10 CHECK TRAILER DECKING AND CHANGE AS NEEDED		
		20 CHECK LIGHTS AND WIRING HARNESS		
		30 CHECK TIRES AND WHEEL BEARINGS		
		40 CHECK TRAILER HITCH		
		50 GENERAL INSPECTION		

End of Asset B2ASXQUT

**B2ASXQWA Water Pump**

No PMs for B2ASXQWA

**B2ASXQWD Wash Down Pump**

122	BSL-2427	MONTHLY FIRE PUMP MAINT. & INSP.	B2AS-MA	1 MONTHS
	Next 7/8/12	Next Job BSL-15175	Use Target Start: Y	
	BSL-15175	MONTHLY FIRE PUMP MAINT. & INSP.		1
		10 INSPECT PUMP		
		20 CHECK FOR OIL LEAKS		
		30 CHECK WATER LINE FOR LEAKS		
		40 RUN PUMP		
		50 CLEAN & PAINT AS NEEDED		

End of Asset B2ASXQWD

**B2ASXQWP 2" Water Pumps (2)**

123	BSL-1431	WEEKLY 2" WATER PUMP MAINT. & INSP.	B2AS-MA	1 WEEKS
	Next 6/17/12	Next Job BSL-13710	Use Target Start: Y	
	BSL-13710	WEEKLY 2" WATER PUMP MAINT. & INSP.		1
		10 CHECK OIL AND GAS		
		20 CHECK HOSE FITTINGS AND CONNECTIONS		
		30 CHANGE OIL AND FILTERS AS NEEDED		
		40 CLEAN UNIT		

End of Asset B2ASXQWP

**B2ASXQWT Welding Trailer**

124	BSL-1947	WEEKLY BOBCAT WELDER MAINT. & INSP.	B2AS-MA	1 WEEKS
	Next 6/17/12	Next Job BSL-14552	Use Target Start: Y	
	BSL-14552	WEEKLY BOBCAT WELDER MAINT. & INSP.		1

		10 CHECK WELDING LEADS			
		20 CHECK BATTERY AND TERMINALS			
		30 CHECK GAS & OIL			
		40 CHECK AND CLEAN SPARK ARRESTOR			
		50 CHECK HITCH ON TRAILER			
		60 CHECK SAFETY CHAINS AND LIGHTS			
125	BSL-1948	90 DAY BOBCAT WELDER MAINT. & INSP.	B2AS-MA	90 DAYS	
	Next 6/29/12		Use Target Start: Y		
	Date BSL-14553	90 DAY BOBCAT WELDER MAINT. & INSP.		1	
		10 CHANGE OIL AND OIL FILTER			
		20 CHANGE FUEL FILTER			
		30 BLOW OUT OR VACUUM INSIDE OF UNIT			
		40 CHANGE AIR FILTER			

End of Asset B2ASXQWT

**B2ASXQWU Emergency Winch Units**

No PMs for B2ASXQWU

**B2ASXS Security**

126	BSL-1387	WEEKLY SECURITY CHECKS OF FENCE LINE - EAST SIDE	B2AS-MA	7 DAYS	
	Next 6/11/12		Use Target Start: Y		
	Date BSL-13617	WEEKLY SECURITY CHECK OF FENCE LINE - EAST SIDE		1	
		10 CHECK FENCE LINE FOR BREAKS			
		20 FILL ANY HOLES UNDER FENCE			
		30 CHECK SIGNS ON FENCE			
127	BSL-1390	WEEKLY SECURITY CHECK OF FENCE LINE - WEST SIDE	B2AS-MA	7 DAYS	
	Next 6/17/12		Use Target Start: Y		
	Date BSL-13620	WEEKLY SECURITY CHECK OF FENCE LINE - WEST SIDE		1	
		10 CHECK FENCE LINE FOR BREAKS			
		20 FILL ANY HOLES UNDER FENCE			
		30 CHECK SIGNS ON FENCE			

End of Asset B2ASXS

**B2ASXSG Security Gates**

No PMs for B2ASXSG

**B2ASXSGEG Eastside Entrance Gate**

128	BSL-1384	MONTHLY EAST SIDE ENTRANCE GATE MAINT. & INSP.	B2AS-MA	1 MONTHS	
	Next 7/9/12		Use Target Start: Y		
	Date BSL-13613	MONTHLY EAST SIDE ENTRANCE GATE MAINT. & INSP.		1	
		10 CHECK OUT OPERATION OF GATE			
		20 CHECK ELECTRICAL - REPAIR AS NEEDED			
		30 GENERAL INSPECTION			
		40 MAKE REPAIRS AS NEEDED			

End of Asset B2ASXSGEG

**B2ASXSGEGR Entry/Exit Card Reader**

No PMs for B2ASXSGEGR

**B2ASXSGPF Perimeter Fence**

No PMs for B2ASXSGPF

**B2ASXSGWG Westside Entrance Gate**

129	BSL-1383	MONTHLY WEST SIDE ENTRANCE GATE MAINT. & INSP.	B2AS-MA	1 MONTHS	
	Next 7/9/12		Use Target Start: Y		
	Date BSL-13587	MONTHLY WEST SIDE ENTRANCE GATE MAINT. & INSPECTION		1	
		10 CHECK OUT OPERATION OF GATE			
		20 CHECK ELECTRICAL IF NEEDED			
		30 GENERAL INSPECTION OF GATE			
		40 MAKE REPAIRS AS NEEDED			

End of Asset B2ASXSGWG

**B2ASXSGWGF Entry/Exit Card Reader**

No PMs for B2ASXSGWGR

**B2ASXSV Security Video System**

			No PMs for B2ASXSV		
<b>B2ASXSVCS</b>	<b>CCure System</b>				
			No PMs for B2ASXSVCS		
<b>B2ASXSVDR</b>	<b>Digital Recorder</b>				
			No PMs for B2ASXSVDR		
<b>B2ASXSVPD</b>	<b>Pedestal Cameras</b>				
			No PMs for B2ASXSVPD		
<b>B2ASXSVPL</b>	<b>Pelco Cameras</b>				
			No PMs for B2ASXSVPL		
<b>B2ASXW</b>	<b>Water System</b>				
			No PMs for B2ASXW		
<b>B2ASXWCW</b>	<b>City Water Supply System</b>				
130	BSL-1396	MONTHLY WATER LINE MAINT. AND INSP.		B2AS-MA	1 MONTHS
	Next 7/9/12		Next Job BSL-13630	Use Target Start: Y	
	Date BSL-13630	MONTHLY WATER LINE MAINT. & INSPECTION			1
		10 VISUAL INSPECTION OF WATER LINE FOR LEAKS AND SEEPAGE			
		20 REPAIR AS REQUIRED			
		30 WEEDEAT AND MAINTAIN AREAS AROUND GUARD RACKS			
			End of Asset B2ASXWCW		
<b>B2ASXWWC</b>	<b>Water Coolers</b>				
131	BSL-1397	YEARLY WATER COOLER MAINT. & INSP.		B2AS-MA	1 YEARS
	Next 6/13/12		Next Job BSL-13633	Use Target Start: Y	
	Date BSL-13633	YEARLY WATER COOLER MAINT. & INSP.			1
		10 CHECK ELECTRICAL CORD - REPLACE IF NEEDED			
		20 CHECK FOR LEAKS			
		30 CLEAN UNIT			
		40 OIL MOTOR			
			End of Asset B2ASXWWC		
<b>BSL-4030</b>	<b>Hazard Waste Container</b>				
			No PMs for BSL-4030		
<b>BSL-4035</b>	<b>WORK BARGE</b>				
			No PMs for BSL-4035		

This report pulls all Asset records in Operating status for the Site ID and USACE Org Code specified in the parameters along with all active Preventative Maintenance records (schedules) linked to the Assets and their related Job Plans.

The Frequency and Unit fields indicate how often the PM schedule runs. Sequence indicates which Job Plan will be used every *n* times the PM runs. For further explanation, see your Site or District FEM POC, or consult the FEM PM Guide on the FEM SharePoint site.

Database fields used (Table.Field):

ASSET.ASSETNUM, ASSET.DESCRPTION, PM.PMNUM, PM.DESCRPTION, PM.FREQUENCY, PM.FREQUNIT, PM.CREWMD, PM.NEXTDATE, PM.EXTDATE, PM.JPNUM, PM.USETARGETDATE, PMMETER.METERNAME, PMMETER.FREQUENCY, PMSEQUENCE.JPNUM, PMSEQUENCE.INTERVAL, JOBPLAN.DESCRPTION

## D.2. Lower Monumental Lock and Dam

### PM & Jobplan Listing by Asset w/tasks

See the last page for field explanations  
Site = NWW-LOM

ASSET	PM	JOB PLAN	iptask	Org Code	G4R0QL0	CREW	FREQUENCY
							SEQUENCE
<b>G4-3N000000 NAVIGATION LOCK</b>							
1	G4-3LIGHTNAV	NAVLOCK AREA(S) LIGHTING RELAMPING (Q)		G4-3ELECT	3 MONTHS		
	Next	10/1/10		Next Job	G4-3LIGHTNA	Use Target Start:	Y
	G4-3LIGHTNAV	NAVLOCK AREA(S) LIGHTING RELAMPING	Quarterly		1		
		5	SAFE CLEARANCE: REVIEW AHA AND ARC FLASH REQUIREMENTS				
		10	RELAMP NAVLOCK AREAS				
2	G4-3NAVLOCK	LOMO NAVLOCK MAINTENANCE -Mechanics		G4-3MECH	1 YEARS		
	Next	10/1/08	Ext 10/1/08	Next Job	G4-3NAVLOCK	Use Target Start:	Y
	G4-3NAVLOCK	LOMO NAVLOCK MAINTENANCE			1		
		10	UPSTREAM NORTH AREA				
		20	#4 TAINTER VALVE MACHINERY ROOM				
		30	UPSTREAM GATES NORTH MACHINERY ROOM				
		40	UPSTREAM GATE SOUTH MACHINERY ROOM				
		50	#3 TAINTER VALVE MACHINE ROOM				
		60	UNWATERING PUMP 35				
		70	DOWNSTREAM GATE MACHINERY ROOM***(NORTH TOWER)				
		80	TAINTER VALVE MACHINERY ROOM 1&2				
		90	DOWNSTREAM GATE MACHINE ROOM***(SOUTH TOWER)				
		100	NON-OVERFLOW COMP ROOM				
3	G4-3NAVLOCKRI	NAVLOCK ROUNDS ELECTRICAL	Electricians	G4-3ELECT	1 WEEKS		
	Next	7/2/12		Next Job	G4-3NELECT	Use Target Start:	Y
	G4-3NELECTNLR	NAV LOCK WEEKEND ROUNDS ELECTRICAL			1		
		10	Tainter Emptying Valves Machinery Room				
		20	Downstream Gate Machinery Room, Navlock North Tower				
		30	Downstream Gate Machinery Room, Navlock South Tower				
		40	Tainter Filling Valve # 4 Machinery Rooms, North Side Upstream. Power				
		50	Tainter Filling Valve # 3 Machinery Rooms, South Side Upstream. Power				
		60	Upstream Gate Machinery Room , Navlock North Side LCQ4				
		70	Upstream Gate Machinery Room , LCQ3 Navlock South Side				
		80	Check Down Stream Nav Lock Gate #1				
4	G4-3NELECTNLE	NAV LOCK WEEKEND ROUNDS - Electricians		G4-3ELECT	1 WEEKS		
	Next	4/7/11		Next Job	G4-3NELECT	Use Target Start:	Y
	G4-3NELECTNLR	NAV LOCK WEEKEND ROUNDS ELECTRICAL			1		
		10	Tainter Emptying Valves Machinery Room				
		20	Downstream Gate Machinery Room, Navlock North Tower				
		30	Downstream Gate Machinery Room, Navlock South Tower				
		40	Tainter Filling Valve # 4 Machinery Rooms, North Side Upstream. Power				
		50	Tainter Filling Valve # 3 Machinery Rooms, South Side Upstream. Power				
		60	Upstream Gate Machinery Room , Navlock North Side LCQ4				
		70	Upstream Gate Machinery Room , LCQ3 Navlock South Side				
		80	Check Down Stream Nav Lock Gate #1				
5	G4-3NEMM-EA	EMERGENCY & EGRESS LIGHTS-NAV LOCK		G4-3ELECT	1 MONTHS		
	Next	7/1/12		Next Job	G4-3PSEMME	Use Target Start:	Y
	G4-3PSEMME	EMERGENCY & EGRESS LIGHTING			1		
		5	CHECK SHEETS LOCATED:				
		10	COORDINATE WORK WITH OPERATIONS and PLANT PERSONNEL.				
		20	BEFORE STARTING OPERATIONAL TEST				
		30	SECURE POWER BY PANEL BREAKER or FROM POWER SOURCE.				
		40	INSTALL TEST LABEL WITH DATE and INITIALS.				
		50	EXIT SIGNS:				
		60	FOLLOW ALL PROJECT SAFETY, OPERATIONAL, ARC FLASH PROCEDURES ar				
6	G4-3NWINTM	WINTERIZE PROJECT: NAVIGATION LOCK - Mechanics		G4-3MECH	6 MONTHS		
	Next	11/1/12		Next Job	G4-3NWINTRI	Use Target Start:	Y

G4-3NWNTRM-S WINTERIZE PROJECT: (LOWER MONUMENTAL)-(S) 1  
 10 SAFE CLEARANCE: NAVIGATION LOCK  
 20 NAVIGATION AREA -OCTOBER  
 30 NAVIGATION AREA - APRIL

End of Asset G4-3N000000

**G4-3NAC1000 #1 NAV LOCK COMPRESSOR**

7 G4-3DA2E COMPRESSOR: AIR # 1 LS-100 - Electricians G4-3ELECT 6 MONTHS  
 Next 7/1/12 Next Job G4-3DA2E-A Use Target Start: Y

G4-3DA2E-A COMPRESSOR: AIR #1 LS-1000 & REFRIGERATED Semi Annual 1  
 10 SAFE CLEARANCE OR SWITCHING PERMIT: SOUTH NON-OVERFLOW  
 20 CHECK CONTROL & POWER CIRCUITS. CHECK CONTACTS &  
 30 CHECK FOR LOOSE WIRE TERMINAL CONNECTIONS  
 40 CHECK & ADJUST PRESSURE SWITCHES, TEMPERATURE  
 50 LUBE MOTOR BEARINGS (IF NECESSARY) AND CHECK MOTOR  
 60 VISUAL CHECK OVERHEAD  
 70 VISUAL CHECK FLOOR LEVEL  
 90 CHECK ALL CONTROL & POWER CIRCUITS  
 100 CHECK COOLING ANS & WIRES  
 110 CHECK FOR LOOSE PARTS  
 120 RECORD RUNNING TIME

End of Asset G4-3NAC1000

**G4-3NAC2000 #2 NAV LOCK COMPRESSOR**

No PMs for G4-3NAC2000

**G4-3NAC3000 #3 NAV LOCK COMPRESSOR**

No PMs for G4-3NAC3000

**G4-3NB00000 BULKHEADS**

No PMs for G4-3NB00000

**G4-3NBBZ000 STOPLOGS**

No PMs for G4-3NBBZ000

**G4-3NBEV200 LOCK EMPTYING VALVE BULKHEAD V2**

No PMs for G4-3NBEV200

**G4-3NBF000 FLOATING BULKHEADS**

8 G4-3NBFBM BULKHEAD: FLOATING - Mechanics G4-3MECH 5 YEARS  
 Next 8/13/13 Ext 8/1/13 Next Job G4-3NBFBM-A Use Target Start: Y

G4-3NBFBM-A BULKHEAD: FLOATING ANNUAL 1  
 5 WEAR FLOATATION VEST ON FLOATING BULKHEADS: P.M.  
 10 SAFE CLEARANCE: NAVAGATION LOCK  
 20 OPEN AND CLOSE VALVES. LUBE VALVE THREADS  
 30 OPERATE CENTERING ARMS  
 40 SEE THAT 3" VENT AND SOUNDING TUBES ARE CAPPED  
 50 REMOVE HATCH, CHECK INTERIOR AIR TIGHT COMPARTMENT  
 60 CHECK CONDITION OF DRAFT GAGES & PAINT IF NEEDED  
 70 CHECK MOORING LINES TO SEE IF SECURED AND IN GOOD

End of Asset G4-3NBF000

**G4-3NBFUP00 FLOATING BULKHEADS UNWATERING PUMPS**

9 G4-3NBFBPE PUMPS:(4) FLOATING BULKHEAD SOUTH SHORE - Electricians G4-3ELECT 1 YEARS  
 Next 2/1/13 Next Job G4-3NBFBPE- Use Target Start: Y

G4-3NBFBPE-A PUMPS: 1- 1/2 HP FLOATING BULKHEADS Annual 1  
 5 NOTE: WEAR FLOTATION VEST ON BULKHEAD. 2 PEOPLE  
 10 SAFE CLEARANCE: SOUTH SHORE  
 20 GIVE A RUNNING INSPECTION  
 30 CHECK MOTOR STARTERS  
 40 CHECK MOTOR RUNNING CURRENT  
 50 CHECK POWER CORD  
 60 MEGGER MOTOR \_\_\_\_\_M OHM

End of Asset G4-3NBFUP00

	<b>G4-3NBFUP10</b>	<b>FLOATING BULKHEADS UNWATERING PUMP #1</b>				
			No PMs for G4-3NBFUP10			
	<b>G4-3NBFUP1C</b>	<b>MOTOR CONTROLLER</b>				
			No PMs for G4-3NBFUP1C			
	<b>G4-3NBFUP20</b>	<b>FLOATING BULKHEADS UNWATERING PUMP #2</b>				
			No PMs for G4-3NBFUP20			
	<b>G4-3NBFUP2C</b>	<b>MOTOR CONTROLLER</b>				
			No PMs for G4-3NBFUP2C			
	<b>G4-3NBFUP30</b>	<b>FLOATING BULKHEADS UNWATERING PUMP #3</b>				
			No PMs for G4-3NBFUP30			
	<b>G4-3NBFUP3C</b>	<b>MOTOR CONTROLLER</b>				
			No PMs for G4-3NBFUP3C			
	<b>G4-3NBFUP40</b>	<b>FLOATING BULKHEADS UNWATERING PUMP #4</b>				
			No PMs for G4-3NBFUP40			
	<b>G4-3NBFUP4C</b>	<b>MOTOR CONTROLLER</b>				
			No PMs for G4-3NBFUP4C			
	<b>G4-3NBFV300</b>	<b>LOCK FILL VALVE BULKHEAD V3</b>				
			No PMs for G4-3NBFV300			
	<b>G4-3NBFV400</b>	<b>LOCK FILL VALVE BULKHEAD V4</b>				
			No PMs for G4-3NBFV400			
	<b>G4-3NBWSSG</b>	<b>UNWATERING SUMP SLUCE GATE</b>				
			No PMs for G4-3NBWSSG			
	<b>G4-3NBVB000</b>	<b>FILL/EMPTYING VALVE BULKHEADS</b>				
10	<b>G4-3NBBZM</b>	<b>BULKHEAD:(6) TANTER VALVES - Mechanics</b>	<b>G4-3MECH</b>		<b>1 YEARS</b>	
	Next	3/1/13	Next Job	G4-3NBBZM-A	Use Target Start:	Y
	G4-3NBBZM-A	<b>BULKHEADS: TANTER VALVE - ANNUAL</b>				1
		5	SAFE CLEARANCE: TANTER VALVES (6)			
		20	CHECK SEALS			
		30	CHECK WELDS ON LIFTING EYES			
		40	PERFORM OVERALL INSPECTION			
		50	Route completed PM through Chief of Maintenance for hydroamp update			
			End of Asset G4-3NBVB000			
	<b>G4-3NBVE000</b>	<b>LOCK EMPTYING VALVE BULKHEAD</b>				
			No PMs for G4-3NBVE000			
	<b>G4-3NBVE100</b>	<b>LOCK EMPTYING VALVE BULKHEAD V1</b>				
			No PMs for G4-3NBVE100			
	<b>G4-3NBVF000</b>	<b>LOCK FILL VALVE BULKHEAD</b>				
			No PMs for G4-3NBVF000			
	<b>G4-3NECC100</b>	<b>CONTROL CONSEL</b>				
			No PMs for G4-3NECC100			
	<b>G4-3NECC200</b>	<b>CONTROL CONSEL</b>				
			No PMs for G4-3NECC200			
	<b>G4-3NECS000</b>	<b>CONTROL STANDS</b>				
11	<b>G4-3NECS2E</b>	<b>STAND: LOCK CONTROL #S2 Electricians</b>	<b>G4-3ELECT</b>		<b>1 YEARS</b>	
	Next	2/1/13	Next Job	G4-3NECS2E-	Use Target Start:	Y
	G4-3NECS2E-A	<b>STAND: LOCK CONTROL # S2 Semi Annual</b>				1
		10	SAFE CLEARANCE: NAVIGATION LOCK DECK			
		20	CHECK STOP & GO LIGHTS, CHANGE BULBS			
		40	CHECK FOR LOOSE WIRE TERMINAL CONNECTIONS			
		50	CHECK BUBBLER CONTROL SYSTEM			

End of Asset G4-3NECS000

**G4-3NECS0DS DOWN STREAM CONTROL STAND**

No PMs for G4-3NECS0DS

**G4-3NECS0US UP STREAM CONTROL STAND**

12	G4-3NECS1E	STAND: LOCK CONTROL #S1 Electricians	G4-3ELECT	1 YEARS
	Next 4/1/13	Next Job G4-3NECS1E	Use Target Start: Y	
	G4-3NECS1E	STAND: LOCK CONTROL # S1 Annual		1
		10 SAFE CLEARANCE: NAVIGATION LOCK DECK		
		20 CHECK STOP & GO LIGHTS, CHANGE BULBS		
		30 CHECK HORN SIGNAL CONTROLS		
		40 CHECK FOR LOOSE WIRE TERMINAL CONNECTIONS		
		50 CHECK BUBBLER CONTROL SYSTEM		
		70 CHECK NO SMOKING LIGHTS		
13	G4-3NECS1M	STAND: LOCK CONTROL #S1 - Mechanics	G4-3MECH	6 MONTHS
	Next 8/1/12	Next Job G4-3NECS1M-	Use Target Start: Y	
	G4-3NECS1M-A	LOCK CONTROL STAND: # S1-		2
		10 SAFE CLEARANCE: NAVIGATION LOCK DECK		
		20 CHECK BUBBLER CONTROL SYSTEM		
		30 PERFORM WINDOW & DOOR MAINTENANCE		
	G4-3NECS1M-S	LOCK CONTROL STAND: # S1- SEMI-ANNUAL		1
		10 SAFE CLEARANCE: NAVIGATION LOCK DECK		
		20 CHECK BUBBLER CONTROL SYSTEM		
		30 PERFORM WINDOW & DOOR MAINTENANCE		
14	G4-3NECS2M	STAND: LOCK CONTROL #S2 - Mechanics	G4-3MECH	6 MONTHS
	Next 8/1/12	Next Job G4-3NECS2M-	Use Target Start: Y	
	G4-3NECS2M-A	LOCK CONTROL STAND: # S2 - ANNUALY		2
		10 SAFE CLEARANCE: NAVIGATION LOCK DECK		
		20 CHECK BUBBLER CONTROL SYSTEM		
		30 PERFORM WINDOW & DOOR MAINTENANCE		
	G4-3NECS2M-S	LOCK CONTROL STAND: # S2 - SEMI-ANNUAL		1
		10 SAFE CLEARANCE: NAVIGATION LOCK DECK		
		20 CHECK BUBBLER CONTROL SYSTEM		
		30 PERFORM WINDOW & DOOR MAINTENANCE		

End of Asset G4-3NECS0US

**G4-3NEHVAC1 HVAC**

No PMs for G4-3NEHVAC1

**G4-3NEHVAC2 HVAC**

No PMs for G4-3NEHVAC2

**G4-3NEIC000 INTERCOM**

No PMs for G4-3NEIC000

**G4-3NFSP1C MOTOR CONTROLLER**

No PMs for G4-3NFSP1C

**G4-3NFSP2C MOTOR CONTROLLER**

No PMs for G4-3NFSP2C

**G4-3NFSWCDS WATER CONON D/S**

No PMs for G4-3NFSWCDS

**G4-3NFSWCUS WATER CONON U/S**

No PMs for G4-3NFSWCUS

**G4-3NGATE00 GATES**

No PMs for G4-3NGATE00

**G4-3NGDN000 DOWNSTREAM GATE #1**

15	G4-3NGDN1E	GATE: VERTICAL LIFT #1 - Electricians	G4-3ELECT	1 YEARS
	Next 3/1/13	Next Job G4-3NGDN1E-	Use Target Start: Y	
	G4-3NGDN1E-A	GATE: VERTICAL LIFT #1 Annual		1

		10	SAFE CLEARANCE OR SWITCHING PERMIT NAVIGATION LOCK (DOWNSTREAM)		
		20	CHECK DIFFERENTIAL PRESSURE CONTROL ADJUSTMENT		
		30	CHECK & TIGHTEN LIMIT SWITCH & SELSYN DRIVE		
		40	CHECK CONTROL PANEL EQUIPMENT		
		50	GATE HYDRAULIC DRIVE MOTOR		
		60	CHECK ADJUSTMENT OF TEMPERATURE SWITCHES		
		70	CHECK TOWER MONORAIL HOIST MOTOR AND CONTROLS		
		71	CHECK TOWER HEATERS AND FAN MOTORS		
		80	INSPECT GATE LIMIT SWITCHES		
		90	CONTROL STAND:		
		100	CHECK THRUSTER BRAKE OIL LEVEL		
16	G4-3NGDN1EL		GATE: VERTICAL LIFT #1 - Eltech	G4-3ELTECH	3 MONTHS
	Next	9/29/12		Next Job	G4-3NGDN1EL Use Target Start: Y
	G4-3NGDN1EL-Q		GATE: VERTICAL LIFT #1 Quarterly		1
		10	SAFE CLEARANCE:NAVIGATION LOCK		
		20	CHECK ELECTRONIC CONTROLS		
17	G4-3NGDN1M		GATE: VERTICAL LIFT #1 (DOWNSTREAM) -Mechanics	G4-3MECH	1 YEARS
	Next	2/1/13		Next Job	G4-3NGDN1M Use Target Start: Y
	G4-3NGDN1M-A		GATE: VERTICAL LIFT # 1 ( A)		1
		10	SAFE CLEARANCE: NAVIGATION LOCK		
		20	LUBRICATE SHAFT COUPLINGS, CHECK FOR EVIDENCE OF		
		30	INSPECT BRAKE, LUBE PIVOT POINTS, DRAIN THRUSTOR		
		40	REPLACE HYDRAULIC FILTERS		
		50	CHECK RELIEF VALVE SETTINGS ( 2500 PSI )		
		60	REPAIR OIL LEAKS, PIPE CONNECTIONS & SEALS		
		70	SERVICE TOWER MONORAILS & GATE WHEEL HOISTS		
		80	CHECK OIL LEVEL IN GEAR REDUCERS ( EP 140 )		
		90	INSPECT & DRESS CABLE AT DRUM ENDS IN BOTH TOWERS-		
		100	DOPE CABLE DRUM OPEN GEARS IN BOTH TOWERS-		
		110	APPLY MT-55 ACCULUBE TO GATE SHOE WITH PAINT		
		120	CHECK GATE INDICATOR MACHINERY (MARFAK #2); LUBE		
		130	CHECK COUPLINGS FOR ALIGNMENT & LUBE		
		140	CHECK GEAR BOXES ( DORRIS ) FOR LUBE LEVEL ,CLEAN-		
		150	CHECK WINSMITH GEAR BOX; LUBE WITH EP-90		
		160	GREASE GUIDE WHEELS		
		170	INSPECT CABLES & GREASE SHEAVES		
		180	CHECK MOUNTING BOLTS & TIGHTEN AS NEEDED		
		190	CLEAN UP AREA; USE CLEAN PAPER ON DECKS AS NEEDED		
		200	REMOVE LOWER WHEELS ON GATE		
		210	STRUCTURAL:		
		220	MECHANICAL:		
		230	HYDRAULIC HOISTING UNIT #1 & #2		
		240	MAIN HOIST GEAR BEARINGS		
18	G4-3NGDNSHM		GATE: VERTICAL LIFT #1 SEAL HEATER - Mechanics	G4-3MECH	1 YEARS
	Next	11/1/12		Next Job	G4-3NGDNSH Use Target Start: Y
	G4-3NGDNSH-A		VERTICAL LIFT GATE #1 SEAL HEATER- ANNUAL		1
		10	SAFE CLEARANCE: NAVIGATION LOCK		
		20	DURING UNWATERING PERIOD TAP DIRT LEGS		
		30	CHECK VALVES FOR LEAKAGE		
		40	CHECK THERMAL OIL LEVEL		
		50	CHECK FLEX PIPE CONNECTIONS FOR LEAKS OR		

End of Asset G4-3NGDN000

**G4-3NGDN0BS BEARINGS**

No PMs for G4-3NGDN0BS

**G4-3NGDN0CD CABLE DRUM**

No PMs for G4-3NGDN0CD

**G4-3NGDN0ES ELECTRICAL SYSTEM**

No PMs for G4-3NGDN0ES

**G4-3NGDN0GR GEAR REDUCERS**

No PMs for G4-3NGDN0GR

**G4-3NGDN0GS GATE STRUCTURE**

			No PMs for G4-3NGDN0GS		
	<b>G4-3NGDN0HC</b>	<b>CABLES</b>			
			No PMs for G4-3NGDN0HC		
	<b>G4-3NGDN0HE</b>	<b>HOISTING EQUIPMENT DOWNSTREAM GATE 1</b>			
			No PMs for G4-3NGDN0HE		
	<b>G4-3NGDN0HS</b>	<b>HYDRAULIC SYSTEM</b>			
			No PMs for G4-3NGDN0HS		
	<b>G4-3NGDN0LG</b>	<b>LIFT GATE CONTROLS</b>			
			No PMs for G4-3NGDN0LG		
	<b>G4-3NGDN0MC</b>	<b>MOTOR CONTROL CENTER</b>			
			No PMs for G4-3NGDN0MC		
	<b>G4-3NGUP000</b>	<b>UPSTREAM GATE #2</b>			
19	G4-3NGUP2E	GATE: VERTICAL LIFT #2		G4-3ELECT	1 YEARS
	Next 2/2/13		Next Job G4-3NGUP2E- Use Target Start:	Y	
	G4-3NGUP2E-A	GATE: VERTICAL LIFT #2 Annual			1
		10 SAFE CLEARANCE OR SWITCHER: NAVAGATION LOCK			
		30 CHECK & TIGHTEN LIMIT SWITCH & SELSYN DRIVE			
		40 CHECK CONTROL PANEL EQUIPMENT			
		50 GATE HYDRAULIC DRIVE MOTOR			
		80 INSPECT GATE LIMIT SWITCHES			
		90 CONTROL STAND:			
		100 CHECK THRUSTER BRAKE OIL LEVEL			
		110 LUBRICATE PUMP DRIVE MOTOR BEARINGS			
20	G4-3NGUP2M	GATE: VERTICAL LIFT# 2 (UPSTREAM) -Mechanics		G4-3MECH	1 YEARS
	Next 2/2/13		Next Job G4-3NGUP2M- Use Target Start:	Y	
	G4-3NGUP2M-A	GATE: VERTICAL LIFT # 2 (UPSTREAM) - ANNUAL			1
		10 SAFE CLEARANCE:NAVIGATION LOCK			
		20 LUBRICATE SHAFT COUPLINGS, CHECK FOR EVIDENCE OF			
		30 INSPECT BRAKE, LUBE PIVOT POINTS, DRAIN THRUSTOR			
		40 REPLACE HYDRAULIC FILTERS			
		50 CHECK RELIEF VALVE SETTINGS ( 2500 PSI )			
		60 REPAIR OIL LEAKS, PIPE CONNECTIONS & SEALS			
		80 CHECK OIL LEVEL IN GEAR REDUCERS ( EP 140 )			
		90 INSPECT & DRESS CABLE AT DRUM ENDS IN BOTH TOWERS-			
		100 DOPE CABLE DRUM OPEN GEARS IN BOTH TOWERS-			
		120 CHECK GATE INDICATOR MACHINERY (MARFAK #2); LUBE			
		130 CHECK COUPLINGS FOR ALIGNMENT & LUBE			
		140 CHECK GEAR BOXES ( DORRIS ) FOR LUBE LEVEL ,CLEAN-			
		150 CHECK WINSMITH GEAR BOX; LUBE WITH EP-90			
		170 INSPECT CABLES & GREASE SHEAVES			
		180 CHECK MOUNTING BOLTS & TIGHTEN AS NEEDED			
		190 CLEAN UP AREA; USE CLEAN PAPER ON DECKS AS NEEDED			
		200 HYDRAULIC HOISTING UNIT #3 & #4			
		210 STRUCTURAL:			
		220 MECHANICAL:			
21	G4-3NGUPSHM	GATE: VERTICAL LIFT #2 SEAL HEATER -Mechanics		G4-3MECH	1 YEARS
	Next 11/1/12		Next Job G4-3NGUPSH Use Target Start:	Y	
	G4-3NGUPSHM-A	VERTICAL LIFT GATE # 2 SEAL HEATER- ANNUAL			1
		10 SAFE CLEARANCE: NAVIGATION LOCK			
		20 CHECK VALVES FOR LEAKAGE			
		30 CHECK THERMAL OIL LEVEL			
		40 CHECK PUMP DRIVE, PACKING & COUPLING AND LUBE PACKING			
		50 CLEAN & CHECK STRAINER			
		60 TAP DIRT LEGS LOCATED IN UP STREAM CROSS OVER			
		70 CHECK FLEX CONNECTORS FOR LEAKS OR DETERIORATION			
			End of Asset G4-3NGUP000		
	<b>G4-3NGUP0BS</b>	<b>BEARINGS</b>			
			No PMs for G4-3NGUP0BS		
	<b>G4-3NGUP0CD</b>	<b>CABLE DRUM</b>			

			No PMs for G4-3NGUP0CD		
	<b>G4-3NGUP0ES</b>	<b>ELECTRICAL SYSTEM</b>			
			No PMs for G4-3NGUP0ES		
	<b>G4-3NGUP0GR</b>	<b>GEAR REDUCER</b>			
			No PMs for G4-3NGUP0GR		
	<b>G4-3NGUP0GS</b>	<b>GATE STRUCTURE</b>			
			No PMs for G4-3NGUP0GS		
	<b>G4-3NGUP0HC</b>	<b>CABLES</b>			
			No PMs for G4-3NGUP0HC		
	<b>G4-3NGUP0HE</b>	<b>HOISTING EQUIPMENT UPSTREAM GATE 2</b>			
			No PMs for G4-3NGUP0HE		
	<b>G4-3NGUP0HS</b>	<b>HYDRAULIC SYSTEM</b>			
			No PMs for G4-3NGUP0HS		
	<b>G4-3NI00000</b>	<b>INFRASTRUCTURE</b>			
			No PMs for G4-3NI00000		
	<b>G4-3NIBU000</b>	<b>BUILDINGS</b>			
22	G4-3NIBUE	BUILDING: NAVLOCK Electricians		G4-3ELECT	1 YEARS
	Next 10/4/12	Next Job G4-3NIBUE-A	Use Target Start:	Y	
	G4-3NIBUE-A	BUILDING: NAVLOCK Annual			1
		20 VENTILATION			
		30 HEATING			
		40 PLUMBING			
23	G4-3NIBUM	BUILDING: NAVLOCK - Mechanics		G4-3MECH	6 MONTHS
	Next 10/4/12	Next Job G4-3NIBUM-S	Use Target Start:	Y	
	G4-3NIBUM-S	BUILDING: NAVLOCK SEMI-ANNUAL			1
		10 SAFE CLEARANCE: NAVIGATION LOCK SERVICE GALLERY			
		20 CHECK PIPING AND VALVING FOR LEAKS			
		30 CHECK PIPE HANGERS AND PIPE SUPPORTS			
		End of Asset G4-3NIBU000			
	<b>G4-3NIDF000</b>	<b>DIFFUSERS</b>			
			No PMs for G4-3NIDF000		
	<b>G4-3NIFGW00</b>	<b>FLOATING GUIDEWALL</b>			
24	G4-3NIGWE	GUIDEWALL: FLOATING NAVIGATION LOCK - UPSTREAM - Electricians		G4-3ELECT	6 MONTHS
	Next 9/1/12	Next Job G4-3NIGWE-S	Use Target Start:	Y	
	G4-3NIGWE-S	GUIDEWALL: (FLOATING) Semi Annual			1
		10 SAFE CLEARANCE: NAVIGATION LOCK (LIFE JACKETS)			
		20 CHECK 3 EACH REELITES			
		30 CHECK GROUND CABLE AND CONNECTION			
		40 CHECK POLE, STRAP AND WIND GAUGE TRANSMITTER			
		50 CHECK THE CONDITION OF RECEPTACLES			
		60 CHECK CONDITION OF LIGHT STANDARDS			
		70 CHECK CONDITION OF CABLE CONNECTIONS			
25	G4-3NIGWM	GUIDEWALL: FLOATING NAVIGATION LOCK - UPSTREAM - Mechanics		G4-3MECH	6 MONTHS
	Next 7/1/12	Next Job G4-3NIGWM-S	Use Target Start:	Y	
	G4-3NIGWM-S	GUIDEWALL: (FLOATING) SEMI-ANNUAL			1
		10 SAFE CLEARANCE: NAVIGATION LOCK (LIFE JACKETS)			
		20 CHECK AIRLINE FOR LEAKS (FLEXIBLE HOSE COUPLINGS)			
		30 CHECK OPERATION OF BUBBLE PIPES & AIR			
		40 CHECK CONDITION OF HANDRAILS, GATE & LADDER			
		50 INSPECT ANCHOR LINKAGE			
		60 CHECK THE CONDITION OF THE KEY LOCK ROLLER			
		70 CHECK WATER LEVELS IN EACH COMPARTMENT, AND PUMP			
		80 CHECK HANDWINCH			
		90 LUBE SHEAVES			

			End of Asset G4-3NIFGW00		
	<b>G4-3NIGW000</b>	<b>GUIDEWALLS</b>			
			No PMs for G4-3NIGW000		
	<b>G4-3NILC000</b>	<b>LOCK CHAMBER</b>			
			No PMs for G4-3NILC000		
	<b>G4-3NLS000</b>	<b>LOCK STRUCTURE</b>			
26	G4-3NIBCMA	BARGE CLEATS- Mechanics	G4-3MECH	1 YEARS	
	Next 5/1/13	Next Job G4-3NIBCAM	Use Target Start: Y		
	G4-3NIBCAM	BARGE CLEATS Annual		1	
		10 INSPECT COMMERCIAL BARGE CLEATS FOR			
		End of Asset G4-3NLS000			
	<b>G4-3NILT000</b>	<b>NAVLOCK LIGHTING</b>			
			No PMs for G4-3NILT000		
	<b>G4-3NIMB000</b>	<b>MOORING BITS</b>			
27	G4-3NIMBM	BIT: MOORING, FLOATING #1 - #8 - Mechanics	G4-3MECH	1 YEARS	
	Next 7/1/12	Next Job G4-3NIMBM-A	Use Target Start: Y		
	G4-3NIMBM-A	BIT: MOORING, FLOATING #1 - #8 ANNUAL		1	
		10 SAFE CLEARANCE: NAVIGATION LOCK			
		20 BIT: #1			
		30 BIT: #2			
		40 BIT: #3			
		50 BIT: #4			
		60 BIT: #5			
		70 BIT: #6			
		80 BIT: #7			
		90 BIT: #8			
		End of Asset G4-3NIMB000			
	<b>G4-3NIRO000</b>	<b>ROADWAYS</b>			
			No PMs for G4-3NIRO000		
	<b>G4-3NIWS000</b>	<b>WEATHER STATION</b>			
			No PMs for G4-3NIWS000		
	<b>G4-3NM00000</b>	<b>MISCELLANEOUS</b>			
28	G4-3NMHOISM	HOIST: NAVLOCK - Mechanics	G4-3MECH	1 YEARS	
	Next 5/1/13	Next Job G4-3NMHOISM	Use Target Start: Y		
	G4-3NMHOISM-A	HOIST: NAVLOCK (A)		1	
		5 SAFE CLEARANCE: NAVIGATION LOCK			
		10 INSPECT HOIST: #S 22226 & 22227			
		20 LUBRICATE HOIST AS NECESSARY			
		30 TEST CABLE AT 5000 LBS CAPACITY			
		40 LUBRICATE TROLLY			
		50 CHECK HOOK B 30.9			
		60 TEST TWO BLOCK			
		End of Asset G4-3NM00000			
	<b>G4-3NPLQ300</b>	<b>LQ-3 480 Volt Distribution Panel</b>			
			No PMs for G4-3NPLQ300		
	<b>G4-3NPLR300</b>	<b>LR-3 SWITCHGEAR</b>			
			No PMs for G4-3NPLR300		
	<b>G4-3NPLR500</b>	<b>LR-5 SWITCHGEAR</b>			
			No PMs for G4-3NPLR500		
	<b>G4-3NPLRS20</b>	<b>LRS-2 SWITCHGEAR</b>			
			No PMs for G4-3NPLRS20		
	<b>G4-3NS00000</b>	<b>STATION SERVICE</b>			
29	G4-3NSLQE	MOTOR CONTROL CENTERS: PANELBOARD & SUBSTATIONS - Electricians	G4-3ELECT	4 YEARS	

	Next 11/1/13	Ext 11/1/13	Next Job G4-3AFFPWG	Use Target Start	Y	
	G4-3AFFPWGE-Q	FISHWAY ATTR. PUMP 1, 2, & 3 (Q)				1
		10 SAFE CLEARANCE ELEVATION 407				
		40 VISUALLY CHECK FISHWAY BUTTERFLY FLOW VALVE				
		50 INSPECT OPERATION WHEN SHUTTING DOWN PUMP " ONLY"				
		60 CHECK ALL CONTROL SWITCHES				
		End of Asset G4-3NS00000				
	<b>G4-3NSLCQ10</b>	<b>LCQ-1 480 Volt Control Center</b>				
		No PMs for G4-3NSLCQ10				
	<b>G4-3NSLCQ20</b>	<b>LCQ-2 480 Volt Control Center</b>				
		No PMs for G4-3NSLCQ20				
	<b>G4-3NSLCQ30</b>	<b>LCQ-3 480 Volt Control Center</b>				
		No PMs for G4-3NSLCQ30				
	<b>G4-3NSLCQ40</b>	<b>LCQ-4 480 Volt Control Center</b>				
		No PMs for G4-3NSLCQ40				
	<b>G4-3NSLP000</b>	<b>4160 LOAD CENTER</b>				
		No PMs for G4-3NSLP000				
	<b>G4-3NSLQ000</b>	<b>480 LOAD CENTER</b>				
		No PMs for G4-3NSLQ000				
	<b>G4-3NSLQ100</b>	<b>LQ-1 480 Volt Distribution Panel</b>				
		No PMs for G4-3NSLQ100				
	<b>G4-3NSLQ400</b>	<b>LQ-4 480 Volt Distribution Panel</b>				
		No PMs for G4-3NSLQ400				
	<b>G4-3NSLQ500</b>	<b>LQ-5 480 Volt Distribution Panel</b>				
		No PMs for G4-3NSLQ500				
	<b>G4-3NSLR000</b>	<b>120 VOLT LOAD CENTER</b>				
		No PMs for G4-3NSLR000				
	<b>G4-3NSLR100</b>	<b>LR-1 SWITCHGEAR</b>				
		No PMs for G4-3NSLR100				
	<b>G4-3NSLR200</b>	<b>LR-2 SWITCHGEAR</b>				
		No PMs for G4-3NSLR200				
	<b>G4-3NSLR400</b>	<b>LR-4 SWITCHGEAR</b>				
		No PMs for G4-3NSLR400				
	<b>G4-3NSLRS10</b>	<b>LRS-1 SWITCHGEAR</b>				
		No PMs for G4-3NSLRS10				
	<b>G4-3NSLSP100</b>	<b>LSP1 4160 VOLT SWITCHGEAR</b>				
		No PMs for G4-3NSLSP100				
	<b>G4-3NSLSP200</b>	<b>LSP2 4160 VOLT SWITCHGEAR</b>				
		No PMs for G4-3NSLSP200				
	<b>G4-3NSLSQ10</b>	<b>LSQ-1 480-volt switchgear</b>				
		No PMs for G4-3NSLSQ10				
	<b>G4-3NSLSQ20</b>	<b>LSQ-2 480 Volt Switchgear</b>				
		No PMs for G4-3NSLSQ20				
	<b>G4-3NV00000</b>	<b>TAINTER VALVES</b>				
		No PMs for G4-3NV00000				
	<b>G4-3NVDV100</b>	<b>DRAIN VALVE #1</b>				
30	G4-3NVDZ1E	VALVE: TANTIER #1 (EMPTYING VALVE) Electricians	G4-3ELECT			1 YEARS
	Next 2/2/13	Next Job G4-3NVDZ1E-	Use Target Start	Y		

	G4-3NVDZ1E-A	VALVE: TAITNER #1 Annual		1
		10 SAFE CLEARANCE OR SWITCHER: NAVIGATION LOCK		
		20 CHECK AND ADJUST LIMIT SWITCHES AND SELSYNS		
		30 CHECK AND ADJUST PERMISSIVE SWITCHES.		
		40 CHECK OIL HEATERS AND EQUIPMENT HEATERS		
		50 CHECK GATE AND VALVE INTERLOCKS		
		60 CHECK INTERLOCK BY-PASSES		
		70 CHECK INDICATING LIGHTS AND SELSYN RECEIVERS		
		80 CHECK FLOAT SWTCH		
		90 LUBE PUMP MOTOR BEARINGS		
		100 MEGGAR MOTOR		
31	G4-3NVDZ1M-A	VALVE, TAITNER #1 (EMPTYING VALVE) - Mechanics	G4-3MECH	1 YEARS
	Next 3/1/13	Next Job G4-3NVDZ1M- Use Target Start:	Y	
	G4-3NVDZ1M-A	TAINTER VALVES 1-2		1
		10 RECORD TIME FOR ADMINISTRATIVE FUNCTIONS (AHA, HECF, CLEARANCE		
		12 INSTALL BULKHEADS AND OPEN SLUCE GATE		
		14 UNWATER		
		19 REPLACE BROKEN OR DAMAGED LUBE LINES		
		20 INSPECT LUBRICATION: FARVAL LUBE SYSTEM		
		30 VALVE TRUNNION ( 2EA ) METERED QUANTITY, USE		
		40 LOWER ROD PIN : METERED QUANTITY,USE		
		50 CROSSHEAD PIN : METERED QUANTITY, USE		
		60 CROSSHEADS GUIDES ( 2EA ) METERED QUANTITY, USE		
		70 PUSH ROD GUIDE: AS NEEDED QUANTITY, USE		
		80 INDICATOR SYSTEM: ( USE BUTTON HEAD FITTINGS ) USE		
		90 ROLLER CHAIN , IDLER SHAFT UPPER & IDLER SHAFT -		
		100 REDUCER: USE EP150 ; CHECK OIL LEVEL		
		110 REDUCER : DRIVE SHAFT PILLOW BLOCKS & SPROCKETS		
		111 LUBRICATE SHAFT COUPLING AND CHECK ALIGNMENT		
		120 HYDRAULIC PUMP SYSTEM: USE TEXACO REGAL OIL -		
		121 CHECK HYDRAULIC FLUID LEVEL (R&O 32)		
		131 REPAIR OIL LEAKS.		
		221 DURING UNWATERING PERIOD		
		222 LUBE INDICATOR ASSEMBLY GUIDES AND CHAIN		
		223 TIGHTEN MACHINERY MOUNTING BOLTS		
		240 CLEAN CYLINDER PIT AND DRAIN		
		241 TIGHTEN CYLINDER MOUNTING BOLTS		
		242 VENT AIR FROM HYDRAULIC CYLINDERS		
		250 CLEAN UP MACHINERY ROOM		
		260 REPLACE FILTER CARTRIDGES		
		270 CHECK FLEXIBLE HOSES FOR DAMAGE		
		275 CHECK VALVES FOR CRACKED WELDS AT POINT OF		
		280 CHECK FOR VALVE DRIFT. ADJUST AS NECESSARY		
		290 CHECK ADJUSTMENT OF RELIEF VALVES		
		300 CHECK VALVE OPENING & CLOSING SPEED;		
		310 TAKE OIL SAMPLES		
		320 TAP TRUNNION MOUNTING BOLTS TO CHECK FOR BROKEN OR		
		330 CHECK SEALS FOR DAMAGE & REPLACE IF NEEDED		
		340 CHECK SEAL KEEPER BOLTS FOR LOOSE OR BROKEN BOLTS.		
		350 CHECK OPERATING ROD GUIDE MOUNTING BOLTS & BEARING		
		360 CHECK & TIGHTEN INDICATOR ROD ATTACHMENTS		
		370 CHECK OPERATOR ROD & INDICATOR ROD PACKING		
		380 INSPECT LINER & TRANSITION PLATES FOR CAVITATION		
		390 CHECK CULVERTS & LATERIALS FOR CAVITATION & DEBRIS		
		400 INSTALL UPSTREAM & DOWNSTREAM BULKHEADS		
		410 INSPECT INDICATOR ROD BRACKET, INDICATOR ROD PIN,		
		420 CLOSE SLUCE GATE AND WATER UP		
		430 REMOVE BULK HEADS		
		End of Asset G4-3NVDV100		
	<b>G4-3NVDV1HC</b>	<b>HYDRAULIC CYL</b>		
		No PMs for G4-3NVDV1HC		
	<b>G4-3NVDV1TV</b>	<b>TAINTER VALVE #1</b>		
		No PMs for G4-3NVDV1TV		
	<b>G4-3NVDV200</b>	<b>DRAIN VALVE #2</b>		
32	G4-3NVDZ2E	VALVE: TAITNER #2 (EMPTYING VALVE) Electricians	G4-3ELECT	1 YEARS

	Next	2/2/13	Next Job	G4-3NVDZ2E- Use Target Start	Y	
		G4-3NVDZ2E-A		VALVE: TAINTER #2 (EMPTY. VALVE) Annual		1
		10		SAFE CLEARANCE: NAVIGATION LOCK		
		20		CHECK AND ADJUST LIMIT SWITCHES AND SELSYNS		
		30		CHECK AND ADJUST PERMISSIVE SWITCHES.		
		40		CHECK OIL HEATERS AND EQUIPMENT HEATERS		
		50		CHECK GATE AND VALVE INTERLOCKS		
		60		CHECK INTERLOCK BY-PASSES		
		70		CHECK INDICATING LIGHTS AND SELSYN RECEIVERS		
		80		CHECK FLOAT SWMCH		
		90		LUBE PUMP MOTOR BEARINGS		
		100		MEGGAR MOTOR		
33		G4-3NVDZ2M-A		VALVE, TAINTER #2 ( EMPTYING VALVE) - Mechanics	G4-3MECH	1 YEARS
	Next	3/1/13	Next Job	G4-3NVDZ1M- Use Target Start	Y	
		G4-3NVDZ1M-A		TAINTER VALVES 1-2		1
		10		RECORD TIME FOR ADMINISTRATIVE FUNCTIONS (AHA, HECF, CLEARANCE		
		12		INSTALL BULKHEADS AND OPEN SLUCE GATE		
		14		UNWATER		
		19		REPLACE BROKEN OR DAMAGED LUBE LINES		
		20		INSPECT LUBRICATION: FARVAL LUBE SYSTEM		
		30		VALVE TRUNNION ( 2EA ) METERED QUANTITY, USE		
		40		LOWER ROD PIN : METERED QUANTITY,USE		
		50		CROSSHEAD PIN : METERED QUANTITY, USE		
		60		CROSSHEADS GUIDES ( 2EA ) METERED QUANTITY, USE		
		70		PUSH ROD GUIDE: AS NEEDED QUANTITY, USE		
		80		INDICATOR SYSTEM: ( USE BUTTON HEAD FITTINGS ) USE		
		90		ROLLER CHAIN , IDLER SHAFT UPPER & IDLER SHAFT -		
		100		REDUCER: USE EP150 ; CHECK OIL LEVEL		
		110		REDUCER : DRIVE SHAFT PILLOW BLOCKS & SPROCKETS		
		111		LUBRICATE SHAFT COUPLING AND CHECK ALIGNMENT		
		120		HYDRAULIC PUMP SYSTEM: USE TEXACO REGAL OIL -		
		121		CHECK HYDRAULIC FLUID LEVEL (R&O 32)		
		131		REPAIR OIL LEAKS.		
		221		DURING UNWATERING PERIOD		
		222		LUBE INDICATOR ASSEMBLY GUIDES AND CHAIN		
		223		TIGHTEN MACHINERY MOUNTING BOLTS		
		240		CLEAN CYLINDER PIT AND DRAIN		
		241		TIGHTEN CYLINDER MOUNTING BOLTS		
		242		VENT AIR FROM HYDRAULIC CYLINDERS		
		250		CLEAN UP MACHINERY ROOM		
		260		REPLACE FILTER CARTRIDGES		
		270		CHECK FLEXIBLE HOSES FOR DAMAGE		
		275		CHECK VALVES FOR CRACKED WELDS AT POINT OF		
		280		CHECK FOR VALVE DRIFT. ADJUST AS NECESSARY		
		290		CHECK ADJUSTMENT OF RELIEF VALVES		
		300		CHECK VALVE OPENING & CLOSING SPEED;		
		310		TAKE OIL SAMPLES		
		320		TAP TRUNNION MOUNTING BOLTS TO CHECK FOR BROKEN OR		
		330		CHECK SEALS FOR DAMAGE & REPLACE IF NEEDED		
		340		CHECK SEAL KEEPER BOLTS FOR LOOSE OR BROKEN BOLTS.		
		350		CHECK OPERATING ROD GUIDE MOUNTING BOLTS & BEARING		
		360		CHECK & TIGHTEN INDICATOR ROD ATTACHMENTS		
		370		CHECK OPERATOR ROD & INDICATOR ROD PACKING		
		380		INSPECT LINER & TRANSITION PLATES FOR CAVITATION		
		390		CHECK CULVERTS & LATERIALS FOR CAVITATION & DEBRIS		
		400		INSTALL UPSTREAM & DOWNSTREAM BULKHEADS		
		410		INSPECT INDICATOR ROD BRACKET, INDICATOR ROD PIN,		
		420		CLOSE SLUCE GATE AND WATER UP		
		430		REMOVE BULK HEADS		

End of Asset G4-3NVDV200

**G4-3NVDV2HC HYDRUALIC CYL**

No PMs for G4-3NVDV2HC

**G4-3NVDV2HU HYDRUALIC UNIT**

No PMs for G4-3NVDV2HU

**G4-3NVDV2TV TAINTER VALVE #2**

			No PMs for G4-3NVDV2TV		
	<b>G4-3NVDVC00</b>	<b>DRAIN VALVE CONTROLS</b>			
			No PMs for G4-3NVDVC00		
	<b>G4-3NVDVLS1</b>	<b>AUTO LUBE SYS</b>			
			No PMs for G4-3NVDVLS1		
	<b>G4-3NVDVLS2</b>	<b>AUTO LUBE SYS</b>			
			No PMs for G4-3NVDVLS2		
	<b>G4-3NVDZ000</b>	<b>DRAIN VALVES</b>			
			No PMs for G4-3NVDZ000		
	<b>G4-3NVDZ0HD</b>	<b>HYDRAULIC UNIT</b>			
			No PMs for G4-3NVDZ0HD		
	<b>G4-3NVFV300</b>	<b>FILL VALVLE #3</b>			
34	G4-3NVFZ3E	VALVE: TAINTER #3 (FILLING VALVE) Electricians	G4-3ELECT	1	YEARS
	Next 2/2/13	Next Job G4-3NVFZ3E- Use Target Start:	Y		
	G4-3NVFZ3E-A	VALVE: TAINTER #3 FILL VALVE Annual		1	
		10 SAFE CLEARANCE:NAVIGATION LOCK			
		20 INDICATING ROD ASSEMBLY			
		30 PERMISSIVE SWTCHES			
		40 CHECK OIL HEATERS AND EQUIPMENT HEATERS			
		50 CHECK GATE AND VALVE INTERLOCKS			
		60 CHECK INTERLOCK BY-PASSES			
		70 CONTROL STANDS:			
		80 CHECK FLOAT SWTCH.			
		90 LUBE PUMP MOTOR BEARINGS			
35	G4-3NVFZ3M	VALVE: TAINTER #3 (FILLING VALVE) Mechanics	G4-3MECH	1	YEARS
	Next 3/1/13	Next Job G4-3NVFZ3M- Use Target Start:	Y		
	G4-3NVFZ3M-2	TAINTER # 3 (A)		1	
		10 SAFE CLEARANCE:NAVIGATION LOCK			
		20 LUBRICATION: FARVAL LUBE SYSTEM, FOLLOW INST-			
		30 VALVE TRUNNION ( 2EA ) METERED QUANTITY, USE			
		40 LOWER ROD PIN : METERED QUANTITY,USE			
		50 CROSSHEAD PIN : METERED QUANTITY, USE			
		60 CROSSHEADS GUIDES : METERED QUANTITY, USE			
		70 PUSH ROD GUIDE: AS NEEDED QUANTITY, USE			
		80 INDICATOR SYSTEM: ( USE BUTTON HEAD FITTINGS ) USE			
		90 ROLLER CHAIN , IDLER SHAFT UPPER & IDLER SHAFT -			
		100 REDUCER: USE MEROPA 3 ; CHECK OIL LEVEL			
		110 REDUCER : DRIVE SHAFT PILLOW BLOCKS & SPROCKETS			
		120 HYDRAULIC PUMP SYSTEM: USE TEXACO REGAL OIL -			
		130 CHECK HYDRAULIC FLUID LEVEL (R&O 32)			
		140 REPLACE FILTER CARTRIDGES			
		150 CHECK FLEXIBLE HOSES FOR DAMAGE			
		160 CHECK FOR VALVE DRIFT. ADJUST AS NECESSARY			
		170 CLEAN UP MACHINERY ROOM			
		180 REPLACE BROKEN OR DAMAGED LUBE LINES			
		190 DURING UNWATERING PERIOD			
		200 LUBE INDICATOR ASSEMBLY GUIDES AND CHAIN			
		210 CHECK ADJUSTMENT OF RELIEF VALVES			
		220 CHECK VALVE OPENING AND CLOSING SPEED			
		221 CHECK VALVES FOR CRACKED WELDS AT			
		230 REPAIR OIL LEAKS			
		231 TAKE OIL SAMPLE			
		240 TIGHTEN MACHINERY MOUNTING BOLTS			
		241 TAP TRUNNION MOUNTING BOLTS TO CHECK FOR BROKEN OR			
		250 LUBRICATE SHAFT COUPLINGS AND CHECK ALIGNMENT			
		260 CLEAN CYLINDER PIT AND DRAIN			
		270 TIGHTEN CYLINDER MOUNTING BOLTS			
		280 VENT AIR FROM HYDRAULIC CYLINDERS			
		290 CHECK SEALS FOR DAMAGE AND REPLACE IF NEEDED			
		291 CHECK SEAL KEEPER BOLTS FOR LOOSE OR BROKEN BOLTS			
		300 CHECK OPERATING ROD GUIDE MOUNTING BOLTS			
		310 CHECK AND TIGHTEN INDICATOR ROD ATTACHMENT			

- 311 CHECK OPERATING ROD AND INDICATOR ROD PACKING
- 312 INSPECT INDICATOR ROD BRACKET, INDICATOR ROD PIN,
- 320 INSPECT LINER AND TRANSITION PLATES FOR CAVITATION
- 321 INSPECT CULVERTS AND LATERALS FOR CAVITATION
- 330 INSTALL UPSTREAM AND DOWNSTREAM BULKHEADS

End of Asset G4-3NVFV300

**G4-3NVFV3HC HYDRAULIC CYL**

No PMs for G4-3NVFV3HC

**G4-3NVFV3HU HYDRAULIC UNIT**

No PMs for G4-3NVFV3HU

**G4-3NVFV3TV TANTER VALVE #3**

No PMs for G4-3NVFV3TV

**G4-3NVFV400 FILL VALVE #4**

36	G4-3NVFZ4E	VALVE: TANTER #4 (FILLING VALVE) Electricians	G4-3ELECT	1 YEARS
	Next 2/2/13	Next Job G4-3NVFZ4E- Use Target Start:	Y	
	G4-3NVFZ4E-A	VALVE: TANTER #4 FILL VALVE Annual		1
		10 SAFE CLEARANCE:NAVIGATION LOCK		
		20 INDICATING ROD ASSEMBLY		
		30 PERMISSIVE SWITCHES		
		40 CHECK OIL HEATERS AND EQUIPMENT HEATERS		
		50 CHECK GATE AND VALVE INTERLOCKS		
		60 CHECK INTERLOCK BY-PASSES		
		70 CONTROL STANDS:		
		80 CHECK FLOAT SWITCH.		
		90 LUBE PUMP MOTOR BEARINGS		
37	G4-3NVFZ4M	VALVE: TANTER #4 (FILLING VALVE) - Mechanics	G4-3MECH	1 YEARS
	Next 2/2/13	Next Job G4-3NVFZ4M- Use Target Start:	Y	
	G4-3NVFZ4M-2	TANTER # 4 (A)		1
		10 SAFE CLEARANCE NAVIGATION LOCK		
		20 LUBRICATION: FARVAL LUBE SYSTEM, FOLLOW INST-		
		30 VALVE TRUNNION ( 2EA ) METERED QUANTITY, USE		
		40 LOWER ROD PIN : METERED QUANTITY, USE		
		50 CROSSHEAD PIN : METERED QUANTITY, USE		
		60 CROSSHEADS GUIDES : METERED QUANTITY, USE		
		70 PUSH ROD GUIDE: AS NEEDED QUANTITY, USE		
		80 INDICATOR SYSTEM: ( USE BUTTON HEAD FITTINGS ) USE		
		90 ROLLER CHAIN , IDLER SHAFT UPPER & IDLER SHAFT -		
		100 REDUCER: USE CHEVRON GEAR COMPOUND EP ISO 150 ; CHECK OIL LEVEL		
		110 REDUCER : DRIVE SHAFT PELLOW BLOCKS & SPROCKETS		
		120 HYDRAULIC PUMP SYSTEM: USE R&O 32		
		130 CHECK HYDRAULIC FLUID LEVEL (R&O 32)		
		140 REPLACE FILTER CARTRIDGES		
		150 CHECK FLEXIBLE HOSES FOR DAMAGE		
		160 CHECK FOR VALVE DRIFT. ADJUST AS NECESSARY		
		170 CLEAN UP MACHINERY ROOM		
		180 REPLACE BROKEN OR DAMAGED LUBE LINES		
		DURING UNWATERING PERIOD		
		200 LUBE INDICATOR ASSEMBLY GUIDES AND CHAIN		
		210 CHECK ADJUSTMENT OF RELIEF VALVES		
		220 CHECK VALVE OPENING AND CLOSING SPEED		
		221 CHECK VALVES FOR CRACKED WELDS AT		
		230 REPAIR OIL LEAKS		
		231 TEST OIL WITH PORTABLE PARTICLE COUNTER		
		240 TIGHTEN MACHINERY MOUNTING BOLTS		
		241 TAP TRUNNION MOUNTING BOLTS TO CHECK FOR BROKEN OR		
		250 LUBRICATE SHAFT COUPLINGS AND CHECK ALIGNMENT		
		260 CLEAN CYLINDER PIT AND DRAIN		
		270 TIGHTEN CYLINDER MOUNTING BOLTS		
		280 VENT AIR FROM HYDRAULIC CYLINDERS		
		290 CHECK SEALS FOR DAMAGE AND REPLACE IF NEEDED		
		291 CHECK SEAL KEEPER BOLTS FOR LOOSE OR BROKEN BOLTS		
		300 CHECK OPERATING ROD GUIDE MOUNTING BOLTS		
		310 CHECK AND TIGHTEN INDICATOR ROD ATTACHMENT		
		311 CHECK OPERATING ROD AND INDICATOR ROD PACKING		

- 312 INSPECT INDICATOR ROD BRACKET, INDICATOR ROD PIN,
- 320 INSPECT LINER AND TRANSITION PLATES FOR CAVITATION
- 321 INSPECT CULVERTS AND LATERALS FOR CAVITATION
- 330 INSTALL UPSTREAM AND DOWNSTREAM BULKHEADS

End of Asset G4-3NVFV400

**G4-3NVFV4HC HYDRAULIC CYL**

No PMs for G4-3NVFV4HC

**G4-3NVFV4HU HYDRAULIC UNIT**

No PMs for G4-3NVFV4HU

**G4-3NVFV4TV TAINTER VALVE #4**

No PMs for G4-3NVFV4TV

**G4-3NVFVC00 FILL VALVE CONTROLS**

No PMs for G4-3NVFVC00

**G4-3NVFVLS3 AUTO LUBE SYSTEM**

No PMs for G4-3NVFVLS3

**G4-3NVFVLS4 AUTO LUBE SYS**

No PMs for G4-3NVFVLS4

**G4-3NVFZ000 FILL VALVES #3 & 4**

No PMs for G4-3NVFZ000

**G4-3NW00000 DRAINAGE & UNWATERING SYSTEM**

No PMs for G4-3NW00000

**G4-3NWP1000 UNWATERING PUMP #1**

38	G4-3NWPLUE	PUMP 1 LOCK UNWATERING - Electricians	G4-3ELECT	6 MONTHS
	Next 7/1/12	Next Job G4-3NWPLUE Use Target Start:	Y	
	G4-3NWPLUE-A	PUMP 1&2: LOCK UNWATERING Annual		1
		10 SAFE CLEARANCE:NAVIGATION LOCK		
		20 CHECK CONTROLS		
		30 CLEAN AND CHECK BREAKER		
		40 CHECK BEARING OIL LEVEL		
		60 LUBRICATE BREAKER		
		70 GIVE RUNNING INSPECTION		
		80 CHECK BY HAND TOUCHING MOTOR FRAME ASSURE MOTOR HEATER IS WO		

39	G4-3NWPLUM	PUMP 1 LOCK UNWATERING - Mechanics	G4-3MECH	6 MONTHS
	Next 7/1/12	Next Job G4-3NWPU1M Use Target Start:	Y	
	G4-3NWPU1M-A	PUMPS 1-5 : LOCK UNWATERING ANNUAL		2
		10 SAFE CLEARANCE:NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30 FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40 CHECK COUPLING AND MOUNTING BOLTS		
		50 CHECK REVERSE RATCHET MECHANISM FOR WEAR		
	G4-3NWPU1M-S	PUMPS 1-5 LOCK UNWATERING SEMI-ANNUAL		1
		10 SAFE CLEARANCE: NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30 FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40 CHECK COUPLING AND MOUNTING BOLTS		
		50 CHECK REVERSE RATCHET MECHANISM FOR WEAR		

End of Asset G4-3NWP1000

**G4-3NWP1MC0 MOTOR CONTROLLER**

No PMs for G4-3NWP1MC0

**G4-3NWP2000 UNWATERING PUMP #2**

40	G4-3NWPLU2M	PUMP 2 LOCK UNWATERING - Mechanics	G4-3MECH	6 MONTHS
	Next 7/1/12	Next Job G4-3NWPU1M Use Target Start:	Y	
	G4-3NWPU1M-A	PUMPS 1-5 : LOCK UNWATERING ANNUAL		2
		10 SAFE CLEARANCE:NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		

		30	FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40	CHECK COUPLING AND MOUNTING BOLTS		
		50	CHECK REVERSE RATCHET MECHANISM FOR WEAR		
	G4-3NWPU1M-S		PUMPS 1-5 LOCK UNWATERING SEMI-ANNUAL		1
		10	SAFE CLEARANCE: NAVIGATION LOCK		
		20	GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30	FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40	CHECK COUPLING AND MOUNTING BOLTS		
		50	CHECK REVERSE RATCHET MECHANISM FOR WEAR		
41	G4-3NWPLUE2		PUMP 2 LOCK UNWATERING - Electricians	G4-3ELECT	6 MONTHS
	Next 7/1/12		Next Job G4-3NWPLUE Use Target Start: Y		
	G4-3NWPLUE-A		PUMP 1&2: LOCK UNWATERING Annual		1
		10	SAFE CLEARANCE:NAVIGATION LOCK		
		20	CHECK CONTROLS		
		30	CLEAN AND CHECK BREAKER		
		40	CHECK BEARING OIL LEVEL		
		60	LUBRICATE BREAKER		
		70	GIVE RUNNING INSPECTION		
		80	CHECK BY HAND TOUCHING MOTOR FRAME ASSURE MOTOR HEATER IS WO		
			End of Asset G4-3NWP2000		

**G4-3NWP2MC0 MOTOR CONTROLLER**

No PMs for G4-3NWP2MC0

**G4-3NWP3000 UNWATERING PUMP #3**

42	G4-3NWPD3E		PUMP #3: LOCK UNWATERING - Electricians	G4-3ELECT	6 MONTHS
	Next 7/1/12		Next Job G4-3NWPU3E Use Target Start: Y		
	G4-3NWPU3E-A		PUMP: #3 DRAINAGE Annual		1
		10	SAFE CLEARANCE: NAVIGATION LOCK (RIVER SIDE)		
		20	CHECK CONTROLS		
		30	CLEAN AND CHECK BREAKER		
		70	GIVE RUNNING INSPECTION		
		80	MEGGAR MOTOR		
		90	CURRENT READING		
43	G4-3NWPD3M		PUMP #3: LOCK UNWATERING - Mechanics	G4-3MECH	6 MONTHS
	Next 10/4/12		Next Job G4-3NWPU3M Use Target Start: Y		
	G4-3NWPU3M-S		PUMP: #3 DRAINAGE SEMI-ANNUAL		1
		10	SAFE CLEARANCE: NAVIGATION LOCK (RIVER SIDE)		
		20	GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30	INSPECT GLAND LEAK OFF		
		40	CHECK COUPLING AND MOUNTING BOLTS		
		50	FILL PACKING WATER PIPE FOR COOLING THE PACKING		
		60	CHECK SHAFT PACKING		
		70	CLEAN, INSPECT, AND REPAIR ANY LEAKS		
		80	INPECT WATER DISCHARGE		
44	G4-3NWPLU3M		PUMP 3 LOCK UNWATERING - Mechanics	G4-3MECH	6 MONTHS
	Next 7/1/12		Next Job G4-3NWPU1M Use Target Start: Y		
	G4-3NWPU1M-A		PUMPS 1-5 : LOCK UNWATERING ANNUAL		2
		10	SAFE CLEARANCE:NAVIGATION LOCK		
		20	GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30	FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40	CHECK COUPLING AND MOUNTING BOLTS		
		50	CHECK REVERSE RATCHET MECHANISM FOR WEAR		
	G4-3NWPU1M-S		PUMPS 1-5 LOCK UNWATERING SEMI-ANNUAL		1
		10	SAFE CLEARANCE: NAVIGATION LOCK		
		20	GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30	FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40	CHECK COUPLING AND MOUNTING BOLTS		
		50	CHECK REVERSE RATCHET MECHANISM FOR WEAR		
			End of Asset G4-3NWP3000		

**G4-3NWP3MC0 MOTOR CONTROLLER**

No PMs for G4-3NWP3MC0

**G4-3NWP4000 TANTIER VALVE UW PUMP #4**

45	G4-3NWPLU4M	PUMP 4 LOCK UNWATERING - Mechanics	G4-3MECH	6 MONTHS
	Next 7/1/12	Next Job G4-3NWPU1M	Use Target Start: Y	
	G4-3NWPU1M-A	PUMPS 1-5 : LOCK UNWATERING ANNUAL		2
		10 SAFE CLEARANCE:NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30 FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40 CHECK COUPLING AND MOUNTING BOLTS		
		50 CHECK REVERSE RATCHET MECHANISM FOR WEAR		
	G4-3NWPU1M-S	PUMPS 1-5 LOCK UNWATERING SEMI-ANNUAL		1
		10 SAFE CLEARANCE: NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30 FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40 CHECK COUPLING AND MOUNTING BOLTS		
		50 CHECK REVERSE RATCHET MECHANISM FOR WEAR		
46	G4-3NWPUTE	PUMP 4 LOCK UNWATERING - Electricians	G4-3ELECT	1 YEARS
	Next 1/1/13	Next Job G4-3NWPUTE	Use Target Start: Y	
	G4-3NWPUTE-S	PUMP 4 & 5: LOCK UNWATERING Annual		1
		10 OBTAIN SAFE CLEARANCE OR SWITCHER NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		40 MEGGER THE MOTOR WINDING AND RECORD		
		50 CHECK MOTOR STARTERS		
		60 CHECK MOTOR RUNNING CURRENT. MOTOR PROTECTOR BY OVERLOADS AT		

End of Asset G4-3NWP4000

**G4-3NWP4MC0 MOTOR CONTROLLER**

No PMs for G4-3NWP4MC0

**G4-3NWP5000 TANTER VALVE UW PUMP #5**

47	G4-3NWPLU5M	PUMP 5 LOCK UNWATERING - Mechanics	G4-3MECH	6 MONTHS
	Next 7/1/12	Next Job G4-3NWPU1M	Use Target Start: Y	
	G4-3NWPU1M-A	PUMPS 1-5 : LOCK UNWATERING ANNUAL		2
		10 SAFE CLEARANCE:NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30 FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40 CHECK COUPLING AND MOUNTING BOLTS		
		50 CHECK REVERSE RATCHET MECHANISM FOR WEAR		
	G4-3NWPU1M-S	PUMPS 1-5 LOCK UNWATERING SEMI-ANNUAL		1
		10 SAFE CLEARANCE: NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		30 FILL PUMP SHAFT LUBRICATOR WITH DTE OIL. CLEAN		
		40 CHECK COUPLING AND MOUNTING BOLTS		
		50 CHECK REVERSE RATCHET MECHANISM FOR WEAR		

End of Asset G4-3NWP5000

**G4-3NWP5MC0 MOTOR CONTROLLER**

No PMs for G4-3NWP5MC0

**G4-3NWPU000 PUMPS**

48	G4-3NWPUTE-5	PUMP 5 LOCK UNWATERING- Electricians	G4-3ELECT	1 YEARS
	Next 4/1/12	Ext 4/1/13	Next Job G4-3NWPUTE	Use Target Start: Y
	G4-3NWPUTE-S	PUMP 4 & 5: LOCK UNWATERING Annual		1
		10 OBTAIN SAFE CLEARANCE OR SWITCHER NAVIGATION LOCK		
		20 GIVE RUNNING INSPECTION, LISTEN FOR NOISE, WATCH		
		40 MEGGER THE MOTOR WINDING AND RECORD		
		50 CHECK MOTOR STARTERS		
		60 CHECK MOTOR RUNNING CURRENT. MOTOR PROTECTOR BY OVERLOADS AT		

End of Asset G4-3NWPU000

**G4-3NX00000 COMPRESSED AIR SYSTEM**

No PMs for G4-3NX00000

**G4-3NXAC1MC MOTOR CONTROLLER**

No PMs for G4-3NXAC1MC

**G4-3NXAC2MC MOTOR CONTROLLER**

			No PMs for G4-3NXAC2MC		
<b>G4-3NXAC3MC</b>	<b>MOTOR CONTROLLER</b>				
			No PMs for G4-3NXAC3MC		
<b>G4-3NXBU000</b>	<b>BUBBLERS</b>				
			No PMs for G4-3NXBU000		
<b>G4-3NXEL000</b>	<b>NORTH ELEVATOR</b>				
			No PMs for G4-3NXEL000		
<b>G4-3NXELS00</b>	<b>SOUTH ELEVATOR</b>				
			No PMs for G4-3NXELS00		
<b>G4-3NXFS000</b>	<b>FIRE SYSTEMS</b>				
48	G4-3NMDWM	WATER: DECK WASH - Mechanics		G4-3MECH	1 YEARS
	Next 4/1/13		Next Job G4-3NMDWM- Use Target Start:	Y	
	G4-3NMDWM-A	WATER : DECK WASH - ANNUAL			1
		10 SAFE CLEARANCE: NAVIGATION LOCK			
		20 INSPECT ALL PIPING & VALVING FOR LEAKS IN THE			
		30 CHECK ALL PIPE HANGERS MOUNTING BOLTS, TIGHTEN			
		40 CHECK FIRE HOSE & PIPE STANDARDS			
50	G4-3NXFSFP7E	FIRE PROTECTION: FIRE PUMPS #7 - Electricians		G4-3ELECT	6 MONTHS
	Next 11/1/12		Next Job G4-3NXFSFP7E Use Target Start:	Y	
	G4-3NXFSFP7E-A	FIRE PROTECTION: FIRE PUMPS Semi Annual			2
		10 SAFE CLEARANCE OR SWITCHER NAVIGATION LOCK			
		20 PUMP: FIRE PROTECTION			
	G4-3NXFSFP7E-S	FIRE PROTECTION: FIRE PUMPS Semi Annual			1
		10 SAFE CLEARANCE NAVIGATION LOCK			
		20 PUMP: FIRE PROTECTION			
51	G4-3NXFSFP7M	FIRE PROTECTION: FIRE PUMPS #7 - Mechanics		G4-3MECH	6 MONTHS
	Next 10/20/12		Next Job G4-3NXFSFP6M Use Target Start:	Y	
	G4-3NXFSFP6M-A	FIRE PROTECTION: FIRE PUMPS Annual			2
		10 RECORD TIME FOR ADMINISTRATIVE FUNCTIONS (AHA HECP, CLEARENACE E			
		15 MEGGAR MOTOR			
		20 CHECK WATER SYSTEM:			
		30 PUMP: FIRE PROTECTION			
		40 FIRE HOSE AND PIPE STANDARDS			
		50 OPEN VALVES TEST HOSE			
		60 CHECK MOTOR RUNNING CURRNET			
	G4-3NXFSFP6M-S	FIRE PROTECTION: FIRE PUMPS - S -			1
		10 SAFE CLEARANCE NAVIGATION LOCK			
		20 PUMP: #6 & #7 FIRE PROTECTION			
52	G4-3NXFSFPE	FIRE PROTECTION: FIRE PUMPS #6 - Electricians		G4-3ELECT	6 MONTHS
	Next 9/1/12		Next Job G4-3NXFSFP7E Use Target Start:	Y	
	G4-3NXFSFP7E-A	FIRE PROTECTION: FIRE PUMPS Semi Annual			2
		10 SAFE CLEARANCE OR SWITCHER NAVIGATION LOCK			
		20 PUMP: FIRE PROTECTION			
	G4-3NXFSFP7E-S	FIRE PROTECTION: FIRE PUMPS Semi Annual			1
		10 SAFE CLEARANCE NAVIGATION LOCK			
		20 PUMP: FIRE PROTECTION			
53	G4-3NXFSFPM	FIRE PROTECTION: FIRE PUMPS #6 - Mechanics		G4-3MECH	6 MONTHS
	Next 10/4/12		Next Job G4-3NXFSFP6M Use Target Start:	Y	
	G4-3NXFSFP6M-A	FIRE PROTECTION: FIRE PUMPS Annual			2
		10 RECORD TIME FOR ADMINISTRATIVE FUNCTIONS (AHA HECP, CLEARENACE E			
		15 MEGGAR MOTOR			
		20 CHECK WATER SYSTEM:			
		30 PUMP: FIRE PROTECTION			
		40 FIRE HOSE AND PIPE STANDARDS			
		50 OPEN VALVES TEST HOSE			
		60 CHECK MOTOR RUNNING CURRNET			
	G4-3NXFSFP6M-S	FIRE PROTECTION: FIRE PUMPS - S -			1
		10 SAFE CLEARANCE NAVIGATION LOCK			
		20 PUMP: #6 & #7 FIRE PROTECTION			

54	G4-3NXFSM	FIRE HOSE CABINET - Mechanics	G4-3MECH	6 MONTHS
	Next	7/1/12	Next Job	G4-3NXFSM-A Use Target Start: Y
	D t	G4-3NXFSM-3	FIRE HOSE CABINET <sup>P</sup> (3 Y)	6
		5	NAVIGATION LOCK:	
		10	INSPECT NOZZLES, HOSE, AND PLUG WRENCH AND CABINET	
		20	INSPECT HOSES AND PRESSURE TEST	
		30	CHECK PIPING FOR LEAKS	
		40	CLEAN UP AREA AND INSIDE OF CABINET	
		50	PAINT CABINET	
	G4-3NXFSM-A	FIRE HOSE CABINET- (A)		2
		5	NAVIGATION LOCK:	
		10	INSPECT NOZZLES, HOSE AND CABINET	
		20	INSPECT HOSES AND PRESSURE TEST	
		30	CHECK PIPING FOR LEAKS	
		40	CLEAN UP AREA AND INSIDE OF CABINET	
	G4-3NXFSM-S	FIRE HOSE CABINET		1
		5	NAVIGATION LOCK:	
		10	INSPECT NOZZLES, HOSE AND CABINET	

End of Asset G4-3NXFS000

**G4-3NXFSP10 FIRE PUMP #1**

No PMs for G4-3NXFSP10

**G4-3NXFSP20 FIRE PUMP #2**

No PMs for G4-3NXFSP20

This report pulls all Asset records in Operating status for the Site ID and USACE Org Code specified in the parameters along with all active Preventative Maintenance records (schedules) linked to the Assets and their related Job Plans.

The Frequency and Unit fields indicate how often the PM schedule runs. Sequence indicates which Job Plan will be used every *n* times the PM runs. For further explanation, see your Site or District FEM POC, or consult the FEM PM Guide on the FEM SharePoint site.

Database fields used (Table.Field):

ASSET.ASSETNUM, ASSET.DESCRPTION, PM.PMNUM, PM.DESCRPTION, PM.FREQUENCY, PM.FREQUNIT, PM.CREWID, PM.NEXTDATE, PM.EXTDATE, PM.JPNUM, PM.USETARGETDATE, PMMETER.METERNAME, PMMETER.FREQUENCY, PMSEQUENCE.JPNUM, PMSEQUENCE.INTERVAL, JOBPLAN.DESCRPTION

### D.3. New Cumberland Lock and Dam

#### PM & Jobplan Listing by Asset w/tasks

See the last page for field explanations  
District: LRP

ASSET	PM	CREW	FREQUENCY
JOB PLAN		SEQUENCE	
<b>Pittsburgh , Ops Division Site -- Location: LRPO-LON-L - New</b>			
<b>H4LONL</b>	<b>LON Lock</b>		
1	H4LON%9970 Next 10/3/12	Greasing Rack & Sector Gears MPG2-Q Next Job Plan: H4LON30366	H4LON-MC 3 MONTHS
	H4LON30366	Greasing Rack and Sector Gears with MPG2	Use Target Y 1
	<u>10</u>	See Long Discription 1. Grease all teeth on Rack and Sector gears 2. Inspect all teeth and Machinery for wear	
2	H4LON7762 Next 7/25/12	Hydraulic Pumps-M Next Job Plan: H4LON24242	H4LON-MC 1 MONTHS
	H4LON24242	Hydraulic Pumps -M	Use Target Y 1
	<u>10</u>	see long description 1. Inspect mounting bolts, all piping and valves adjacent to pump. 2. Observe operation of pump and motor during lockage. 3. Inspect for oil leaks.	
3	H4LON7823 Next 9/9/12	Floating Mooring Pins 600'-SA Next Job Plan: H4LON24363	H4LON-MC 6 MONTHS
	H4LON24363	Floating Mooring Pins	Use Target Y 1
	<u>10</u>	see long description Inspect mooring bitt to see that no binding is occurring in the moving parts Under load. No lubrication is needed.  One mooring bitt will be dewatered and inspected for corrosion or pitting on the exterior. The magnesium anodes will be inspected for deterioration. If corrosion or pitting is found dewatered two more bitts and inspect. If further defects are found, inspect all bitts in chamber. Otherwise a different bitt will be inspected each time. Bitts are counted from upstream to downstream.	
		1. 130.1 ( Land Wall ) 2. 130.2 3. 130.3 4. 130.4 5. 130.5 6. 130.6  7. 131.1 ( Middle Wall ) 8. 131.2 9. 131.3 10. 131.4 11. 131.5 12. 131.6	
4	H4LON8465 Next 10/2/12	Operating Levers, Rollers & Guides-Q Next Job Plan: H4LON25323	H4LON-MC 3 MONTHS
	H4LON25323	Rack and Sector Gears, Operating Levers, Anchorage, Rollers and	Use Target Y 1
	<u>10</u>	see long description 1200' and 600' Chamber Miter Gates  Quarterly 1. Inspect and Lubricate Rollers and Guides with 630AA.	

2. Inspect and Lubricate Rack and Sector Gears with MPG 2.
3. Inspect and Lubricate Operating Levers and Linkage Assemblies with MPG 2.
4. Visually check Anchorage for cracks and overall condition.
5. Check for looseness, wear and proper operation

End of Asset H4LONL

**H4LONL01 LON Lock, Primary Lock Chamber 01**

5	H4LON10018	Grease Inspection 1200' Lock Machinery-BW	H4LON-MC	2 WEEKS
	Next 7/25/12	Next Job Plan: H4LON32887	Use Target Y	
	H4LON32887	Greasing Inspection 1200' Lock Chamber	1	

10 See long discription  
 Inspect the lock gate gudgeon pins, pintle bearings, roller pins & guides, sector gear bearings & arm bushings and pins with 630AA. Carefully inspect all bearings, rollers, guides and moving parts for wear and looseness. Inspect all pin keeper plates for looseness. Inspect for broken bolts or movement; lubricate, lock operating levers and linkage assembly. Inspect and swab the sector gears and racks. Inspect condition of oak bumping blocks.

1. Upper lock gates ' Inspect and lubricate gate operating machinery.
2. Lower lock gates ' Inspect and lubricate gate operating machinery.
3. Upper lock gates ' Inspect and lubricate linkage assembly, sector gears and rack. Inspect linkage for loose pins.
4. Lower lock gates ' Inspect and lubricate linkage assembly, sector gears and rack. Inspect linkage for loose pins.
5. Bumping Blocks ' Inspect and replace if needed.
6. Upper lock gates ' Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks and adjust as needed.
7. Lower lock gates ' Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks and adjust as needed.
8. Upper lock gates ' Check and adjust timing of upper gates.
9. Lower lock gates ' Check and adjust timing of lower gates.
10. Upper lock gates ' Inspect and lubricate flexible hydraulic line coupling.
11. Lower lock gates ' Inspect and lubricate flexible hydraulic line coupling.
12. All lock gates ' Clean up all excess grease and grease fittings.

6	H4LON7553	Greasing 1200' Lock Machinery-BW	H4LON-MC	2 WEEKS
	Next 7/17/12	Next Job Plan: H4LON23747	Use Target Y	
	H4LON23747	Greasing 1200 ft. Lock Chamber	1	

- 10 1. Upper lock gates Inspect and lubricate gate operating machinery.
- 20 2. Lower lock gates Inspect and lubricate gate operating machinery.
- 30 3. Upper lock gates Inspect and lubricate linkage assembly, sector gears
- 40 4. Lower lock gates Inspect and lubricate linkage assembly, sector gears
- 50 5. Bumping Blocks Inspect and replace if needed.
- 60 6. Upper lock gates Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks an
- 70 7. Lower lock gates Inspect and lubricate hydraulic cylinder and stem.
- 80 8. Upper lock gates Check and adjust timing of upper gates.
- 90 9. Lower lock gates Inspect and adjust timing of lower gates.
- 100 10. Upper lock gates Inspect and lubricate flexible hydraulic line coupling.
- 110 11. Lower lock gates Inspect and lubricate flexible hydraulic line coupling.
- 120 12. All lock gates Clean up all excess grease and grease fittings.

7	H4LON7846	Latching Devices-SA	H4LON-MC	6 MONTHS
	Next 9/22/12	Next Job Plan: H4LON24416	Use Target Y	
	H4LON24416	Latching Devices	1	

10 see long description  
 Operate latching devices and steamboat ratchets for freeness of operation and lubricate as needed.

1. Upstream 600ft land wall gate.
2. Upstream 600ft middle wall gate.
3. Downstream 600ft land wall gate.
4. Downstream 600ft middle wall gate.

5. Upstream 1200ft river wall gate.
6. Upstream 1200ft middle wall gate.
7. Downstream 1200ft river wall gate.
8. Downstream 1200ft middle wall gate.

End of Asset H4LONL01

**H4LONL01G LON Lock, Primary Lock Chamber Gates**

No PMs for H4LONL01G

**H4LONL01GM LON Lock, Primary Lock Chamber Gates, Miter**

No PMs for H4LONL01GM

**H4LONL01GMD LON Lock, Gates, Miter, Downstream, Primary Chamber**

No PMs for H4LONL01GMD

**H4LONL01GMDLON Lock, Gates, Operating Equip & Mach, Downstream, Primary Chamber**

No PMs for H4LONL01GMDM

**H4LONL01GMULON Lock, Gates, Miter, Upstream, Primary Chamber**

No PMs for H4LONL01GMU

**H4LONL01GMULON Lock, Gates, Operating Equip & Mach, Upstream, Primary Chamber**

No PMs for H4LONL01GMUM

**H4LONL01GOB LON Lock, Gates, Air Bubbler System, Primary Chamber**

No PMs for H4LONL01GOB

**H4LONL01GOM LON Lock, Gates, Embedded Metals, Primary Chamber**

No PMs for H4LONL01GOM

**H4LONL01GOS LON Lock, Gates, Seals, Primary Chamber**

No PMs for H4LONL01GOS

**H4LONL01GPD LON Lock, Gates, Storm Protection, Downstream, Primary Chamber**

No PMs for H4LONL01GPD

**H4LONL01GPU LON Lock, Gates, Storm Protection, Upstream, Primary Chamber**

No PMs for H4LONL01GPU

**H4LONL01S LON Lock, Primary Lock Chamber Structure**

No PMs for H4LONL01S

**H4LONL01SB LON Lock, Navigation Aides, Floating Mooring Bits, Primary Chamber**

8	H4LON7835	Floating Mooring Pins 1200'-SA	H4LON-MC	6 MONTHS
---	-----------	--------------------------------	----------	----------

Next	9/8/12	Next Job Plan: H4LON24410	Use Target	Y
------	--------	---------------------------	------------	---

H4LON24410	Floating mooring pins 1200 chamber	1
------------	------------------------------------	---

10 see long description

Inspect mooring bitt to see that no binding is occurring in the moving parts Under load. No lubrication is needed.

One mooring bitt will be dewatered and inspected for corrosion or pitting on the exterior. The magnesium anodes will be inspected for deterioration. If corrosion or pitting is found dewatered two more bits and inspect. If further defects are found, inspect all bits in chamber. Otherwise a different bitt will be inspected each time. Bits are counted from upstream to downstream.

1. 132.1 ( Middle Wall )
2. 132.2
3. 132.3
4. 132.4

5. 133.1 ( River Wall )
6. 133.2

- 7. 133.3
- 8. 133.4
- 9. 133.5
- 10. 133.6
- 11. 133.7
- 12. 133.8

End of Asset H4LONL01SB

**H4LONL01SED LON Lock, Erosion Protection, Downstream Approach, Primary Chamber**

No PMs for H4LONL01SED

**H4LONL01SEU LON Lock, Erosion Protection, Upstream Approach, Primary Chamber**

No PMs for H4LONL01SEU

**H4LONL01SF LON Lock, Floor System, Primary Chamber**

No PMs for H4LONL01SF

**H4LONL01SGD LON Lock, Guard Sill, Downstream, Primary Chamber**

No PMs for H4LONL01SGD

**H4LONL01SGU LON Lock, Guard Sill, Upstream, Primary Chamber**

No PMs for H4LONL01SGU

**H4LONL01SMD LON Lock, Miter Sill, Downstream, Primary Chamber**

No PMs for H4LONL01SMD

**H4LONL01SMU LON Lock, Miter Sill, Upstream, Primary Chamber**

No PMs for H4LONL01SMU

**H4LONL01T LON Lock, Structures, Navigation Aides, Tow Haulage Systems, Primary Chaml**

No PMs for H4LONL01T

**H4LONL02 LON Lock, Auxiliary Lock Chamber 02**

9	H4LON10020	Grease Inspection 600' Lock Machinery-BW	H4LON-MC	2 WEEKS
	Next 7/25/12	Next Job Plan: H4LON32895	Use Target Y	
	H4LON32895	Greasing Inspection 600' Lock Chamber-BW	1	

10 See long discription  
 Inspect the lock gate gudgeon pins, pintle bearings, roller pins & guides, sector gear bearings & arm bushings and pins with 630AA. Carefully inspect all bearings, rollers, guides and moving parts for wear and looseness. Inspect all pin keeper plates for looseness. Inspect for broken bolts or movement; lubricate, lock operating levers and linkage assembly. Inspect and swab the sector gears and racks. Inspect condition of oak bumping blocks.

1. Upper lock gates ' Inspect and lubricate gate operating machinery.
2. Lower lock gates ' Inspect and lubricate gate operating machinery.
3. Upper lock gates ' Inspect and lubricate linkage assembly, sector gears and rack. Inspect linkage for loose pins.
4. Lower lock gates ' Inspect and lubricate linkage assembly, sector gears and rack. Inspect linkage for loose pins.
5. Bumping Blocks ' Inspect and replace if needed.
6. Upper lock gates ' Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks and adjust as needed.
7. Lower lock gates ' Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks and adjust as needed.
8. Upper lock gates ' Check and adjust timing of upper gates.
9. Lower lock gates ' Check and adjust timing of lower gates.
10. Upper lock gates ' Inspect and lubricate flexible hydraulic line coupling.
11. Lower lock gates ' Inspect and lubricate flexible hydraulic line coupling.
12. All lock gates ' Clean up all excess grease and grease fittings.

10	H4LON7552	Greasing 600' Lock Machinery-BW	H4LON-MC	2 WEEKS
	Next 7/17/12	Next Job Plan: H4LON23745	Use Target Y	

H4LON23745 Greasing 600 ft. Lock Chamber

1

- 10 See Long Description for work needing done  
Lubricate the lock gate gudgeon pins, pintle bearings, roller pins & guides, sector gear bearings & arm bushings and pins with 630AA. Carefully inspect all bearings, rollers, guides and moving parts for wear and looseness. Inspect all pin keeper plates for looseness. Inspect for broken bolts or movement; lubricate, lock operating levers and linkage assembly. Inspect and swab the sector gears and racks. Inspect condition of oak bumping blocks.
1. Upper lock gates ' Inspect and lubricate gate operating machinery.
  2. Lower lock gates ' Inspect and lubricate gate operating machinery.
  3. Upper lock gates ' Inspect and lubricate linkage assembly, sector gears and rack. Inspect linkage for loose pins.
  4. Lower lock gates ' Inspect and lubricate linkage assembly, sector gears and rack. Inspect linkage for loose pins.
  5. Bumping Blocks ' Inspect and replace if needed.
  6. Upper lock gates ' Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks and adjust as needed.
  7. Lower lock gates ' Inspect and lubricate hydraulic cylinder and stem. Inspect packing for leaks and adjust as needed.
  8. Upper lock gates ' Check and adjust timing of upper gates.
  9. Lower lock gates ' Check and adjust timing of lower gates.
  10. Upper lock gates ' Inspect and lubricate flexible hydraulic line coupling.
  11. Lower lock gates ' Inspect and lubricate flexible hydraulic line coupling.
  12. All lock gates ' Clean up all excess grease and grease fittings.

End of Asset H4LONL02

**H4LONL02G LON Lock, Auxiliary Lock Chamber Gates**

No PMs for H4LONL02G

**H4LONL02GM LON Lock, Auxiliary Lock Chamber Gates, Miter**

No PMs for H4LONL02GM

**H4LONL02GMD LON Lock, Gates, Miter, Downstream, Auxiliary Chamber**

No PMs for H4LONL02GMD

**H4LONL02GMD LON Lock, Gates, Operating Equip & Mach, Downstream, Auxiliary Chamber**

No PMs for H4LONL02GMDM

**H4LONL02GMULON Lock, Gates, Miter, Upstream, Auxiliary Chamber**

No PMs for H4LONL02GMU

**H4LONL02GMULON Lock, Gates, Operating Equip & Mach, Upstream, Auxiliary Chamber**

No PMs for H4LONL02GMUM

**H4LONL02GOB LON Lock, Gates, Air Bubbler System, Auxiliary Chamber**

No PMs for H4LONL02GOB

**H4LONL02GOM LON Lock, Gates, Embedded Metals, Auxiliary Chamber**

No PMs for H4LONL02GOM

**H4LONL02GOS LON Lock, Gates, Seals, Auxiliary Chamber**

No PMs for H4LONL02GOS

**H4LONL02GPD LON Lock, Gates, Storm Protection, Downstream, Auxiliary Chamber**

No PMs for H4LONL02GPD

**H4LONL02GPU LON Lock, Gates, Storm Protection, Upstream, Auxiliary Chamber**

No PMs for H4LONL02GPU

**H4LONL02S LON Lock, Auxiliary Lock Chamber Structure**

No PMs for H4LONL02S

**H4LONL02SB LON Lock, Navigation Aides, Floating Mooring Bits, Auxiliary Chamber**

			No PMs for H4LONL02SB		
	<b>H4LONL02SED</b>	<b>LON Lock, Erosion Protection, Downstream Approach, Auxiliary Chamber</b>			
			No PMs for H4LONL02SED		
	<b>H4LONL02SEU</b>	<b>LON Lock, Erosion Protection, Upstream Approach, Auxiliary Chamber</b>			
			No PMs for H4LONL02SEU		
	<b>H4LONL02SF</b>	<b>LON Lock, Floor System, Auxiliary Chamber</b>			
			No PMs for H4LONL02SF		
	<b>H4LONL02SGD</b>	<b>LON Lock, Guard Sill, Downstream, Auxiliary Chamber</b>			
			No PMs for H4LONL02SGD		
	<b>H4LONL02SGU</b>	<b>LON Lock, Guard Sill, Upstream, Auxiliary Chamber</b>			
			No PMs for H4LONL02SGU		
	<b>H4LONL02SMD</b>	<b>LON Lock, Miter Sill, Downstream, Auxiliary Chamber</b>			
			No PMs for H4LONL02SMD		
	<b>H4LONL02SMU</b>	<b>LON Lock, Miter Sill, Upstream, Auxiliary Chamber</b>			
			No PMs for H4LONL02SMU		
	<b>H4LONLC</b>	<b>LON Lock, Cranes</b>			
			No PMs for H4LONLC		
	<b>H4LONLCA</b>	<b>LON Lock, Crane, Auxiliary</b>			
			No PMs for H4LONLCA		
	<b>H4LONLCAC</b>	<b>LON Lock, Crane, Auxiliary, Power And Controls</b>			
			No PMs for H4LONLCAC		
	<b>H4LONLCAM</b>	<b>LON Lock, Crane, Auxiliary, Motors And Machinery</b>			
			No PMs for H4LONLCAM		
	<b>H4LONLCAS</b>	<b>LON Lock, Crane, Auxiliary, Structure</b>			
			No PMs for H4LONLCAS		
	<b>H4LONLCP</b>	<b>LON Lock, Crane, Primary</b>			
			No PMs for H4LONLCP		
	<b>H4LONLCPC</b>	<b>LON Lock, Crane, Primary, Power And Controls</b>			
			No PMs for H4LONLCPC		
	<b>H4LONLCPM</b>	<b>LON Lock, Crane, Primary, Motors And Machinery</b>			
			No PMs for H4LONLCPM		
	<b>H4LONLCPS</b>	<b>LON Lock, Crane, Primary, Structure</b>			
			No PMs for H4LONLCPS		
	<b>H4LONLI</b>	<b>LON Lock, Instrumentation</b>			
11	H4LON7568	Water Log Digital Gage Readers-W		H4LON-MC	1 WEEKS
	Next 7/18/12	Next Job Plan: H4LON23938	Use Target	Y	
	H4LON23938	Water Log Digital Gage Readers			1
	10	See long discription for work needing done			
		1. Check for proper operation, accuracy and visual inspection of componets			
		2. Power sources			
		3. Calibrate if needed			
			End of Asset H4LONLI		
	<b>H4LONLID</b>	<b>LON Lock, Instrumentation, Data Management Systems</b>			
			No PMs for H4LONLID		
	<b>H4LONLIDC</b>	<b>LON Lock, Instrumentation, Communication &amp; Warning Systems</b>			

12	H4LON7695	Radios, Receiving & Transmitting Equipment-M	H4LON-MC	1 MONTHS
	Next 8/2/12	Next Job Plan: H4LON24085	Use Target Y	
	H4LON24085	Radios, Receiving and Transmitting Equipment	1	
	<u>10</u>	see long description		
		1. Check unit for proper operation on both transmit and receive.		
		2. Put on charge when required.		
		3. Report to Lockmaster any discrepancies, including light bulbs, damaged antennas, disruption to the operation or any other malfunction.		
		4. Once a month radios not used for an extended period of time will be removed from storage and turned on and left in the receive mode for several hours. The following day the radio will be charged for a period of 4 to 8 hours.		

End of Asset H4LONLIDC

**H4LONLIL LON Lock, Instrumentation, Data Loggers**

No PMs for H4LONLIL

**H4LONLIM LON Lock, Instrumentation, Alignment Monuments**

No PMs for H4LONLIM

**H4LONLIP LON Lock, Instrumentation, Piezometers**

13	H4LON7859	Piezometers-SA	H4LON-MC	6 MONTHS
	Next 10/26/12	Next Job Plan: H4LON24422	Use Target Y	
	H4LON24422	piezometer	1	
	<u>10</u>	see long description		
		The readings should be recorded with date, time, upper gauge, lower gauge and lock chamber(600ft) level. Numbered from upstream to downstream.		
		1. Reading of #1 piezometer and record.		
		2. Reading of #2 piezometer and record.		
		3. Reading of #3 piezometer and record.		

End of Asset H4LONLIP

**H4LONLM LON Lock, Miscellaneous Systems**

14	H4LON7760	Disk Springs-M	H4LON-MC	1 MONTHS
	Next 7/13/12	Next Job Plan: H4LON24250	Use Target Y	
	H4LON24250	Disk Springs	1	
	<u>10</u>	See long description		
		1. Inspect and lubricate upstream 600ft gates.		
		2. Inspect and lubricate downstream 600ft gates.		
		3. Inspect and lubricate upstream 1200ft gates.		
		4. Inspect and lubricate downstream 1200ft gates.		
		5. Check, measure and record drifting on upstream 600ft gates.		
		6. Check, measure and record drifting on downstream 600ft gates.		
		7. Check, measure and record drifting on upstream 1200ft gates.		
		8. Check, measure and record drifting on downstream 1200ft gates.		

End of Asset H4LONLM

**H4LONLME LON Lock, Miscellaneous Systems, Elevator**

No PMs for H4LONLME

**H4LONLMEC LON Lock, Miscellaneous Systems, Elevator, Cars And Equipment**

15	H4LON10450	Elevator Assembly-TA	H4LON-MC	3 YEARS
	Next 12/16/12	Next Job Plan: H4LON35243	Use Target Y	
	H4LON35243	Elevator-TA	1	
	<u>10</u>	see long description		
		Inspected and Certified by Licensed Contractor.		
16	H4LON10464	Elevator-A	H4LON-MC	1 YEARS
	Next 12/2/12	Next Job Plan: H4LON35988	Use Target Y	

H4LON35988 Elevator-A 1  
 10 Elevator-A  
 Annual NO-LOAD Inspection to be performed by certified Inspector. Required by state of Ohio.

		End of Asset H4LONLMEC
<b>H4LONLMEM</b>	<b>LON Lock, Other Structures, Elevator Tower, Penthouse/Machinery Room</b>	No PMs for H4LONLMEM
<b>H4LONLMEP</b>	<b>LON Lock, Miscellaneous Systems, Elevator, Power And Controls</b>	No PMs for H4LONLMEP
<b>H4LONLMER</b>	<b>LON Lock, Elevator Tower, Roof</b>	No PMs for H4LONLMER
<b>H4LONLMES</b>	<b>LON Lock, Elevator Tower, Structure And Foundation</b>	No PMs for H4LONLMES
<b>H4LONLMESP</b>	<b>LON Lock, Elevator Tower, Pit</b>	No PMs for H4LONLMESP
<b>H4LONLS</b>	<b>LON Lock, Structures</b>	No PMs for H4LONLS
<b>H4LONLSE</b>	<b>LON Lock, Structures, Embankments</b>	No PMs for H4LONLSE
<b>H4LONLSED</b>	<b>LON Lock, Structures, Embankments, Downstream Approach</b>	No PMs for H4LONLSED
<b>H4LONLSEE</b>	<b>LON Lock, Structures, Embankments, Landward Of Esplanade</b>	No PMs for H4LONLSEE
<b>H4LONLSEP</b>	<b>LON Lock, Structures, Erosion Protection</b>	No PMs for H4LONLSEP
<b>H4LONLSEPD</b>	<b>LON Lock, Structures, Erosion Protection, Downstream, Landside Embankmen</b>	No PMs for H4LONLSEPDLE
<b>H4LONLSEU</b>	<b>LON Lock, Structures, Embankments, Upstream Approach</b>	No PMs for H4LONLSEU
<b>H4LONLSO</b>	<b>LON Lock, Structures, Other Structural Systems</b>	No PMs for H4LONLSO
<b>H4LONLSOB</b>	<b>LON Lock, Bridges</b>	No PMs for H4LONLSOB
<b>H4LONLSOBFD</b>	<b>LON Lock, Footbridge, Deck &amp; Miscellaneous</b>	No PMs for H4LONLSOBFD
<b>H4LONLSOBFP</b>	<b>LON Lock, Footbridge, Piers, Supports &amp; Foundations</b>	No PMs for H4LONLSOBFP
<b>H4LONLSOBFS</b>	<b>LON Lock, Footbridge, Superstructure</b>	No PMs for H4LONLSOBFS
<b>H4LONLSOBS</b>	<b>LON Lock, Service Bridge, Deck &amp; Miscellaneous</b>	No PMs for H4LONLSOBS
<b>H4LONLSOBSP</b>	<b>LON Lock, Service Bridge, Piers, Supports &amp; Foundations</b>	No PMs for H4LONLSOBSP
<b>H4LONLSOBSS</b>	<b>LON Lock, Service Bridge, Superstructure</b>	

No PMs for H4LONLSOBSS

**H4LONLSOCB LON Lock, Control Buildings**

No PMs for H4LONLSOCB

**H4LONLSOCBLLON Lock, Other Structures, Control Buildings, Land Wall**

17	H4LON7551	John Deere Tractor-W		H4LON-MC	1 WEEKS
	Next 7/18/12		Next Job Plan: H4LON23737	Use Target Y	
	H4LON23737	John Deere Tractor			1

- 10 See Long Description
1. Check engine oil level, check gas level, check tire pressure and operated.
  2. After first 20 hours of operation ' check and tighten wheel bolts and loose hardware. Change engine oil and filter
  3. After first 50 hours of operation ' check and tighten wheel bolts, change transmission oil and filter, change hydraulic oil filter and change engine oil only.
  4. After first 100 hours of operation ' change engine oil and filter.
  5. Every 50 hours ' check tire pressure, check transmission oil level, lubricate front wheel spindles and axle pivot, check and clean air cleaner element, and check and tighten wheel bolts.
  6. Every 100 hours or annually ' check and tighten loose hardware, check battery electrolyte level, clean battery, check and clean air cleaner element, change engine oil only, and inspect spark plugs and check gap.
  7. Every 200 hours or annually ' change engine oil and filter.
  8. Every 200 hours or two years ' replace fuel filter.
  9. Every 250 hours ' change transmission oil and filter, and change hydraulic oil filter.
  10. Every 500 hours ' check engine idle speeds, check carburetor adjustment check and adjust valve clearance and check fuel lines.
  11. Hour meter reading.

End of Asset H4LONLSOCBL

**H4LONLSOCBLON Lock, Control Building, Middle Wall**

No PMs for H4LONLSOCBM

**H4LONLSOE LON Lock, Structures, Esplanade Paving System**

No PMs for H4LONLSOE

**H4LONLSOR LON Lock, Structures, Retaining Walls**

No PMs for H4LONLSOR

**H4LONLSOS LON Lock, Structures, Slope Paving System**

No PMs for H4LONLSOS

**H4LONLSW LON Lock, Structures, Lock Walls**

18	H4LON7776	Wind Socks-M		H4LON-MC	1 MONTHS
	Next 8/11/12		Next Job Plan: H4LON24274	Use Target Y	
	H4LON24274	Wind Socks			1

- 10 see long description
1. Inspect for any defects.
  2. Lubricate bearings.
  3. Change as needed.

19	H4LON7795	Poly Overpack-Q		H4LON-MC	3 MONTHS
	Next 10/5/12		Next Job Plan: H4LON24305	Use Target Y	
	H4LON24305	poly overpack			1

- 10 poly overpack  
Check the condition of the drum and its contents. Inventory contents.
1. Inspect drum.
  2. 10 absorbent booms 6" X 18' long. Inspect and inventory.
  3. 100 absorbent pads 18" X 18". Inspect and inventory.
  4. 2 absorbent booms 3" X 10' long. Inspect and inventory.

- 5. 12 absorbent booms 2" X 4' long. Inspect and inventory.
  - 6. 10 plastic bags. Inspect and inventory.
  - 7. 3 Haz-Mat suits. Inspect and inventory.
  - 8. 3 pair of inner gloves. Inspect and inventory.
  - 9. 3 pair of silver shield outer gloves. Inspect and inventory.
  - 10. 1 roll of duct tape. Inspect and inventory.
- 20 H4LON7913 Anchorage Assembly, Gudgeon Pin & Pintle Assembly-A H4LON-MC 1 YEARS  
 Next 4/26/13 Next Job Plan: H4LON24497 Use Target Y
- H4LON24497 Anchorage Assembly, Gudgeon Pin & Pintle Assembly 1
- 10 see long description  
 Inspect anchorage assembly, gudgeon pin and pintle assembly; operate gate and check all above water parts for wear or looseness.  
 Check level of gates by placing machinist level on mitre end of gate and check during full travel of gate for level.
- 1. Upper 600ft land wall gate leaf.
  - 2. Upper 600ft middle wall gate leaf.
  - 3. Lower 600ft land wall gate leaf.
  - 4. Lower 600ft middle wall gate leaf.
  - 5. Upper 1200ft middle wall gate leaf.
  - 6. Upper 1200ft river wall gate leaf.
  - 7. Lower 1200ft middle wall gate leaf.
  - 8. Lower 1200ft river wall gate leaf.

End of Asset H4LONLSW

**H4LONLSWCD LON Lock, Structures, Cutoff Walls, Downstream**

No PMs for H4LONLSWCD

**H4LONLSWCU LON Lock, Structures, Cutoff Walls, Upstream**

No PMs for H4LONLSWCU

**H4LONLSWDD LON Lock, Structures, Lock Walls, Lower Guide Wall**

No PMs for H4LONLSWDD

**H4LONLSWDR LON Lock, Structures, Lock Walls, Lower Guard Wall**

No PMs for H4LONLSWDR

**H4LONLSWL LON Lock, Structures, Lock Walls, Land Wall**

- H4LON8083 Fall device to Sea Mule-Q H4LON-MC 3 MONTHS  
 Next 9/15/12 Next Job Plan: H4LON24845 Use Target Y
- H4LON24845 Fall device to Sea Mule 1
- 10 Load test to 433lb every 4 years
  - 20 Check Fall device for proper operation
  - 30 Check Safety Harness

End of Asset H4LONLSWL

**H4LONLSWM LON Lock, Structures, Lock Walls, Middle Wall**

No PMs for H4LONLSWM

**H4LONLSWR LON Lock, Structures, Lock Walls, River Wall**

No PMs for H4LONLSWR

**H4LONLSWUD LON Lock, Structures, Lock Walls, Upper Guide Wall**

- H4LON7934 Tainter Valve Bulkheads-TA H4LON-MC 3 YEARS  
 Next 7/5/13 Next Job Plan: H4LON24524 Use Target Y
- H4LON24524 Tainter Valve Bulkheads 1
- 10 see long description  
 Tainter valve bulkheads should be inspected for rust and corrosion each year. Inspect flood gates for proper operation and grease. Check rubber seals for looseness, breaks or cracking. Clean and paint as needed.
- 1. #1 Bulkhead
  - 2. #2 Bulkhead
  - 3. #3 Bulkhead

4. #4 Bulkhead

End of Asset H4LONLSWUD

**H4LONLSWUR LON Lock, Structures, Lock Walls, Upper Guard Wall**

No PMs for H4LONLSWUR

**H4LONLU LON Lock, Utility Systems**

No PMs for H4LONLU

**H4LONLUA LON Lock, Utility Systems, Air System**

21	H4LON7575	Air Receivers-W	Next 7/19/12	Next Job Plan: H4LON23940	H4LON-MC Use Target Y	1 WEEKS
	H4LON23940	Draining Air Receivers			1	
	<p><u>10</u> See Long Discription for work needing done. During hot months (April ' October) drain air receivers of moisture.</p> <ol style="list-style-type: none"> <li>1. Air receiver at upper end of gallery.</li> <li>2. Air receiver under the operations building.</li> <li>3. Air receiver at lower end of gallery.</li> </ol>					

22	H4LON7577	Ingersoll Rand Air Compressor-W	Next 7/18/12	Next Job Plan: H4LON23952	H4LON-MC Use Target Y	1 WEEKS
	H4LON23952	Ingersoll Rand Air Compressor			1	
	<p><u>10</u> See long discription for work needing done 1-5 are checked daily and recorded weekly.</p> <ol style="list-style-type: none"> <li>1. Inspect coolant level.</li> <li>2. Inspect discharge temperature (Air)</li> <li>3. Inspect separator element differential.</li> <li>4. Inspect air filter Delta P ( At Full Load ).</li> <li>5. Inspect oil filter Delta P.</li> <li>6. Tighten fan blade bolts and motor bolts every three months.</li> <li>7. Check temperature sensor ' 1000 hours.</li> <li>8. Replace coolant filter ' 2000 hours or 6 months.</li> <li>9. Clean separator scavenge screen and orifice ' 4000 hours or yearly.</li> <li>10. Clean cooler cores and replace air filters ' 4000 hours or yearly.</li> <li>11. Replace separator element ( see special note on page 19 )</li> <li>12. Replace coolant ' 8000 hours or two years.</li> <li>13. Inspect starter contactors ' 8000 hours or yearly.</li> </ol>					

End of Asset H4LONLUA

**H4LONLUAC LON Lock, Utility Systems, Air System, Controls**

No PMs for H4LONLUAC

**H4LONLUAD LON Lock, Utility Systems, Air System, Distribution System**

No PMs for H4LONLUAD

**H4LONLUAP LON Lock, Utility Systems, Air System, Pumps, Valves & Receivers**

23	H4LON7924	Air Receivers-BA	Next 10/14/13	Ext 8/1/13	Next Job Plan: H4LON24518	H4LON-MC Use Target Y	2 YEARS
	H4LON24518	Air Receivers				1	
	<p><u>10</u> see long description Inspect air receivers for safe operating condition. Check safety valves for good operating condition and correct pressure. Repair and adjust as needed to provide good operation. This inspection will be made by district office inspector. Inspection certificate will be posted near receiver. Lockmaster will make annual inspection.</p> <ol style="list-style-type: none"> <li>1. Air receiver in middle wall gallery at upper end.</li> <li>2. Air receiver in gallery under operations building.</li> </ol>						

3. Air receiver in middle wall gallery at lower end.
4. Air receiver on bulkhead hoist.

End of Asset H4LONLUAP

<b>H4LONLUE LON Lock, Utility Systems, Electrical Power &amp; Controls</b>				
24	H4LON7582	Ground Fault Circuit Interrupters-M	H4LON-MC	1 MONTHS
	Next	7/15/12	Next Job Plan: H4LON23959	Use Target Y
	H4LON23959	Ground Fault Circuit Interrupters		1
	<u>10</u>	See long discription for work needing done		
		1. Inspect wire for broken areas.		
		2. Test GFI with push to teat button.		
		3. Use GFI tester for inspection		

End of Asset H4LONLUE

**H4LONLUEC LON Lock, Utility Systems, Electric Power & Control, Control Systems**

No PMs for H4LONLUEC

**H4LONLUED LON Lock, Utility Systems, Electric Power & Control, Distributon Systems**

No PMs for H4LONLUED

**H4LONLUEGM LON Lock, Utility Systems, Electric Power & Control, Switch Gear/Motor Contr**

No PMs for H4LONLUEGM

**H4LONLUEL LON Lock, Utility Systems, Electric Power & Control, Lighting Systems**

No PMs for H4LONLUEL

**H4LONLUEP LON Lock, Utility Systems, Electric Power & Control, Lightning Protection Syst**

No PMs for H4LONLUEP

**H4LONLUH LON Lock, Utility Systems, Hydraulic System**

No PMs for H4LONLUH

**H4LONLUHD LON Lock, Utility Systems, Hydraulic System, Distribution System**

No PMs for H4LONLUHD

**H4LONLUHPB LON Lock, Utility Systems, Hydraulic System, Pumps, Backup**

	H4LON7548	Hydraulic Holding Pump-W	H4LON-MC	1 WEEKS
	Next	7/18/12	Next Job Plan: H4LON23688	Use Target Y
	H4LON23688	Holding Pump		1
	<u>10</u>	Inspect mounting bolts and general operation		
	<u>20</u>	Lubricate in accordance with manufacturers recommendations		
	<u>30</u>	Keep on Line		

End of Asset H4LONLUHPB

**H4LONLUHPP LON Lock, Utility Systems, Hydraulic System, Pumps, Primary**

25	H4LON7546-3	Hydraulic Pumps-W	H4LON-MC	1 WEEKS
	Next	7/18/12	Next Job Plan: H4LON23595-3	Use Target Y
	H4LON23595-3	Hydraulic Pumps1,2,3		1
	<u>10</u>	Inspect polarized electrical plug and wiring Hydraulic Pump Motor		
		1. Inspect polarized electrical plug and wiring.		
		2. On Line.		
		3. Off Line.		
		4. Inspect the complete operation, if put on line, listen for unusual noises check the pressure should be 850lb, make sure the timing is correct and the motor is not coming on at the same time as another motor. If adjustments to the timing or pressure is needed make the necessary adjustments.		

20 On Line

30 Inspect the complete operation, if put on line, listen for unusual noises check the pressure should

26	H4LON7863	Faulk couplings-SA	H4LON-MC	6 MONTHS
----	-----------	--------------------	----------	----------

Next 10/19/12 Next Job Plan: H4LON24433 Use Target Y  
 H4LON24433 faulk couplings 1  
10 see long description  
 Faulk Couplings

Inspect, clean, and lubricate Faulk Coupling between hydraulic pumps and electric motors.

1. Hydraulic holding pump and electric motor.
2. #1 hydraulic oil pump and electric motor.
3. #2 hydraulic oil pump and electric motor.
4. #3 hydraulic oil pump and electric motor.

End of Asset H4LONLUHPP

**H4LONLUHVC LON Lock, Utility Systems, Hydraulic System, Valves And Controls**

27 H4LON7878 Filters, Strainers & Bypass Relief Valves-A H4LON-MC 1 YEARS  
 Next 3/22/13 Next Job Plan: H4LON24455 Use Target Y  
 H4LON24455 Filters, Strainers and Bypass Relief Valves 1

10 see long description  
 Each year it will be necessary to remove the oil filters in the return line of the hydraulic oil system from the housing and clean both the cartridges and the interior of the housing. Flush with fuel oil and clean with soft brush. Do not use abrasive material for cleaning. At the time the filters are dismantled, the basket-type strainer shall be removed and cleaned. It will not be necessary to stop lockage during the cleaning as each strainer or filter can be isolated from the hydraulic system.

The operation of the by-pass relief valve will be tested after the filters and strainers have been cleaned. The procedure will be to close the manual stop valve to one filter. With one pump operating, slowly close the manual valve on the discharge side of the other filter. Watch the pressure gauge on the inlet side of this filter. When the pressure on this gauge reaches 17 lbs., the relief valve is working properly. If the pressure continues to rise, adjust valve and retest.

1. Inspect and clean filters.
2. Inspect and clean strainers.
3. Inspect and test by-pass relief valves.

28 H4LON7908 Hydraulic Relief & Unloading Valves-A H4LON-MC 1 YEARS  
 Next 4/26/13 Next Job Plan: H4LON24490 Use Target Y  
 H4LON24490 Relief & Unloading Valve 1

10 see long description  
 Relief and Unloading Valves

Check setting of relief and unloading valves by operating each pump separately and noting the pressure gauge reading at which the pump unloads or the relief valve opens.

1. Unloading valve for #1 pump ' set at 850 lb.
2. Unloading valve for #2 pump ' set at 850 lb.
3. Unloading valve for #3 pump ' set at 850 lb.
4. Relief valve for holding pump ' set at 1,000 lb.

End of Asset H4LONLUHVC

**H4LONLUSPW LON Lock, Utility Systems, Combined Service/Potable Water System**

No PMs for H4LONLUSPW

**H4LONLUSPWD LON Lock, Utility Systems, Combined Service/Potable Water System, Distribution**

No PMs for H4LONLUSPWD

**H4LONLUSW LON Lock, Utility Systems, Service Water (Only) System**

No PMs for H4LONLUSW

**H4LONLUSWP LON Lock, Utility Systems, Service Water (Only) System, Pumps & Controls**

No PMs for H4LONLUSWP

**H4LONLV LON Lock, Valves**

29 H4LON10023 Grease Inspection Tainter Valves-BW H4LON-MC 2 WEEKS  
 Next 7/25/12 Next Job Plan: H4LON32903 Use Target Y  
 H4LON32903 Inspection of Tainter Valves 600 ft. and 1200 ft. Chamber- BW 1

10 See long Discription  
 Inspect tainter valve operating machinery including rocker base, crosshead gibs, upper strut pin, spring and trunnion bearings. Check all machinery for looseness and wear. Check for broken flexible grease lines. Check indicator rods and traveling nut limit switch rods for broken bolts or rod.

1. Inspect and lubricate operating machinery in land wall filling valve.
  2. Inspect flexible grease lines and indicator rods in land wall filling valve.
  3. Inspect and lubricate operating machinery in land wall emptying valve.
  4. Inspect flexible grease lines and indicator rods in land wall emptying valve.
  5. Inspect and lubricate operating machinery in middle wall filling valve.
  6. Inspect flexible grease lines and indicator rods in middle wall filling valve.
  7. Inspect and lubricate operating machinery in middle wall emptying valve.
  8. Inspect flexible grease lines and indicator rods in middle wall emptying valve.
  9. Inspect and lubricate operating machinery in river wall filling valve.
  10. Inspect flexible grease lines and indicator rods in river wall filling valve.
  11. Inspect and lubricate operating machinery in river wall emptying valve.
  12. Inspect flexible grease lines and indicator rods in river wall emptying valve.
  13. Clean all excess grease and fittings.
- SR. Inspect and lubricate hydraulic cylinder and stem. Inspect packing for Leaks and adjust as needed.

End of Asset H4LONLV

**H4LONLV01G LON Lock, Valves, Other Items, Debris Guards, Intakes, Primary Chamber**

No PMs for H4LONLV01G

**H4LONLV02G LON Lock, Valves, Other Items, Debris Guards, Intakes, Auxiliary Chamber**

No PMs for H4LONLV02G

**H4LONLVT LON Lock, Valves, Tainter**

30 H4LON7554 Greasing Tainter Valves-BW H4LON-MC 2 WEEKS  
 Next 7/17/12 Next Job Plan: H4LON23751 Use Target Y  
 H4LON23751 Lubrication of Tainter Valves 600ft Chamber 1

10 See Long Description for work needing done  
 Lubricate tainter valve operating machinery including rocker base, crosshead gibs, upper strut pin, spring and trunnion bearings. Check all machinery for looseness and wear. Check for broken flexible grease lines. Check indicator rods and traveling nut limit switch rods for broken bolts or rod.

1. Inspect and lubricate operating machinery in land wall filling valve.
2. Inspect flexible grease lines and indicator rods in land wall filling valve.
3. Inspect and lubricate operating machinery in land wall emptying valve.
4. Inspect flexible grease lines and indicator rods in land wall emptying valve.
5. Inspect and lubricate operating machinery in middle wall filling valve.
6. Inspect flexible grease lines and indicator rods in middle wall filling valve.
7. Inspect and lubricate operating machinery in middle wall emptying valve.
8. Inspect flexible grease lines and indicator rods in middle wall emptying valve.
9. Inspect and lubricate operating machinery in river wall filling valve.
10. Inspect flexible grease lines and indicator rods in river wall filling valve.
11. Inspect and lubricate operating machinery in river wall emptying valve.
12. Inspect flexible grease lines and indicator rods in river wall emptying valve.

- 13. Clean all excess grease and fittings.
- SR. Inspect and lubricate hydraulic cylinder and stem. Inspect packing for Leaks and adjust as needed.

31	H4LON7757	Valve Interlock System-M	H4LON-MC	1 MONTHS
	Next 8/11/12	Next Job Plan: H4LON24235	Use Target Y	
	H4LON24235	Valve Interlock System	1	

- 10 see long description
- 1. Check physical condition of lights, switches and wiring.
- 2. Open upper 600 miter gates and try to operate all valves for that chamber.
- 3. Open lower 600 miter gates and try to operate all valves for that chamber.
- 4. Open upper 1200 miter gates and try to operate all valves for that chamber.
- 5. Open lower 1200 miter gates and try to operate all valves for that chamber.

End of Asset H4LONLVT

**H4LONLVTEL LON Lock, Valves, Tainter, Emptying, Land Wall**

No PMs for H4LONLVTEL

**H4LONLVTELE LON Lock, Valves, Embedded Metals, Emptying Valves, Land Wall**

No PMs for H4LONLVTELE

**H4LONLVTELG LON Lock, Valves, Debris Guards, Emptying Valves, Land Wall**

No PMs for H4LONLVTELG

**H4LONLVTELM LON Lock, Valves, Operating Machinery, Emptying Valve, Land Wall**

No PMs for H4LONLVTELM

**H4LONLVTELS LON Lock, Valves, Seals, Emptying Valves, Land Wall**

No PMs for H4LONLVTELS

**H4LONLVTEM LON Lock, Valves, Tainter, Emptying, Middle Wall**

No PMs for H4LONLVTEM

**H4LONLVTEME LON Lock, Valves, Embedded Metals, Emptying Valves, Middle Wall**

No PMs for H4LONLVTEME

**H4LONLVTEMG LON Lock, Valves, Debris Guards, Emptying Valves, Middle Wall**

No PMs for H4LONLVTEMG

**H4LONLVTEMM LON Lock, Valves, Operating Machinery, Emptying Valve, Middle Wall**

No PMs for H4LONLVTEMM

**H4LONLVTEMS LON Lock, Valves, Seals, Emptying Valves, Middle Wall**

No PMs for H4LONLVTEMS

**H4LONLVTER LON Lock, Valves, Tainter, Emptying, River Wall**

No PMs for H4LONLVTER

**H4LONLVTERE LON Lock, Valves, Embedded Metals, Emptying Valves, River Wall**

No PMs for H4LONLVTERE

**H4LONLVTERG LON Lock, Valves, Debris Guards, Emptying Valves, River Wall**

No PMs for H4LONLVTERG

**H4LONLVTERM LON Lock, Valves, Operating Machinery, Emptying Valve, River Wall**

No PMs for H4LONLVTERM

**H4LONLVTERS LON Lock, Valves, Seals, Emptying Valves, River Wall**

No PMs for H4LONLVTERS

**H4LONLVTFL LON Lock, Valves, Tainter, Filling, Land Wall**

No PMs for H4LONLVTFL

<b>H4LONLVTFLE LON Lock, Valves, Embedded Metals, Filling Valves, Land Wall</b>				
		No PMs for H4LONLVTFLE		
<b>H4LONLVTFLG LON Lock, Valves, Debris Guards, Filling Valves, Land Wall</b>				
		No PMs for H4LONLVTFLG		
<b>H4LONLVTFML LON Lock, Valves, Operating Machinery, Filling Valve, Land Wall</b>				
		No PMs for H4LONLVTFML		
<b>H4LONLVTFLS LON Lock, Valves, Seals, Filling Valves, Land Wall</b>				
		No PMs for H4LONLVTFLS		
<b>H4LONLVTFM LON Lock, Valves, Tainter, Filling, Middle Wall</b>				
		No PMs for H4LONLVTFM		
<b>H4LONLVTFME LON Lock, Valves, Embedded Metals, Filling Valves, Middle Wall</b>				
		No PMs for H4LONLVTFME		
<b>H4LONLVTFMGLON Lock, Valves, Debris Guards, Filling Valves, Middle Wall</b>				
		No PMs for H4LONLVTFMG		
<b>H4LONLVTFMM LON Lock, Valves, Operating Machinery, Filling Valve, Middle Wall</b>				
		No PMs for H4LONLVTFMM		
<b>H4LONLVTFMS LON Lock, Valves, Seals, Filling Valves, Middle Wall</b>				
		No PMs for H4LONLVTFMS		
<b>H4LONLVTFR LON Lock, Valves, Tainter, Filling, River Wall</b>				
32	H4LON10473	Reovate Riverwall filling Valve;Middle wall Filling Valve and Operating Machinery		0 YEARS
	Next	Next Job Plan:	Use Target	Y
		End of Asset H4LONLVTFR		
<b>H4LONLVTFRE LON Lock, Valves, Embedded Metals, Filling Valves, River Wall</b>				
		No PMs for H4LONLVTFRE		
<b>H4LONLVTFRGLON Lock, Valves, Debris Guards, Filling Valves, River Wall</b>				
		No PMs for H4LONLVTFRG		
<b>H4LONLVTFRMLON Lock, Valves, Operating Machinery, Filling Valve, River Wall</b>				
		No PMs for H4LONLVTFRM		
<b>H4LONLVFRS LON Lock, Valves, Seals, Filling Valves, River Wall</b>				
		No PMs for H4LONLVFRS		
<b>H4LONLXE LON Lock, Closure Systems, Dual Purpose Maintenance/Emergency</b>				
		No PMs for H4LONLXE		
<b>H4LONLXEB LON Lock, Closure Systems, Maintenance, Bulkheads</b>				
33	H4LON7902	Bulkhead Recess Filler Blocks, Turnbuckles and Anchors-A	H4LON-MC	1 YEARS
	Next	4/27/13	Next Job Plan: H4LON24472	Use Target Y
	H4LON24472	Bulkhead Recess Filler Blocks, Turnbuckles and Anchors		1
	<u>10</u>	see long description		
		Make detailed inspection and examine the bulkhead recess filler blocks after each use. If filler blocks are not to be used for considerable time, inspect at least once a year. Check to determine that filler blocks are firmly seated in the recesses and flush with the face of the lock walls. Lubricate turnbuckles, clevises, and pins, as required. Inspect for excessive corrosion or deterioration. Painting will be required when the protective coating is damaged or worn off.		
		1. Filler block at land wall pier.		
		2. Turnbuckle and anchor at land wall pier.		
		3. Filler block at middle wall pier Ohio side.		

4. Turnbuckle and anchor at middle wall pier Ohio side.
5. Filler block at middle wall pier West Virginia side.
6. Turnbuckle and anchor at middle wall pier West Virginia side.
7. Filler block at river wall pier.
8. Turnbuckle and anchor at river wall pier.

End of Asset H4LONLXEB

**H4LONLXEF LON Lock, Closure Systems, Maintenance, Lifting Frames**

No PMs for H4LONLXEF

**H4LONLXEH LON Lock, Closure Systems, Maintenance, Hoisting Equipment**

No PMs for H4LONLXEH

This report pulls all Asset records in Operating status for the Site ID and USACE Org Code specified in the parameters along with all active Preventative Maintenance records (schedules) linked to the Assets and their related Job Plans.

The Frequency and Unit fields indicate how often the PM schedule runs. Sequence indicates which Job Plan will be used every *n* times the PM runs. For further explanation, see your Site or District FEM POC, or consult the FEM PM Guide on the FEM SharePoint site.

Database fields used (Table.Field):

ASSET.ASSETNUM, ASSET.DESCRPTION, PM.PMNUM, PM.DESCRPTION,  
 PM.FREQUENCY, PM.FREQUNIT, PM.CREVMID, PM.NEXTDATE, PM.EXTDATE,  
 PM.JPNUM, PM.USETARGETDATE, PMMETER.METERNAME, PMMETER.FREQUENCY,  
 PMSEQUENCE.JPNUM, PMSEQUENCE.INTERVAL, JOBPLAN.DESCRPTION

# REPORT DOCUMENTATION PAGE

*Form Approved*  
*OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

<b>1. REPORT DATE (DD-MM-YYYY)</b> September 2013			<b>2. REPORT TYPE</b> Final			<b>3. DATES COVERED (From - To)</b>		
<b>4. TITLE AND SUBTITLE</b> Asset Management and Facility Equipment Maintenance Nexus: Maintenance Effectiveness						<b>5a. CONTRACT NUMBER</b>		
						<b>5b. GRANT NUMBER</b>		
						<b>5c. PROGRAM ELEMENT NUMBER</b>		
<b>6. AUTHOR(S)</b> Stuart D. Foltz, Carlos B. Bislip-Morales, and E. Allen Hammack						<b>5d. PROJECT NUMBER</b> 371013		
						<b>5e. TASK NUMBER</b>		
						<b>5f. WORK UNIT NUMBER</b>		
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> U.S. Army Engineer Research and Development Center (ERDC) Construction Engineering Research Laboratory (CERL) PO Box 9005 Champaign, IL 61826-9005						<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> ERDC TR-13-16		
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Headquarters US Army Corps of Engineers 441 G Street NW Washington DC 20314-1000						<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> HQUSACE		
						<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>		
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release. Distribution is unlimited								
<b>13. SUPPLEMENTARY NOTES</b>								
<b>14. ABSTRACT</b>  The US Army Corps of Engineers (USACE) has constructed a wide variety of civil works structures. Many of these structures have surpassed their design life and deteriorated to a point that better tools and more extensive analysis are needed to identify the most critical maintenance and repair (M&R) needs. The work documented in this report analyzes how data collected in Facility Equipment Maintenance (FEM) can be used to evaluate the effectiveness of maintenance to improve the condition of lock infrastructure components. This includes analyzing how data already being collected in FEM can be used to evaluate maintenance effectiveness and also what additional data could be collected. In the process of addressing these objectives, numerous limitations in how FEM and Operational Condition Assessment (OCA) could be used to address this question were discovered, and they are documented in this report. The report also discusses numerous ways FEM could be used more effectively to address this question and the general benefit of USACE. A pilot Maintenance Effectiveness Review (MER) was held at a USACE lock and dam project.								
<b>15. SUBJECT TERMS</b> Civil Works, Data Management, Facilities Equipment Maintenance (FEM), Asset Management (AM), Locks and Dams, Maintenance Effectiveness Review (MER), Navigation structures								
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>		<b>18. NUMBER OF PAGES</b>		<b>19a. NAME OF RESPONSIBLE PERSON</b>	
<b>a. REPORT</b> Unclassified	<b>b. ABSTRACT</b> Unclassified	<b>c. THIS PAGE</b> Unclassified	UU		255		<b>19b. TELEPHONE NUMBER (include area code)</b>	