

## **Appendix V**

### **Water Supply Assessment Evaluation Method**



## V.1 Approach

The evaluation approach selected for the Forum's water supply assessment is based on a technique called multi-attribute rating. The premise of this technique is that single objective planning no longer meets the complex needs of society. And in fact, projects and alternatives should be evaluated against multiple, and sometimes even conflicting objectives. This approach also allows decision-makers to clearly see trade offs between alternatives and to test the sensitivity of their values and preferences.

Multi-attribute rating begins with the development of appropriate evaluation criteria. The selected evaluation criteria for the 2009 Regional Water Supply Outlook (2009 Outlook) are:

### 1. Supply Reliability

This criterion is to evaluate ability to meet current and future municipal water supply needs with a high degree of reliability. Specifically the criterion will measure:

- Future availability of supply
- Hydrological and hydrogeological variability
- Vulnerability to effects of emergency disruptions

### 2. Water Quality

This criterion is to evaluate ability to provide for safe drinking water through the development and use of supplies with the best available source water quality for the proposed use. Specifically the criterion will measure:

- Existing source water quality
- Vulnerability of potential source contamination
- Water quality compatibility with other supplies

### 3. Environment

This criterion is to evaluate ability to minimize impacts to the natural environment from supply development through mitigation and other methods; and to seek opportunities to enhance the natural environment. Specifically the criterion will measure:

- Net adverse environmental impacts, including energy
- Environmental enhancement opportunities above, over and above mitigation

#### 4. Implementation

This criterion is to evaluate ease of or ability to maximize implementation of a source portfolio. Specifically this criterion will measure:

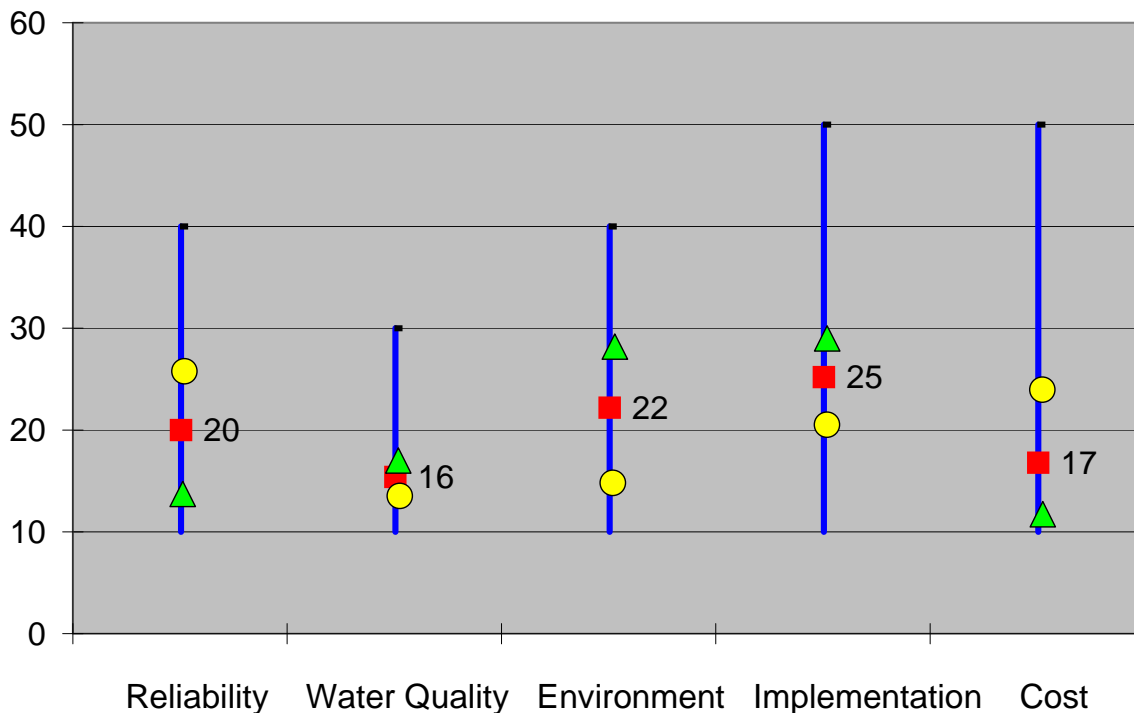
- Ease of obtaining permits (especially water rights)
- Impacts on tribal treaty interests
- Public and political support
- Institutional barriers
- Project timing and readiness

#### 5. Cost

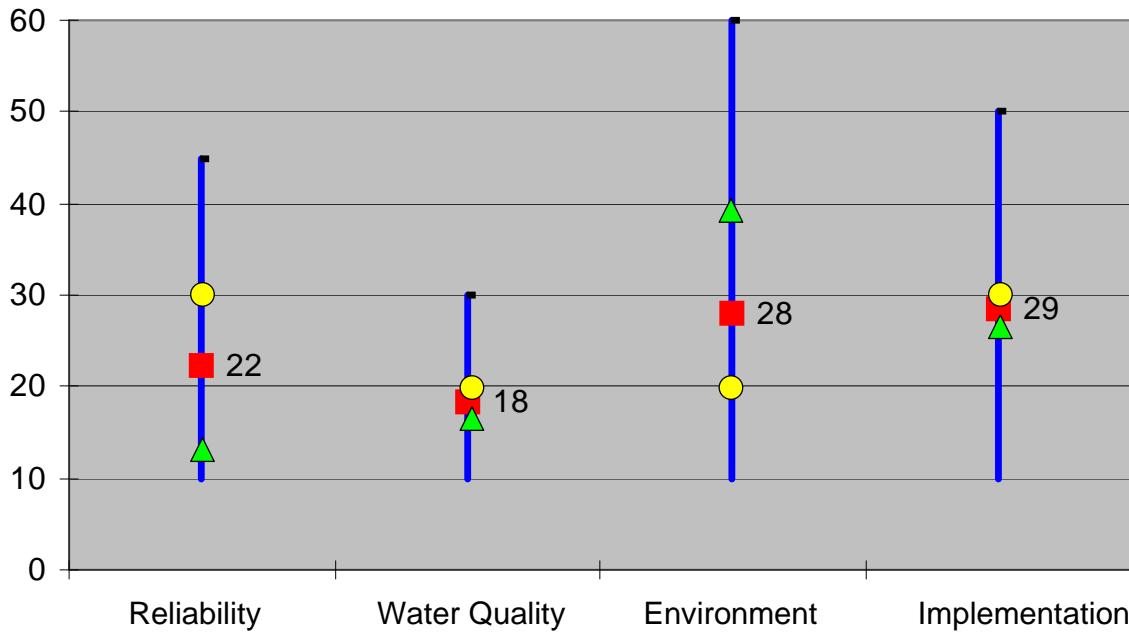
This criterion is to evaluate the overall unit cost (e.g., \$/mgd) of a source portfolio.

In preparing the Outlook, the supply advisory committee members assigned weights to these criteria, with and without the cost criterion included. These weights are presented in Figures V1 and V2. In the charts, the red square indicates the mean (or average) results for all participants; the yellow circle represents the average for water utility participants; and the green triangle represents the average for non-utility participants. The length of the blue line represents the full range of participant weightings.

**Figure V1 Supply Evaluation Criteria Weighting (with Cost Included)**



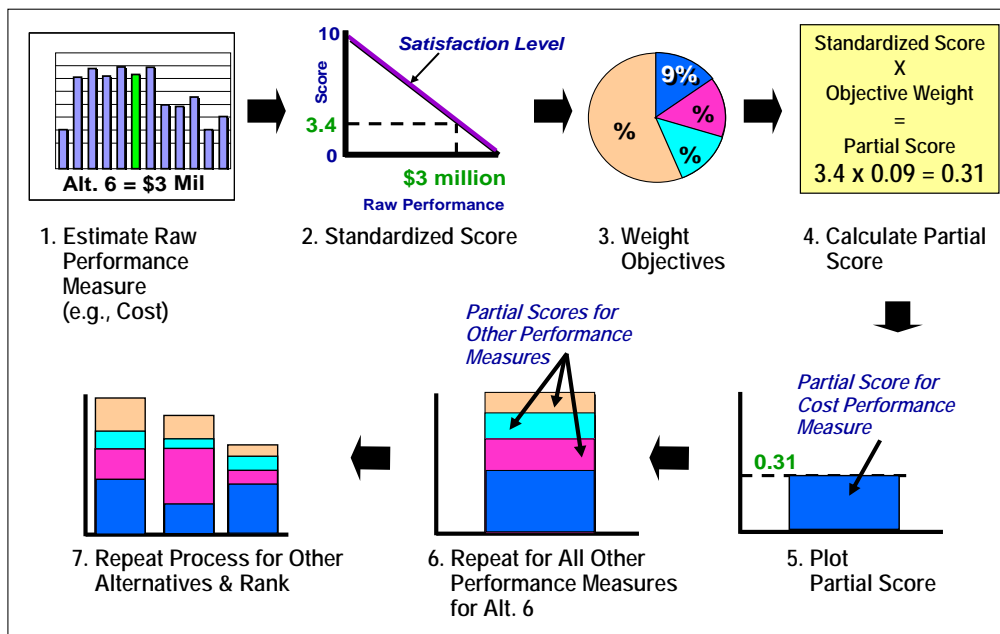
**Figure V2 Supply Evaluation Criteria Weighting (without Cost Included)**



There are two widely used techniques for using multiple objectives to evaluate alternatives. The first approach is a classic use of multi-attribute rating, where all criteria (including cost) are used to determine an overall decision score. In this method, a decision-maker can see how all criteria affect the decision.

Figure V3 presents how the multi-attribute rating technique works.

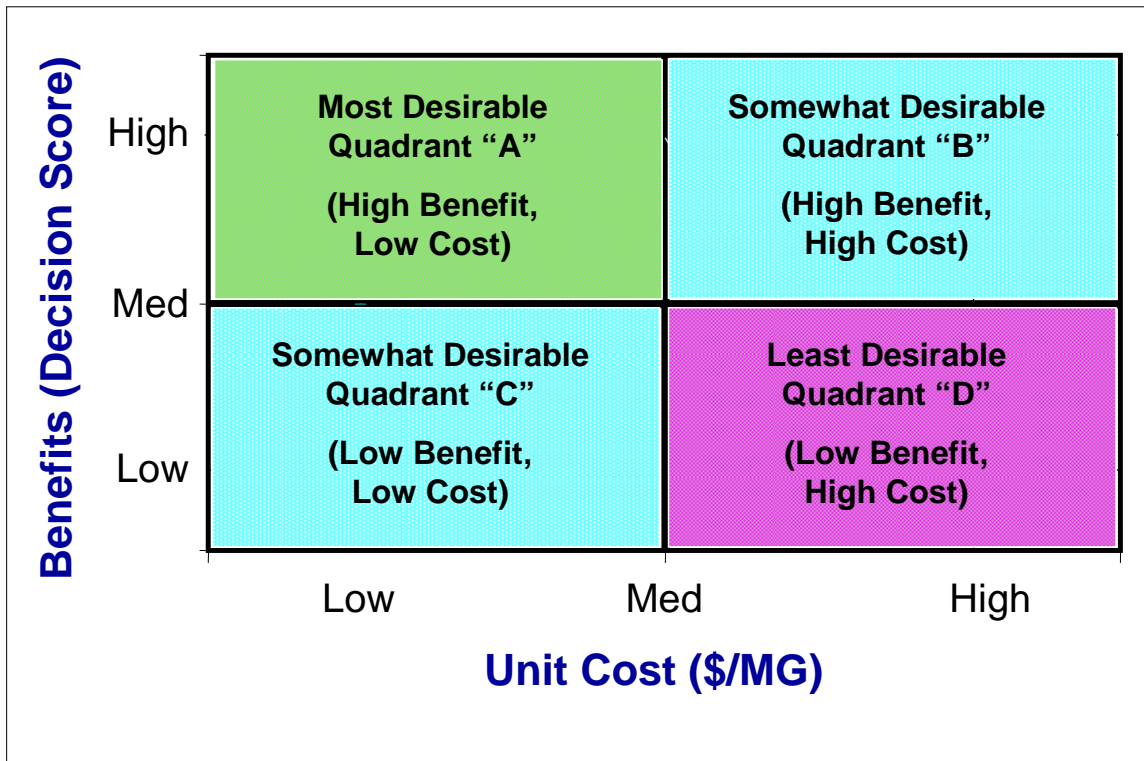
**Figure V3 Multi-Attribute Rating Technique**



Step 1 of the method plots the raw performance of each criterion, in this case cost. Step 2 converts this raw performance into a standardized score using a satisfaction level. This is necessary because each criterion may be measured in different units, and standardization allows the performance of the criteria to be added together. Step 3 applies weightings for the criteria (or objectives). Step 4 calculates a partial score, taking the standardized score for a given criterion multiplied by its weight. Step 5 plots this partial score. Step 6 repeats this method for all the other criteria. And Step 7 repeats steps 1 through 6 for each alternative and compares them against each other.

The second approach starts with a classic use of multi-attribute rating, but does not include the cost criterion. A decision score (without cost) is derived, and then plotted on a quadrant graph with the decision score plotted on the vertical axis, and cost on the horizontal axis. Figure V4 presents a typical quadrant analysis. Projects that fall in quadrant A are always ranked the highest because the benefits are highest, while cost is lowest. Projects that fall in quadrant D are always ranked lowest because benefits are lowest, while cost is highest. The decision for projects that fall in quadrants B or C is more difficult because it depends on the value or importance placed on cost.

**Figure V4 Example of Quadrant Analysis**



There are advantages and disadvantages with both methods, and because of this, the Supply Advisory Committee decided to use both methods to demonstrate the Forum's supply evaluation method.

One leading software for conducting multi-attribute rating is called Criterium DecisionPlus 3.0 (CDP), developed by InfoHarvest, Inc. CDP is industry standard software for decision making. It is easy to use and well supported software, costing approximately \$900 for each license.

When applying the CDP software to the set of supply alternatives identified in Chapter 10, CDM used the default settings, meaning the min and max values were represented by the actual min cost alternative and max cost alternative, and a linear satisfaction curve was used without setting any thresholds.