Chapter 7 Project Evaluation & Prioritization

Project Prioritization Criteria

Candidate projects included in the OWOW Plan were evaluated and prioritized based on the degree to which they comply with Evaluation Criteria developed by SAWPA staff. These were based on the goals and objectives, strategies and targets established by the Steering Committee and the Pillars. The achievement of goals and objectives by a project is directly related to the projects ability to obtain Proposition 84, Chapter 2 funding. Chapter 6 described the process followed to develop and weight the criteria.

Evaluation criteria were the basis for ranking projects in a reproducible way, using numerical scores for quantitative and qualitative criteria, and applying a consistent scoring and ranking process, described below. A performance measure was created for each criterion to numerically establish the degree to which a project meets each criterion. In some cases, more than one performance measure was used for a given criterion.

The evaluation criteria and performance measures for project prioritization had the following attributes:

Non-redundant: each criterion needs to measure something not measured by others to avoid a bias decision.

Specific: each criterion is described in detail, clearly specifying what is being measured and the rationale for it.

Relevant: criteria and, particularly, performance measures need to help discriminate between "better" and "worse" projects in terms of matching with goals and objectives. If a performance measure value does not vary between projects (if the score for all projects is the same for a given performance measure) the performance measure is unnecessary or inadequate.

Table 7-1 below presents the description of all criteria and their respective performance measures.

Table 7-1 Ranking Criteria and Performance Measures

Project evaluation criteria	Criteria Weights	Performance measures	Performance Measure Units	Performance Measure Weights
1. Provide water supply benefits	22%	Reduction in imported water use from recycling, desalination, storm water use, water transfers, surface water storage, groundwater storage and/or any other new source of water	AFY	90%
		Percentage of project area implementing water use efficiency or conservation best management practices	%	10%
2. Provide restoration and flood management benefits	10%	New or restored habitat area, and flood plain protected	Acres	100%
3. Provide water quality and salt management benefits	12%	Volume of water treated	mgd	50%
		Salt or contaminants removed	Tons/year	50%
4. Provide recreational benefits	5%	Area of open space and parks created	Acres	100%
5. Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes	4%	Percentage of project benefitting disadvantaged communities	%	50%
		Percentage of project benefitting Native American tribes	%	50%
6. Reduce greenhouse gas emissions from water management activities	2%	Numeric estimates of reductions on greenhouse gas, and actions or project features to accomplish those reductions	1 to 5 Qualitative Score	100%
7. Increase resource-efficient land use and reduce impact on natural hydrology	8%	Percentage of project using Low Impact Development or other resource-efficient land use	%	50%
		Impacts or changes to natural hydrology	1 to 5 Qualitative Score	50%
8. Cost match	7%	Percent of project cost funded and secured from non-state funding	%	100%
9. Cost effectiveness	12%	Standardized unit cost indicator measuring cost per unit of benefit	$/[unit of benefit]; for example, $/AFY, $/mgd, $/acre	100%
10. Project readiness	9%	Phase of project development	1 to 5 Qualitative Score	100%
11. Increase active participation	9%	Number of Partners	1 to 5 Qualitative Score	50%
		Partners Role or level of participation	1 to 5 Qualitative Score	50%

Project Prioritization Process

SAWPA received candidate projects from agencies in the Watershed for inclusion in the OWOW plan and potential Proposition 84 funding. All projects were evaluated by SAWPA staff to determine their eligibility to be part of the OWOW Plan. Additionally, since the projects received were in different stages of development, projects in advanced stages of development were given priority to receive Proposition 84 funding. It is important to reiterate that ranking is based on self-reported project data.

Project Scoring

The first step of the prioritization process was to score each project. Project sponsors provided a project nomination form with information about each project (**Project Form**). Scoring is the process by which the information provided by the project sponsors is converted to a numerical value for each sub-criterion using the performance measures presented in **Table 7-1** above. In many instances, the information provided in the nomination forms need to be processed or combined to establish the numerical value of each performance measure. Relevant methodological notes on the scoring of each performance measures are presented below. The Project Form may be found in the Appendices.

Provide water supply benefits - Reduction in imported water use from recycling, desalination, storm water use, water transfers, surface water storage, groundwater storage and/or any other new source of water:

The score for this performance measure was calculated by adding the yearly supply benefits from every source in the nomination form: recycling, ocean desalination, brackish groundwater desalination, storm water beneficially used, water transfers, operational efficiencies and other new sources of water (such as rainwater capture). The great majority of projects provide only one of the sources mentioned, but in some cases more than one source existed. Two additional sources of supply possible are surface and groundwater storage (including conjunctive use of groundwater basins). The project nomination forms included information on the storage and/or recharge capacity developed. For storage-related projects, the supply benefit as an annual volume in AFY was assumed to be one third of the storage reported. This assumption was applied for all projects.

Provide water supply benefits - Percentage of project area implementing water use efficiency or conservation best management practices:

The score for this performance measure was simply taken from the project nomination forms, as the value reported by the sponsor.

Provide restoration and flood management benefit - New or restored habitat area, and flood plain protected:

The score for this performance measure was estimated by adding the values of acreage reported in the nomination forms, for habitat created or restored and for floodplain area protected.

Provide water quality and salt management benefits - Volume of water treated:

The score was calculated as the sum of flows treated under the categories of wastewater treatment, well head treatment for remediation, and stormwater treatment. Water treatment for drinking water standards for subsequent distribution was not counted under this measure to avoid redundancy with the water supply score.

Provide water quality and salt management benefits – Salt or contaminants removed:

The score was obtained directly from the project nomination forms when the value reported corresponded to salt removal, given the rationale for the salt management objective. Other contaminant removal estimates were not counted to avoid redundancy with the volume of water treated reported.

Provide recreational benefits – Area of open space and parks created:

The score was obtained directly from the project nomination forms.

Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes - Percentage of project benefitting disadvantaged communities:

The score was obtained directly from the project nomination forms.

Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes - Percentage of project benefitting Native American tribes:

The score was obtained directly from the project nomination forms.

Reduce greenhouse gas emissions from water management activities - Numeric estimates of reductions on greenhouse gas, and actions or project features to accomplish those reductions:

A scale of 1 to 5 was developed as a qualitative score. The rationale for this scale was that, while the methodology to estimate reductions in GHG emissions is significantly well established, the assumptions about direct versus indirect benefits from a project can vary widely. In some cases, project estimates can include a number of externalities and count them as reductions associated with the project. In other cases, the values reported constitute only direct reductions from a project (such as a more efficient pump engine requiring less energy). Given the potential inconsistencies with the values reported in the project nomination forms, the scale established for this score was a combination of the estimates and the actions and considerations supporting those estimates. The scale developed was:

1 = no information
3 = narrative description only
4 = numeric estimate without specific actions

5 = numeric estimate with specific actions, with 5 being the highest score. The sensitivity of the ranking to this performance measure was tested after the ranking was completed, and the ranking did not show to be sensitive to this qualitative score.

Increase resource-efficient land use and reduce impact on natural hydrology - Percentage of project using Low Impact Development or other resource-efficient land use:

The score was obtained directly from the project nomination forms.

Increase resource-efficient land use and reduce impact on natural hydrology - Impacts or changes to natural hydrology:

A scale of 1 to 5 was developed as a qualitative score:

1 = Negative impacts
3 = No impacts
5 = Positive impacts

Cost Match - Percent of project cost funded and secured from non-state funding:

The score was obtained directly from the project nomination forms.

Cost Effectiveness - Standardized unit cost indicator measuring cost per unit of benefit:

Projects of different types provide benefits that are measured in varying units. For water supply projects, the units used in the supply performance measure are AFY. For water quality projects, the units of the water treated are in mgd, while the units of salt removal are in tons/year. Cost effectiveness was therefore measured as:

- $/AFY of water supply benefits, i.e., total project cost/ water supply benefits (in AFY)
- $/mgd of water treated, i.e., total project cost/ water treated (in mgd)
- $/acres of habitat restored and open space created, i.e., total project cost/ open space created and habitat restored (in acres)
- $/(tons/year) of salt removed, i.e., total project cost/ salt removed (in tons/year)

To be able to perform the ranking as described in the next section, a score with the same units is necessary for a given performance measure, which required the normalization of cost effectiveness scores by project category. For example, projects providing water supply benefits were scored in $/AFY, but the score then was normalized to a unit-less score between 1 and 5. Projects providing water quality benefits were scored in $/mgd, but the score then was normalized to a unit-less score between 1 and 5. Once all cost effectiveness scores were normalized, the score of 1 to 5 can be used for ranking. The process and need for *normalization* are explained in a section below in this chapter.

Project Readiness - Phase of project development:

The following scale of 1 to 5 was developed to score the projects:

1 = Planning studies completed
2 = Conceptual design (15%) completed
3 = Preliminary design (30%) completed
4 = Final design (100%) completed
5 = Project ready for construction bids (permits secured)

Increase Active Participation - Number of Partners:

The following 1 to 5 scale was developed for this performance measure based on number of partners:

1 = None
3 = One
5 = Multiple

Increase Active Participation - Partners role or level of participation:

The following 1 to 5 scale was developed for this performance measure:

1 = No or limited partnership
3 = Coordination with others
5 = Cost-share or in-kind funding partner

OWOW Project Ranking

The project scores for each performance measure were used for the ranking of the projects using a multi-criteria ranking method. The method is known as Multi-Attribute Rating Technique (MART). The method consists of applying the weights for each criterion to the criteria scores, and adding the weighted criteria scores to obtain an overall weighted and final score to use in ranking. For the ranking process, the commercial software used was developed by Infoharvest, Inc., called Criterium Decision Plus (CDP). CDP uses MART for ranking projects or planning alternatives.

One of the steps in the MART consists of normalizing the scores. The *normalization* of a score is necessary to eliminate the units of the scores and to be able to add, average, or compare scores from different performance measures. *Normalization* basically means converting any dimensional or dimensionless quantity to a common scale.

Normalization of scores was done at two levels in this prioritization process. The first level of normalization was done within the scoring (i.e., before the application of CDP) where a criterion required addition or averaging of performance measures. The following performance measures were normalized to a scale of 1-5:

For the criterion "Provide water quality and salt management benefits" the performance measures:

- Flows treated [mgd]
- Salt or contaminant removed [tons/year]

Once these two performance measures were normalized, they were combined in a composite score of 1-5 to be used for prioritization.

For the criterion "Cost effectiveness" the performance measures:

- Unit cost of water supply benefits [$/AFY]
- Unit cost of water treated [$/mgd]
- Unit cost of habitat restored and/or open space created [$/AF]
- Unit cost of salt/contaminant removed [$/(tons/year)]

The normalized scores in the scale of 1 to 5 then were combined in an average as a composite score of cost effectiveness to be used in prioritization.

The second case in which *normalization* was conducted was within the ranking process, for all of the scores. This step always is performed in MART and it's a step performed within CDP. CDP normalizes all scores using a scale of 0 to 1.

In addition to the normalization score in CDP, there are five other basic steps in MART (Figure 7-1). The first step is the scoring of the project against each sub-criteria as described in the earlier sections. In the example described in Figure 7-1, the project has a score of 12 acres (raw performance measure) for recreational benefits. As different criteria have different units of measurement (for example restoration and flood management benefits are measured in acres, water supply benefits are measured in AFY, etc.) normalization is used, as mentioned above. In the example depicted in Figure 7-1, the recreational benefits score is converted with a scale between 0 and 1, using a linear scale. The raw performance of 12 acres translates into a normalized score of 0.34 (where the score of 0 indicates the worst performance, i.e. no acres for open space, and the score of 1.0 indicates the best performance, i.e. largest recreational and open space area provided by any project).

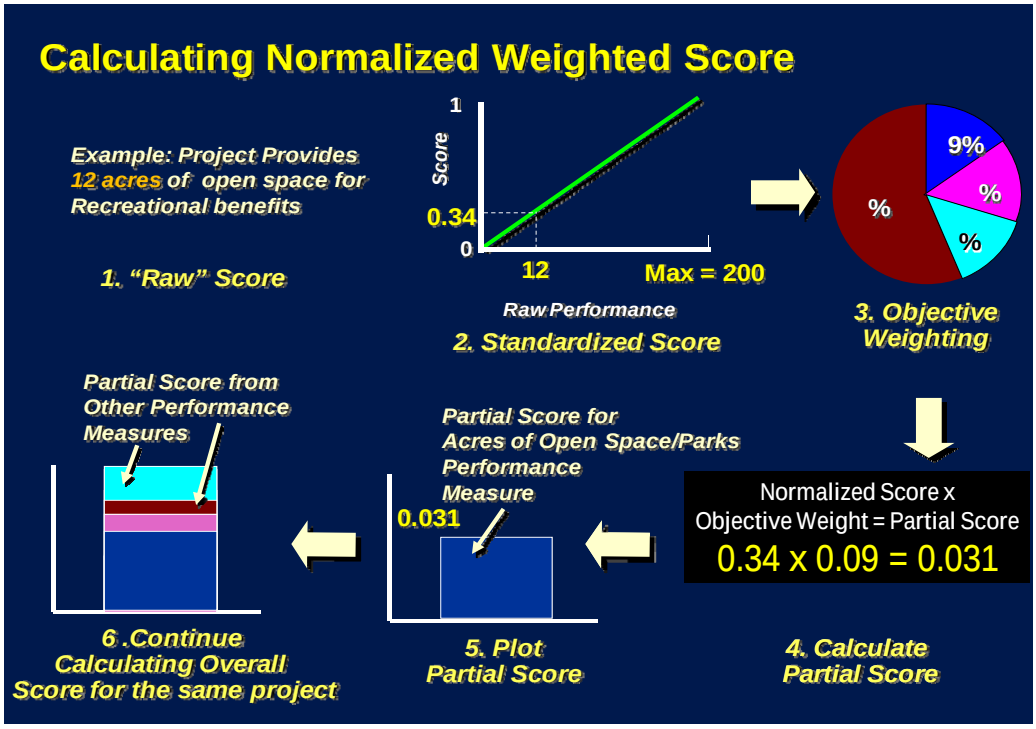
Step 3 on Figure 7-1 shows the weighting of the criteria. The process of weighting the criteria was described in Chapter 6. In Step 4 in Figure 7-1, the normalized score is multiplied by the weight of the criterion. In the example in Figure 7-1, the open space criterion received a weight of 9 percent (out of a possible 100 percent). The normalized score (0.34) is multiplied by its weight of 9 percent in order to get a partial score of 0.031 for the project.

The partial score of 0.031 then is plotted on a graph for that project [Step 5 in Figure 7-1]. This procedure is repeated for all of the other criteria (or performance measures) for the same project until a total decision score for the alternative is calculated [Step 6 in Figure 7-1].

Finally, after all projects receive a total score, they can be compared to the rest of the projects and ranked according to the overall CDP score, also called *decision score*.

Figure 7-1 shows the example of a linear scale for normalization of scores in Step 2. In the process of normalizing scores for the OWOW projects, however, some of the normalization scales were defined as non-linear scales. This was necessary to avoid an effect called "shadowing" by which a few projects with significantly higher raw scores can generate low scores for the rest of the projects when a linear scale is used. For example, in a situation in which 95 percent of projects have benefits under 100 acres, but one or two percent of projects have benefits over 5,000 acres, a linear scale could result in the lowest score for the 95 percent of projects under 100 acres. The shadowing of those high performing projects could render the performance measure irrelevant since the normalized score would not serve as a discriminator for 95 percent of projects.

Figure 7-1 Multi-Attribute Rating Technique to Rank Any Type of Alternatives or Projects



In the OWOW ranking process, the scales for water supply, water quality, restoration and flood protection, and open space and recreation required non-linear normalization scales. The cost effectiveness scales for these benefits also required a non-linear normalization score.

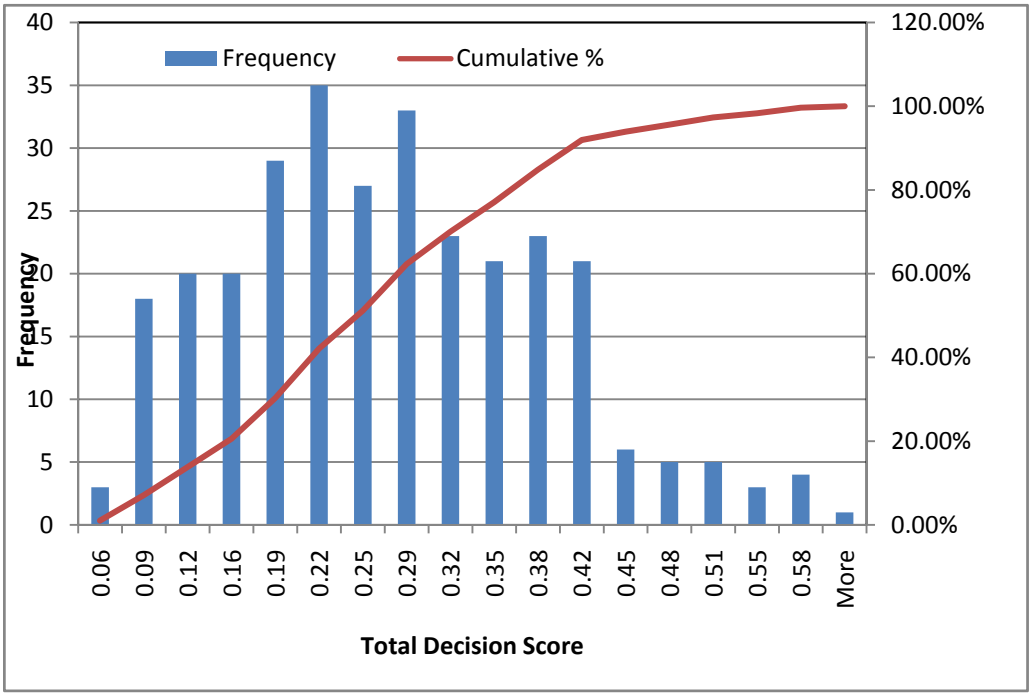
Project Prioritization Results

All 297 projects included in the OWOW plan were ranked using MART with the criteria weights established by the Steering Committee as explained in Chapter 6. The complete ranked list of projects is presented in **Appendix H**.

Figure 7-2 presents the spread of decision scores (ranking scores) in a histogram (and a cumulative histogram). The figure shows an inflection point around 90 percent of projects. This means that about ten percent of the projects (between 25 and 20 projects) distinguish from the rest obtaining scores that would indicate that they provide more benefits and/or perform significantly better than the rest of the projects for most of the criteria.

In order to test the robustness of the ranking method used (including the qualitative scales and the non-linear normalization scales), a series of sensitivity analyses were run on the model. Additionally the sensitivity of the ranking to the weights of the sub criteria also was tested. Results of the sensitivity analysis showed that the ranking is not sensitive to the qualitative scales (such as the greenhouse gas scale of 1 to 5). The model is not sensitive to the actual shape of the non-linear scales used for normalization of some criteria, as long as the scale remains non linear (to avoid the "shadowing" effect). Similarly, the ranking generally is not sensitive to reasonable changes in the weights of the criteria (changes of ten percentage points). The ranking, however, does show a sensitivity to the actual raw scores (numbers reported in the project nomination forms) mainly for water supply and water quality benefits. For a ranking of projects to determine the actual Proposition 84 funding, the information provided in the nomination form would have to be vetted to avoid biases in decision scores due to inaccurate information.

Figure 7-2 Distribution of Total Decision Scores for all OWOW



The final prioritized OWOW project implementation list is presented in Appendix H. Projects are ranked from highest CDP decision score to lowest CDP decision score. Scores range from about 0.06 for the lowest ranked projects to above 0.60 for the highest ranked projects (shown in **Figure 7-2**). The "perfect" theoretical score is 1.0. The results of the ranking with the highest ranked project around 0.61 are not unexpected given the great number and diversity of sub-criteria. Generally, in any multi-criteria ranking process, the greater the number of criteria, the lower the decision scores tend to be, as it becomes increasingly less likely that the best project will score well for all criteria.