WSACC – Integrating Asset Management and Master Planning to Assess Future Investment Needs

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Acknowledgements

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Van Rowell | WSACC Retired Engineer Director
Wayne Francisco | Principal Consultant

LandDesign
Willis Engineers
Organizational background - WSACC

- Formed in 1992 as a wholesale provider of wastewater and water services to Cabarrus County, NC
- Made up of five separate municipal jurisdictions
- Has a 9 member board with appointed members from each of the Jurisdictions
Municipal utility service areas

Service is provided to these municipalities within Cabarrus County, as well as Charlotte Mecklenburg, NC.
Project approach

Current needs assessment and inventory → Future demand → Future needs → Prioritization → Monitor and update

Suitability Based Growth Model (Community Viz)

Land Supply (Available Land) → Future Land Use → Suitability → Growth Forecasts

Vacant Lands Underutilized Parcels Redevelopments → Allowable Densities (Per Adopted Land Use Plans) Recent Development Approvals → Economic Factors Environmental Constraints Local Policies & Infrastructure Investments
Integrated planning – Why not?

- Asset Management planning
- Future growth demand planning
- Master planning

Integrated planning
Existing condition – Land Use
Future – Land Use
**Future condition – Land Supply**

- Land available for future development/growth
  - Vacant Parcels (per Tax records)
  - Underutilized parcels
    - Parcels whose structure value is very low relative to land use, per tax assessor’s data and verified by local jurisdiction staff.
Future condition – Land Supply
Suitability

• Mimics factors influencing location decisions:
  – Physical attributes (parcel size, topography)
  – Available infrastructure (transportation facilities, water lines, sewer lines)
  – Proximity to other uses, facilities (schools, parks, rooftops)

• Model sends growth (projected households and jobs) first to the parcels with the highest suitability.
Suitability analysis

- Suitability considered for different land use categories:
  - SF - Single Family Residential
  - MF - Multi-family Residential
  - COM/SVC - Commercial/Service
  - IND - Industrial
  - OIGOV - Office, Institutional, Government
  - LODGING – Lodging
Growth identified

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Kannapolis</th>
<th>Concord</th>
<th>Harrisburg</th>
<th>Midland</th>
<th>Locust</th>
<th>Mt. Pleasant</th>
<th>Northeast</th>
<th>Total Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total EMP, 2012</td>
<td>11,542</td>
<td>44,923</td>
<td>4,362</td>
<td>1,028</td>
<td>11</td>
<td>934</td>
<td>307</td>
<td>63,107</td>
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</table>

<p>| Employment Growth 2012-2040 |</p>
<table>
<thead>
<tr>
<th>Service Area</th>
<th>Kannapolis</th>
<th>Concord</th>
<th>Harrisburg</th>
<th>Midland</th>
<th>Locust</th>
<th>Mt. Pleasant</th>
<th>Northeast</th>
<th>Total Jobs</th>
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</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>1,200</td>
<td>3,848</td>
<td>505</td>
<td>1,010</td>
<td>72</td>
<td>184</td>
<td>111</td>
<td>6,929</td>
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<tr>
<td>Commercial</td>
<td>914</td>
<td>3,446</td>
<td>433</td>
<td>593</td>
<td>125</td>
<td>331</td>
<td>5</td>
<td>5,846</td>
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<tr>
<td>OIGOV</td>
<td>4,541</td>
<td>12,605</td>
<td>2,613</td>
<td>1,220</td>
<td>0</td>
<td>1,149</td>
<td>117</td>
<td>22,245</td>
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<tr>
<td>Lodge</td>
<td>98</td>
<td>555</td>
<td>62</td>
<td>31</td>
<td>19</td>
<td>27</td>
<td>0</td>
<td>793</td>
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<tr>
<td>Service</td>
<td>504</td>
<td>3,426</td>
<td>449</td>
<td>181</td>
<td>100</td>
<td>146</td>
<td>0</td>
<td>4,806</td>
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<tr>
<td>Total Added</td>
<td>7,256</td>
<td>23,880</td>
<td>4,061</td>
<td>3,035</td>
<td>316</td>
<td>1,838</td>
<td>234</td>
<td>40,620</td>
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<tr>
<td>Total EMP, 2040</td>
<td>18,798</td>
<td>68,803</td>
<td>8,423</td>
<td>4,063</td>
<td>327</td>
<td>2,773</td>
<td>540</td>
<td>103,727</td>
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</tbody>
</table>

[Map showing employment figures by area and growth rates from 2002-2010 for Kannapolis, Concord, Harrisburg, Midland, Locust, and Mt. Pleasant, Northeast regions.]
Housing identified
Why master plan?

• Long range plan focused on future planning of an organization
• Look at facilities that are planned to be built within the next 20 years, so that adequate customer services can be supplied (i.e., water, wastewater, and reclaimed water services).
Water Demand Forecast

- New Demand 2040 (GPD) / SQ MILES:
  - 1,195 - 10,000
  - 10,010 - 25,000
  - 25,010 - 50,000
  - 50,010 - 75,000
  - 75,010 - 100,000
  - 100,100 - 150,000
  - 150,100 - 200,000
  - 200,100 - 300,000
  - Utility Service Areas
  - Counties
WSACC Basin Sewer Model
Why asset management?
Asset management planning approach: governance questions to be answered

What is the current state of my assets?
- What do I own?
- Where is it?
- What condition is it in? what is its performance?
- What is its remaining life?
- What is its remaining economic life?

What is my required level of service (LOS)?
- What is the demand for my services by my stakeholders?
- What do regulators require?
- What is my actual performance?

Which assets are critical to sustained performance?
- How does it fail?
- How can it fail?
- What is the likelihood of failure?
- What does it cost to repair?
- What are the consequences of failure?

What are my beset O&M and CIP investment strategies?
- What alternative management options exist?
- Which are the most feasible for my organization?

What is my best long-term funding strategy?
- How does this relate to proposed capital investments for both short term and long term opportunities?
The need for asset management planning

The asset management planning process allows us to identify the need for investing in replacing our assets, which allows us to sustain the current levels of service.

The process also allows us to identify the need to invest in treating any identified significant risks.
The need for asset management planning

Asset rehabilitation and replacement needs are documented in the CIP along with new and augmented assets to meet growth and regulatory changes.

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Location</th>
<th>Project</th>
<th>Justification</th>
<th>Price</th>
<th>Recipe</th>
<th>When</th>
<th>WACC Discount</th>
<th>Major Capital</th>
<th>Repair/Replacement</th>
<th>O&amp;M</th>
<th>CM&amp;E Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>RRRWWTP</td>
<td>Large Diameter Underground Piping</td>
<td>Condition questionable due to age, no redundancy</td>
<td>$ 675,000</td>
<td>Group with Plant Expansion Project, Exploration of Extent of Work Needed</td>
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<tr>
<td>25</td>
<td>RRRWWTP</td>
<td>Main PS Mechanical Screens</td>
<td>Health/Safety Concerns, Operating Issues, No Bypass</td>
<td>$ 3,660,000</td>
<td>Reconfigure Screen, Provide Bypass, Minimize Eliminate Safety Issues</td>
<td></td>
<td></td>
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<tr>
<td>24</td>
<td>RRRWWTP</td>
<td>Secondary Clarifiers Refurbishment Step 1 (17, 8, 9 &amp; 10)</td>
<td>Ongoing replacement of worksites</td>
<td>$ 400,000</td>
<td>Replace Worksites</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>26</td>
<td>RRRWWTP</td>
<td>Secondary Clarifiers Refurbishment Step 2 (17, 8, 9 &amp; 10)</td>
<td>Ongoing replacement of worksites</td>
<td>$ 400,000</td>
<td>Replace Worksites</td>
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<td></td>
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<tr>
<td>27</td>
<td>RRRWWTP</td>
<td>Hoodwalks Screen</td>
<td>Questionable structural condition</td>
<td>$ 2,000,000</td>
<td>Provide a New, Reinforced Screen</td>
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<td></td>
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<td></td>
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<tr>
<td>28</td>
<td>RRRWWTP</td>
<td>Primary Clarifiers</td>
<td>Provide Additional Primary Clarifiers for Future Capacity</td>
<td>$ 12,000</td>
<td>Confirm Operations, Construct Required Clarifiers &amp; Sludge Pumping (Assumed co-settling w/SSC for 4-Acid PVG)</td>
<td></td>
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<td></td>
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<tr>
<td>29</td>
<td>RRRWWTP</td>
<td>Biological Reactors</td>
<td>Provide Additional Reactors for Future Capacity</td>
<td>$ 17,000</td>
<td>Construct 5 Reactors for Capacity Need</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>30</td>
<td>RRRWWTP</td>
<td>Parshall Flume</td>
<td>Provide Large Pumps for Future Capacity</td>
<td>$ 150,000</td>
<td>Construct New Flume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>31</td>
<td>RRRWWTP</td>
<td>Chlorine Contact Tank</td>
<td>Provide Additional Contact Volume for Future Capacity</td>
<td>$ 2,800</td>
<td>Construct New 400,000 Gallon Chlorine Contact Tank</td>
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<tr>
<td>32</td>
<td>RRRWWTP</td>
<td>Hypochlorite Pumps</td>
<td>Provide Additional Pumps for Future Capacity</td>
<td>$ 220,000</td>
<td>Construct New Hypochlorite Pumping</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>33</td>
<td>RRRWWTP</td>
<td>Decolorization Pumps/Task</td>
<td>Provide Additional Pump/Storage for Future Capacity</td>
<td>$ 360,000</td>
<td>Construct New Decolorization Pumping &amp; Storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>34</td>
<td>RRRWWTP</td>
<td>Gravity Thickener #3</td>
<td>Provide Additional Volumes for Operational Flexibility</td>
<td>$ 2,600,000</td>
<td>Construct New Thickener</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Asset management filters

- Condition Based - Asset operates sufficiently but aged or in a deteriorating state, requires extraordinary means to keep working properly
- Capacity - Asset cannot provide the future level of service with projected flows
- Operations - Asset does not have proper redundancy, not operating at best efficiency or staff requested
- Safety - Asset does not meet applicable safety regulations/standards
- Permitting - Asset cannot meet future discharge permit requirements
Capital needs development

- Capacity
- Operations
- Condition
- Permitting
- Safety

WSACC Operations capital/ repair needs
WSACC O&M budget
WSACC capital improvement
Example of future plant needs when applying the filter

- **Condition Based / Repair, Replace, Refurbish**
  - Main Pump Station Mechanical Screens & Conveyor
  - Secondary Clarifiers Structural Investigation
  - Administration Building
  - Maintenance Building Expansion
  - Oxygen Control Building Underground Steel Air Piping
  - Mount Pleasant WTP Cofferdam

- **Capacity**
  - Lower Rocky River PS Pumps Expansion

- **Operations**
  - New Thickener
  - Cake Holding Storage Facility
  - New NPW Pump
  - Effluent Flume

- **Permitting**
  - Modernize Furnace Controls to Meet Regulatory Requirements
How the analysis was done

• The key activities undertaken to produce the list of projects were:
  – Document the assets in an asset register
  – Determine the age based renewal needs
  – Capture condition and performance data
  – Estimate the consequences associated with assets failing
  – Calculate the relative ranking of the risks associated with assets failing
  – Determine the condition based renewal investment needs
  – Determine the risk based investment needs
Explanation of analytical tools used

- A series of spreadsheets were developed to facilitate the analysis.
- To keep them manageable there are six spreadsheets containing the asset registers (e.g. WSACC Asset Registry - RRRWWTP).
- There is another spreadsheet used to produce the asset management plan tables and graphs (e.g. CIP Combined Investment Model).
## Sample register

<table>
<thead>
<tr>
<th>System</th>
<th>Sub-system or Facility</th>
<th>Component</th>
<th>Sub Component</th>
<th>Condition Rating</th>
<th>Performance Rating</th>
<th>Redundancy</th>
<th>LOF</th>
<th>COF</th>
<th>COF (incl. redundancy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Roads</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Stormwater Management &amp; Site Landscape</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Fencing/Site Security</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Underground Piping</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Underground Piping (plant drain, non-potable water line, disinfection influent line)</td>
<td>4</td>
<td>3</td>
<td>0</td>
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<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Manholes and Flow Distribution Structures</td>
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<td>0</td>
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<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Site/Civil</td>
<td>Site Lighting</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Main Pumping Station</td>
<td>Mechanical Screens and Screenings Conveyor</td>
<td>4</td>
<td>3</td>
<td>1</td>
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<td>2</td>
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<td>Main Pumping Station</td>
<td>Influent Pumps</td>
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<td>1</td>
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<td>3</td>
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<td>Rocky River WWTP</td>
<td>Main Pumping Station</td>
<td>Piping</td>
<td>2</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Main Pumping Station</td>
<td>Valves &amp; Gates</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
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<td>Structure</td>
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<td>2</td>
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<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Main Pumping Station</td>
<td>Stairs, Handrailing, Grating, Hatches</td>
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<td>Main Pumping Station</td>
<td>Heating and Ventilation</td>
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<td>0</td>
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<td>2</td>
<td>2</td>
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<td>Rocky River WWTP</td>
<td>Main Pumping Station</td>
<td>Electrical</td>
<td>2</td>
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<td>2</td>
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<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Main Pumping Station</td>
<td>Instrumentation &amp; Controls</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Headworks Structure</td>
<td>Mechanical Screens and Screenings Conveyor</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Headworks Structure</td>
<td>Grit Collectors, Degrifer and Classifier</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Headworks Structure</td>
<td>Grit Pumps</td>
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<td>Piping</td>
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<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Headworks Structure</td>
<td>Valves &amp; Gates</td>
<td>2</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Wastewater Treatment</td>
<td>Rocky River WWTP</td>
<td>Headworks Structure</td>
<td>Structure</td>
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<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Explanation of analytical tools used

- The asset registers contain three types of general fields:
  - **Editable fields** – these are fields that are regularly or routinely edited to keep the data up to date.
  - **Partially editable fields** – these are fields that are infrequently edited, typically only when an asset has been renewed.
  - **Non editable fields** – these are fields that are never edited, typically because these fields contain calculated results.
**Explanation** of analytical tools used

- The asset hierarchy is the backbone of the asset register. The fields are all partially editable fields.
- The structure is hierarchical in nature; i.e., a parent-child relationship.
- For example:
  - Wastewater Treatment (**System**)
    - Rocky River WWTP (**Sub-system or Facility**)
      » Main Pumping Station (**Component**)
      » Influent Pumps (**Sub Component**)
- The data in the asset hierarchy needs to be updated whenever the asset configuration changes.
**Asset attributes**

- **Installation date** - The data is entered when the asset is installed.

- **Estimated useful life** is data based upon a WSACC managed table on typical asset lives. The data is entered when the asset is installed.

- **Age based remaining life** is calculated based upon the installation date and estimated useful life fields.

- **Condition based remaining life** is calculated based upon the installation date, estimated useful life and condition and performance rating fields.
Asset attributes

- **The condition rating** - The data in this field is regularly kept up to date. It is used in planning the replacement of an asset (condition based remaining life) and in determining the risk rating for an asset (likelihood of failure).

- **The performance rating** - The data in this field is regularly kept up to date. It is used in determining the risk rating for an asset where the performance rating supersedes the condition rating for the purposes of determining the likelihood of failure.
Asset risk

Consequence of failure VS Likelihood of failure

- A: Immediate work
- B: Sample monitoring
- C: Aggressive monitoring
- Aggressive monitoring program
Asset risk

- **LOF (likelihood of failure)** data is calculated based upon the condition rating field.

- **COF (consequence of failure)** The data is entered when the asset is installed and reflects the expected impact of the asset failing. The data in the field needs to be updated whenever the system configuration changes.
Asset replacement cost

- The replacement cost is an editable field. The data in this field is regularly kept up to date. It is used in planning the replacement of an asset to project investment needs.
Asset management plan template

- Stakeholder summary
- LOS + Project demand
- State of the assets
- Asset risk profiles + Failure management strategies
- Asset strategies
- Expenditure model + Revenue model
- Expenditure/investment profile
- Revenue profile
- Comment on the gap

- Defining the services/assets gap, and what is needed to close the gap
- Points of reference for stakeholders
- Financial plan
- Drives capital and recurrent budgeting
- Improving confidence with asset management

Business improvement plan
Asset Management Plan

- The asset management plan explains the process used to develop the data and undertake the analysis to produce the results contained within it.
- It contains the reference tables used for various fields in the asset register (e.g. Table 3-4 contains the redundancy scoring).
- It contains the results in the form of tables of needs and graphs of key findings.
- The plan is the prime output of the asset management program and is used as an input to the budgeting process.
- The plan needs to be updated on a regular basis. The financial/investment planning section of the plan should be updated each budget cycle.
Recommended next steps

- Identify the need within WSACC for keeping the asset registers up to date
- Identify the need within WSACC to regularly (e.g., as part of the budget cycle) keep the investment model results up to date
- Identify the role within WSACC that will be the owner of the analytical tools
- Identify the business processes required to be developed in order to facilitate keeping the editable and partially editable fields up to date
- Develop the required business processes
- Train WSACC staff in applying the business processes
- Implement the business processes

- Master Plan and Asset Management Plan were formally adopted in May 2014. WSACC is working to make this process apart of their day to day business.