Nevada State Water Plan
PART 2 —WATER USE AND FORECASTS

Section 5
Technical Supplement
Water Use Coefficient and Related Forecast Factor Development and Application

Introduction

This technical supplement to the water withdrawal (use) forecasts presented in Section 3, Part 2 of the *Nevada State Water Plan* provides more detailed information as to the methodology behind the forecasts. Specifically, this section provides (1) a description of the water withdrawal categories analyzed and forecasted in this water plan and (2) the process by which specific water use coefficients and related forecast factors were estimated and the methodology used in the forecast development process. Graphs are also provided which present county-specific water use coefficients and other, related forecasts factors. The water use coefficients or factors, presented in gallons per person per day for municipal and industrial (M&I) water use and domestic water use, gallons per worker per day for commercial and industrial water use, or acre-feet per acre per year for irrigation water use, allow for the direct incorporation of socioeconomic forecasts (population, employment, irrigated acreage) into the water planning and forecasting process. This methodology provides the means by which forecasts of water withdrawals for certain economic sectors can be determined directly from changes in related socioeconomic factors.

Water Withdrawal (Use) Forecast Categories (Sectors)

The following water withdrawal categories were analyzed and forecast in this plan.

Total Water Withdrawals — Includes water withdrawals from both public and self-supplied sources for the categories of domestic, commercial and industrial, thermoelectric, public use and losses, mining and agricultural water uses.

Domestic (Residential) Water Withdrawals — Water withdrawn normally for residential purposes, including household use, personal hygiene, drinking, washing clothes and dishes, flushing toilets, watering of domestic animals, and outside uses such as car washing, swimming pools, and for lawns, gardens, trees and shrubs. The water may be obtained from a public supply water system or may be may be self supplied. The State Water Plan presents forecasts for total domestic, public supply domestic and self-supplied domestic water withdrawals.

Commercial and Industrial Water Withdrawals — Water withdrawals for motels, hotels, restaurants, office buildings, and other commercial facilities and institutions, both civilian and military. The water may be obtained from a public supply or may be self supplied. As used in this plan, commercial and industrial water withdrawal forecasts include all water withdrawals by businesses and industry, excluding thermoelectric and mining.

Public Use and Losses — Water supplied from a public water supply system (PWSS) and used for such purposes as fire fighting, street washing, and municipal parks, golf courses, and swimming pools. Also includes system water losses (water lost to leakage). Also referred to as public water use or utility water use.

Thermoelectric Water Withdrawals — Water withdrawals used for thermoelectric power generation and for cooling purposes in electric power plants. The water may be obtained from a public water supply system or may be self supplied. Only total thermoelectric water withdrawals are forecast within this water plan.

Mining Water Withdrawals — Consists of water withdrawals for mining processing functions (presumed to be consumptive uses) and for mine dewatering purposes (assumed to be a non-consumptive use). In actuality, all processing uses are not necessarily consumptive in nature and, similarly, all mine dewatering is not necessarily non-consumptive. For purposes of this water plan, forecasts are presented for total mining water withdrawals as well as those withdrawals for mine processing use and mine dewatering.

Total Agricultural Water Withdrawals — All water withdrawals for agricultural purposes consisting of water withdrawals for both irrigation applications (crops and irrigated pasture lands) and livestock watering purposes. Forecasts are presented for total agricultural water withdrawals and its component parts of irrigation water withdrawals and livestock (to include fishery, i.e., hatchery) water withdrawals.

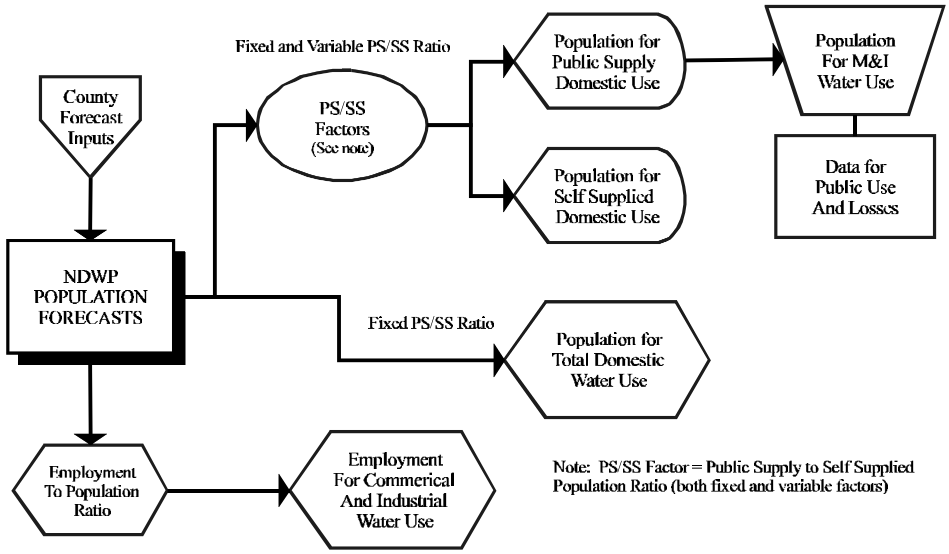
Municipal and Industrial (M&I) Water Withdrawals — All water withdrawals supplied by public supply water systems. For the purposes of this planning and forecasting effort, these withdrawals are assumed to consist of water withdrawals for domestic (residential), commercial, industrial and thermoelectric purposes. Unlike the water "use" categories listed above which comprise total water withdrawals, M&I water withdrawals are not so much a water use as it is a measure of the withdrawals from a water "source".

Water Use Coefficient Development and Application in the Water Withdrawal Forecasts

The presentation on water use coefficients (or water use factors) and related factor terms and their application to forecasting water withdrawals for the State of Nevada and its counties is presented in the following sections. These sections pertain specifically to the development of specific and county-unique water use coefficients and their use in forecasting municipal and industrial (M&I) water withdrawals, domestic (residential) water withdrawals (both public supply and self supplied withdrawals), commercial and industrial water withdrawals and total agricultural water withdrawals (consisting of both irrigation and livestock water withdrawals). [*Note:* The terms "water withdrawal" and "water use" are used interchangeably in this presentation. While assumed to have the same in meaning, the term water withdrawal is a more descriptive term as it is intended to represent the total water withdrawn for a specific use category and makes no inference as to degree of consumptive use and return flows from that particular use.]

Flow Chart 1. Population Forecasts and Water Withdrawals shows the basic relationship between the county population forecasts and various water withdrawals by sector. Water withdrawals may be considered as by the source of water, i.e., M&I water from public supply water systems, or by use, i.e., domestic, commercial, industrial, thermoelectric, etc. Population forecasts constitute a crucial part of the forecasts for municipal and industrial (M&I) water withdrawals, public use and losses (from M&I water withdrawals), domestic water withdrawals (both public supply and self supplied), and commercial and industrial water withdrawals (from employment which was based on employment-to-population ratios). The remaining flow charts in this technical supplement reflect the method by which water withdrawal forecasts were determined and are described in greater detail by the equations which follow.

Flow Chart 1. Population and Water Withdrawal Forecasts



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Municipal and Industrial (M&I) Water Withdrawals

The technique to develop M&I water withdrawals is presented in Flow Chart 2. Municipal & Industrial (M&I) Water Withdrawals and the equations which follow. The forecasts for (M&I) Public Use and Losses were based on a county-specific fixed relationship (factor) between the M&I water withdrawal forecast and historical use patterns and then aggregated for the total state. These factors averaged between 9 and 10 percent on a statewide based and are presented for each county in Appendix 3 of the Appendices.

This section on M&I water withdrawals is presented in two parts. Part (A) describes the development of M&I water withdrawals forecasts based on a fixed proportion of the total resident population remaining on public supply water systems whereas Part (B) incorporates a specific variation in this proportion which is unique to each county and uses, as a starting value, the proportion figures for each county for the year 1995. The basic assumption under Part (B) was that there will exist a change in the proportion of the population on public supply water systems, which tends to agree with historical experience. The specific M&I water withdrawal forecasts incorporated in the water plan use the assumption of a variable proportion of the population on public supply water systems.

__**M&I Fixed Water Withdrawals.**__ (Assumption: A fixed proportion of the population remains on public supply water systems resulting in the use of a fixed total M&I water use coefficient). This population assumption is shown in Equation [1]:

$$[\text{Population on Public Supply Water Systems}]_{\text{Fixed Proportion}} = [\text{Total Resident Population Forecast}] \times [\text{Constant PS/SS Percentage Factor}] \quad [1]$$

The term [Total Resident Population Forecast] in Equation [1] represent the county population forecasts based on NDWP's population growth assumptions (see Appendix 2 of the Appendices for each county's forecasts and aggregated forecasts for the total state). Also in Equation [1], the term

[Constant PS/SS Percentage Factor] [2]

represents a constant proportion (PS/SS = public supply population to self supplied population) of the resident population for 1995 assumed to remain on public supply water systems (and therefore a constant proportion continues to be self supplied). These county-unique fixed proportions are presented in the summary table of water use coefficients and related forecasting factors in Appendix 3 of the Appendices. From this information, total M&I water withdrawals, measured in acre-feet per year and based on a fixed proportion of the population on public supply water systems was determined from

[Total M&I Water Withdrawals]$_{\text{Fixed}}$
= [Population on Public Supply]$_{\text{Fixed Proportion}}$ x [M&I Water Use Factor]$_{\text{Fixed}}$ [3]

where the M&I water use coefficient (factor) was determined from 1995 historical data by

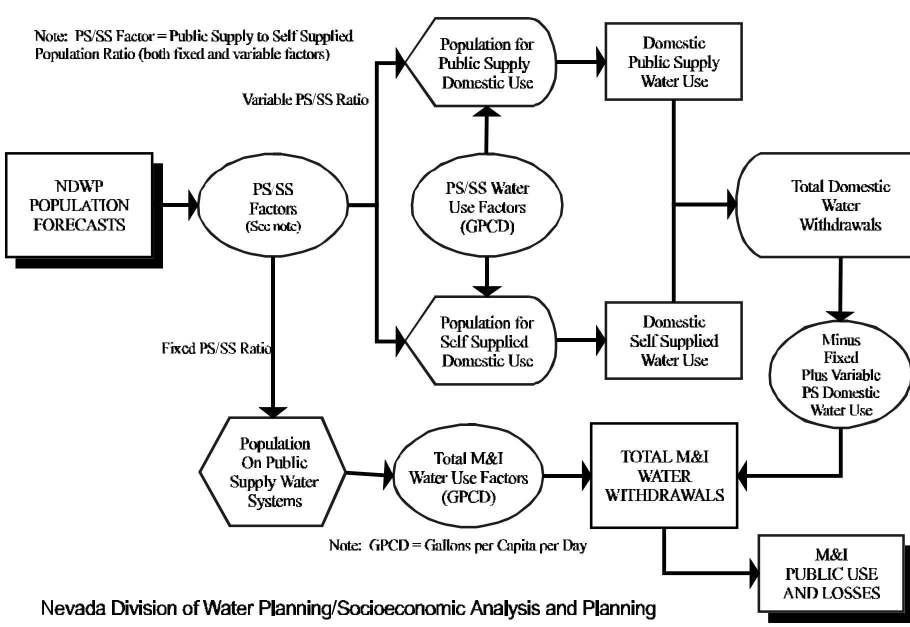
[M&I Water Use Factor]$_{\text{Fixed}}$ = [M&I Water Use]$_{1995}$ / [Population on Public Supply]$_{1995}$ [4]

and is measured in gallons per capita (per person) per day (GPCD).

M&I Variable Water Withdrawals. (Assumption: A variable proportion of the population was on public supply water systems resulting in a variable total M&I water use coefficient; variation in total M&I water use coefficient was based on the difference in total domestic water use based on a varying percent of the population on public supply water systems and the differences in the water use coefficients for domestic public supply usage and domestic self supplied usage). Conceptually, total M&I water withdrawals based on the assumption of a varying proportion of the population on public supply water systems could be calculated using a relationship similar to that presented in Equation [3] above, or,

[Total M&I Water Withdrawals]$_{\text{Variable}}$
= [Population on Public Supply]$_{\text{Variable Proportion}}$ x [M&I Water Use Factor]$_{\text{Variable}}$ [5]

Flow Chart 2. Municipal & Industrial (M&I) Water Withdrawals



where the population on public supply water systems in Equation [5] was determined from Equation [6] presented below:

$$[\text{Population on Public Supply}]_{\text{Variable Proportion}} = [\text{Total Resident Population Forecast}] \times [\text{Variable PS/SS Percentage Factor}] \quad [6]$$

In Equation [6], the term [Variable PS/SS Percentage Factor] represents a variable proportional term unique for each county based on the historical (1995) proportion of the population on public supply water systems and forecasts of changes in this proportion through the year 2020. This information for each county is presented in Appendix 3 of the Appendices. However, the water use coefficient term, $[\text{M\&I Water Use Factor}]_{\text{Variable}}$, presented in Equation [5] is unknown in this situation as it will vary by population proportions (public and self supplied) and specific water use coefficients for these types of uses. Furthermore, it cannot be readily calculated and will therefore have to be calculated indirectly.

The change in total M&I water withdrawals based on the forecast assumption of a varying proportion of the population on public supply water systems, however, can be determined from the change in total domestic water withdrawals based on changes in the proportion of the population on public supply water systems. Therefore, the following equation will be used in lieu of Equation [5] to calculate the total M&I water withdrawals based on variations in the population on public supply water systems:

$$[\text{Total M\&I Water Withdrawals}]_{\text{Variable}} = [\text{Total M\&I Water Withdrawals}]_{\text{Fixed}} - [\text{Public Supply Domestic Water Withdrawals}]_{\text{Fixed}} + [\text{Public Supply Domestic Water Withdrawals}]_{\text{Variable}} \quad [7]$$

In Equation [7] the term $[\text{Total M\&I Water Withdrawals}]_{\text{Fixed}}$ was calcuated in Equation [3], above, and both the terms $[\text{Public Supply Domestic Water Withdrawals}]_{\text{Fixed}}$ and $[\text{Public Supply Domestic Water Withdrawals}]_{\text{Variable}}$ can be determined directly from population forecasts, estimated proportions of the population on public supply water systems, and appropriate domestic public and self supplied water use coefficients. These calculations and equations are presented in the next section on forecasting domestic water withdrawals.

The term $[\text{Public Supply Domestic Water Withdrawals}]_{\text{Variable}}$ in Equation [7], unlike the term $[\text{Public Supply Domestic Water Withdrawals}]_{\text{Fixed}}$, will therefore incorporate the effects of a varying proportion of the population on public supply water systems. Inherent in this methodology is that the water use factors for other components of M&I water use, i.e., commercial and industrial, will not change over time. From Equation [7], the variable M&I water use coefficient term, $[\text{M\&I Water Use Factor}]_{\text{Variable}}$, measured in gallons per capita (person) per day (GPCD), can then be determined from Equation [8]:

$$[\text{M\&I Water Use Factor}]_{\text{Variable}} = [\text{Total M\&I Water Withdrawals}]_{\text{Variable}} / [\text{Population on Public Supply}]_{\text{Variable Proportion}} \quad [8]$$

As the calculation of this M&I water use coefficient (factor) in Equation [8] is made “after the fact,” that is, after the (variable population) total M&I water withdrawals have already been calculated, the coefficient itself serves no useful function in the forecast development and only shows the resultant variation in the M&I water use coefficient based on the assumption of a varying proportion of the population being served by public supply water systems. Also, since the coefficient incorporates specific assumptions about population forecasts and forecasts of the proportion of that population on public supply water systems, its usefulness in future forecasts and planning is restricted to retaining these exact assumptions.

The final water use forecast described in this section deals with public use and losses. As shown in Flow Chart 2, forecasts of this type of water withdrawal are based directly on the level of M&I water withdrawals. The relationship between each county's historical public use and losses and its total M&I water withdrawals resulted in a county-specific public use and loss factor as presented in Appendix 3 of the Appendices. These factors were then used to forecast public use and losses as follows:

$$[\text{Public Use and Losses}] = [\text{Total M\&I Water Withdrawals}]_{\text{Variable}} \times [\text{Public Use and Losses Factor}]_{\text{Fixed}} \qquad [9]$$

from which the fixed term [Public Use and Losses Factor]$_{\text{Fixed}}$ in Equation [9] is based on historical 1995 data as calculated from

$$\text{Public Use and Losses Factor}]_{\text{Fixed}} = [\text{Public Use and Losses}]_{1995} / [\text{Total M\&I Water Withdrawals}]_{1995} \qquad [10]$$

No changes in these factor terms for all counties were made over the forecast horizon.

Total Domestic (Residential), Public Supply Domestic, and Self-Supplied Domestic Water Withdrawals

The technique to develop the domestic water withdrawal forecasts are presented in Flow Chart 3. Total Domestic (Residential) Water Withdrawals. This flow chart, and the equations below, describe the method used to develop water use forecasts on both a fixed and variable basis, that is, (1) the assumption that a fixed proportion of the population remains on public supply systems (Part A) and (2) that this proportion varies over the forecast horizon (Part B). This distinction becomes important as it is the variable Total Domestic Water Withdrawal forecasts that are incorporated in this plan and are also used for the development of the Total M&I Water Withdrawal forecasts presented in the previous section.

Total Domestic, Public Supply and Self-Supplied Fixed Water Withdrawals. (Assumption: A fixed proportion of the resident population remains on public supply water systems resulting in a fixed total domestic water use coefficient). Total domestic water withdrawals, in acre-feet per year, can be calculated from the relationship in Equation [11]:

$$[\text{Total Domestic Water Withdrawals}]_{\text{Fixed}} = [\text{Total Resident Population Forecast}] \times [\text{Total Domestic Water Use Factor}]_{\text{Fixed}} \qquad [11]$$

where the water use factor, in gallons per capita (person) per day (GPCD), was determined from historical information on water withdrawals and populations such that

$$[\text{Total Domestic Water Use Factor}]_{\text{Fixed}}$$

$$= [\text{Total Domestic Water Use}]_{1995} \,/\, [\text{Total Resident Population}]_{1995} \qquad [12]$$

Similarly, for the domestic public supply water withdrawals, in acre-feet per year, we can use

$$[\text{Domestic Public Supply Water Withdrawals}]_{\text{Fixed}}$$
$$= [\text{Resident Population}]_{\text{Public Supply–Fixed}} \text{ x } [\text{Domestic Public Supply Use Factor}]_{\text{Fixed}} \qquad [13]$$

where the domestic public supply water use factor, measured in gallons per capita (person) per day (GPCD), was calculated using historical relationships such that

$$[\text{Domestic Public Supply Water Use Factor}]_{\text{Fixed}}$$
$$= [\text{Domestic Public Supply Water Use}]_{1995} \,/\, [\text{Population on Public Supply}]_{1995} \qquad [14]$$

Likewise, for the domestic self-supplied water withdrawals, also measured in acre-feet per year, we can use

$$[\text{Domestic Self-Supplied Water Withdrawals}]_{\text{Fixed}}$$
$$= [\text{Resident Population}]_{\text{Self Supplied–Fixed}} \text{ x } [\text{Domestic Self-Supplied Use Factor}]_{\text{Fixed}} \qquad [15]$$

where the domestic self-supplied water use factor, measured in gallons per capita (person) per day (GPCD), was calculated using historical data such that

$$[\text{Domestic Self-Supplied Water Use Factor}]_{\text{Fixed}}$$
$$= [\text{Domestic Self-Supplied Water Use}]_{1995} \,/\, [\text{Population being Self Supplied}]_{1995} \qquad [16]$$

Total Domestic, Public Supply and Self-Supplied Variable Water Withdrawals. (Assumption: A variable proportion of the population is on public supply water systems resulting in a variable total domestic water use coefficient; variation in the total domestic water use coefficient is based on the differences in the domestic public supply usage rate and the domestic self supplied usage rate). Here, the total domestic water withdrawals cannot be calculated directly due to the variations that will occur in the total domestic water use factor from the changing proportion of the population on public supply water systems. Therefore, total domestic water withdrawals are calculated from its separate components, as shown in Equation [17] below:

$$[\text{Total Domestic Water Withdrawals}]_{\text{Variable}} = [\text{Domestic Public Supply Water Withdrawals}]_{\text{Variable}}$$
$$+ [\text{Domestic Self-Supplied Water Withdrawals}]_{\text{Variable}} \qquad [17]$$

where domestic public supply water withdrawals, measured in acre-feet per year and assuming a variable proportion of population on public supply water systems, can be calculated from Equation [18] below:

$$[\text{Domestic Public Supply Water Withdrawals}]_{\text{Variable}}$$
$$= [\text{Population on Public Supply}]_{\text{Variable Proportion}} \text{ x } [\text{Domestic Public Supply Use Factor}]_{\text{Fixed}} \qquad [18]$$

Similarly, the domestic self supplied water withdrawals in acre-feet per year can be calculated from

$$[\text{Domestic Self-Supplied Water Withdrawals}]_{\text{Variable}}$$

= [Population being Self Supplied]$_{\text{Variable Proportion}}$ x [Domestic Self-Supplied Use Factor]$_{\text{Fixed}}$ [19]

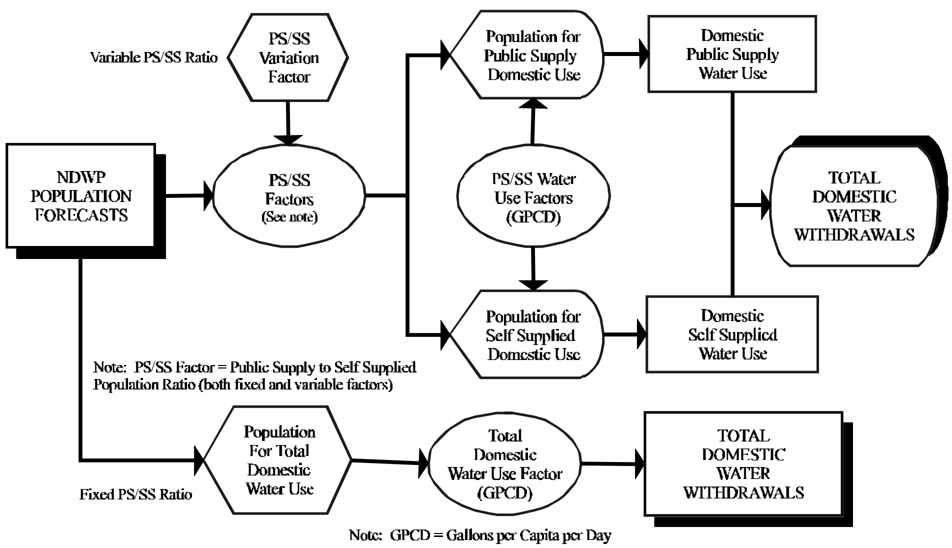
In order to determine the proportion of the resident population being self supplied, we can use the relationship shown in Equation [6] for the determination of the variations in the population on public supply water systems (and therefore the population being self supplied). Based on this relationship, we have the relationship shown in Equation [20]:

[Population on Public Supply]$_{\text{Variable Proportion}}$ = [Total Resident Population Forecast] x [Variable PS/SS Percentage Factor] [20]

with the requirement that

[Total Resident Population Forecast] = [Population on Public Supply]$_{\text{Variable Proportion}}$ + [Population being Self Supplied]$_{\text{Variable Proportion}}$ [21]

Flow Chart 3. Domestic (Residential) Water Withdrawals



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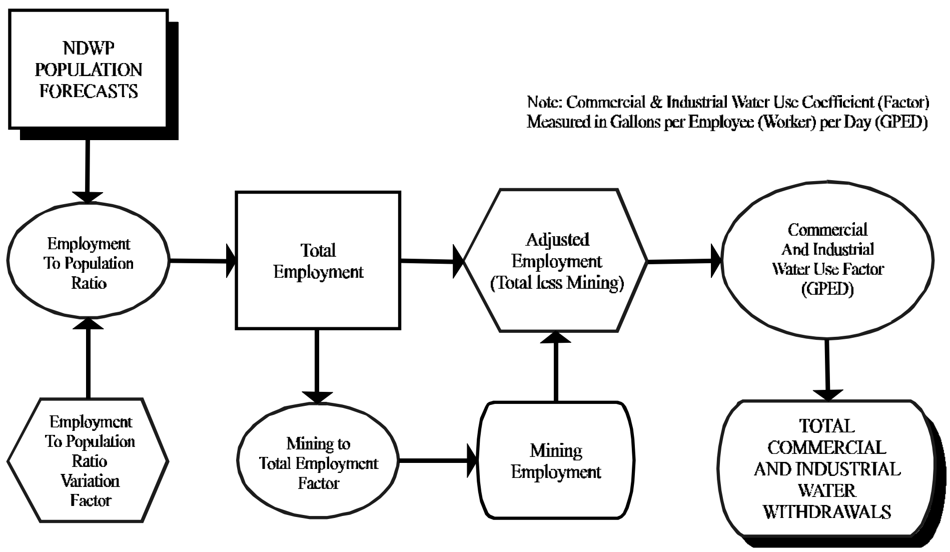
Calculations of total domestic, public supply domestic and self supplied domestic water withdrawal forecasts, along with all assumptions, water use factors and population proportions on public supply water systems, are presented in Appendix 3 of the Appendices for all counties and aggregated for the total state.

Commercial and Industrial Water Withdrawals

The water withdrawal forecasts for commercial and industrial water use are presented in Flow Chart 4. Commercial and Industrial Water Withdrawals and presented in more detail in the equations below. Flow Chart 4 shows that this forecast methodology incorporates three forecast factors. First, total employment was estimated for each county based on a unique forecast of that county's employment-to-population ratio. This ratio was based on the county's 1997 figure and assumed to vary over the forecast horizon. The ratio variation rate constituted the second forecast factor. The third forecast factor was the county-specific commercial and industrial water use coefficient, in gallons per employee (per worker) per day (GPED), and was based on each individual county's commercial structure and historical water use patterns. This coefficient was kept constant over the forecast horizon as its value was based more on the nature of production and the state of technology.

Total commercial and industrial water withdrawals were therefore forecast using forecasts of a socioeconomic measure (i.e., employment) and a water use factor. The water use factor, in gallons per employee per day, represented an average water usage rate for all employment classifications. While it is known that various industry sectors use water at different rates (i.e., at varying gallons per employee per day, or GPED's) based on unique processing and business conditions, so long as the overall composition of employment and production does not show significant changes over the forecast horizon, this fixed commercial water use coefficient represents a reasonable assumption of average water use rate for all industry sectors.

Flow Chart 4. Commercial & Industrial Water Withdrawals



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One important alteration in this methodology was the exclusion of mining employment from the total employment figures and from the determination of the commercial and industrial water use coefficient calculation. This was necessary as mining water withdrawals were determined from direct forecasts of mining output. Using this methodology, total commercial and industrial water withdrawals, measured in acre-feet per year, were calculated from Equation [22]:

$$[\text{Commercial \& Industrial Water Withdrawals}] = [\text{Total Employment}]_{\text{Adjusted}} \times [\text{Commercial \& Industrial Use Factor}]_{\text{Fixed}} \qquad [22]$$

where the adjusted total employment term in Equation [22] was derived from

$$[\text{Total Employment}]_{\text{Adjusted}} = [\text{Total Employment}] - [\text{Mining Employment}] \qquad [23]$$

Equation [23] reflects the removal of the forecasted mining employment from the forecasts of each county's total employment. These forecasts of total employment and mining employment are presented In Appendix 3 of the Appendices for each county and the total state, with the statewide total being an aggregation of the individual counties. The commercial and industrial water use coefficient, measured in gallons per worker per day, was calculated from historical data on water use and employment using the following equation:

$$[\text{Commercial \& Industrial Use Factor}]_{\text{Fixed}}$$

$$= [\text{Commercial \& Industrial Water Use}]_{1995} \,/\, [\text{Total Employment} - \text{Mining Employment}]_{1995} \qquad [24]$$

As can be seen from Equation [24], above, the development of the commercial and industrial water use factor also incorporated the removal of mining employment. Total employment for each county was determined uniquely from historical relationships between the total employment and the total resident population and presented in the form of a county-unique employment-to-population ratio.

Historical employment-to-population ratios for 1997 for Nevada and all counties are presented in Fig. 5–9. Employment to Population Ratios. These ratio, which varied uniquely for each county over the forecast horizon, were then used to forecast each county's total employment (and the total state from an aggregation of the county forecasts) as shown in the following equation:

$$[\text{Total Employment}] = [\text{Total Resident Population Forecast}] \times [\text{Employment-to-Population Ratio}]_{\text{Variable}} \qquad [25]$$

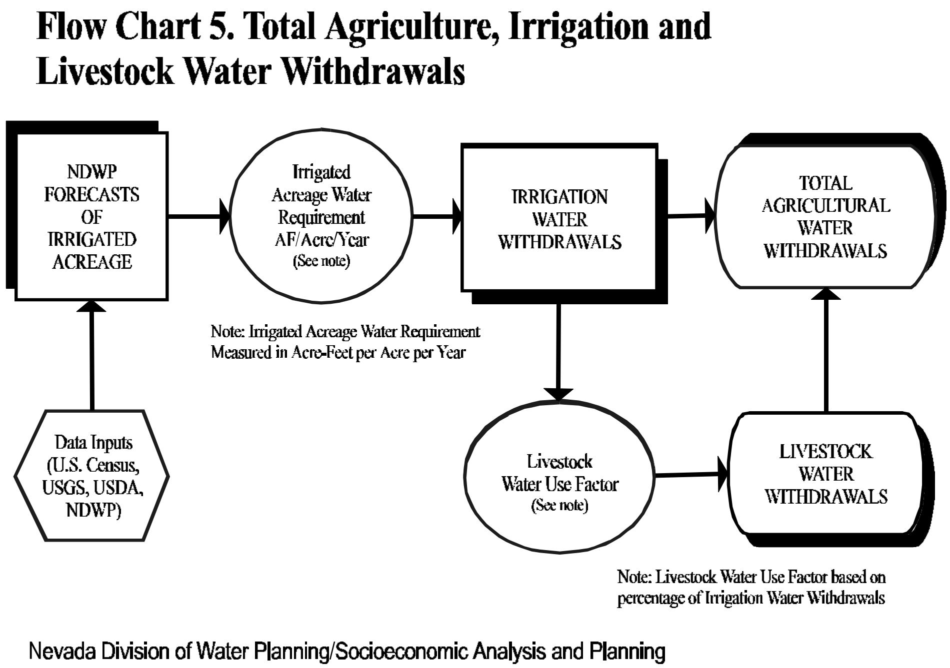
where forecasts of the term $[\text{Employment-to-Population Ratio}]_{\text{Variable}}$ in Equation [25] were estimated uniquely for each county based on forecasts of future industrial development and related employment trends versus population forecasts. Each county's mining employment (aggregated to a statewide total) was also determined uniquely based on current mining conditions and trends and forecasts of future mining activity. These forecasts of mining employment are presented in detail for each county in Appendix 3 of the Appendices and were based on the following calculation:

$$[\text{Mining Employment}] = [\text{Total Employment}] \times [\text{Mining Employment Factor}]_{\text{Variable}} \qquad [26]$$

where $[\text{Mining Employment Factor}]_{\text{Variable}}$ represented the assumption of a variable percent of mining employment to total county employment.

Agricultural Water Withdrawals

The methodology for total agricultural, irrigation and livestock water withdrawals is presented in Flow Chart 5. Total Agricultural, Irrigation and Livestock Water Withdrawals and is presented greater detail in the equations below. Agricultural water withdrawals were driven from forecasts of (1) irrigated acreage, (2) county-unique irrigated acreage water use requirements, and (3) county-specific relationships of irrigation water withdrawals and livestock water withdrawals. This assumption of a consistent link (i.e., fixed factor) between livestock water needs and irrigation water withdrawals represented a simplifying assumption and precluded the need to make county-specific livestock forecasts independently of forecasts of irrigated acreage and pasture lands, which itself may be subject to errors and inconsistencies. All historical trends, irrigation and livestock forecast assumptions, and forecasts for both irrigation and livestock water withdrawals are presented in Appendix 4 of the Appendices for each county and aggregated for the statewide total.



The basic calculation for forecasting each county's total agricultural water withdrawals, measured in acre-feet per year, was based on the relationship shown in Equation [27]:

[Total Agricultural Water Withdrawals]
= [Irrigation Water Withdrawals] + [Livestock Water Withdrawals] [27]

where forecasted irrigation water withdrawals in Equation [27] are based on forecasts of total irrigated acreage (including irrigated pasture lands) times a fixed irrigated acreage water use requirement, measured in acre-feet per acre per year, such that

[Irrigation Water Withdrawals]
= [Irrigated Acreage] x [Irrigated Acreage Water Use Requirement]$_{\text{Fixed}}$ [28]

Livestock water withdrawals in Equation [27] are based on the level of irrigation water withdrawals times a "livestock water use factor" which is based on historical conditions, or

$$[\text{Livestock Water Withdrawals}] = [\text{Irrigation Water Use}] \times [\text{Livestock Water Use Factor}]_{\text{Fixed}} \qquad [29]$$

Forecasts of each county's irrigated acreage were based on historical trends and a "best fit" non-linear line (curve fit) of these trends extrapolated out to the year 2020. Graphs and tables of historical data and forecasts for each county's irrigated acreage are presented in detail in Appendix 4 of the Appendices. The irrigated acreage water use requirement coefficient term was determined from historical water use patterns by the equation

$$[\text{Irrigated Acreage Water Use Requirement}]_{\text{Fixed}} = [\text{Irrigation Water Withdrawals}]_{1995} \,/\, [\text{Total Irrigated Acreage}]_{1995} \qquad [30]$$

The livestock water withdrawals were assumed to be based on the level of irrigation water withdrawals and a fixed factor term, $[\text{Livestock Water Use Factor}]_{\text{Fixed}}$, in Equation [29] representing the historical relationships between livestock water withdrawals and irrigation water withdrawals, such that

$$[\text{Livestock Water Use Factor}]_{\text{Fixed}} = [\text{Livestock Water Withdrawals}]_{1995} \,/\, [\text{Irrigation Water Withdrawals}]_{1995} \qquad [31]$$

Both the irrigated acreage water use requirement (as shown in Fig. 5-11. Irrigated Acreage Water Requirement) and the livestock use coefficient (as shown in Fig. 5-12. Livestock to Irrigation Water Withdrawals), while unique to each county, are assumed to be fixed over the forecast horizon. State of Nevada totals for both irrigation water withdrawals and livestock water withdrawals were based on the aggregation of individual county forecasts of these measures.

Graphs: Water Use Coefficients and Related Forecast Factors

The graphs on the following pages present the county-specific water use coefficients and related forecasts factors used in the forecast model equations just described.

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