

Timing is Everything: CIP Prioritization Methods

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Ideas in motion.

Agenda

- Introduction to Anchorage Water and Wastewater Utility
- AWWU's Former CIP Prioritization
 - Process
 - Drivers to Improve
- Alternative CIP Prioritization Methods
- Asset Management / Risk-Based Solution
- What's Else and What's Next?

But first...



How Much Time Spent Prioritizing?



Introduction to Anchorage Water and Wastewater Utility



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Anchorage Water and Wastewater Utility (AWWU)



- 300 Employees
- Annual CAPEX: \$50M
- 2 WTPs; 3 WWTPs
- 50 MG in reservoirs
- 850 miles of water main / 750 miles of sewers
 - Average cover is 10 feet
- 350,000 population served
 - 40% of AK population; heavily regulated by state (ARC)
- Strategic Asset Services Section \approx 10 years old

AWWU's Former CIP Prioritization

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"The Matrix" – Excel based

| Prepared By: Stephen Nuss | | Date: 6/21/2016 | | | | | | | | | | | | | | | | | | | |
|---|--|--|--|---|--|--|--|--|---|---|--|--|--|----------------------------|--|--|--|----------------------|--|------|--|
| Project: 3000 Arctic IT Office Upgrades | | PSID#: _____ | | Plan Years: 2017 | | Project Score: 3.94 | | | | | | | | | | | | | | | |
| A | | B | | C | | D | | E | | F | | G | | H | | I | | J | | | |
| Weighting Factor | | 19.3% | | 15.9% | | 6.6% | | 6.6% | | 7.6% | | 4.4% | | 12.4% | | 1.6% | | 16.7% | | 8.3% | |
| Safety & Security Consequence of Failure | | Environment & Regulation Consequence of Failure | | Critical Assets Consequence of Failure | | Customer Needs Consequence of Failure | | Reliability Consequence of Failure | | Coordination with Outside Entities Consequence of Failure | | Maintenance Requirements Consequence of Failure | | Excellence thru Innovation | | Financial Benefit (5 year NPV) (CBA Required) | | Strategic Importance | | | |
| 100 FALSE 19.3 | | 100 FALSE 15.9 | | 100 FALSE 6.6 | | 100 FALSE 6.6 | | 100 FALSE 7.6 | | 100 FALSE 4.4 | | 100 FALSE 12 | | 100 FALSE 1.6 | | 100 FALSE 16.7 | | 100 FALSE 8.9 | | | |
| I | | High expectation of a serious injury, or life-threatening potential. | Compliance order or regulation that requires immediate action. | Major deficiency affecting a large population of end-users. There is no possibility of a work-around without asset. | Complete disruption of service; inaccurate billing; customer communication to Utility completely inoperable. | Current system (equipment) not reliable, exhibits problem on a daily basis and no immediate fix (correction) is available. | Window of opportunity for project is limited to project timeline being driven by an outside entity and there is immediate demonstrated need. Intangible benefit can be realized by coordinating schedule to coincide and another | High risk of major system failure that would cause interruption of service, or damage to property or equipment. | Provider opportunity to employ state-of-the-art technology with benefit proven through application elsewhere. | Project's implementation will result in demonstrable enhanced revenue/cost reductions: \$1,000,000 over the next five years above the cost of the project. Alternatively, failure of an un-maintained system would cost \$1,000,000 in higher costs over the next five years. | Specifically identified as an Achievement in current AWWU Strategic Plan, or high priority element of Utility-wide plan. | | | | | | | | | | |
| II | | Medium risk of serious injury | Regulation that requires compliance in near future 1-5 years OR Anticipated regulation with major implications for AWWU Operations | Major deficiency affecting small population of end-users. There is no possibility of a work-around without asset. | Intermittent service to customers; poor communication with customers | Current system (configuration) is complex which leads to human error, or is aging and exhibits problem on a weekly basis and no immediate correction is available. | There is an immediate and demonstrated need for the project and an outside entity has a like-project. Another opportunity is improbable. | High risk of system failure and the potential for interruption of service, or damage to property or equipment. | Project will advance the state-of-the-art with probable consequential benefit identified. | Project's implementation will result in demonstrable enhanced revenue/cost reductions: \$150,000 over the next five years above the cost of the project. Alternatively, failure of an un-maintained system would cost \$1,000,000 or > \$150,000 over the next five years. | High priority for AWWU Board and endorsed by the MOA. | | | | | | | | | | |
| III | | Low risk of serious injury | Anticipated regulation (regulation in the current legislative/regulatory process) | Major deficiency with possibility of affecting large population of end-users. Work-around possible with heavy burden on Utility resources. Asset is at or exceeds service capacity and does not | Service is adequate, but could use improvement. Complaints handled but in less than efficient manner. | Current system exhibits problems on a monthly basis - a work-around is available but is difficult to learn and is prone to human error. | There is a demonstrated long-term need for the project and an outside entity has a like-project. Intangible benefit can be realized by coordinating schedule to coincide. | Risk of system failure and the potential for interruption of service, damage to property or equipment in a limited area. | Project will advance the state-of-the-art without significant consequential benefit. | Project's costs are repaid (through lower costs or enhanced revenue) within 1st year of completion: "Year 1 break even". Alternatively, failure of an un-maintained system would cost what the prepared project costs in Year 1. | High priority for AWWU Board. | | | | | | | | | | |
| IV | | Low risk of minor injury | Potential regulation anticipated in next 5-10 years. | Moderate deficiency affecting a population of end-users where work-around is possible, however it is inconvenient and limits functionality. | Work-around or replace technological innovation making work flow difficult | System produces reliable results, technology is old and difficult or expensive to maintain. A system failure would result in undetected problems. | The project may be needed. An outside entity has a like-project. | System or system is not supported by a vendor and it is reaching the end of its predicted useful life. | Project will eliminate an outmoded practice. | Project's costs are repaid (through lower costs or enhanced revenue) within 5 years of completion: "Year 5 break even". Alternatively, failure of an un-maintained system would cost what the prepared project costs through Year 5. | Project supports far more Achievements in current AWWU Strategic Plan, or is identified in a Utility-wide plan. | | | | | | | | | | |
| V | | Risk on affect of quality of public service, employee stress | Potential regulation anticipated in >10 years. | Minor deficiency affecting a population of end-users. Annoying, but not disruptive | Little impact on customer, mostly in-house work items are affected | System technology is aging, support and/or parts are not readily available | Though we have not determined a need, an outside entity has a like-project | Risk of system failure and the potential for interruption of service | Project will advance AWWU facilities and/or practices to current state-of-the-art | Between 50% and 100% of project's costs will be repaid within first five years of completion | Project supports far more Goals listed in current AWWU Strategic Plan | | | | | | | | | | |

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AM Definition





Risk

=

**Likelihood of
Failure**

X

**Consequence of
Failure**

Triple-Bottom Line



Projects Scored in 10 Categories

- Reliability
- Maintenance Requirements
- Safety and Security
- Excellence through Innovation
- Environment + Regulation
- Financial Benefit
- Critical Assets
- Strategic Importance
- Customer Needs
- Coordination with Outside Entities

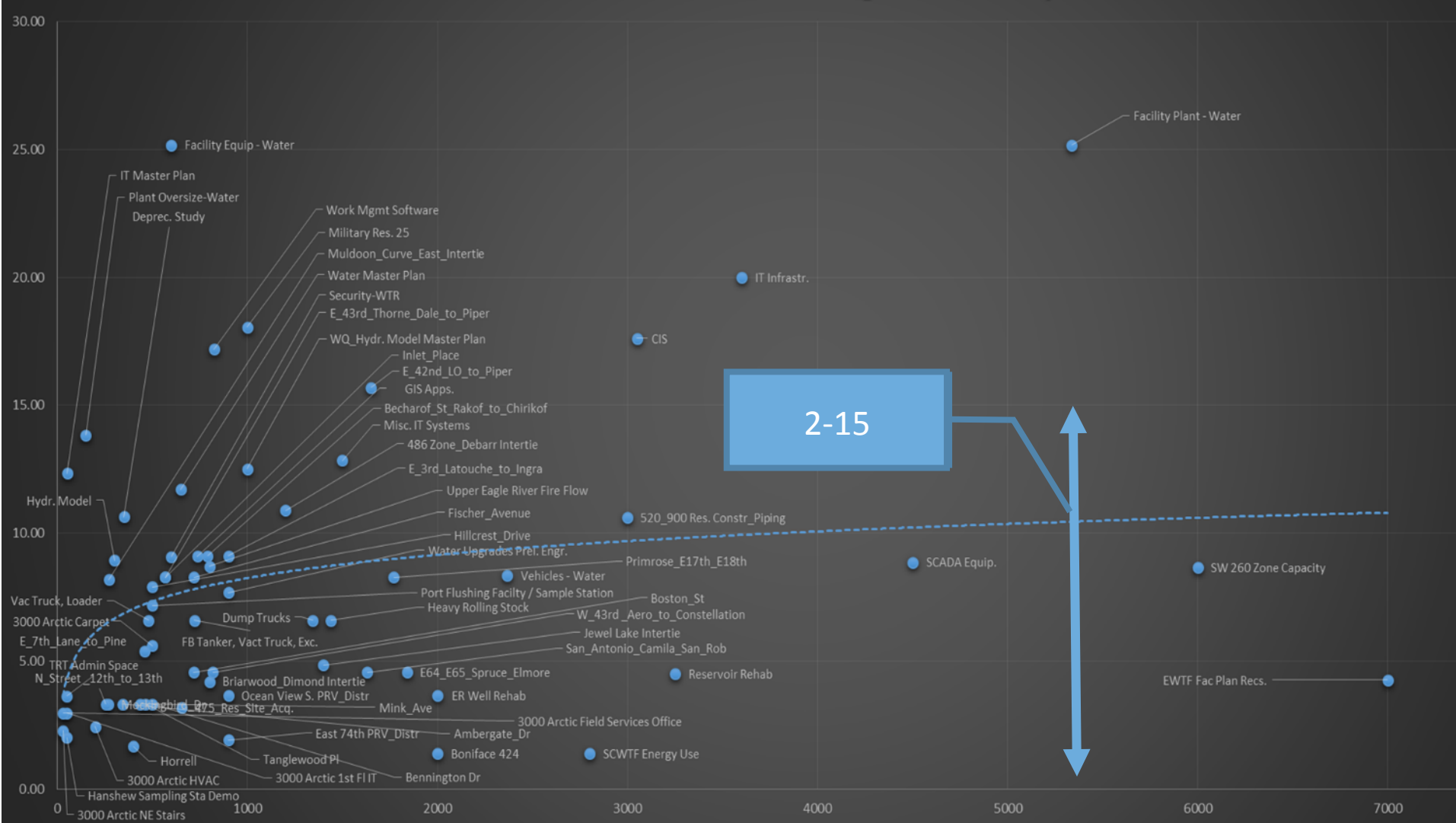
Scoring

Project by Project Assessments Made in Excel by a Leadership Team

| | A | B |
|------------------|---|---|
| Weighting Factor | 19.3% | 15.9% |
| | Safety & Security Consequence of failure | Environment & Regulation Consequence of failure |
| I | 100 FALSE <input type="checkbox"/> 19.3 High expectation of a serious injury, or life-threatening potential. | 100 FALSE <input type="checkbox"/> 15.9 Compliance order or regulation that requires immediate action. |
| II | 50 <input type="checkbox"/> 9.65 Medium risk of a serious injury | 50 <input type="checkbox"/> 7.95 Regulation that requires compliance in near future 1-5 years. |
| III | 20 <input type="checkbox"/> 3.86 Low risk of a serious injury | 20 <input type="checkbox"/> 3.18 Anticipated regulation (regulation in the current year) |
| IV | 10 <input checked="" type="checkbox"/> 1.93 Low risk of minor injury | 10 <input type="checkbox"/> 1.59 Potential regulation anticipated in next 5-10 years. |
| V | 5 <input type="checkbox"/> 0.965 Risk can affect quality of public service, employee stress | 5 <input type="checkbox"/> 0.795 Potential regulation anticipated in > 10 years. |
| n/a | 0 <input type="checkbox"/> 0 Impacts do not apply. | 0 <input checked="" type="checkbox"/> 0 Impacts do not apply. |
| | 1.93 | 0.00 |

Results – Water CIP

2017 Matrix Scores v. Budget - Water Only



Results – Wastewater CIP

2017 Matrix Scores vs. Budget - Wastewater Only

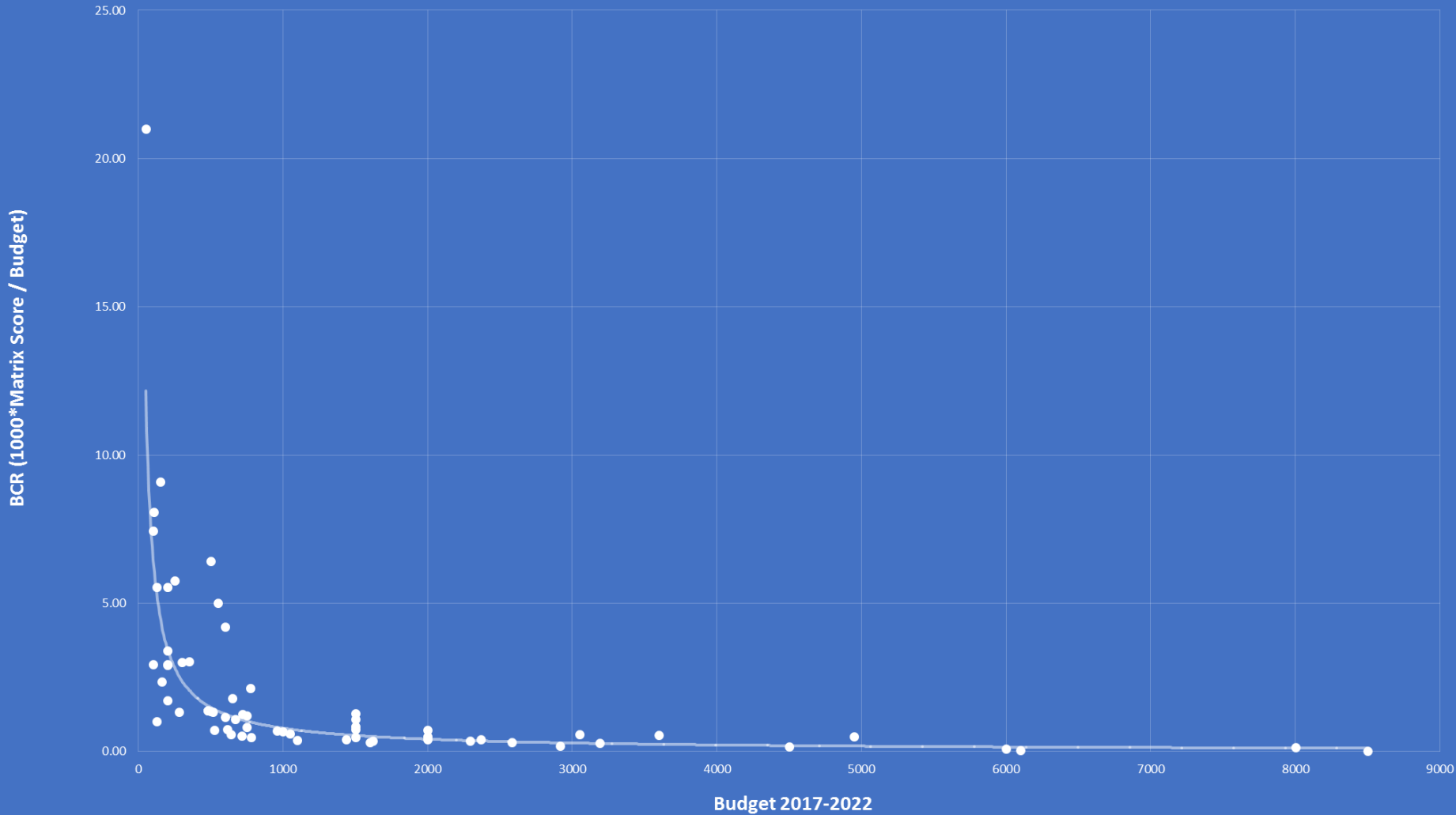


Obvious Issues Identified

- Larger clustering of projects – difficult to identify priorities
- Max score for most projects was less than 20 out of a possible 100
 - Most utilities have their largest risks addressed

Project Score / Budget (BCR)

2017 BCR VS. BUDGET - WASTEWATER ONLY



Less Obvious Issues Identified

- Scoring for smaller projects (that addressed smaller issues) was artificially inflated
- There was overlap in some of the matrix categories
- Many projects didn't fit easily in the matrix
 - IT projects
 - Planning projects
- Scoring system was subjective in many cases

Overlap

System or subsystem is not supported by a vendor and is reaching the end of its useful life

System technology is aging, support and/or parts are not readily available

| Reliability | Maintenance Requirements |
|--|---|
| Consequence of failure | Consequence of failure |
| <p>100</p> <p><input type="checkbox"/> <input type="checkbox"/> 7.6</p> <p>Current system (equipment) is not reliable, exhibits problems on a daily basis and no immediate fix (correction) is available.</p> | <p>100</p> <p><input type="checkbox"/> <input type="checkbox"/> 12.4</p> <p>High risk of major system failure that would cause interruption of service, or damage to property or equipment.</p> |
| <p>50</p> <p><input type="checkbox"/> <input type="checkbox"/> 3.8</p> <p>Current system (configuration) is complex which leads to human errors, or is aging and exhibits problems weekly and no immediate correction is available.</p> | <p>50</p> <p><input type="checkbox"/> <input type="checkbox"/> 6.2</p> <p>High risk of system failure and the potential for interruption of service, or damage to property or equipment.</p> |
| <p>20</p> <p><input type="checkbox"/> <input type="checkbox"/> 1.52</p> <p>Current system exhibits problems on a monthly basis - a work around is available but is difficult to learn and prone to human error.</p> | <p>20</p> <p><input type="checkbox"/> <input type="checkbox"/> 2.48</p> <p>Risk of subsystem failure and the potential for interruption of service, damage to property or equipment in a limited area.</p> |
| <p>10</p> <p><input type="checkbox"/> <input type="checkbox"/> 0.76</p> <p>System produces reliable results, technology is old and difficult or expensive to maintain. A system failure would result in undetected problems.</p> | <p>10</p> <p><input type="checkbox"/> <input type="checkbox"/> 1.24</p> <p>System or subsystem is not supported by a vendor and it is reaching the end of its predicted useful life.</p> |
| <p>5</p> <p><input checked="" type="checkbox"/> 0.38</p> <p>System technology is aging, support and/or parts are not readily available; infrequent failures are possible.</p> | <p>5</p> <p><input type="checkbox"/> <input type="checkbox"/> 0.62</p> <p>Risk of subsystem failure and the potential for interruption of service to one customer, or damage to property or equipment</p> |

More Overlap

| Critical Assets Consequence of failure | Customer Needs Consequence of failure |
|--|---|
| <p>100</p> <p><input type="checkbox"/> 6.6</p> <p>Major deficiency affecting a large population of end-users. There is no possibility of a work-around without asset.</p> | <p>100</p> <p><input type="checkbox"/> 6.6</p> <p>Complete disruption of services; Inaccurate billing; customer communication to Utility completely inoperable</p> |
| <p>50</p> <p><input type="checkbox"/> 3.3</p> <p>Major deficiency affecting a small population of end-users. There is no possibility of a work-around without asset.</p> | <p>50</p> <p><input type="checkbox"/> 3.3</p> <p>Intermittent service to customers; poor communications with customers</p> |

Speculative Scoring

Potential regulation anticipated in next 5-10 years

| Environment & Regulation | |
|-------------------------------------|---|
| Consequence of failure | |
| <input type="checkbox"/> | 15.9 Compliance order or regulation that requires immediate action. |
| <input type="checkbox"/> | 7.95 Regulation that requires compliance in near future 1-5 years OR Anticipated regulation with major implications for AWWU Operations |
| <input type="checkbox"/> | 3.18 Anticipated regulation (regulation in the current legislative/regulator process) |
| <input checked="" type="checkbox"/> | 1.59 Potential regulation anticipated in next 5-10 years. |
| <input type="checkbox"/> | 0.795 Potential regulation anticipated in >10 years. |
| <input checked="" type="checkbox"/> | 0 Impacts do not apply |
| 1.59 | |

Alternatives CIP Prioritization Methods

DC Water

| Category | Score | Percentage |
|----------------------------------|-------|------------|
| Regulatory Compliance | 100 | 28% |
| Health and Safety | 73 | 20% |
| Risk Reduction | 62 | 17% |
| Financial Benefits | 35 | 10% |
| System Capacity | 30 | 8% |
| Public Image | 23 | 6% |
| Supplemental Benefits | 19 | 5% |
| Coordination with other projects | 16 | 4% |

10. Prioritization Analysis

| | Score (1-5) | Justification / Explanation |
|---------------------------------------|-------------|-----------------------------|
| Physical Condition | 4 | |
| Performance / Process Condition | 4 | |
| Regulatory / Environmental | 4 | |
| Service Level / Reliability | 4 | |
| Efficiency / Energy | 3 | |
| Operations and Maintenance and Hazard | 4 | |
| Growth / Public / Community | 2 | |
| Public Image | 3 | |
| Financial | 3 | |

Hartford MDC

| Criteria | Evaluation Score (1-5) | Committee Evaluation Score (1-5) | Justification / Explanation |
|--|--|----------------------------------|--|
| Risk or EUL Bucket Score | 5 | | RPS model prioritizes mains to be in Group 1 (first 5 years) based on risk and historical break information. |
| Service Level Alignment Score | 5 | | Number of pipe breaks and critical customers aligns well with service levels required |
| <input type="checkbox"/> System Water Quality Complaints | <input type="checkbox"/> Wastewater Treatment Effectiveness Rate | | |
| <input checked="" type="checkbox"/> Water Pipeline Integrity | <input checked="" type="checkbox"/> Collection System Integrity | | Numerous breaks in these water lines reduces the integrity of the system |
| <input type="checkbox"/> Drinking Water Compliance | <input type="checkbox"/> Sewer System Overflows | | |
| <input checked="" type="checkbox"/> Water System R&R Rate | <input type="checkbox"/> WW System R&R Rate | | |
| <input type="checkbox"/> Non-Revenue Water | | | |
| Other Considerations Score | | | |
| <input checked="" type="checkbox"/> Financial Impact | 4 | | DPH previously approved funding for a 8% Grant & 92% Loan, but will need to reapply in 2017. Value of grant is approx \$600,000. |
| <input checked="" type="checkbox"/> Efficiency Impact | 2 | | Water is wasted during water main breaks. This will be addressed by replacing these pipelines. |
| <input checked="" type="checkbox"/> Member Town Priorities | 2 | | Pipeline serves several hospital as well as state offices. |
| Total Priority Score | 4.8 | | $(\text{Max}(\text{Risk, EUL}) \times 0.5) + (\text{Service Level} \times 0.3) + (\text{Max}(\text{Other Factors}) \times 0.2)$ |

Asset Management / Risk-Based Solution to CIP Prioritization

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Ideas in motion.

Triple-Bottom Line



Triple Bottom Line

Categorized Parameters

| Safe Environment | | Impacts on Customer Needs | | |
|-------------------|--------------------------|---------------------------|------------------------|----------------------|
| 16.0% | 12.6% | 9.5% | 8.2% | 9.1% |
| Safety & Security | Environment & Regulation | Service Interruptions | Stakeholder Confidence | Community Disruption |

| Financial | | Reliability | Sustainability | |
|------------------------------------|--------------------------|-----------------------------------|---------------------------|----------------------|
| 8.4% | 9.1% | 9.1% | 9.1% | 8.9% |
| Coordination with Outside Entities | Direct Financial Impacts | Reliability of Assets and Service | Improving Asset Knowledge | Strategic Importance |

Eliminated Overlap

Incorporated Planning Projects

Less Speculation

| Environment & Regulation | |
|---------------------------------|--|
| 100 <input type="checkbox"/> | 12.6 Compliance order or regulation that requires action <u>immediately</u> or within 6 years. |
| 50 <input type="checkbox"/> | 6.3 Significant <u>unpermitted</u> environmental discharge, or smaller but frequent discharges that could or will, in the eyes of the AWWU Board, lead to significant enforcement action |
| 20 <input type="checkbox"/> | 2.52 Minor, infrequent, <u>unpermitted</u> discharge |
| 10 <input type="checkbox"/> | 1.26 Significant <u>permitted</u> discharge that is infrequent and unlikely to result in additional action by a regulatory body |
| 5 <input type="checkbox"/> | 0.63 Minor <u>permitted</u> discharge(s), unlikely to result in additional action by a regulatory body |

Simplification

Coordination with Outside Entities

Financial savings alone from coordination significantly outweighs (a) the value lost by reducing existing asset life (if project is accelerated) or additional risk (if project is delayed); another opportunity during the assets' life is improbable.

Window of opportunity is driven by an outside entity; there is immediate demonstrated AWWU need. Financial and community savings from coordination outweighs outweigh (a) the value lost by reducing existing asset life (if project is accelerated) or additional risk (if project is delayed); another opportunity during the assets' life is improbable.

There is an immediate and demonstrated need for the AWWU project and an outside entity has a like-project. Another opportunity is possible or probable. Financial and community savings from coordination approximate the loss of existing asset life.

Planning Projects

| | | | |
|---|--|--|---|
| <p>Improving Asset Knowledge</p> | <p>Project will generate data needed to produce required documents (e.g. master plans); or infrastructure decisions made w/o the data could cost > \$1,000,000 in loss of asset life or asset failure that could have been prevented. Project addresses IT system failures that have the above impacts.</p> | <p>Project will generate (or protect) data to support infrastructure decisions - the absence of that data would cost \$250,000 to \$1,000,000 in loss of asset life or asset failure that could have been prevented.</p> | <p>Project will generate (or protect) data to support infrastructure decisions - the absence of that data would cost up to \$250,000 in loss of asset life or asset failure that could have been prevented.</p> |
|---|--|--|---|

Scaling

| | | | |
|------------------------------------|---|---|--|
| <p>Community Disruption</p> | <p>Project implementation will avoid: property damage > \$1,000,000; or extensive outage of a major highway; or long-term impacts to businesses due to lack of vehicular or pedestrian traffic or; significant drinking water taste or color issue</p> | <p>Project implementation will avoid: \$250,000 to \$1,000,000 in property damage; or extensive outage of a major roadway; or moderate impacts to businesses due to lack of vehicular or pedestrian traffic</p> | <p>Project will avoid: Up to \$250,000 in property damage; or short-term outage of a major road or highway; or minor impacts to businesses due to lack of vehicular or pedestrian traffic; or minor drinking water taste and color issue</p> |
|------------------------------------|---|---|--|

Benefit / Cost Approach

| | | |
|------------------------------|----------------|-------------------------|
| | BCR x 1000: | 76.60 |
| Project Score: | | 19.15 |
| Project Cost (\$k): | | 250 |
| Sustainability | | |
| 9.1% | | 8.9% |
| Improving Asset Knowledge | | Strategic Importance |

What's Else and What's Next?

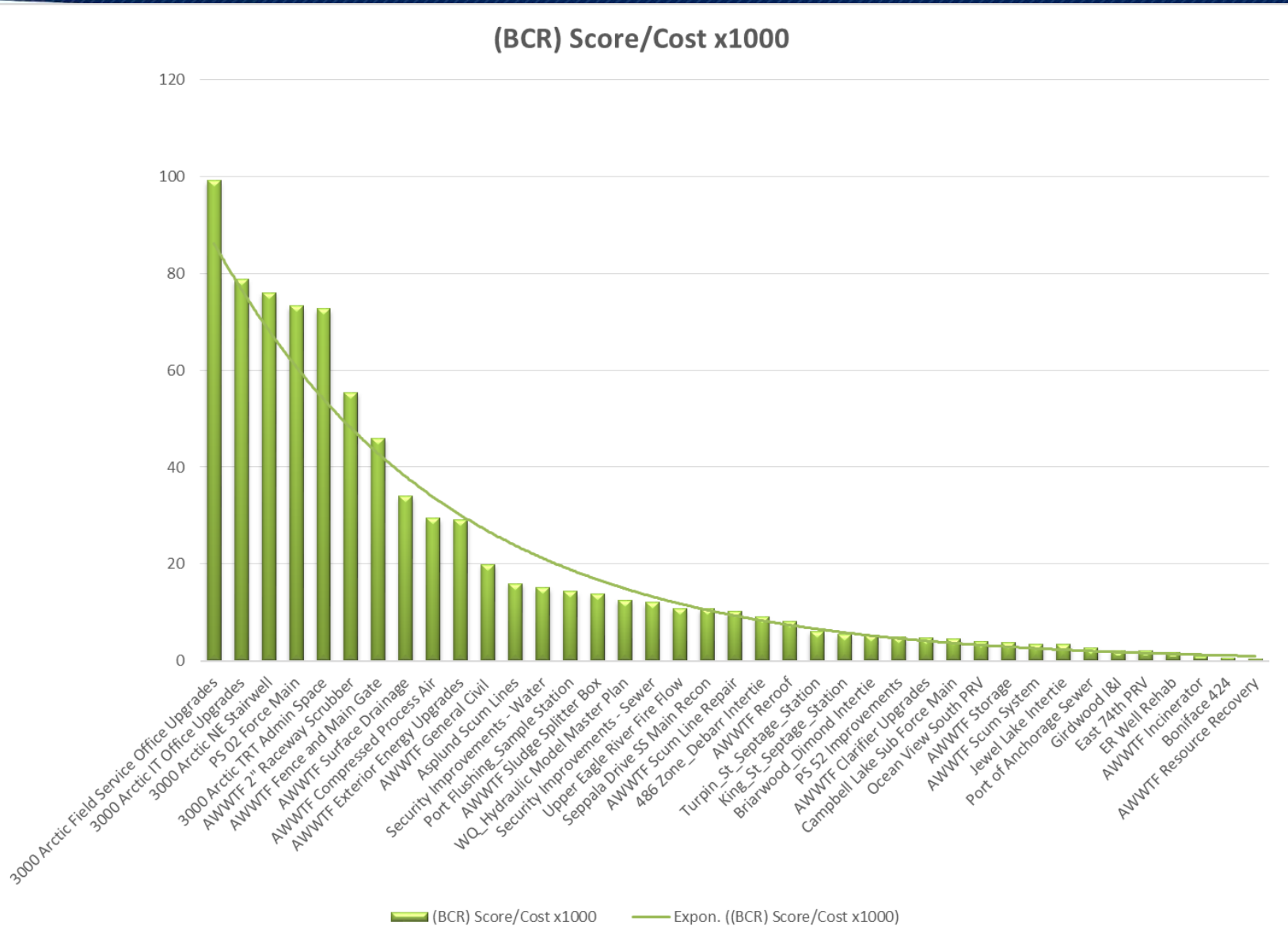
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Ideas in motion.

Partial Risk Reduction

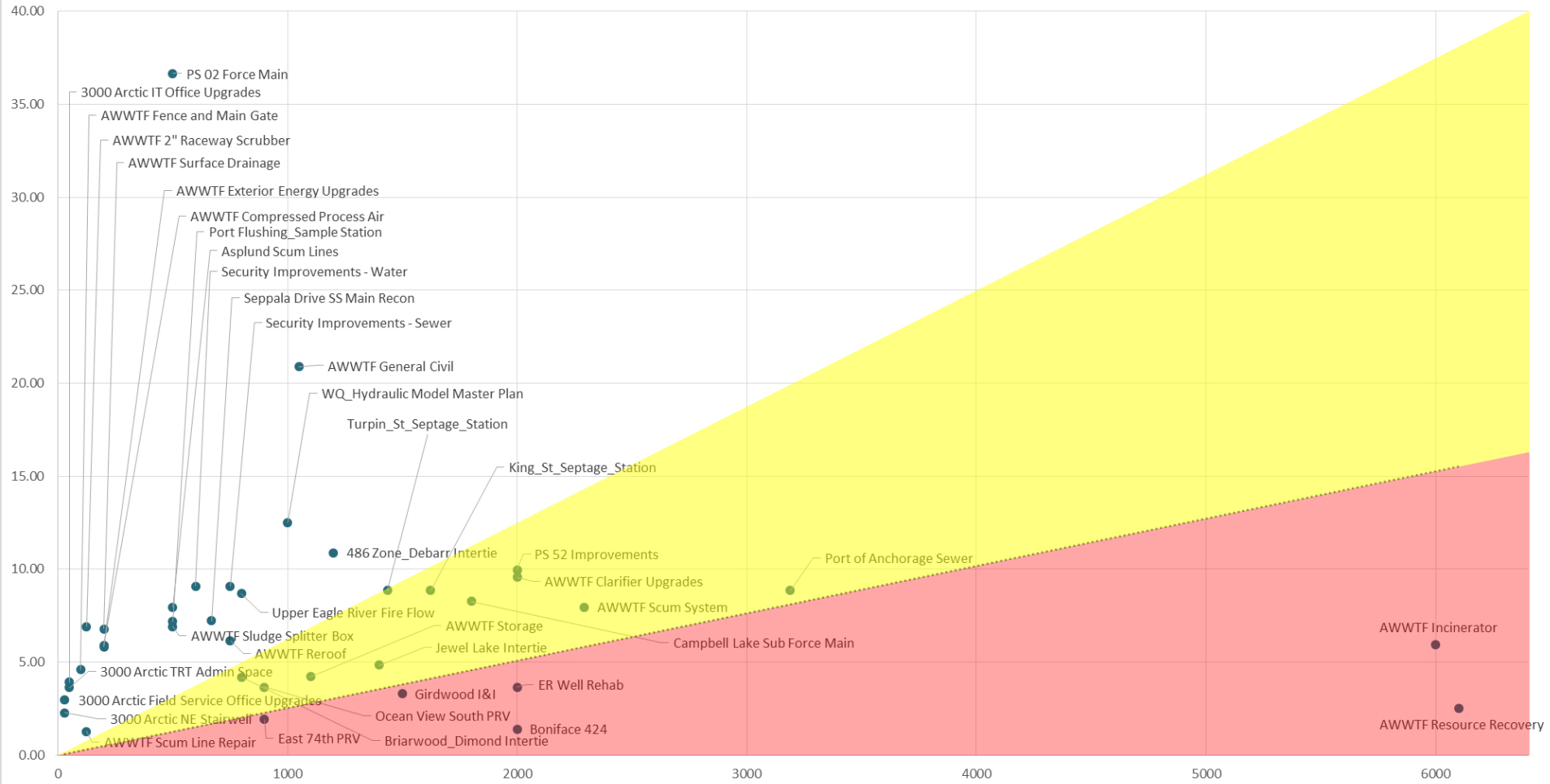
| | | Safety & Security |
|-----|-----|--|
| I | 100 | <input type="checkbox"/> 16 |
| | | High expectation of a serious injury, or life-threatening potential. |
| II | 50 | <input checked="" type="checkbox"/> 8 |
| | | Medium risk of a serious injury |
| III | 20 | <input type="checkbox"/> 3.2 |
| | | Low risk of a serious injury |
| IV | 10 | <input checked="" type="checkbox"/> 1.6 |
| | | Low risk of minor injury |
| V | 5 | <input type="checkbox"/> 0.8 |
| | | Risk can affect quality of public service, employee stress |
| n/a | 0 | <input type="checkbox"/> 0 |
| | | Impacts do not apply. |
| | | 6.40 |

Automation / Dashboarding



Banding Projects

Total Score v. Budget



TBL Monetized Prioritization

| D | E | F | G |
|------------------------------|---|---------------------------|-----------------|
| Prepared by: | | Date: | 1/20/2017 |
| Project: | | Capital Budget: | \$1,500,000 |
| Additional Info: | | Total Project Benefits: | \$2,324,000 |
| | | Benefit:Cost ratio (BCR): | 1.55 |
| | | | Project Benefit |
| Safety & Security | Number of statistical lives impacted over the lifecycle of the project | 0.2 | \$2,324,000 |
| | Value of statistical life | \$9,100,000 | |
| | Number of serious injuries or illnesses avoided over the lifecycle of the project | | |
| | Average value of a serious injury | \$50,000 | |
| | Number of minor injuries or illnesses avoided over the lifecycle of the project | 100 | |
| | Average value of a minor injury | \$5,000 | |
| | Number of employees with reduced stress and increased productivity | 4 | |
| | Average value of reduced stress and increased productivity | \$1,000 | |

Questions and Comments

Thank you!

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