Summary of IRP Demand Expert Responses

The table below summarizes preliminary insights from individual feedback received to date from the IRP expert consultants on water demand. This summary was prepared for the purpose of facilitating interaction at the March 23, 2021 IRP Demand Experts Panel workshop. These insights are based on Metropolitan's compilation of the work in progress and ongoing discussions with individual experts. They do not represent the finalized or consensus group findings by the expert panel. A compiled report will be forthcoming from each expert.

	Question	Preliminary Insights
1	***What are the most important drivers that influence water demands?***	Demographics are generally recognized as major drivers influencing water demand. Demographic drivers include: • Households and housing (type, density, policy, location) • Population • Employment (including Business/Industry Mix) Other important drivers identified: weather, climate (not weather), price of water, affluence/income, compliance with policy, other "shock drivers" (see below) Drivers can be categorized in different ways. In terms of timing: • Long-term– population growth, changes in future climate (not weather variability), and adherence to plumbing codes and landscape ordinances • Mid-term – development trends such as shifts between multi-family and single-family homes, lot size and density, and emerging factors such as continuing work-at-home shifts, and California's Alternative Dwelling Unit (ADU) permitting • Shock– short-term inflections resulting from year-to-year weather variability, economic recession/recovery, consumer drought response (while important to measure, especially in terms of not double-counting or mistaking for longer-term shifts, shock drivers are not well-suited to capture in scenario planning) In terms of effect: • Scale Effect (e.g., population growth) • Composition Effect (e.g., housing type/land use) • Intensity Effect (e.g., per capita use for each housing type) • Although effects are interrelated, relationships may not be linear • Relationships can be explained but often not intuitive "Median is not the message" – Using averages without context can be problematic because means and medians do not account for skewness. For example, assessing water affordability by averaging water use data and household water expenditures with a single summary statistic (e.g., mean, median) is less helpful than to consider the entire distribution of use and income within a district to better understand affordability implications.

	Question	Preliminary Insights
2	***How can we estimate plausible ranges of future outcomes for each driver?***	Suggestions included examination of historical annual growth rates and ranges used by other regional planning organizations and government agencies. For example, the U.S. Census Bureau prepared a range of population projections using 2020 as a starting point to show a significant but plausible range of impact from uncertainties in future immigration on U.S. population (whereas other variables such as birth and death rates do not have comparable ranges of uncertainty) Ranges for long-term demographic projections (population, households, housing mix, persons per household, employment) should be based on varying assumptions about long-term health of Southern California economy via Stephen Levy. Ranges for long-term shifts in climate should be made using ranges of downscaled climate models that produce different predictions of temperature and precipitation for Southern California. Instead of assembling all climate models, a plot of changes in temperature and rainfall for each climate model/emissions assumptions would be used to create a quartile map (hot/dry, hot/wet, warm/dry, and warm/wet). Then ensembles of the climate models within each quartile can be used for demand changes. Ranges for plumbing code/landscape ordinances should be based on levels of future homes/businesses for current codes and ordinances on the higher end of the demand forecast and using 50 GPCD target for indoor per capita water use on the lower end of the demand forecast. Ranges for density of development is a professional judgment call, especially if California's Alternative Dwelling Unit (ADU) directive is implemented to expected levels. ADUs on existing single-family lots might occur on existing building footprints (e.g., second story or conversion of garage), or they might occur as a new structure in the backyard. If the ADU's occur as a new structure footprint, irrigation demand for that single-family home would be reduced.

	Question	Preliminary Insights
3	***What are approaches or methodologies to quantify the effects of the drivers?***	One approach to quantify driver effects on demands could be to develop a model to simulate demand over time under different assumptions regarding the plausible ranges discussed in Question #2. A stochastic dynamic model could represent uncertainty by particular distributions and be simulated over time. Particular shocks could be evaluated to illustrate how demand would change over time given uncertainty. Climate change, population growth, etc., could be included in this model. One of many possibilities could be to perform a Monte Carlo simulation and develop a distribution of outcomes under different scenarios over a certain number of years into the future (a time profile of use sufficient to account for uncertainty). MWD already has an econometric demand model by sector. This model is sufficient to estimate the impact on water use for most of the drivers I have listed. However, MWD would benefit from another type of statistical modeling of total monthly water use for the entire region (i.e., water production data vs. billing data by sector). This type of statistical model would be better suited for modeling impacts of year-to-year weather variations, long-term climate change, and shock variables such as economic recessions and droughts. For such a model, the dependent variable would be historical monthly per capita water use (controlling for growth). Independent variables that have been shown to normalize demands before shocks of economic recession and droughts for other water agencies have included max month temperature, monthly precipitation, previous month precipitation, mix of multi-family to total housing, % of post-2010 housing to total housing (to account for plumbing code efficiency). For measuring economic recessions, monthly unemployment rate can be used, and to account for drought impacts binary variables can be created to measure different stages of drought water restrictions. Development of this model would be relatively feasible for MWD to implement without additional member agency data collection or surveys. Recommended data sources include the ALN Apartment Database, Bureau of Labor statistics, the Census Bureau, SCAG, and SANDAG. Emerging trends in development are important to track as recent changes in types of land use yet to be developed has a significant impact on future indoor and outdoor water demands, especially in the single-family residential sector. Some drivers are becoming more difficult to measure. For example, measuring price impacts is becoming more difficult to tease out because of strict plumbing codes and landscape ordinances, availability of conservation rebates and incentives, and state-mandated per capita water use goals. If these other water conservation variables are handled correctly, inclusion of future price of water becomes less important and, in fact, can lead to double counting of future water conservation.

	Question	Preliminary Insights
4	***What are any major interrelations between ranges and direction of future outcomes for these drivers and how to treat these drivers with internal consistency within the IRP scenarios?***	Aggregate demand must be decomposed into its relevant parts and it is those parts that need to be internally consistent with one another as well as the many contexts under which the parameters were derived. Several interactions need to be accounted for in terms of the potential for double-counting impacts. Examples include the relationship between population growth and increased density for housing units, which has implications for irrigation demands; modeling for adherence to the CA Model Water Efficient Landscape Ordinance for future development should be done carefully in light of ADUs on single-family lots to avoid double-counting reduction in irrigation water use; and potential for double-counting impacts of price of water and passive and active water conservation. One would expect as regulatory requirements tighten, water use will decrease. However, the magnitude is really what is in question, and that depends on a number of factors, including current water use and its distribution. Whether households are in areas that are already somewhat coded for more efficient water use will matter, and/or the degree to which an agency's own practices (e.g., pricing and pricing structure, rebates, messaging) have moved customers in the direction such at newly imposed regulatory requirements may be non-binding. With regard to demographics, employment growth drives growth in population and household formation. However, success of housing policies and the physical and spatial characteristics of housing stock are major determinants of the region’s economic competitiveness, as access to affordable housing affects the region’s share of U.S. jobs and population. All other things being equal, population and water use are positively related. But other things may not be equal. Care has to be taken in how past per capita estimates are used in projecting future water demand due to population growth since agencies are pricing and messaging differently; regulations and coding have changed; and the type of water use or service (indoor vs outdoor) and residential unit (high density housing; rental; single family) will influence this relationship.