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City of Oxnard

Public Works Integrated Master Plan

WATER

PROJECT MEMORANDUM 2.4 CONDITION ASSESSMENT

FINAL DRAFT
December 2015

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City of Oxnard

Public Works Integrated Master Plan

WATER

PROJECT MEMORANDUM 2.4
CONDITION ASSESSMENT

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1.0 INTRODUCTION

This purpose of this report is to present and summarize the condition assessment of water assets conducted for the City of Oxnard (City) by Carollo Engineers (Carollo) as part of the Public Works Integrated Master Plan. This assessment was conducted to identify rehabilitation and replacement (R&R or renewal) needs. The effort included using asset management methodology to identify the existing water assets and to conduct a visual condition assessment of above ground assets, a seismic evaluation of structures, a desktop evaluation of below ground assets, and a cathodic protection system evaluation.

To prioritize the R&R needs, a risk assessment was conducted that examined the vulnerability, or likelihood of failure, and criticality, or consequence of failure for each asset. Consistent risk scoring methodology was applied to both above- and below-ground assets to allow for prioritization across these varied asset types.

The findings from this report will be incorporated into a detailed and comprehensive CIP that summarizes all Public Works Integrated Master Plan recommendations. The CIP will reflect the combined planning considerations of the R&R needs identified here, as well as regulatory-driven needs, growth-driven needs, and other enhancements.

2.0 APPROACH

2.1 Asset Registry

Using multiple references provided by the City, Carollo compiled an inventory of above- and below-ground assets with the appropriate level of detail for a visual condition assessment and system-wide capital planning projects. An asset was defined as a functional component valued at $10,000 or more, or one critical to plant performance. Equipment such as smaller valves, sump pumps, and local control panels were not included as individual assets, rather were addressed as ancillary items. Assets were classified by facility type, site location, and discipline.

Carollo reviewed the history of replacements and major rehabilitations with City staff and identified data gaps or areas of uncertainty for focus during the field assessment. Where possible, existing references were used to identify design and sizing criteria, age, capacity, and other information prior to the assessment.

2.2 Asset Risk

Risk of an asset is a measure of the impact of asset failure on the overall system. By quantifying and assessing the risk of failure or inability of an asset to meet its intended

function, R&R projects can be selected and implemented to mitigate the risk. The following sections detail the calculation used to estimate risk for both above- and below- ground assets.

2.2.1 Vulnerability

The vulnerability metric reflects the "likelihood of asset failure." Failure can occur from physical failure, performance failure, or technological obsolescence. The vulnerability of an asset is inversely proportional to the Evaluated Remaining Useful Life (EvRUL), which is determined as part of the condition assessment. The vulnerability expresses the likelihood of failure of an asset in the next year. Because the vulnerability was calculated with a slightly different approach for above- and below-ground assets, the details on this methodology are presented in the respective sections for these different asset types.

2.2.2 Criticality

The criticality scoring system divides probable "consequences of failure" into four categories:

- Public Health and Safety.
- Financial Impact.
- Effect on Customers / Public Confidence.
- Cost of Repairs.

The criticality scoring scale used in the assessment of each facility is shown in Table 1. This scale is adapted from the *International Infrastructure Management Manual, New Zealand National Asset Management Steering Group, and the Institute of Public Works Engineering of Australia* (April 2011). The criticality of an asset is the sum of the score from each of the four categories multiplied by the category weighting factor. Because the approach for below-ground assets included pipe size and geospatial factors, additional details on the criticality methodology for below-ground assets can be found in Section 4.3.

2.2.3 Risk

Just as risk is expressed as the economic cost or as the product of cost and chance, risk is calculated in this analysis as the product of the consequence of the failure and the likelihood of failure, or:

Risk = Criticality x Vulnerability

At a minimum, assets with higher risk ratings must be closely monitored and targeted for corrective or preventative action, including maintenance, rehabilitation, or replacement.

Table 1 Criticality Scoring Matrix for Assets
Public Works Integrated Master Plan
City of Oxnard

Criticality Category	Weight	Negligible = 1	Low = 4	Moderate = 7	Severe = 10
Public and Employee Health and Safety	30%	No injuries or adverse health effects	Minor injury with no lost-time or medical attention	Lost-time injury or medical attention	Multiple persons' lost-time injury or medical attention
Financial Impact	20%	Absorbed within current budget and under GM signature authority < $25,000	Requires Council approval $25,000 to $150,000	Requires Council approval $150,000 to $250,000	Requires Council approval > $250,000
Environmental or Regulatory Compliance	30%	Overall compliance with permits	Loss of expected efficiency	Hazardous material release	Single permit violation
Customer Service (Ability to Respond)	20%	Function restored within 8 hours	Function restored in 8 to 24 hours	Function restored in more than 24 hours but less than 3 days	Function restored in more than 3 days

3.0 ABOVE-GROUND ASSET ASSESSMENT

3.1 Above-Ground Overview

Above-ground assets included structures and equipment owned and operated by the City. A consistent approach was used for assessing and valuing all above-ground assets, regardless of whether they were within supply, treatment, or distribution. In total, 165 assets were identified across six blending stations and individual wells. The assets range from smaller instrumentation items to large building structures or reservoirs. Each asset was placed into an inventory and categorized by its asset type and discipline.

Carollo observed approximately 11 building structures, 41 pumps, 16 wells, and a variety of other assets. All assets are owned and operated by the City of Oxnard. The recorded age of each asset varied from 1965 to the present.

3.2 Above-Ground Vulnerability

The above-ground vulnerability is addressed based on visual condition assessment findings. The condition of each asset was evaluated on a one-through-five ranking scale, based on the International Infrastructure Management Manual (IIMM). In the IIMM, condition is expressed in terms of the amount of repair needed to bring an asset to "like new" condition. The definitions for the one-through-five condition ranking system from the IIMM are presented in Table 2. The assessment included inquiries into maintenance and performance history as well as design criteria, installation date, and typical condition parameters that could be used to standardize the procedure for future assessments.

Table 2 Asset Condition Ranking
Public Works Integrated Master Plan
City of Oxnard

Score[1]	Description[1]	Required Rehabilitation Percentage[1,2]
1	Very Good	0%
2	Good	1-10%
3	Fair	11-20%
4	Poor	21-50%
5	Very Poor	>50%

Notes:
(1) Adapted from the International Infrastructure Management Manual.
(2) Percentage of asset requiring rehabilitation: The percentage of the asset value needed to return the asset to a condition ranking of one.

3.2.1 Condition Assessment Findings

Significant findings are summarized below for each of the facility types. Details can be found in Appendix A.

3.2.1.1 Water Campus (Blending Stations 1 and 6)

The Water Campus is located at 251 S Hayes Ave in Oxnard, California. The Water Campus is the combined site for Blending Station No. 1 and Blending Station No. 6. This site contains six well locations and four buildings. The well locations include Wells No. 20, 22, 23, 32, 33, and 34. The assets at the Water Campus and surrounding well locations were found to be in variable condition depending on the age and type of the equipment.

The main Water Campus was recently redesigned along with the new Reverse Osmosis (RO) building that accompanies it. The assets at this location were found to be in relatively new condition since most of the parts were recently installed in 2008. The RO equipment has a shorter life span than most of the other asset types. Performance monitoring of this equipment is recommended to determine replacement timing.

The North Generator Building, located adjacent to the RO Building, contains older equipment that includes two generators, VFDs, two switchboards, and transfer switches. The generators and electric equipment were all found to be in fair to poor condition. The operator noted that the generators have not been maintained since 2010, and the VFDs are no longer produced by the manufacturer. Near term replacement of this equipment is recommended based on maintenance feasibility.

The Water Campus also contains a chemical building with an attached lab. The equipment at this location was found to be in generally good condition, similar to the RO equipment.

The six wells that are associated with the two blending stations were found to be varying condition. Well 34 was observed to be in poor condition and was not operable at the time of the assessment. The staff noted that the VFD was in need of replacement and a motor rewind. Well 22 was noted to have its column pipe replaced recently and was found to be in good condition. Well 32 and 33 were noted as requiring significant maintenance due to age.

The South Power Building was inspected during the site visit. This building contains a generator, switchgear, and VFDs that support the equipment on the southern portion of the Water Campus. This equipment was found to be in moderate condition, with the VFD powering Well 34 requiring replacement, and all other assets showing moderate aging.

3.2.1.2 Blending Stations 2 through 5

Blending Station No. 2 was observed to be in fair to poor condition. Both wells at this location were abandoned and no longer in use. The functional assets at this site include two valves, which are manually operated. The electrical and SCADA systems at this location

were observed to be nonfunctional and obsolete, requiring replacement. The two storage buildings at this location were observed to be in fair condition.

Blending Station No. 3 was observed to be in fair to very good condition. A majority of the assets at this location were installed in 2006. Well 30 and Well 31 require minor rehabilitation. All other assets at this location were observed to be in good condition.

Blending Station No. 4 was observed to be in fair to poor condition. A portion of the electrical equipment at this site is not currently in use including the three VFDs. Two of the horizontal split case pumps at this location are not currently in use. The center valve train was observed to be leaking and in poor condition, requiring rehabilitation.

Blending Station No. 5 was observed to be in fair to good condition. No issues were noted.

3.2.1.3 Wells

A list of the various components at each well is shown in Table 3. Well assets were generally found in good condition, except where noted.

3.2.2 Water Campus Cathodic Protection System Evaluation

A cathodic protection (CP) system evaluation of the Water Campus was conducted and is presented in a separate report titled Asset Corrosion Assessment and CP Evaluation Survey, dated September 2014. Key findings of the report were that the Water Campus has an existing cathodic protection system consisting of galvanic test stations located throughout the facility. At most of these anode test stations the pipe-to-soil potentials did not meet the NACE Criteria. Additional work will be required to design and install new galvanic anodes in order to provide adequate soil-side corrosion control. The 600,000 gallon steel water tank at this facility does not have corrosion control to mitigate water-side (internal) corrosion activity, but the tank reportedly has an internal protective coating system.

3.2.3 Remaining Useful Life Calculations

The following sections detail the approach for calculating remaining useful life for above-ground assets, which in turn is used to calculate vulnerability. The values calculated for each asset can be found in Appendix A.

Table 3 Well Assets Summary
Public Works Integrated Master Plan
City of Oxnard

	Water Campus (BS1 and BS6 Wells)						BS3 WELLS				Golf Course Wells	
	Well 20	**Well 22**	**Well 23**	**Well 32**	**Well 33**	**Well 34**	**Well 28**	**Well 29**	**Well 30**	**Well 31**	**Well 18**	**Well 27**
Motor HP	300	300	250	450	600	500	300	450	300	250	60	150?
Motor Mfr	US Motor	US Motor	US Motor	US Motor	Emerson	U S Motor	US Motor	US Motor	US Motor	US Motor	Newman?	N/A
Voltage	460	460	460	460	460	460	460	460	460	460	460	460
Frequency (HZ)	60	60	60	60	60	60	60	60	60	60	60	60
RPM	1775	1775	1780	1780	1775	1780	1785	1780	1780	1780	1765	1785
Safety Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Water Flush/Oil Lube	Water Flush	Water Flush	Water Flush	Water Flush	Water Flush	Water Flush	Water Flush	Water Flush	Water Flush	Water Flush	Oil Lube	Water Flush
Discharge Pipe Size	12"	12"	12"	14"	14" & 16"	12" & 14"	14"	14"	14"	14"	10" ?	10"
Mainline Check Valve	12"	12"	12"	14"	16"	14"	14"	14"	14"	14"	8"?	10"
Air/Vac Valve	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Magmeter (other)	12"	12"	12"	14"	14"	12"	14"	14"	14"	14"	Insertion	Insertion
Mainline Butterfly Valve	12"	12"	12"	N/A	N/A	N/A	14"	N/A	14"	14"	8"	10"
Mainline Acuated BFV	N/A	N/A	N/A	14"	16"	14"	N/A	14"	N/A	N/A	N/A	N/A
Air Release Valve	N/A	N/A	N/A	2"	2"	2"	N/A	N/A	N/A	N/A	N/A	N/A
PTW/Surge Pipe/Valve Size	6" & 4"	6" & 4"	6" & 4"	8"	8"	8"	6"	6"	6"	6"	N/A	N/A
PTW Valve	6"	6"	6"	8"	8"	8"	6"	6"	6"	6"	N/A	8"
PTW Isolation Valve	6"	6"	6"	8"	8"	8"	6"	6"	6"	6"	N/A	N/A
Surge Anticipator Valve	4"	4"	4"	8"	8"	8"	6"	6"	6"	6"	N/A	8"
Surge Anticipator Iso Valve	4"	4"	4"	8"	8"	8"	6"	6"	6"	6"	N/A	N/A
ASR Well/Baski Valve								Yes				
Condition (1 good - 5 bad)	2	1	3	3	3	3	1	1	2	2	4	4

3.2.3.1 Original Useful Life

Original Useful Life is the number of years an asset is expected to be in service as a function of asset type (i.e., mechanical, structural, electrical, instrumentation and control). Original Useful Life is used to develop different estimates of remaining useful life, described below. The Original Useful Life estimates for different types of assets are presented in Table 4. These estimates were based on industry standard guidelines (e.g., American Water Work Association (AWWA), Water Environment Federation (WEF), American Society of Civil Engineers (ASCE), and the International Infrastructure Management Manual (IIMM)).

Table 4 Original Useful Life Based on Asset Category
Public Works Integrated Master Plan
City of Oxnard

Asset Category	Original Useful Life[(1)]
Civil/Sitework	50
Structural	
General	50
Concrete	50
Fiberglass	25
Steel	25
Plastic	10
Mechanical	
General/Other	20
Valves	35
Pumps – Water	20
Pumps – Wastewater	20
Chemical Equipment	10
Coolers/ACs/Fans	15
Electrical	
General	20
VFDs	15
Instrumentation	
General	10
RTUs	15

Note:
(1) These defaults are based on values from the International Infrastructure Management Manual, Edition 2011, USEPA guides, other industry references, and Carollo project experience.

3.2.4 Evaluated Remaining Useful Life

The EvRUL is based on the current condition of the asset and is the estimated remaining number of years until the physical failure of the asset. EvRUL does not take into account the actual age of the asset; rather it reflects an estimate of remaining useful life based on the observed condition alone. EvRUL was calculated as:

$$(1 - \text{Condition Fraction}) \times \text{Original Useful Life}$$

Condition fractions are shown in Table 5. The relationship between condition ranking and condition fraction reflects the logic that once an asset deteriorates to a below-average condition, its probability of failure increases and its remaining years in service decline more rapidly than for assets that are maintained in good condition. The rehabilitation percentages associated with each condition ranking were used to estimate the condition fractions.

Table 5 Condition Fraction
Public Works Integrated Master Plan
City of Oxnard

Condition as Defined in Table 1	Condition Fraction
1 (Very Good)	0
2 (Good)	0.10
3 (Fair)	0.20
4 (Poor)	0.40
5 (Very Poor)	0.90

3.2.5 Economic Remaining Useful Life

The Economic Remaining Useful Life (EcRUL) aims to indicate the cost-based optimum time to rehabilitate an asset. EcRUL is an estimate of the point in an asset's service life before the maintenance costs and the likelihood of failure substantially increase, when the asset could still be restored to like-new condition with reasonable reinvestment or be replaced with a newer model offering improved efficiency. For example, a pump that has been overhauled at the right time with new bearings, gear shaft, and impeller may have a fully renewed service life. If the rehabilitation were postponed too late, however, the pump may no longer be serviceable with routine restoration methods. Likewise, a concrete structure in average condition can often be rehabilitated with crack sealing and coating, but if the structure is allowed to deteriorate too far, corrosion may extend to its members and require a rehabilitation effort with costs similar to that of a new building.

Based on Carollo observation of utilities and the management/reinvestments in assets, this period of time often occurs after the asset value reaches approximately half of its original value, when the cost for maintenance or rehabilitation of the asset begins to increase

considerably. EcRUL is therefore calculated in from the following equation, which begins with half of the original useful life:

(Original Useful Life / 2) - (Original Useful Life * Condition Fraction)

The precise optimum time for reinvestment or asset renewal cannot be predicted for any asset. Nevertheless, rehabilitation activities that extend beyond typical maintenance activities incur a cost, and this cost is usually less than the cost to replace the asset entirely. Therefore, a utility that wants to ideally optimize expenditures needs to examine rehabilitation opportunities prior to incurring the capital expenditures. EcRUL provides the City with a "trigger point" to conduct rehabilitation versus replacement analysis. EcRUL values are presented in Appendix A.

3.2.6 Vulnerability Summary

The highest vulnerability assets were those that have a poor condition and shorter original useful life. Vulnerability scores can be found in Appendix A.

3.3 Above-Ground Criticality

As noted in Section 2.2.2, a criticality matrix was developed for scoring the consequence of failure of assets. Criticality scores can be found in Appendix B. In general, assets with the highest criticality scores were structural or electrical assets. These have a high criticality score in all categories, and electrical assets in particular have a have a high health and safety factor due to hazards associated with troubleshooting these assets.

3.4 Above-Ground Risk

Risk scores can be found in Appendix A. A summary of the highest risk assets within the water system is presented in Table 6.

Table 6 Highest Risk Assets
Public Works Integrated Master Plan
City of Oxnard

Site/Asset	Risk
Blend Station 2	
SCADA System	2.01
Water Campus (BS1 and BS6)	
RO Building RO Filter (#1-3)	0.48
RO Building Cartridge Filter (#1-4)	0.48
Chemical Building Lab PLC	0.33
Well 18	
MCC Single Box	0.40
Pump	0.36

Table 6 Highest Risk Assets Public Works Integrated Master Plan City of Oxnard	
Site/Asset	**Risk**
Well 27	
MCC Cabinet	0.40
Pump	0.36
Blend Station 4	
Standby Generator	0.30
MCC	0.30
Switchboard	0.30

4.0 BELOW-GROUND ASSET ASSESSMENT

4.1 Below-Ground Overview

Figures 1, 2, and 3 show the distribution system by diameter, material, and age respectively.

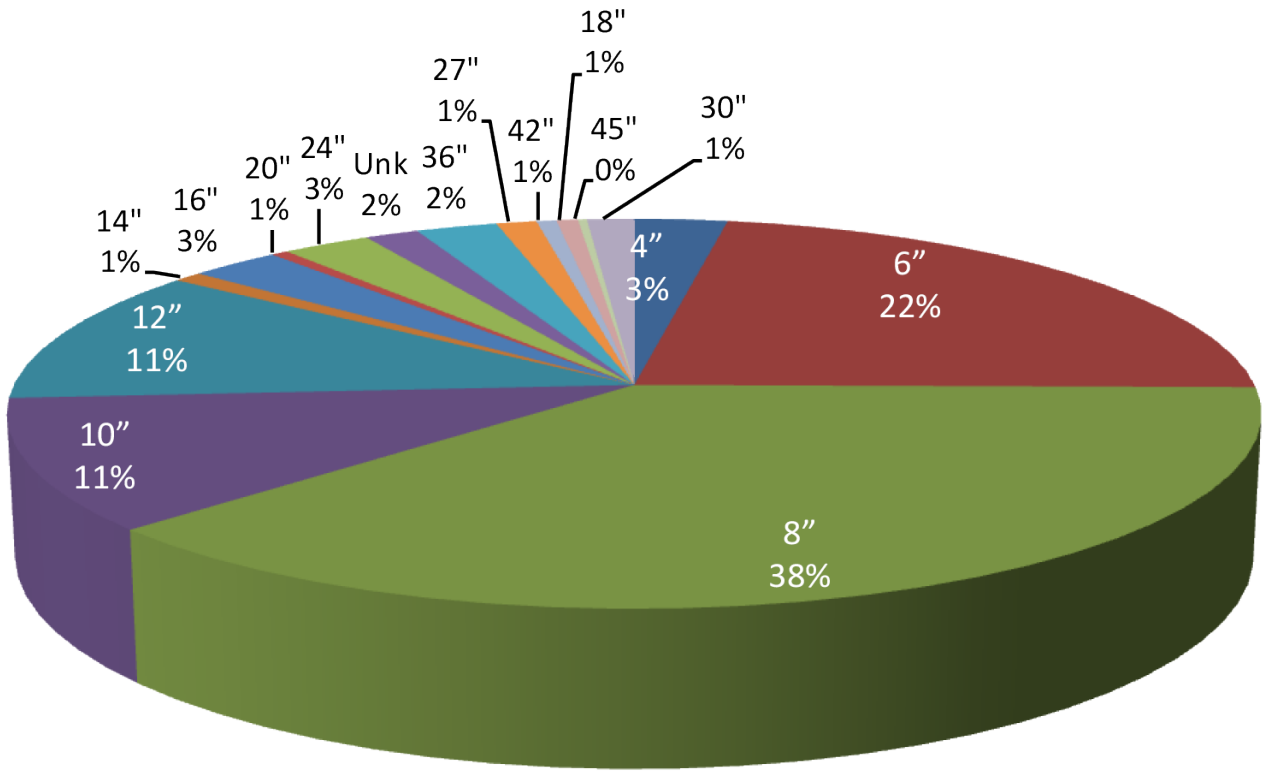
4.2 Below-Ground Vulnerability

The useful life of pipes varies based on several factors other than pipe age and material, but these other factors are often difficult to quantify. Other factors affecting pipe failures include:

- Pipe bedding that is substandard.
- Loading from traffic above pipes in the street.
- High groundwater levels.
- Freeze and thaw action of surrounding soils.
- Soil conditions and corrosivity.
- Construction methods, primarily poor quality work.
- Pipe lining issues.
- Level of and need for cathodic protection.
- Operating beyond recommended limitations of material.

Given the complexity of pipe failure prediction, age is typically used as an indicator of condition and therefore remaining useful life. Table 7 shows the reported original useful life expectancies of different pipe materials and the value chosen for input into the desktop evaluation model.

PIPE LENGTH BY DIAMETER



DISTRIBUTION SYSTEM BY DIAMETER

FIGURE 1

CITY OF OXNARD

PM NO. 2.4 – CONDITION ASSESSMENT

PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

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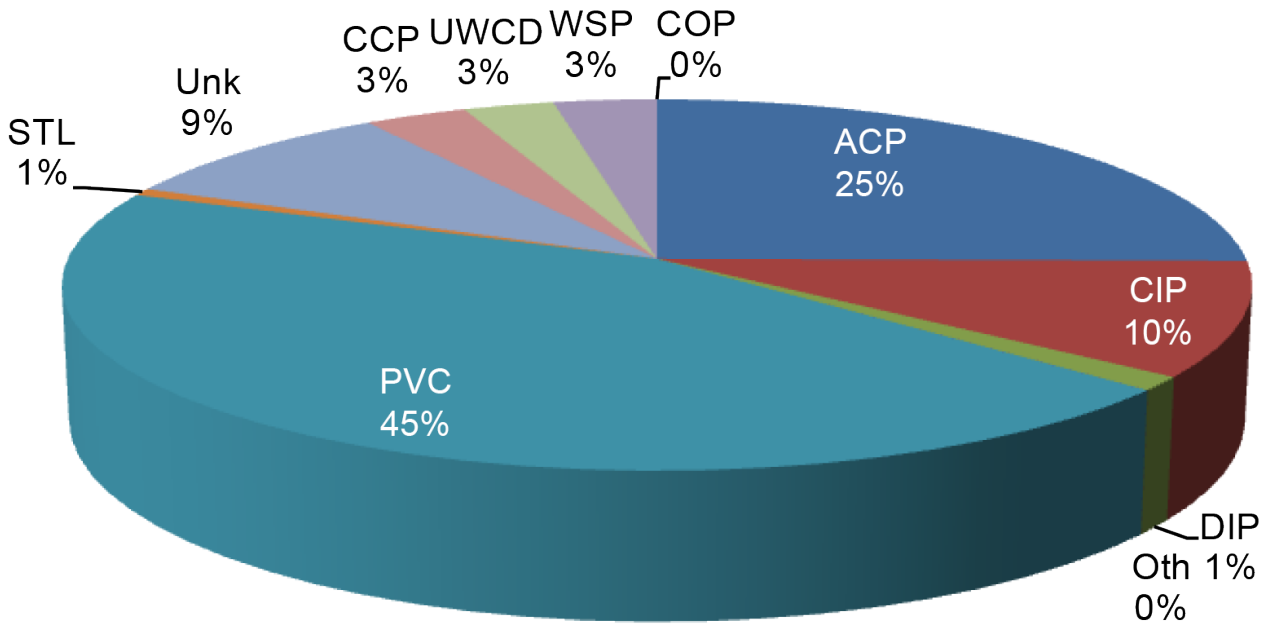
ox0715f46-9587(PM2-4 FIG1).ai

PIPE LENGTH BY MATERIAL



DISTRIBUTION SYSTEM MATERIAL

FIGURE 2

CITY OF OXNARD

PM NO. 2.4 – CONDITION ASSESSMENT

PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

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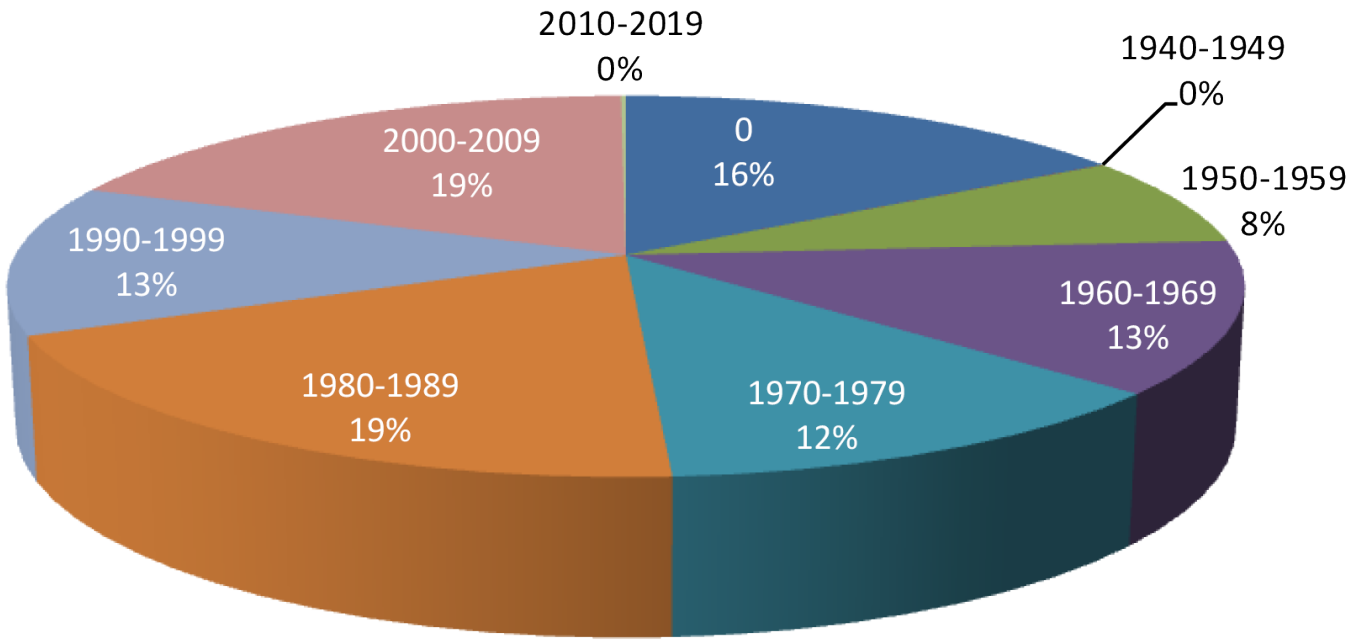
ox0715f47-9587(PM2-4 FIG2).ai

PIPE LENGTH BY DECADE INSTALLED



DISTRIBUTION SYSTEM AGE

FIGURE 3

CITY OF OXNARD
PM NO. 2.4 – CONDITION ASSESSMENT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

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ox0715f48-9587(PM2-4 FIG3).ai

Table 7 Original Useful Life Expectancies for Below-Ground Assets
Public Works Integrated Master Plan
City of Oxnard

Material	Pipe Code	Generally (years)	Life Expectancy Range (years)			Chosen Value
			100%	50%	10%	
Unlined Cast Iron	CIU	20 to 150	20 to 90	30 to 115	50 to 150	70
Lined Cast Iron (original)	CIP	30 to 175	30 to 80	50 to 180	70 to 175	115
Lined Ductile Iron (original)	DIP	30 to 200	30 to 100	50 to 150	90 to 200	100
Steel	SCP	20 to 125	20 to 75	40 to 100	60 to 125	70
Asbestos Cement	ACP	20 to 135	25 to 80	35 to 100	50 to 135	65
Concrete	CONC	30 to 200	30 to 100	40 to 150	60 to 200	95
AWWA C900 PVC	C900	30 to 110	40 to 60	60 to 90	90 to 110	75
PVC	PVC	30 to 150	30 to 100	40 to 130	50 to 150	85
Vitrified Clay Pipe	VCP	100	N/A	N/A	N/A	100
Polyethylene	PE	50	N/A	N/A	N/A	50
Manholes	MAN	30 to 100	N/A	N/A	N/A	70

References:
1. AWWARF Report, *Quantifying Future Rehabilitation and Replacement Needs of Water Mains* (1998).
2. AWWARF Report 91167, *Installation, Condition Assessment and Reliability of Service Lines* (2007).

4.2.1 Desktop Evaluation

The desktop evaluation relied on GIS data of the Oxnard distribution system. The dataset included information on diameter and material for 30,632 of the 39,341 segments. Installation year was available for 38,065 of the 39,341 segments, approximately three percent. Figure 4 shows the estimated vulnerability within the distribution system.

4.2.2 Distribution System Cathodic Protection Findings

As noted in Section 3.2.2, a cathodic protection system evaluation was conducted and is presented in a separate report titled Asset Corrosion Assessment and CP Evaluation Survey, dated September 2014. The cathodic protection systems for many of the water pipeline mains is still operational but reaching the end of their useful life. Most of the anode test stations were missing or could not be located. Three of the ten rectifiers for the water mains were not operational at all and will require immediate replacement of the CP rectifiers and anode ground beds.

Additionally, the study included evaluation of soil corrosivity. This effort included in situ conductivity measurements at multiple locations throughout the City, as well as twelve soil samples collected and analyzed in a certified laboratory. The findings of the corrosivity study were that the soil conditions range from “Corrosive” to “Severely Corrosive.” These conditions place a stronger emphasis on the need for working cathodic protection systems as well as protective coatings.

4.3 Below-Ground Criticality

While the criticality scoring system for below-ground assets was structured similar to that used for above-ground assets, specific criteria were developed for each of the below ground asset systems. These criteria are shown in Table 8. Several of the parameters in the criticality scoring matrix rely on data that is currently being developed in the Public Works Integrated Master Plans modeling efforts. Where data was not available, such as for the number of equivalent dwelling units served by a given segment of pipe, pipe diameter was used as a proxy for criticality. Figure 5 shows a map of the draft criticality scores of the Oxnard distribution system; this information will be combined and cross-referenced with the Below Ground Asset Management Tool (BAM) analysis summarized in PM 2.3, *Infrastructure Modeling and Alternatives* and input into City's GIS system under Phase 2 of this PWIMP effort.

4.4 Below-Ground Risk

Figure 6 shows a map of the City with the pipes color-coded to show the assets with the greatest potential risk of failure. These assets with the highest risk should be targeted for further inspection, repair, or replacement. As noted above, this information will be integrated with the BAM analysis under Phase 2.

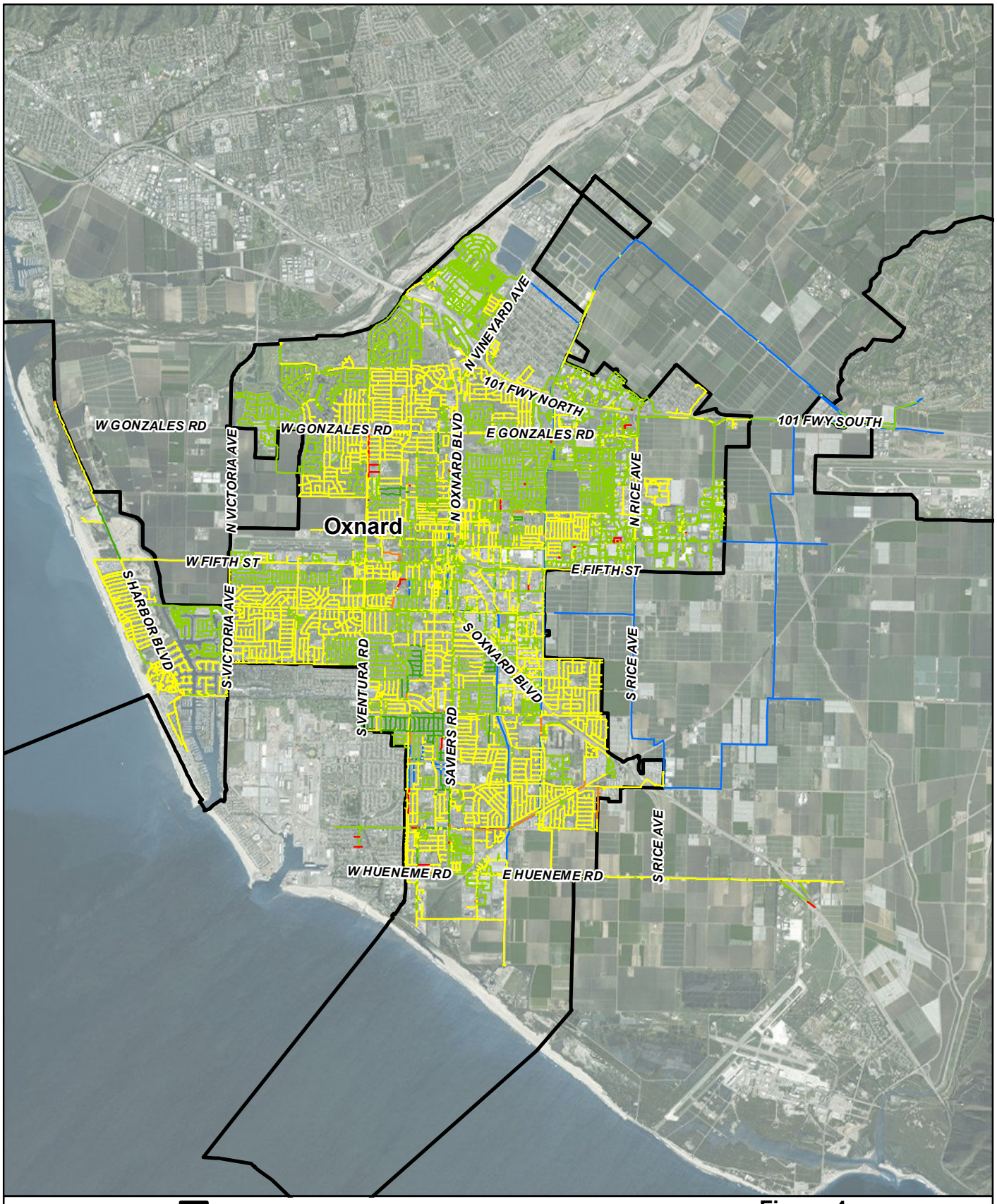

Figure 4
Distribution System Vulnerability

Public Works Integrated Master Plan

CITY OF OXNARD CALIFORNIA

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Table 8 Below-Ground Criticality Ranking Scale
Public Works Integrated Master Plan
City of Oxnard

Criticality Category	Weight	Negligible = 1	Low = 4	Moderate = 7	Severe = 10
Public and Employee Health and Safety	30%	Pipes serving < 100 EDUs	Pipes serving 100-500 EDUs	Pipes serving 500-1,000 EDUs	Pipes serving > 1,000 EDUs or within 500 feet of critical facility
Financial Impact	20%	6” pipes	8” pipes	10” pipes	12” pipes and larger
Environmental or Regulatory Compliance	30%	No pipes	Pipes not within protected habitat or 250 feet of waterway	Uphill from waterway within 250 feet	Pipes in protected natural habitat
Customer Service (Ability to Respond)	20%	Pipes within 2 miles of maintenance headquarters	Pipes greater than 2 miles of maintenance headquarters	Pipes defined as hard to access	Pipes > 12’ deep or > 12” diameter

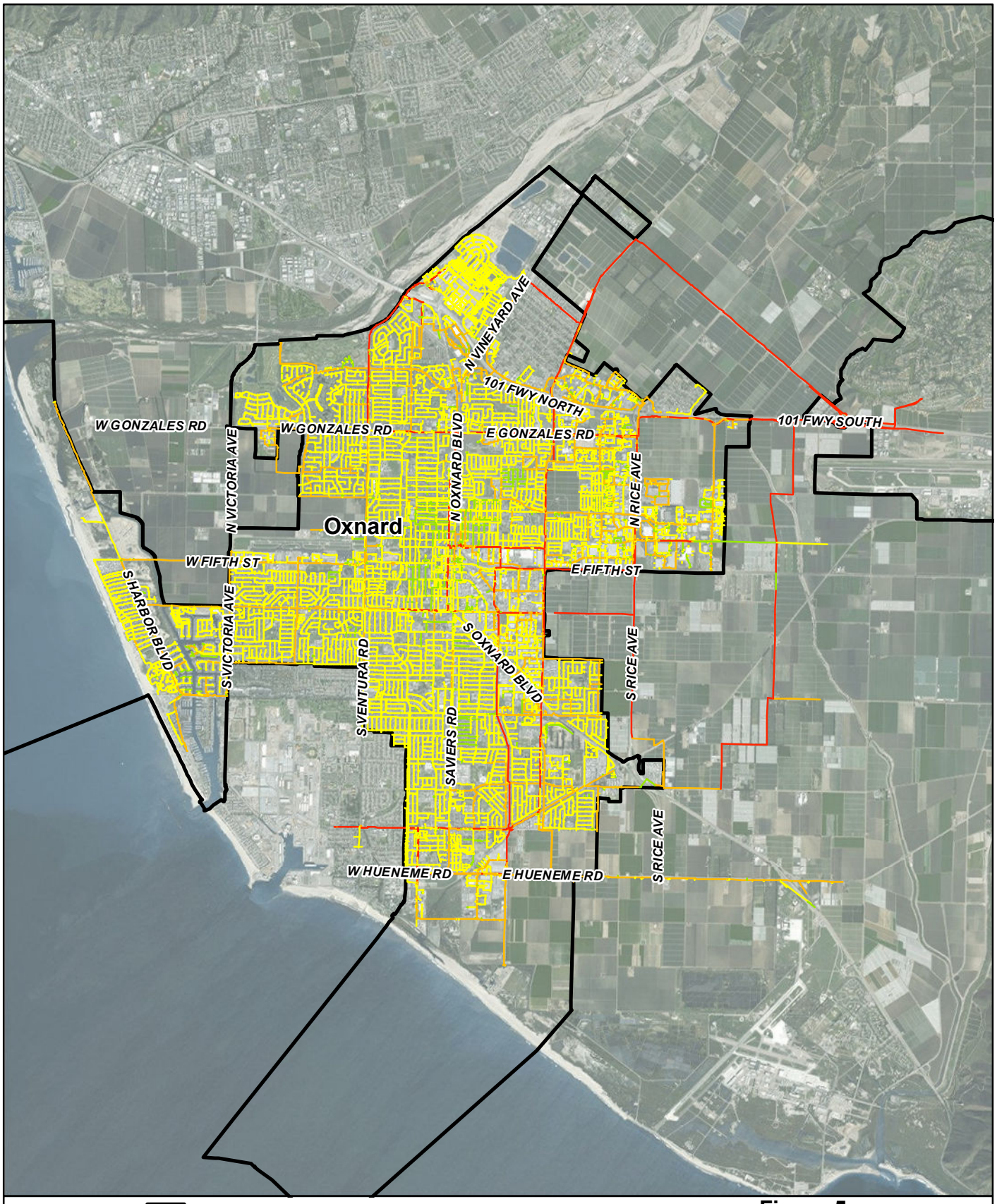

Figure 5
Distribution System Criticality
Public Works Integrated Master Plan

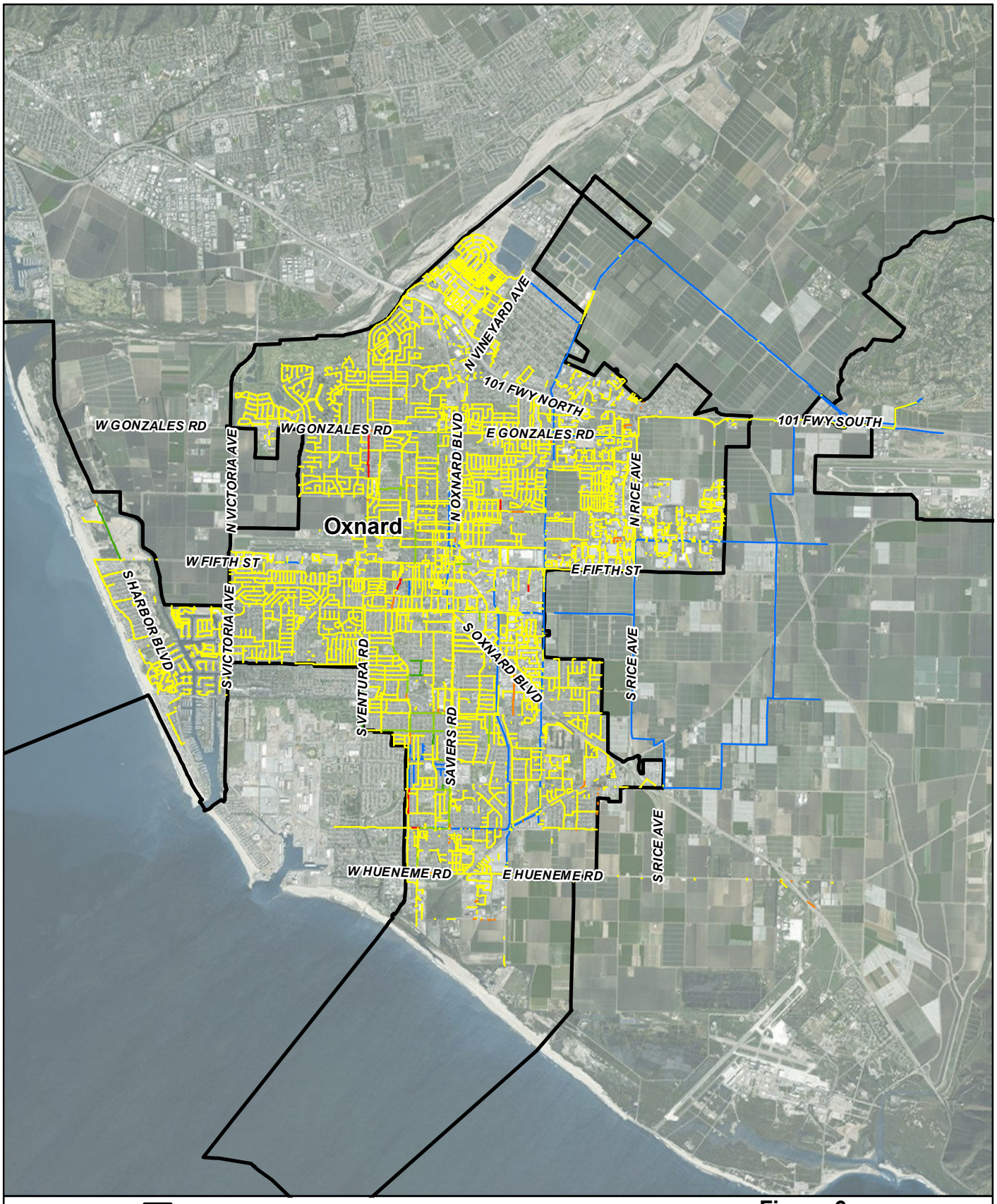

Figure 6
Distribution System Risk
Public Works Integrated Master Plan

APPENDIX A – WATER ASSETS CONDITION ASSESSMENT FINDINGS AND RISK SCORES

Condition Assessment Findings and Risk Scores

Water

Water Campus (BS1 and BS6 Wells)

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
BS 6 Magmeter for Permeate	2008	2	16" Krohne Magmeter. Good condition.	15	13.5	6	0.0741	2.5	0.19
BS 6 Magmeter for United	2008	2	Krohne Mag Meter.	15	13.5	6	0.0741	2.5	0.19
BS 6 Permeate Horizontal Split Case Pump	2008	2		20	18	8	0.0556	6.1	0.34
BS 6 Permeate Pump	2008	2	100 hp, 460 V. Peerless Horizontal Split Case. Serial: 2693402568 5AE11 8X6.	20	18	8	0.0556	6.1	0.34
BS 6 Security Cameras	2008	1		15	15	7.5	0.0667	1.6	0.11
BS 6 United Pump	2008	2	30 hp, 460 V. Horizontal Split Case.	20	18	8	0.0556	6.1	0.34
Chemical Building Ammonia Tank	2008	3		30	24	9	0.0417	7.3	0.3
Chemical Building Chemical Injector 1	2008	3		20	16	6	0.0625	4	0.25
Chemical Building Chemical Injector 2	2008	3		20	16	6	0.0625	4	0.25
Chemical Building Chemical Injector 3	2008	3		20	16	6	0.0625	4	0.25
Chemical Building Lab and Electrical Building	2008	3	20 x 12 x wood roof 25 ft high.	50	40	15	0.025	7.3	0.18
Chemical Building Lab PLC	2008	3		10	8	3	0.125	2.5	0.31

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Chemical Building Magmeter 1	2008	3	16" Krohne Mag Meter. Good condition, some corrosion present.	15	12	4.5	0.0833	2.5	0.21
Chemical Building Magmeter 2	2008	3	16" Krohne Mag Meter. Good condition, some corrosion present.	15	12	4.5	0.0833	2.5	0.21
Chemical Building Magmeter 3	2008	3	16" Krohne Mag Meter. Good condition, some corrosion present.	15	12	4.5	0.0833	2.5	0.21
Chemical Building RTU Tower	2008	1	All blending station connect to the wireless except BS #2.	15	15	7.5	0.0667	3.4	0.23
Chemical Building Security Cameras	1999	1		15	15	7.5	0.0667	1.6	0.11
Chemical Building Sodium Hypo Tank	2008	3		30	24	9	0.0417	7.3	0.3
North Gen Bldg Automated Tranfer Switch 1	2000	3		30	24	9	0.0417	4	0.17
North Gen Bldg Automated Tranfer Switch 2	2000	3		30	24	9	0.0417	4	0.17
North Gen Bldg Generator 1	2010	4	Caterpillar 750 kW. Maintained in 2010.	20	12	2	0.0833	6.7	0.56
North Gen Bldg Generator 2	2010	4	Caterpillar 750 kW. Maintained in 2010.	20	12	2	0.0833	6.7	0.56
North Gen Bldg Generator Building	2005	3	35' x 45'.	50	40	15	0.025	7.3	0.18
North Gen Bldg Switchboard 1	2000	3		20	16	6	0.0625	4	0.25
North Gen Bldg Switchboard 2	2014	3		20	16	6	0.0625	4	0.25
North Gen Bldg VFD 1	2000	4		15	9	1.5	0.1111	3.4	0.38
North Gen Bldg VFD 2	2000	4		15	9	1.5	0.1111	3.4	0.38
North Gen Bldg VFD 3	2000	4		15	9	1.5	0.1111	3.4	0.38

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
RO Building	2008	2	75' x 160'.	50	45	20	0.0222	7.3	0.16
RO Building Antiscalent Feed Pump 1	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Antiscalent Feed Pump 2	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Booster Pump 1	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Booster Pump 2	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Booster Pump 3	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Chem Tank	2008	2		30	27	12	0.037	7.3	0.27
RO Building CIP System VFD	2008	1		15	15	7.5	0.0667	3.4	0.23
RO Building Feed Water Well Pump 1	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Feed Water Well Pump 2	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Feed Water Well Pump 3	2008	2		20	18	8	0.0556	6.1	0.34
RO Building Permeate Room VFD 1	2008	2	Allen Bradly 1360. Rockwell automations. City is looking to replace.	15	13.5	6	0.0741	3.4	0.25
RO Building Permeate Room VFD 2	2008	2	Allen Bradly 1360. Rockwell automations. City is looking to replace.	15	13.5	6	0.0741	3.4	0.25
RO Building Permeate Room VFD 3	2008	2	Allen Bradly 1360. Rockwell automations. City is looking to replace.	15	13.5	6	0.0741	3.4	0.25
RO Building RO Chemical Pumps (6)	2008	2	200 gal.	20	18	8	0.0556	6.1	0.34

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
RO Building RO Clean-In- Place System	2008	2		20	18	8	0.0556	4	0.22
RO Building RO Filter 2	2008	2		10	9	4	0.1111	6.4	0.71
RO Building RO Filter 3	2008	2		10	9	4	0.1111	6.4	0.71
RO Building RO Hypochlorite Tank	2008	2	1900 gal.	30	27	12	0.037	7.3	0.27
RO Building RO NAOH Tank 1	2008	2	4400 gal each.	30	27	12	0.037	7.3	0.27
RO Building RO NAOH Tank 2	2008	2	4400 gal each.	30	27	12	0.037	7.3	0.27
RO Building RO Permeate Booster Pump 3	2008	2	260 gpm, 182 TDH, 15 inch impeller. Weinman Split Case Pump.	20	18	8	0.0556	6.1	0.34
RO Building Sodium Hydroxide Feed Pump 1	2008	2		10	9	4	0.1111	6.1	0.68
RO Building Sodium Hydroxide Feed Pump 2	2008	2		10	9	4	0.1111	6.1	0.68
RO Building Sodium Hydroxide Storage Tank 1	2008	2		30	27	12	0.037	7.3	0.27
RO Building Sodium Hydroxide Storage Tank 2	2008	2		30	27	12	0.037	7.3	0.27
RO Building Switchboard Permeate Room	2008	2		20	18	8	0.0556	4	0.22
RO Building Antiscalent Storage Tank	2008	2		30	27	12	0.037	7.3	0.27
RO Building Cartridge Filter 1	2008	2	5 um. Typically run 2 at a time.	10	9	4	0.1111	6.4	0.71
RO Building Cartridge Filter 2	2008	2	5 um. Typically run 2 at a time.	10	9	4	0.1111	6.4	0.71
RO Building Cartridge Filter 3	2008	2	5 um. Typically run 2 at a time.	10	9	4	0.1111	6.4	0.71
RO Building Cartridge Filter 4	2008	2	5 um. Typically run 2 at a time.	10	9	4	0.1111	6.4	0.71

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
RO Building CIP System Chem Tank	2008	2		30	27	12	0.037	7.3	0.27
RO Building CIP System Tank	2008	2		30	27	12	0.037	7.3	0.27
RO Building CIP System Water Pump	2008	2	75 hp. 1150 gpm, 1750 rpm. Sulzer pump.	20	18	8	0.0556	6.1	0.34
RO Building Diesel Tank	2008	2		30	27	12	0.037	7.3	0.27
RO Building Permeate Booster Pump 1	2008	2	260 gpm, 182 TDH, 15 inch impeller. Weinman Split Case Pump.	20	18	8	0.0556	6.1	0.34
RO Building Permeate Booster Pump 2	2008	2	260 gpm, 182 TDH, 15 inch impeller. Weinman Split Case Pump.	20	18	8	0.0556	6.1	0.34
RO Building Permeate Tank	2008	2	Diameter 70', Height 25.25', (600,000 gal) Oveflow 24.75,Volume 600,000 gallon. Normal capacity. Tank not restrained. Concrete base at ring. All connections have flex tends. Extra outlet for ASR.	50	45	20	0.0222	8.5	0.19
RO Building RO Filter 1	2008	2		10	9	4	0.1111	6.4	0.71
RO Building Solar Inverter	2008	2	10.5 kW.	20	18	8	0.0556	4	0.22
RO Building Solar Panels	2008	2	70' x 80'. (cost is post incentive, total cost= $222,137).	20	18	8	0.0556	2.5	0.14
South Power Bldg Fuel Tank for South Generator	1995	2		20	18	8	0.0556	7.3	0.41
South Power Bldg PLC Panel	2004	2		10	9	4	0.1111	2.5	0.28
South Power Bldg South Power Building Structure	1995	2	25' x 50' Steel and concrete building.	50	45	20	0.0222	7.3	0.16
South Power Bldg Switchboard	1995	2		20	18	8	0.0556	4	0.22

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
South Power Bldg Generator	2008	3	CAT 2000 kW Diesel. Supports everything South of the bridge; wells 34, 33, and 32.	20	16	6	0.0625	6.7	0.42
South Power Bldg VFDs	1999	2		15	13.5	6	0.0741	3.4	0.25
Well 20	2000	1	Water lubricated. Last rehab was 2000. 300 Mfr, US Motors, 460V, 60 HZ, 1775 RPM, 1.15 Safety Factor, Water Flush, 12" discharge, mainline check valve, air/Vac valve, 6" PTW Surge Pipe Valve, 6" PTW Isolation Valve, 6" PTW Isolation Valve. Water lubricated. Last rehab was 2000. 300 Mfr, US Motors, 460V, 60 HZ, 1775 RPM, 1.15 Safety Factor, Water Flush, 12" discharge, mainline check valve, air/Vac valve, 6" PTW Surge Pipe Valve, 6" PTW Isolation Valve, 6" PTW Isolation Valve.	30	30	15	0.0333	6.4	0.21
Well 20 Valves, Meters, Gauges	2000	1		15	15	7.5	0.0667	2.5	0.17
Well 20 Well Pump	2000	1		20	20	10	0.05	6.1	0.31

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Well 22	2013	3	300 Mfr, US Motors, 460V, 60 HZ, 1775 RPM, 1.15 Safety Factor, Water Flush, 12" discharge, mainline check valve, air/Vac valve, 6" PTW Surge Pipe Valve, 6" PTW Isolation Valve, 6" PTW Isolation Valve, 4" Surge Anticiptor Valve. Effluent water can not go through 300 Mfr, US Motors, 460V, 60 HZ, 1775 RPM, 1.15 Safety Factor, Water Flush, 12" discharge, mainline check valve, air/Vac valve, 6" PTW Surge Pipe Valve, 6" PTW Isolation Valve, 6" PTW Isolation Valve, 4" Surge Anticiptor Valve.	30	24	9	0.0417	6.4	0.27
Well 22 Diesel Tank	2013	2		30	27	12	0.037	7.3	0.27
Well 22 Valves, Meters, Gauges	2013	1		15	15	7.5	0.0667	2.5	0.17
Well 22 Vertical Turbine Pump	2013	2	Flexible coupler. Column pipe was replaced- LLS epoxy coated. Pump replaced. Water flush, water lubricated bearings.	20	18	8	0.0556	6.1	0.34
Well 23 Casing Packing	2000	1	Some corrosion leaking on valve for pressure relief. Some corrosion on pump hand. Last rehab in 2000.	30	30	15	0.0333	2.8	0.09
Well 23 Valves, Meters, Gauges	2000	1	Krohne.	15	15	7.5	0.0667	2.5	0.17
Well 23 Vertical Pump	2000	1	12 inch.	20	20	10	0.05	6.1	0.31
Well 32 Paving/Fencing	2007	3	8' x 35'.	50	40	15	0.025	1.6	0.04
Well 32 Pump	2007	3	Christensen pump. Serial number: 504171.	20	16	6	0.0625	6.1	0.38
Well 32 Valves, Meters, Gauges	2007	3	Krohne Magmeter 12".	15	12	4.5	0.0833	2.5	0.21

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Well 32 Casing and Packing	2007	3		30	24	9	0.0417	2.8	0.12
Well 33 Pump	1994	3	Christensen pump. Serial number: 504203.	20	16	6	0.0625	6.1	0.38
Well 33 Casing and Packing	1990	2	Serves RO system.	30	27	12	0.037	2.8	0.1
Well 33 Paving/Fencing	1990	2	Concrete Pad 8' x 25'.	50	45	20	0.0222	1.6	0.04
Well 33 Valves, Meters, Gauges	2007	3	14" Krohn Mag Meter.	15	12	4.5	0.0833	2.5	0.21
Well 34 Casing and Packing	1990	3		30	24	9	0.0417	2.8	0.12
Well 34 Paving/Fencing	1990	2	Concrete Pad 8' x 25'.	50	45	20	0.0222	1.6	0.04
Well 34 Pump	1994	5	Christensen pump. Serial number: 504170. Asset not operable. VFD needs replacement motor rewind.	20	2	-8	0.7	6.1	4.27
Well 34 Valves, Meters, Gauges	1999	3	14" Krohn Mag Meter.	15	12	4.5	0.0833	2.5	0.21
Blend Station 2									
Center Building	1971	3	12' x 20' x 8' tall. Wood roof.	50	40	15	0.025	7.3	0.18
SCADA System- Non Functional	2004	5		10	1	-4	0.9	2.5	2.25
Storage Building 1	1971	3	15' x 15' x 8' tall.	50	40	15	0.025	7.3	0.18
Storage Building 2	1971	3	15' x 15' x 8' tall.	50	40	15	0.025	7.3	0.18
Valves, Meters, Gauges	1999	1	12" Magmeter.	15	15	7.5	0.0667	2.5	0.17
Well 16	2014	3	Abondoned.	20	16	6	0.0625	6.4	0.4
Well 17	2014	3	Abondoned.	20	16	6	0.0625	6.4	0.4
Blend Station 3									
Aqueous Ammonia Tank	2006	2		30	27	12	0.037	7.3	0.27

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Building Structure - North Lab	2006	2	100 ' x 20' x Includes Sampling Station, Lab, SCADA Room, Rest Room, Break Room.	50	45	20	0.0222	7.3	0.16
Building Structure - Southern Garage	2006	2	40' x 30'.	50	45	20	0.0222	7.3	0.16
Building Structure - Western Overhang	2006	2	60' x 25'.	50	45	20	0.0222	7.3	0.16
Fire Suppression System	2006	2		20	18	8	0.0556	4	0.22
Generator	2006	2	1000kW Cummins Diesel Gen, Model DFHD-5707195. Sized to run three wells. Very good condition.	20	18	8	0.0556	6.7	0.37
PLC Cabinet	2006	2		10	9	4	0.1111	2.5	0.28
Pump Skid 1	2006	2	2 diaphragm pump pumps each skid.	20	18	8	0.0556	6.1	0.34
Pump Skid 2	2006	2	2 diaphragm pump pumps each skid.	20	18	8	0.0556	6.1	0.34
Pump Skid 3	2006	2	2 diaphragm pump pumps each skid.	20	18	8	0.0556	6.1	0.34
Security Cameras	2006	2		15	13.5	6	0.0741	1.6	0.12
Sodium Hypochlorite Storage Tank	2006	2		30	27	12	0.037	7.3	0.27
Switchboard	2006	2		20	18	8	0.0556	4	0.22
Transformer	2006	2		20	18	8	0.0556	6.1	0.34
VFDs	2006	2	Allen Bradly.	15	13.5	6	0.0741	3.4	0.25
Water Softener Tank 1	2006	2		30	27	12	0.037	7.3	0.27
Water Softener Tank 2	2006	2		30	27	12	0.037	7.3	0.27
Well 28 Casing and Packing	2006	3		30	24	9	0.0417	2.8	0.12

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Well 28 Pump	2006	3	2235GPM, 364 TDH, 10MF20.	20	16	6	0.0625	6.1	0.38
Well 28 Valves, Meters, Gauges	2006	3		15	12	4.5	0.0833	2.5	0.21
Well 29 Casing and Packing	2006	2	ASR Well.	30	27	12	0.037	2.8	0.1
Well 29 Pump	2006	2	Flowserve (3315 gpm, 390 TDH).	20	18	8	0.0556	6.1	0.34
Well 29 Valves, Meters, Gauges	2006	2		15	13.5	6	0.0741	2.5	0.19
Well 30 Casing and Packing	2006	2		30	27	12	0.037	2.8	0.1
Well 30 Pump	2006	2	2150 GPM, 320 TDH, 10" discharge.	20	18	8	0.0556	6.1	0.34
Well 30 Valves, Meters, Gauges	2006	2	14" Krohne Magmeter.	15	13.5	6	0.0741	2.5	0.19
Well 31 Casing and Packing	2006	2		30	27	12	0.037	2.8	0.1
Well 31 Pump	2006	2	Flowserve (2150 GPM, 320 TDH).	20	18	8	0.0556	6.1	0.34
Well 31 Valves, Meters, Gauges	2006	2	14" Krohne Magmeter.	15	13.5	6	0.0741	2.5	0.19
Blend Station 4									
Booster Pump 1	1994	3	75 hp 2335 GPM, 65 TDH. Toshiba, Horizontal split case pump.	20	16	6	0.0625	6.1	0.38
Booster Pump 2	1994	3	75 hp 2335 GPM, 65 TDH. Toshiba, Horizontal split case pump.	20	16	6	0.0625	6.1	0.38
MCC	1994	4		20	12	2	0.0833	5.5	0.46
Paving/Fencing	1990	3	CMU 40' X 50'x 26' tall.	50	40	15	0.025	1.6	0.04
Pump 1	1994	3		20	16	6	0.0625	6.1	0.38
Pump 2	1994	3		20	16	6	0.0625	6.1	0.38
Pump 3	1994	3		20	16	6	0.0625	6.1	0.38
Security Cameras	1999	3		15	12	4.5	0.0833	1.6	0.13

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Standby Generator	1994	3	Cummins Diesel.	20	16	6	0.0625	6.7	0.42
Switchboard	1994	3		20	16	6	0.0625	4	0.25
VFDs	1999	3	Not used for 15 years.	15	12	4.5	0.0833	3.4	0.28
Blend Station 5									
Magmeter 1	2007	2	12" Magmeter.	15	13.5	6	0.0741	2.5	0.19
PLC	2007	2		10	9	4	0.1111	2.5	0.28
RTU Tower	2007	2		15	13.5	6	0.0741	3.4	0.25
Security Cameras	2007	2		15	13.5	6	0.0741	1.6	0.12
Standby Generator	2007	2	10 kW, diesel engine.	20	18	8	0.0556	6.7	0.37
Structure	2007	2	20' x 9' x 8' CMU walls with steel roof.	50	45	20	0.0222	7.3	0.16
Valve 1	2007	2	18".	35	31.5	14	0.0317	3.4	0.11
Well 18									
Well 18 Pump	2014	4		20	12	2	0.0833	6.1	0.51
Well 18 Valves, Meters, Gauges	1999	4		15	9	1.5	0.1111	2.5	0.28
Well 26									
Maulhard Well	1984	4	Maulhard farms is the owner operator but the city helped finanace it.	30	18	3	0.0556	6.4	0.36
Well 27									
MCC Cabinet	1994	4		20	12	2	0.0833	5.5	0.46
Paving Fencing	1985	4	6' x 20' Concrete pad.	50	30	5	0.0333	1.6	0.05
Pump	1994	4	Used to fill golf course lake. Corrosion around pump head.	20	12	2	0.0833	6.1	0.51

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

Component	Year	Condition	Comments	OUL	EvRUL	EcRUL	Vuln	Criticality	Risk
Well 27 Valves, Meters, Gauges	1999	4	Mcrometer 10" flow meter.	15	9	1.5	0.1111	2.5	0.28

1. Original Useful Life.
2. Evaluated Remaining Useful Life.
3. Economic Remaining Useful Life.
4. Vulnerability.

APPENDIX B – WATER ASSETS CONDITION ASSESSMENT CRITICALITY SCORES

Criticality Scores

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Water					
Water Campus (BS1 and BS6 Wells)					
BS 6 Magmeter for Permeate	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
BS 6 Magmeter for United	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
BS 6 Permeate Horizontal Split Case Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
BS 6 Permeate Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
BS 6 Security Cameras	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
BS 6 United Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Chemical Building Ammonia Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
Chemical Building Chemical Injector 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
Chemical Building Chemical Injector 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Chemical Building Chemical Injector 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
Chemical Building Lab and Electrical Building	Potential for loss of life	More than $250,000	Major	No impacts	7.3
Chemical Building Lab PLC	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Chemical Building Magmeter 1	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Chemical Building Magmeter 2	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Chemical Building Magmeter 3	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Chemical Building RTU Tower	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
Chemical Building Security Cameras	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Chemical Building Sodium Hypo Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
North Gen Bldg Automated Tranfer Switch 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
North Gen Bldg Automated Tranfer Switch 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
North Gen Bldg Generator 1	No lost-time injuries or medical attention	More than $250,000	Major	Short-term impact	6.7
North Gen Bldg Generator 2	No lost-time injuries or medical attention	More than $250,000	Major	Short-term impact	6.7
North Gen Bldg Generator Building	Potential for loss of life	More than $250,000	Major	No impacts	7.3
North Gen Bldg Switchboard 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
North Gen Bldg Switchboard 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
North Gen Bldg VFD 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
North Gen Bldg VFD 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
North Gen Bldg VFD 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
RO Building	Potential for loss of life	More than $250,000	Major	No impacts	7.3
RO Building Antiscalent Feed Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Antiscalent Feed Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Booster Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
RO Building Booster Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Booster Pump 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Chem Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building CIP System VFD	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
RO Building Feed Water Well Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Feed Water Well Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Feed Water Well Pump 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Permeate Room VFD 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
RO Building Permeate Room VFD 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
RO Building Permeate Room VFD 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
RO Building RO Chemical Pumps (6)	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
RO Building RO Clean-In- Place System	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
RO Building RO Filter 2	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building RO Filter 3	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building RO Hypochlorite Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building RO NAOH Tank 1	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building RO NAOH Tank 2	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building RO Permeate Booster Pump 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Sodium Hydroxide Feed Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Sodium Hydroxide Feed Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Sodium Hydroxide Storage Tank 1	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building Sodium Hydroxide Storage Tank 2	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
RO Building Switchboard Permeate Room	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
RO Building Antiscalent Storage Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building Cartridge Filter 1	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building Cartridge Filter 2	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building Cartridge Filter 3	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building Cartridge Filter 4	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building CIP System Chem Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building CIP System Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building CIP System Water Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Diesel Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
RO Building Permeate Booster Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
RO Building Permeate Booster Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
RO Building Permeate Tank	Potential for loss of life	More than $250,000	Major	Short-term impact	8.5
RO Building RO Filter 1	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
RO Building Solar Inverter	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
RO Building Solar Panels	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
South Power Bldg Fuel Tank for South Generator	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
South Power Bldg PLC Panel	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
South Power Bldg South Power Building Structure	Potential for loss of life	More than $250,000	Major	No impacts	7.3
South Power Bldg Switchboard	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
South Power Bldg Generator	No lost-time injuries or medical attention	More than $250,000	Major	Short-term impact	6.7
South Power Bldg VFDs	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
Well 20	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Well 20 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 20 Well Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 22	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
Well 22 Diesel Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
Well 22 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 22 Vertical Turbine Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 23 Casing Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 23 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 23 Vertical Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 32 Paving/Fencing	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Well 32 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 32 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Well 32 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 33 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 33 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 33 Paving/Fencing	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Well 33 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 34 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 34 Paving/Fencing	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Well 34 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 34 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Blend Station 2					
Center Building	Potential for loss of life	More than $250,000	Major	No impacts	7.3
SCADA System- Non Functional	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Storage Building 1	Potential for loss of life	More than $250,000	Major	No impacts	7.3

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Storage Building 2	Potential for loss of life	More than $250,000	Major	No impacts	7.3
Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 16	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
Well 17	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
Blend Station 3					
Aqueous Ammonia Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
Building Structure - North Lab	Potential for loss of life	More than $250,000	Major	No impacts	7.3
Building Structure - Southern Garage	Potential for loss of life	More than $250,000	Major	No impacts	7.3
Building Structure - Western Overhang	Potential for loss of life	More than $250,000	Major	No impacts	7.3
Fire Suppression System	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
Generator	No lost-time injuries or medical attention	More than $250,000	Major	Short-term impact	6.7
PLC Cabinet	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Pump Skid 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Pump Skid 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Pump Skid 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Security Cameras	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Sodium Hypochlorite Storage Tank	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
Switchboard	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
Transformer	Lost-time injury or medical attention	Between $150,000 and $250,000	Minor	Short-term impact	6.1
VFDs	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
Water Softener Tank 1	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
Water Softener Tank 2	Potential for loss of life	Between $25,000 and $150,000	Major	Short-term impact	7.3
Well 28 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 28 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Well 28 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 29 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 29 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 29 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 30 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 30 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 30 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 31 Casing and Packing	No lost-time injuries or medical attention	Less than $25,000	Minor	No impacts	2.8
Well 31 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 31 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Blend Station 4					
Booster Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Booster Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
MCC	No lost-time injuries or medical attention	Between $150,000 and $250,000	Major	Minor disruption	5.5
Paving/Fencing	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Pump 1	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Pump 2	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Pump 3	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Security Cameras	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Standby Generator	No lost-time injuries or medical attention	More than $250,000	Major	Short-term impact	6.7
Switchboard	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	Minor disruption	4
VFDs	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4
Blend Station 5					
Magmeter 1	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
PLC	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
RTU Tower	No lost-time injuries or medical attention	Between $25,000 and $150,000	Minor	No impacts	3.4

Component	Public and Employee Health and Safety	Financial Impact	Environmental or Regulatory Compliance	Customer Service	Total Criticality
Security Cameras	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Standby Generator	No lost-time injuries or medical attention	More than $250,000	Major	Short-term impact	6.7
Structure	Potential for loss of life	More than $250,000	Major	No impacts	7.3
Valve 1	No lost-time injuries or medical attention	Less than $25,000	Minor	Minor disruption	3.4
Well 18					
Well 18 Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 18 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5
Well 26					
Maulhard Well	Lost-time injury or medical attention	Between $25,000 and $150,000	Major	Short-term impact	6.4
Well 27					
MCC Cabinet	No lost-time injuries or medical attention	Between $150,000 and $250,000	Major	Minor disruption	5.5
Paving Fencing	No effect	Between $25,000 and $150,000	No effect	No impacts	1.6
Pump	No lost-time injuries or medical attention	Between $25,000 and $150,000	Major	Long-term impact	6.1
Well 27 Valves, Meters, Gauges	No effect	Between $25,000 and $150,000	Minor	No impacts	2.5