Appendix G
Qualitative Score Guidance

The performance measures used to evaluate portfolios, or combinations of options, against the PWP WIRP objectives are shown in Table G-1. Some performance measures are quantitative in nature (developed using models and analyses), while others are qualitative and are assessed based on a variety of factors using professional judgment.

The following is a description of the factors used in assessing qualitative scores. All qualitative scores are based on a scale of 1 to 5, where 1 = poor performance and 5 = superior performance. Qualitative scores are assigned either to individual options (then rolled up to a portfolio using a weighted average of supply yield), or directly to portfolios. This is indicated in Table G-1 with either 'Qualitative-O' for option level assessment, and 'Qualitative-P' for portfolio level assessment. Table G-2 presents the qualitative scores for individual options when the former method is used.

Hydrologic Variability (Local or Imported): The availability of some sources of water vary depending on weather or climatic conditions, which influence hydrology. The following is some guidance for scoring options that are hydrology-dependent:

- Local surface water supply that is directly used either for non-potable uses or through a treatment plant, and rainwater capture for direct irrigation use (e.g., rain barrels) have the greatest hydrologic variability.

- Imported water supply has great hydrologic variability, but MWD's storage mitigates this variability to some degree.

- Local surface water and stormwater that recharge the groundwater basin are variable on a daily basis; however, the ability to extract the water from the ground is more a function of long-term average recharge and is less subject to hydrologic variability.

- Options such as conservation, recycled water and ocean desalination have essentially zero hydrologic variability.

Vulnerability to Climate Change: Any options that have hydrologic variability also are susceptible to climate change, but to a different degree. In this case, imported water is the most susceptible to reduced supply from climate change. Reliability of imported water is improved with a groundwater banking program, assuming water in storage is supplied during extended drought periods that could result from climate change. Although local surface water is subject to climate change, the localized affect is unknown at this time, and the climate change impacts are assumed to be the same regardless of how the water is utilized (direct or recharge).

Vulnerability to Catastrophe (e.g. fires, earthquakes): Two catastrophe scenarios are considered for scoring this performance measure: (1) fires in the local watershed that results in significant debris in local intake and spreading facilities; and (2) a major earthquake that interrupts imported water supply (either through levee failures in the Delta or severance of a major conveyance pipelines). Under the first scenario, the highest vulnerability is with any surface water diversions from the Arroyo Seco due to sediment issues after watershed fires. Diversions and spreading in Eaton Wash are not as susceptible to watershed fires since Eaton Dam (located upstream of the spreading operations) would mitigate sediment issues. Under the second scenario, any options that require delivery of water through MWD's system would have high vulnerability to major earthquakes, but this vulnerability is mitigated to some extent by MWD's emergency storage. All other options (conservation, recycled water, graywater, and on-site stormwater capture) have low vulnerability.

Fairness in Allocation of Costs between Customer Types: The WIRP analysis assesses the overall cost of each portfolio. Detailed assessment of how this cost would be allocated fairly to customers will likely be determined through a subsequent rate study when the WIRP is completed. At this time, we assumed that a fair rate structure/pricing approach will be able to be implemented for all portfolios except the Hybrid 2 portfolio. Under this portfolio, where the 10% of single family users are targeted to reduce demands by 70%, a very aggressive and penalty-based pricing of water would have to be implemented. This would go well beyond water budget-based rate structures, and therefore would likely get challenged by these top users as being potentially unfair and punitive.

Maintain or Improve Water Quality of Raymond Groundwater Basin: This performance measure is intended to represent very general trends associated with using various water sources. However, generalizations are very subjective since a water source may have better quality for one constituent but worse quality in another constituent when compared with another water source. The following is a description of the rationale behind the qualitative scores:

- *Local surface water:* Under normal situations, natural stream runoff directly from the San Gabriel Mountains is high in water quality.

- *Local groundwater and imported water from MWD:* These two water sources have moderate water quality, with the biggest water quality issues being nitrates and salinity.

- *Recycled water:* Tertiary treated recycled water from the Los Angeles-Glendale Water Reclamation Plant is lower in water quality than PWP's existing water sources. However, some options of recycled water assume advanced water treatment (microfiltration and reverse osmosis), which would produce very high water quality.

- *Graywater:* There is still much uncertainty regarding the water quality from graywater systems. In addition, graywater quality is very dependent on behaviors of homeowners (type of detergents used, articles washed) and maintenance of the graywater filters. Therefore, graywater is assumed to have relatively poorer water quality than PWP's existing water sources.

- *On-site stormwater capture:* The types of residential on-site stormwater capture options evaluated typically have a very high quality, since it is essentially pure rainwater captured from rooftops. If water is captured from the larger property drainage areas, there is some potential negative impact associated with picking up oils, fertilizers, etc. along the drainage course.

- *Conservation:* Reduced outdoor water use would have a slightly positive impact to groundwater quality. This is because outdoor irrigation of lawns has the potential to pick up fertilizers before some of the water is returned to the groundwater basin. With less outdoor water use and conversion to drought-tolerant plants, there is less contaminants to groundwater.

- *Ocean Desalination:* Although desalinated water is very high in water quality, this option assumes that the water is delivered through an exchange of a like quantity of MWD water. Therefore this option would have the same water quality as all other imported water, which is of moderate water quality.

Habitat Impacts in Watersheds of Imported Water Supply: Any local water supplies and water conservation would reduce reliance on imported water originating in the Bay Delta, and thus reduce impacts to the habitats in that watershed.

Preserve or Enhance Local Natural Areas and Water Courses: This performance measure is focused on environmental impacts associated with habitat restoration and preservation for aquatic life in local streams and existing spreading areas. Since there are only a few projects that have direct influence on local habitats, this performance measure was scored at the portfolio level of analysis, depending on the combination of projects in each of the portfolios. Portfolios scored higher in this performance measure if aquatic habitat conditions improved and the following guidelines were used to assess this:

- The proposed Devil's Gate Dam project is assumed to be operated to improve downstream flows, and therefore produce habitat benefits for the Arroyo Seco. In addition, by diverting surface water to Eaton Canyon, the existing spreading grounds there will have more sustained water leading to better habitat conditions.

- Recycled water and stormwater capture that are used for groundwater recharge at Eaton Canyon would have some habitat benefits by keeping the spreading basins full more of the time.

- Options that divert flowing water away from the natural system, such as a new local surface treatment plant or expanded spreading areas could likely have negative habitat impacts.

Maintain Cultural and Historically Significant Areas: This performance measure was assessed based on the level of new conservation, recycled water for non-potable reuse, and remaining supply shortage during imported water restrictions. The maximum conservation level significantly reduces outdoor water use and involves modified landscapes with drought tolerant plant species (which will change the cultural appearance and look of neighborhoods). Therefore, having the maximum conservation option will reduce the score for this performance measure. Portfolios that have the maximum conservation level and also supply shortages will have the lowest score. This is due to "demand hardening" in which there will be little flexibility for drought-conservation if the maximum conservation level is implemented. Additionally, there may be some culturally-significant features (i.e. fountains) that will face shutdown in water use until the shortage scenario is over. Recycled water to irrigation demands (i.e. at golf courses, gardens, universities, etc) is not subject to restrictions and would help to satisfy some landscape demands for participating customers. Therefore, portfolios with recycled water to non-potable customers receive an improved score. The Status Quo portfolio does not propose any new conservation measures, and therefore, the drought conservation is actually more feasible.

Maintain Certain Greenscapes for Recreational Areas and Ball Fields: This performance measure was assessed based on amount of recycled water for non-potable reuse and remaining supply shortage during imported water restrictions. Portfolios that are subject to supply shortages will have a low score. However, recycled water to non-potable reuse will improve the score since this source of supply is not subject to restrictions. Recycled water use for irrigation of recreational areas and ball fields is a very traditional use of this type of source, and the probability of customer connection would be high. Because the status quo scenario would require mandatory restrictions in outdoor water use during a shortage scenario, it has a reduced score in this performance measure.

Allow For Variety of Uses of Water If Done So In An Efficient Manner (e.g. for swimming pools): This performance measure considers the difficulty in implementing additional mandatory restrictions when needed. The assessment is based on the level of new conservation in a portfolio and the size of the remaining supply shortage during imported water restrictions. Portfolios that are subject to larger supply shortages will have a lower score. Additionally, higher levels of new conservation would make it harder to implement mandatory restrictions (due to demand hardening). Portfolios with maximum levels of conservation have a lower score in this performance measure, while portfolios with moderate conservation have a higher score. Recycled water to non-potable reuse also improves the score in this performance measure, since it is not subject to restrictions.

Allow Businesses that Provide Economic Benefit to Use Water in an Efficient Manner: This performance measure considers the burden on developers and businesses for new conservation and certain stormwater programs, and also the negative perceptions businesses may have when chronic shortages exist in Pasadena. Portfolios with higher levels of conservation and certain stormwater projects that require significant contribution of developers receive a lower score, as do portfolios that have significant supply shortages.

Minimize Implementation Risk: This performance measure is based on the level of regulatory, technical, and public process complexity. Existing, or status quo, options are considered the easiest to implement. The following is general guidance for scoring new options against implementation considerations:

- Regulatory: All water projects fall under jurisdiction of local, state, and/or federal laws and permit processes can be time consuming, with some options facing more legal challenges than others. Ocean desalination has the most extensive regulatory and legal challenges. Indirect potable reuse and graywater projects face some challenges with strict regulations for health standards. Recycled water for non-potable use, local surface water and stormwater capture will have moderate regulatory requirements and are generally accepted. Local surface water options that involve modification to diversion or spreading basin structures will have more regulatory requirements (i.e. Department of Fish and Game). Conservation will likely have the least legal or regulatory challenges.

- Technical: Although technological advancements have many benefits, options that propose new technologies have some risk associated with unanticipated problems in implementation. The option with the most technological risk is ocean desalination. Non-potable recycled water and graywater systems pose some technical risk associated with the possibility of cross-connections with potable water. Although such an event is rare, it would have severe consequences.

- Public process: This factor considers the risk associated with the water utility's dependence on voluntary public or customer involvement in order for implementation to be successful. Options that require participation from customers include non-potable reuse, graywater, on-site stormwater capture, and conservation.

Share Resources with Other Agencies and Entities: Any options that promote potential partnerships with other entities (where the supply would otherwise not be available) and/or would have more funding resources (including State and Federal grants, partnerships with other City departments, and cost-sharing with other agencies) are given a higher score. Options that have higher scores in this performance measure include ocean desalination, water transfers and groundwater banking agreements, recycled water, stormwater options, and the Los Angeles County Department of Public Works Water Conservation Planning Section's (LACDPW) Devil's Gate storage project.

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Pasadena Water and Power (PWP) Water Integrated Resources Plan (WIRP)
Table G-1. Objectives, Sub-objectives, and performance measures

Objective	Weight	Sub-Objective	Performance Measure	Scoring Method
Provide a reliable water supply	10%	Hydrologic Variability (Local or Imported)	Score of 1 to 5, 1 - high variability, 5 - low variability	Qualitative-O
	35%	Vulnerability to Delta Restrictions	Annual supply shortage under imported water restrictions	Quantitative
	10%	Vulnerability to Climate Change	Score of 1 to 5, 1 - high vulnerability, 5 - low vulnerability	Qualitative-O
	10%	Vulnerability to Catastrophes (e.g. fires, earthquakes)	Score of 1 to 5, 1 - high vulnerability, 5 - low vulnerability	Qualitative-O
	35%	Maintain a system that can be independent of imported water for a short-term	Supply shortages during a one month shut-down of imported water	Quantitative
Maintain affordability, while addressing fairness and equity	40%	Total Lifecycle Cost	PV dollars, including customer/developer costs	Quantitative
	40%	Pasadena's average cost of water	Average PV $/AF of PWP costs only, over planning horizon	Quantitative
	20%	Fairness in allocation of costs between customer types	Score of 1 to 5, 1 - no difference among customer types, 5 - allocation fairness	Qualitative-P
Protect and enhance source waters and the environment	20%	Replenish the Raymond groundwater basin	2035 total average annual replenishment to the groundwater basin in AFY	Quantitative
	20%	Maintain or improve the water quality of Raymond groundwater basin	Score of 1 to 5, 1 - high neg impact, 5 - high pos impact	Qualitative-O
	20%	Reduce stormwater pollutant discharges to creeks and rivers	mgd of stormwater flows not discharged into receiving waters	Quantitative
	20%	Habitat impacts in watersheds of imported water supply	Score of 1 to 5, 1 - high neg impact, 5 - high pos impact	Qualitative-O
	20%	Preserve or enhance local natural areas and water courses	Score of 1 to 5, 1 - natural areas are not preserved, 5 - natural areas are preserved	Qualitative-P
Protect cultural and recreational resources	20%	Maintain cultural and historically significant areas	Score of 1 to 5, 1 - cultural areas not maintained, 5 - cultural areas are maintained	Qualitative-P
	20%	Maintain certain greenscapes for recreational areas and ball fields	Score of 1 to 5, 1 - greenscapes not maintained, 5 - greenscapes are maintained	Qualitative-P
Maximize efficiency of water use	100%	Maximize conservation savings	2035 total average annual conservation savings in AFY	Quantitative
Maintain quality of life and positive economic climate	50%	Allow a variety of uses of water if done so in an efficient manner (e.g. for swimming pools)	Score of 1 to 5, 1 - restricting water, 5 - allowing water for a variety of uses	Qualitative-P
	50%	Allow businesses that provide economic benefit to use water in an efficient manner	Score of 1 to 5, 1 - restricting water, 5 - allowing water for a variety of uses	Qualitative-P
Reduce risk and maximize opportunities	50%	Minimize Implementation Risk	Score of 1 to 5, 1 - highly complex regulatory/technical/public process, 5 - not complex	Qualitative-O
	25%	Share resources with other agencies and entities	Score of 1 to 5, 1 - fully independent, 5 - maximizes partnerships	Qualitative-O
	25%	Maximize local water resources	Amount of local supply in AFY	Quantitative
Reduce energy footprint for water operations	100%	Carbon emissions	Total annual carbon emissions from water sources in metric tons	Quantitative

Notes:
1. Additional objectives of the Pasadena WIRP are to ensure safe, high quality drinking water and ensure public safety. These objectives must be met, and therefore do not influence the decision among water resource alternatives.

Acronyms:
$/AF: Dollars per acre-foot
AFY: acre-feet per year
neg: negative
NPV: Net Present Value
pos: positive
PV: Present Value
PWP: Pasadena Water and Power
Qualitative-O: Qualitative scores are assigned at the option level of analysis, and portfolio scores are calculated using a weighted average based on option yields.
Qualitative-P: Qualitative scores are assigned at the portfolio level of analysis.

Table G-2. Option Ratings for Qualitative Scores

			Existing Local Supply			Local Surface Water/ Stormwater Diversions				Recycled Water					Gray-water	On-site Stormwater/ Urban Runoff					Imported Water				Ocean Desal	Conservation				
Objective	Sub-objective	Performance Measures	Decreed Groundwater Rights (post 2014)	Eaton Canyon Diversions	Arroyo Seco Diversions	Expanded Arroyo Seco Diversions and Recharge	Local Treatment Plant (Arroyo Seco)	Tunnel Water to Brookside Golf Course	Devil's Gate storage to Eaton Canyon spreading basins	Satellite plants for On-site Non-potable Demands	Indirect Potable Reuse (Tertiary Treatment)	Indirect Potable Reuse (Advanced Treatment)	Non-Potable Demands (Maximum)	Non-Potable Demands (Smaller Phase 1)	Graywater	Residential Rain Barrels	Residential Rain Gardens	Residential infiltration strip/bioswale	Commercial Parking Lot Swales	Permeable Pavement (parking lots)	MWD Treated Imported Water	North of Delta Transfers	Groundwater Banking	Pasadena Groundwater Storage Program (PGSP)	Ocean Desalination	Moderate Conservation	Aggressive Conservation	Maximum Conservation	Top User Conservation
Provide a reliable water supply	Hydrologic Variability (Local or Imported)	Score of 1 to 5, 1 - high variability, 5 - low variability	5	4	4	4	1	3	4	5	5	5	5	5	5	1	3	3	3	3	3	3	3	3	5	5	5	5	5
	Vulnerability to Climate Change	Score of 1 to 5, 1 - high vulnerability, 5 - low vulnerability	4	2	2	2	2	4	2	5	5	5	5	5	5	2	2	2	2	2	1	1	2	2	5	5	5	5	5
	Vulnerability to Catastrophes (e.g. fires, earthquakes)	Score of 1 to 5, 1 - high vulnerability, 5 - low vulnerability	5	4	1	1	1	5	1	5	5	5	5	5	5	5	5	5	5	5	3	3	3	5	3	5	5	5	5
Protect and enhance source waters and the environment	Maintain or improve water quality of Raymond groundwater basin	Score of 1 to 5, 1 - high neg impact, 5 - high pos impact	3	4	4	4	3	3	4	2	2	5	2	2	1.5	4.5	4.5	4	3	3	3	3	3	3	3	3.5	3.5	3.5	3.5
	Habitat impacts in watersheds of imported water supply	Score of 1 to 5, 1 - high neg impact, 5 - high pos impact	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	5	5	5	5	5
Reduce risk and maximize opportunities	Minimize Implementation Risk	Score of 1 to 5, 1 - highly complex regulatory/technical/public process, 5 - not complex	5	5	5	2.5	3.5	4	2.5	3	1	3	3.5	4	1.5	3.5	3.5	3.5	3.5	3.5	5	2	2	3	1	4.5	3.5	2.5	2
	Share resources with other agencies and entities	Potential Partnerships:	NA	NA	NA	Lincoln Ave Water Company	NA	Brookside Golf Course	LACDPW; RBMB; City of Pasadena Public Works	Caltech; PCC	LA-Glendale; RBMB; LACDPW (if combined with pipeline from Devil's Gate to Eaton)	LA-Glendale; RBMB; LACDPW (if combined with pipeline from Devil's Gate to Eaton)	LA-Glendale; Customers	LA-Glendale; Customers	Customers	City of Pasadena Public Works; Customers	City of Pasadena Public Works; Customers	City of Pasadena Public Works; Customers	City of Pasadena Public Works; Customers	City of Pasadena Public Works; Customers	NA	Water Seller; Wheeling Agency (MWD)	Water Seller; Wheeling Agency (MWD)	MWD; Foothill MWD; RBMB	Project Proprietor; Member Agency of MWD Participating; MWD	Customers	Customers	Customers	Customers
		Grant Funding Opportunities:	NA	NA	NA	NA	NA	NA	NA	State and Federal	State and Federal	State and Federal	State and Federal	State and Federal	State	State	State	State	State	State	NA	NA	NA	State and Federal	State and Federal	NA	State	State	State