MEMORANDUM

TO: Regional Offices
Water Allocation Bureau

FROM: Mat Weaver MW

RE: Recommendations for the Processing of Reasonably Anticipated Future Needs (RAFN) Municipal Water Rights at the Time of Application, Licensing, and Transfer

DATE: March 16, 2015

Application Processing No. 74
Permit Processing No. 20
License Processing No. 13
Transfer Processing No. 29

See attached Amended RAFN Municipal Water Right Handbook

IDAHO DEPARTMENT OF WATER RESOURCES

Recommendations for the Processing of Reasonably Anticipated Future Needs (RAFN) Municipal Water Rights at the Time of Application, Licensing, and Transfer

March 2015

Table of Contents

Appendix

1. Introduction

This document is intended to provide guidance and support to Idaho Department of Water Resources (the Department) staff in evaluating and processing applications for reasonably anticipated future needs (RAFN) water rights and can be used to provide assistance to applicants seeking RAFN water rights throughout the application, permit, license, and transfer processes. Guidance does not have the force and effect of law. Rather, it is designed to serve as a primary reference tool to assist agency staff and to assist those impacted by agency actions to comply with the law. The appendix includes a number of resources and support items related to RAFN analysis including the following: "*Municipal Water Right Permit Evaluation" checklist* (Item 5), which can be utilized by the applicant when applying for RAFN water rights; methods for estimating residential demand (Item 3); and a detailed example of the determination of RAFN for a small community that implements the methodology described in this document (Item 6).

RAFN vs. non-RAFN Prior to 1996, common law practices allowed municipalities to establish water rights greater than immediate needs. The 1996 Municipal Water Rights Act provided a statutory process for establishing a municipal water supply for reasonably anticipated future needs (RAFN). The 1996 Municipal Water Rights act was codified in Idaho Statutes in the form of amendments to Idaho Code (I.C.) §42-202, the addition of I.C. §42-202B, amendments to I.C. §42-217, amendments to I.C. §42-219, and amendments to I.C. §42-222. A key distinction of the RAFN right is the allowance of components of the water right, namely the diversion rate, to be perfected without physically completing diversion and use in establishing beneficial use during the development period of the permit.

There are times when a municipal provider will choose to file an application to appropriate water solely for use to meet needs in the near-term (up to five years) without the burden of demonstrating future needs over an established planning horizon. This type of municipal water right has been termed a non-RAFN municipal right. Municipal water rights that are not defined as RAFN in conditional language are by default non-RAFN water rights. *Application Processing Memo #18* presents and discusses the distinctions between both types of municipal water rights and provides guidance to Department staff for processing permits and determining extent of beneficial use for licensing of non-RAFN municipal water right permits. It is not the intent of this document to repeat or duplicate the material presented in AP Memo #18. The focus of this document will be on RAFN municipal water rights. When a water right application has been determined to be for a non-RAFN municipal beneficial use, Department staff should consult AP Memo #18 for processing guidance.

In addition to water rights with a designated municipal beneficial use, municipal providers may also own water rights for non-municipal uses such as domestic, irrigation, commercial, etc. These water rights are often associated with uses such as parks, golf courses, cemeteries, and buildings that are not directly connected to a municipal provider's primary municipal water delivery system. These water rights are sometimes acquired from previous non-municipal water right holders with the acquisition of land by the municipality. In other instances they may have been developed directly by the municipal provider for a demand not distributed throughout the entire existing water service area, or not otherwise qualified as a municipal use. When conducting a review of a municipal provider's suite of water rights, these water rights should be considered along with any existing water rights used for municipal needs, and any evaluation of RAFN should take into consideration beneficial use already being met by these types of water rights.

Types of Municipal Providers
Idaho Code §42-202 provides, in relevant part:

> An application proposing an appropriation of water by a municipal provider for reasonably anticipated future needs shall be accompanied by sufficient information and documentation to establish that the

applicant qualifies as a municipal provider and that the reasonably anticipated future needs, the service area and the planning horizon are consistent with the definitions and requirements specified in this chapter.

Idaho Code §42-202B(5) defines three types of municipal providers:

a) A municipality that provides water for municipal purposes (i.e. incorporated cities);

b) Any corporation or association holding a franchise to supply water for municipal purposes, or a political subdivision of the state of Idaho authorized to supply water for municipal purposes, and which does supply water, for municipal purposes to users within its service area (e.g. Water and Sewer Districts; United Water Idaho, a private company that supplies public drinking water to much of Ada County); or

c) A corporation or association which supplies water for municipal purposes through a water system regulated by the state of Idaho as a "public water supply" as described in I.C. § 39-103(12), Idaho Code. (e.g. developers; subdivision home owner associations).

As set forth in M3 Eagle Final Amended Order[1] (M3 Final Amended Order) a corporation or association seeking to qualify as a municipal provider under subsection c above for RAFN must qualify as a municipal provider at the time application is considered by the Department. In other words, at the time of application, the applicant must already supply water for municipal purposes through a water system that is regulated by the state of Idaho as a public water supply. It is insufficient for the applicant to merely be "*ready, willing, and able*" to be a municipal provider once the permit is issued.

2. Evaluating Reasonably Anticipated Future Needs

This section outlines and develops a fundamental protocol that should be considered by the applicant and Department staff in evaluating reasonably anticipated future water needs for qualified municipal providers.

As discussed above, Idaho law allows a municipal provider to secure water rights for RAFN purposes without relying on immediate diversion and use to establish beneficial use. For a qualified municipal provider, a RAFN estimate has four fundamental components:

1. Service Area (I.C. §42-202B (9)),
2. Planning Horizon (I.C. §42-202B (7)),
3. Population Projections within the Planning Horizon, and
4. Water Demand (necessary to serve the population during the planning horizon throughout the service area)

This protocol explains each one of these four components in order, and then describes how they should be used to evaluate a municipal provider's RAFN.

It is important to recognize at the outset that a conservative standard may be appropriate in estimating future needs to justify a RAFN water right, especially in instances where there is a weighing of public interest in an area of recognized limited water supply. There may be a difference between the supply of water sufficient to sustain an urban population and the supply desirable to keep future operating costs low or to provide aesthetic amenities.

[1] Amended Final Order of the Department in the matter of application to appropriate water no. 63-32573 In the name of M3 Eagle LLC dated January 25, 2010.

Service Area

Idaho Code §42-202B (9) defines the service area for a municipality as follows:

> "Service area" means that area within which a municipal provider is or becomes entitled or obligated to provide water for municipal purposes. For a municipality, the service area shall correspond to its corporate limits, or other recognized boundaries, including changes therein, after the permit or license is issued. The service area for a municipality may also include areas outside its corporate limits, or other recognized boundaries, that are within the municipality's established planning area if the constructed delivery system for the area shares a common water distribution system with lands located within the corporate limits. For a municipal provider that is not a municipality, the service area shall correspond to the area that it is authorized or obligated to serve, including changes therein after the permit or license is issued.

For a municipal provider, Idaho code requires the RAFN service area to be contained within the municipality's "established planning area" (I.C. §42-202B (9)) minus "areas overlapped by conflicting comprehensive land use plans" (I.C. §42-202B (8)).

For smaller widely-separated cities, the concern of overlapping comprehensive land use plans is not typically an issue. For these cities to justify a proposed future service area, the applicant should provide evidence of existing "corporate limits" and "other recognized boundaries" (I.C. §42-202B (9)). Idaho Code §50-102 requires the establishment of corporate limits (recorded metes and bounds description of the incorporated area) in association with the incorporation of a city. These limits are established with the counties within which the city is located. Where the applicant is a city, copies of corporate limits should be provided by the applicant. As necessary, staff can cross check corporate limits by obtaining the boundary directly from the city, governing counties, or the state. In addition, the Department maintains a spatial data layer delineating all incorporated cities and their respective city limits within the State of Idaho. This data layer is based on U.S. Census data that is updated every ten years. This data layer can be a good place to start in determining corporate limits, but there is a chance it may not represent the most current boundary, and, when the applicant is a city, staff should always obtain a current delineation of the corporate limits from the RAFN applicant or permit holder at the time of permitting and licensing. The purpose of this current boundary information is to facilitate the Department's review of the proposed RAFN service area.

Other recognized boundaries can include areas of impact, utility service planning areas, or other unique planning areas, provided they have been legitimately adopted by the municipality with verifiable records, as "established planning area[s]" consistent with I.C. §42-202B (9). Idaho Code §67-6526 in the Local Land Use Planning statutes requires that incorporated cities provide a map *"identifying an area of city impact within the unincorporated area of the county"*. In addition, I.C. §67-6508 requires the creation, adoption, and ongoing update of a comprehensive plan for any incorporated city. The comprehensive plan will typically include maps identifying incorporated limits, areas of city impact, and other legitimate planning boundaries.

For types b and c municipal providers, the "established planning area(s)" language does not apply. Rather, the applicant may submit an approved preliminary plat or other approved planning type documents, Public Utility Commission approval documents, Idaho Department of Environmental Quality public drinking water system approval documents, irrigation district and water and sewer district annexation plan, or other official documents which demonstrate a RAFN service area within which the applicant has the authority or obligation to provide water.

Idaho Code §42-202B (8) states, *"Reasonably anticipated future needs shall not include uses of water within areas overlapped by conflicting comprehensive land use plans."* When evaluating a proposed RAFN service

area where two or more municipal providers abut one another, the applicant should research adjacent community planning areas to confirm that overlaps in competing planning areas *specific to water service* do not exist. If overlaps in comprehensive land use planning areas specific to water service do exist between two different municipal providers, the area of overlap cannot be included in the proposed RAFN service area under consideration. As an example, if a subdivision intersects the planning boundaries of two separate municipal providers, and both entities indicate in their comprehensive land use plans the intent to serve the same subdivision with water, then neither entity can include the subdivision in a proposed RAFN water service area until the conflict has been resolved and one of the two entities relinquishes water service to the other. However, in another example, if an overlap exists in the comprehensive land use plans of two municipal providers, but only one plan addresses water service, and the other plan acknowledges that water service is provided by the other entity, then the area of overlap can be included in the RAFN service area of the entity providing water service.

When the applicant is a municipality with multiple municipal water service providers within its city limits or area of impact, the applicant should normally exclude the existing service areas of other municipal providers from the RAFN service area under consideration. However, if the RAFN applicant presents a sound argument and supporting evidence for the inclusion of competing existing water service areas within its own RAFN service area, Department staff may include them in the final RAFN service area delineation. As an example, if the systems of two water service providers are cross connected to allow for one system to provide water to the other during times of emergency, during periods of routine maintenance, or in support of peak water demands, it would be appropriate to include this demand in the RAFN analysis of the municipality that is providing water to the second water service provider, provided the established need is not already covered by an existing water right. If the established need is covered by an existing water right, a unique combined used limitation condition detailing the water supply relationship should be considered.

In conclusion, RAFN service areas should be delimited to include all existing contiguous and non-contiguous areas of water service (assuming they are combined) and adjacent areas poised for development and likely to occur within the established planning horizon time period. However, the proposed RAFN service area cannot include areas where water is not provided at the time of application if the proposed RAFN service area is overlapped by adjacent land use planning boundaries, or is already included within the existing service area of a municipal water provider other than the municipal provider under consideration. In addition, where the applicant is a municipality, the proposed RAFN service area cannot include areas where water is not provided at the time of application if the proposed service area is outside the municipality's currently adopted planning area. The appendix includes an example of a visual delineation of a RAFN service area based on underlying appurtenant boundaries (appendix Item 2).

<u>Planning Horizon</u>

Idaho Code §42-202B (7) defines the planning horizon for a municipal provider as follows:

> *"Planning horizon" refers to the length of time that the department determines is reasonable for a municipal provider to hold water rights to meet reasonably anticipated future needs. The length of the planning horizon may vary according to the needs of the particular municipal provider.*

A municipal provider's planning horizon is the term of years over which it projects its population change and makes water service decisions based on its projection. At the time of application for RAFN municipal water use, the applicant will present a planning horizon time period, including a specified ending year. Department staff must evaluate, among other things, whether the proposed planning horizon is reasonable. Some additional items to consider include:

- The customary standards of practice for water infrastructure planning

- The planning period identified in any applicable Comprehensive Plan
- Planning periods identified by other applicable planning documents
- Regional planning studies

It is important to note that the maximum development period for beneficial use associated with a non-RAFN water right is five years, which can be extended an additional five to ten years for a total of ten to fifteen years. Therefore, a planning horizon of less than five years would not warrant a RAFN water right. The following table (Table 1) summarizes planning horizon durations as published in six water planning references.

Table 1 - Summary of Published Planning Horizon Periods

Published Reference*	Planning Horizon (years)
Fair 1971	10 - 50
Prasifka 1988	10 - 100
Dzurik 1996	< 50
Boumann 1998	< 50
Stephenson 2003	10 - 20
AWWA 2007	20 - 40

*Refer to Bibliography (Appendix Item 1) for reference details.

Table 2 summarizes planning horizons associated with actual water resource planning documents in the State of Idaho. The references summarized in Table 2 represent a variety of planning documents with unique objectives and planning areas. Some of the values are more applicable than others for use in comparison to proposed RAFN planning periods.

Table 2 - Summary of Actual Water Planning Documents and their Respective Adopted Planning Horizon Periods

Planning Area	Planning Horizon (years)	Planning Document Type
Ada & Canyon Counties	25	IDWR Water Demand Study
City of Coeur d'Alene	20	Comprehensive Water Plan
City of Lewiston	20	Master Water Plan
City of Meridian	50	Master Water Plan
City of Nampa	20	Master Water Plan
City of Pocatello	10	Master Water Plan
City of Rexburg	50	2008 Water System Tech. Memo
City of Twin Falls	30	Water Supply Improvement Plan
Rathdrum Prairie Aq.	50	CAMP Water Demand Projections Study
Treasure Valley	50	CAMP Future Water Demand Study
United Water Idaho	55	Water Demand Study

The data presented in Tables 1 and 2 suggest that planning horizons between 10 and 55 years are the standard amongst the planning profession and in the actual adoption of planning documents within the State of Idaho.

The Department must guard against over-appropriation of the resource and against speculative water right filings. Longer planning horizons increase the level of uncertainty associated with predicted values and must be considered by the Department with greater caution. Planning horizons of 15-20 years are generally reasonable and require little scrutiny unless there is substantiated competition for the resource or some other justification for additional scrutiny arises. Planning horizons greater than 20 years can be considered by the Department, but when proposed they should be supported by long-term planning documents such as those listed in Table 2 and by professionally prepared demographic studies substantiating the duration of the planning horizon period.

Idaho Code §42-202B (8) provides additional guidance regarding the evaluation of planning horizons as follows:

> *"Reasonably anticipated future needs" refers to future uses of water…reasonably expected to be required within the planning horizon of each municipality within the service area not inconsistent with comprehensive land use plans approved by each municipality.*

As a final measure, the planning horizon period proposed by the applicant must not only be reasonable, but also consistent with the adopted Comprehensive Plan of the City. This can be interpreted to mean no greater in length than the planning horizon period associated with the Comprehensive Plan, if no other pertinent planning documents exist. When another pertinent planning document exists, such as a master water plan, then the planning document should be consistent with the master plan for the coincident period of time shared between the planning horizons of both documents.

Population Projection within the Planning Horizon[2]

Idaho Code §42-202B (8) indicates that RAFN should be based on *"population and other planning data."* To establish its RAFN, a municipal provider must estimate its future population within its service area at the end of the planning horizon. For most municipalities, planning and demographic studies of one type or another have been completed, and often multiple relevant studies exist. At a minimum, Comprehensive Plans usually address population growth in some form as required by I.C. §67-6508 (b). The U.S. Census Bureau also provides population and demographic data for most municipalities in Idaho in a variety of formats. For communities where appropriate data exists, Department staff should expect the following components and considerations regarding population forecasts to be addressed and discussed in detail by the applicant.

1. A critical survey of existing contemporary population studies applicable to the local area to establish likely upper and lower boundaries for population growth.
2. Project population using standard technical methods, such as regression, extrapolation, or cohort survival models. To make extrapolation appropriate, one should account for geography, resource constraints, economic conditions, and other limiting factors or anticipated events, such as relocation of a commercial or industrial use.
3. Compare the results of the population projections from step 2 to the results of the critical survey from step 1 and apply professional judgment to evaluate whether the population projections are likely to occur within the planning horizon and are, therefore, reasonable.

Department staff should scrutinize population growth rates and projections that fall near or outside the upper boundary established in the critical survey. Staff should also scrutinize results based on short term trends in population growth. Where sufficient data exists population forecasts should be based on a minimum of thirty years of population data. The U.S. Census Bureau provides decadal populations for every county in Idaho. Since 1970 the population growth rate of the entire state of Idaho has been 1.91%. The maximum growth rate in that time was 3.72% in Teton County and the minimum growth rate was -1.20% in Shoshone County. Since 1970, growth rates in excess of 3.00% were only realized in five counties. Growth rates in excess of 2.50% were realized by less than 14% of Idaho counties. As such, applicants should provide extra justification for requested growth rates in excess of 2.50% annually.

In some instances when municipal providers are providing water to a rural or unincorporated community, existing population data specific to the community might be difficult to acquire or may simply not exist. In

[2] The 'Population Projection within the Planning Horizon' section of the RAFN handbook was prepared in conjunction with and under the review of Don Reading, Ph.D., a consulting economist with Ben Johnson Associates, Inc.

other instances the applicant may lack sufficient experience and/or expertise to forecast populations without assistance. In these select cases, the applicant may rely on a population forecasting tool that has been developed by the Department in Microsoft Excel to assist in population forecasting[3]. The tool summarizes dynamic ranges of U.S. Census Bureau population data by county and supports the regression of exponential and linear growth type models to the county census data to allow for the projection or forecasting of future populations. In addition, the spreadsheet tool allows for the development of exponential and linear population growth rate models based on user input population data. Forecasting conducted with this tool is only appropriate as a means of last resort and should not be used for communities where specific data and/or population and demographic studies already exist. The tool may also be useful directly to Department staff as a means of roughly verifying the population forecasts made by an applicant, allowing Department staff the opportunity to "double check" a proposed growth rate or population forecast.

For communities starting from zero or a very small base population, the method of relying on historical or analogous growth rates may not be applicable. In these instances, reliable growth or build-out projections provided by the applicant may be considered by the Department.

Water Demand

Water demand is the final component of a RAFN that must be considered and evaluated by Department staff. Water demand represents the future projected water use in a community. Water use can broadly be placed into two categories: (1) non-residential use and (2) residential use. Non-residential use consists of irrigation of open common spaces (parks, golf courses, etc.), public facility use, industrial use, commercial use, and any and all other municipal purposes. Residential use can be further broken down into in-home use, out of home use (landscape irrigation, car washing, etc.), and fire protection.

To prevent over-appropriation of water, fire protection flow requirements should not be used as justification for water demand as part of a RAFN application. Per Idaho Code §42-201, *"[W]ater may be diverted from a natural watercourse and used at any time, with or without a water right to extinguish an existing fire on private or public lands, structures, or equipment, or to prevent an existing fire from spreading to private or public lands, structures, or equipment endangered by an existing fire..."* If the Department were to allow fire protection flows to be included in estimating RAFN water demand for municipal purposes, it would result in a water right for municipal purposes in excess of the demonstrated continuous future needs. Water flow rates required solely for fire protection may be listed as a separate use on a RAFN application.

Similar to fire protection flows, an additional groundwater point of diversion used to provide redundant supply to a water distribution system should not be considered as justification for water demand on a RAFN application. The Idaho Rules for Public Drinking Water Systems require new community systems served by ground water to have a minimum of two points of diversion if they are intended to serve more than twenty-five connections (IDAPA 58.01.08.501.17). Though the Department recognizes the necessity and value of redundant ground water points of diversion, additional capacity associated with the redundant point of diversion does not constitute an additional increment of beneficial use, justifying a water right. The inclusion of the diversion capacity associated with a redundant point of diversion in the estimation of RAFN water demand results in a water right for municipal purposes in excess of the demonstrated continuous future needs.

Unaccounted for water (UAW) makes up a third category of water. UAW is considered the difference between a water utility's production and its water sales to consumers. Often municipal water providers authorize some types of UAW, including unmetered uses from fire hydrants, street washing, main flushing, sewer cleaning and storm drain flushing, authorized unmetered connections, and reservoir seepage and evaporation. Examples of

[3] The Microsoft Excel file is titled "PopForecastTool.xlsx" and is available to the applicant from the Department upon request.

unauthorized UAW include water distribution system leakage, unauthorized use by theft, abandoned services, and inaccurate or incorrectly read meters. For typical public water supply systems some engineering references estimate a minimum of 2.0% UAW can be anticipated (Prasifka 1988). United Water Idaho maintains monthly accounting of non-revenue water with values typically reported between 3.0-5.0% (Carr 2009). California Department of Water Resources' Urban Water Use in California Bulletin 166-3 reports that the largest percentage of cooperating agencies reported approximately 10.0% UAW in their water supply systems (CDWR 1994). For existing facilities, UAW values greater than 10% should only be approved by the Department as part of a water demand analysis, when the application includes historical diversion records and a technical engineering discussion of the above normal UAW values. For new systems, UAW values greater than 10% are not acceptable. Planning for UAW values in excess of 10% for a new system is contrary to the requirement for conservation of the water resources of the state.

Residential Water Demand Forecasting Methodologies

There are a number of standard recognized approaches for forecasting residential water demand (i.e. RAFN) including judgment based prediction, time extrapolation, disaggregate requirements analysis, single coefficient model development, multi-coefficient model development, econometric demand model development, or a hybrid of one or more of these approaches. Of these approaches, judgment based predictions or water demand based on time extrapolation forecasts are generally viewed as inadequate forecast approaches. Judgment based predictions are simply forecasts of water demand based on the recommendation of an "expert" familiar with the system, who in theory has an "intuitive" feel for water demand specific to the municipal system through prolonged experience with the system. Time extrapolation relies on the prediction of water demand where the only predicting variable is time. For example, 100,000 GPD were needed in the first 10 years, 200,000 GPD were needed in the second 10 year period, and therefore 300,000 GPD will be needed in the third 10 year period. Both of these forecasting techniques lack a technical rigor that is appropriate and necessary when evaluating RAFN water right applications.

Of the remaining methods, one of the most widely implemented approaches, and the one that is presented in detail in this document, is the per capita requirements method, which is a form of the single coefficient model approach. To determine RAFN utilizing this method projected per capita or per household water demand must be applied to the estimated future population within the service area at the end of the planning horizon.

Per Capita Requirements Method

Municipal water demand is often considered a function of population and per-capita consumption[4] (Prasifika 1988). The per capita requirements method relies on the following components to estimate future water demand: (1) projected future number of people or residential services, (1a) if necessary a conversion factor between people and residences[5], (2) average historical water use per capita, and (3) peaking factor(s). A combined future water demand is equal to the product of historical per capita demand, the total number of people or connections, and an appropriate peaking factor.

Per Capita Water Demand

[4] Strictly speaking the "per capita" metric refers to water use per individual person per unit time. The strict and rigorous use of this "per capita" definition is not always in evidence by water right applicants. Oftentimes municipalities do not know specifically how many people are served and thus employ the potentially more useful "per dwelling unit" metric. The terms "single family residence", "single family service connection", "single family dwelling unit" and "equivalent residential unit" can be synonymous with the term dwelling unit. An essential detail of the RAFN application should be the strict definition of the base water demand metric employed by the municipality.

[5] Population forecasts always predict a future population, depending on whether the city is forecasting water demand by person or by service connection the applicant will need to know the number of people per home in order to convert forecast population values into forecast service connections. The U.S. Census Bureau provides data on "persons per household" in their State and County QuickFacts data sets.

Per-capita water consumption is highly variable from region to region and even from one system to another within the same region. Factors that affect per capita water consumption include metering, lot size, climate, age of system, residential irrigation demand, fire protection demand, water rate structure,[6] and physical characteristics of the system. Table 3 summarizes various published values for estimating per capita consumption.

Table 3 - Summary of Published Values of Average Residential Daily Consumption

Published Reference*	Avg. Daily Consumption per Person (GPD)	Avg. Daily Consumption per Home (GPD)
Linaweaver 1967	100	400
Fair 1971	100 – 150	--
Stephenson 2003	50 – 80	150 - 800
Boumann 1998	--	200
Cook 2001	--	194

*Refer to Bibliography (Appendix Item 1) for reference details.

Residential irrigation can have a dramatic effect on per capita water demand. By some estimates water demand to meet peak residential irrigation needs can be 700% of average daily water demand without irrigation (Linaweaver 1967). Many municipal systems provide residential irrigation. However, a growing number of communities and municipalities do not support residential irrigation or have a separate utility specific to irrigation. It is important when evaluating the reasonableness of water demand values to know for certain whether residential irrigation is included in the demand.

Whenever possible, design flows for community water systems (municipal, community, or residential subdivisions) should be based on historical records or studies of similar water use in the area to be served—ideally historical records within the same system will be used. For established municipalities, historical records should be the primary means of evaluating and determining per capita requirements. When a wealth of historical records are available to draw upon, the applicant should rely on the most contemporary values, as they are most likely to reflect future water usage practices.

Frequently, recent data reflect lower per capita usage than older data. This decreasing trend evident in Idaho communities is consistent with national trends over the past three decades and is primarily due to a declining number of residents per household and an increasing pervasiveness of water-conserving (low flow) appliances in the home.[7]

[6] Water rate structures are the frame work in which municipal water providers set the prices for their retail water sales. Examples include flat rate and increasing block rate structures. In a flat rate structure the water user is charged a flat rate regardless of how much water is used. In an increasing block rate structure the unit price for water increases as the volume consumed increases, with prices being set for each block of water use. An increasing block rate structure is much more likely to communicate the value of water and encourage the efficient use of water amongst the users.

[7] For national trends see: Rockaway, P.A. et. al. Residential water use trends in North America. Journal AWWA, 103:2, February 2011. In Idaho, United Water (Boise and SW Ada County) reported that from 2003 to 2011, the average UW customer's water usage has fallen nearly 23 percent. Greg Wyatt, United Water Idaho Vice President and General Manager, attributed the reduced consumption to "successful implementation of a conservation program, as well as weather patterns, plumbing codes and the economy" (United Water 2011). In addition, the City of Meridian has seen not only a reduction in per capita demand, but also in total potable water demand since 2007, despite a rising population. Research conducted for the City's Water Master Plan showed that residents served surface water for irrigation used about 112 gpcpd of potable water while residents that use potable water for irrigation used about 224 gpcpd of potable water (both figures based on ADD). Because all new customers will be served using surface water for irrigation, the overall per capita demand should continue to drop without conservation measures (City of Meridian 2011).

It is not always possible, especially for newer communities, to estimate design flow from historical records as described above. On a case by case basis, the Department can accept calculated estimates for individual systems. There are several "per capita" estimation methods outlining practices and guidelines for estimating domestic design flows currently supported by the Idaho Department of Environmental Quality and the Department. Item 3 of the appendix includes a discussion and comparison of the various methodologies. Item 3 also describes and recommends a method than can be relied upon by the applicant to estimate demand as a last resort when actual historical data does not exist. It is worth emphasizing that the preference in determining per capita demand is always given to actual historical records and that it is only in rare instances that relying upon an artificial means of estimating water demand by the methodology presented in appendix Item 4 is appropriate.

Peaking Factors

In the long term, water demand requirements can vary widely, increasing and decreasing in direct correlation with changes to the population base that is served. Wide variation in water demand occurs in the short term as well. Based upon the transient needs of a static population base, water demand will vary seasonally, daily, and hourly. For example, water demand may be greater during the irrigation season as opposed to the non-irrigation season. Daily in-home demand also increases during times of high use at the start and end of the workday, with daily lows occurring during the middle of the night and early morning. These fluctuations in demand are normally estimated in terms of peaking factors or multipliers, which are often expressed as a percent of average demand.

In general, distribution systems are traditionally designed to carry peak hour flows that typically amount to 200-300 percent of the average day demand, with higher rates usually associated with smaller systems (Robinson and Blair 1984).

When discussing peaking factors, it is important to distinguish between average daily demand (ADD), maximum day demand (MDD), maximum monthly average day demand (MMAD), peak hourly demand (PHD), and peak instantaneous demand (PID). All or some of these terms will often be used in the discussion of a municipal water supply system and as they are used by the Department these terms are defined below. Table 4 summarizes several published ranges of values for residential peaking factors.

Table 4: Summary of Published Peaking Factor Values

Published Reference*	MDD: ADD	PHD: ADD
Dewberry 2002	1.5 - 3.0: 1	2.25 - 4.50: 1
Fair 1971	1.5 - 3.5: 1	1.5 - 3.5: 1
Harberg 1997	1.4 - 1.7: 1	2.0 - 4.0: 1
Linaweaver 1967	2.0: 1	5.0 - 7.0: 1
Lindeburg 1999	1.5 - 1.8: 1	2.0 - 3.0: 1
Mays 2000	1.5 - 3.5: 1	2.0 - 7.0: 1

*Refer to Bibliography (Appendix Item 1) for reference details.

Average Daily Demand (ADD):

The average daily demand is the average of the daily volumes for a continuous 12 month design period expressed as a volume per unit time (typically gallons per day). Often municipal records will only contain monthly or yearly diversion values. In these instances average daily demand for the system is equal to annual diversion volume or the sum of the monthly diversion volumes for one year divided by the number of days in the year.

Maximum Month Average Daily Demand (MMAD):
The maximum monthly average daily demand is the average daily demand from the peak demand month, which is typically July or August when out of home residential water use is at its peak. This value can only be calculated when municipal records contain monthly diversion data. It is obtained by dividing the monthly diversion volume by the number of days in the month, for each month, and selecting the largest monthly value.

Maximum Day Demand (MDD):
The design maximum day flow is the largest volume of flow to be received during a continuous 24 hour period in a calendar year, expressed as a volume per unit time. In order to determine this value, diversion records must have a daily recording interval. Often daily records are not available. In these instances MDD values can be estimated by multiplying ADD or MMAD values by an appropriate peaking factor. If storage is used by the water provider to meet peak demands, then the MDD value represents the maximum diversion rate that should be authorized by the RAFN water right permit.

Peak Hourly Demand (PHD):
The design peak hourly flow is the largest volume of flow to be received during a one hour period expressed as a volume per unit time. In order to determine this value, diversion records must have an hourly recording interval. Municipal data with an hourly recording interval usually does not exist for the entire water system and may only exist for a representative sample of the existing service area for the specific requirement of determining peaking factors. In instances where hourly data does not exist at all, an alternative means of estimating the peaking factor must be employed. If storage is not used by the water provider, then the PHD value represents the maximum diversion rate that should be authorized by the RAFN water right permit.

Peak Instantaneous Demand (PID):
The peak instantaneous demand is a municipal water supply system's anticipated maximum instantaneous water flow. PID is typically met through a combination of direct diversion from surface water and/or wells and the release of storage water. PID should not be confused with the maximum diversion capacity of some or all points of diversion associated with a municipal water supply system (flow into the system), which is an altogether different value that has historically been used by the Department during field examinations as a quantification of beneficial use. In municipal systems PID usually exceeds diversion capacity, with storage releases making up the difference. The PID design value can be appropriate in the sizing of water mains, storage capacity, and other appurtenances associated with a municipal water supply system, but it is not typically recognized in the field of water supply planning and forecasting as an appropriate design standard for projecting future system demand. As such, the use of PID in establishing a diversion rate in association with a RAFN application is generally considered unsound and unlikely to be approved by the Department. This position is consistent with the Idaho Rules for Public Drinking Water Systems, which require that public drinking water system be designed to provide either PHD or the MDD plus equalization storage (IDAPA 58.01.08 501.03).

Ideally, an engineering report or comprehensive plan should be submitted to the Department, which includes the records, studies, and considerations used in arriving at design flows, including all relevant peaking factors. In the absence of historical data or studies, the peaking factor(s) used to determine the diversion rate of the RAFN permit could be estimated from an analogous system. To be considered analogous, water systems should have similar characteristics including demographics, housing sizes, lot sizes, climate, water rate structure, conservation practices, use restrictions, and soils and landscaping. If neither historical data nor an analogous system can be found to estimate peaking factors, then the default peaking factors summarized in Table 5 may be used by the applicant.

Table 5 - Department Standard Default Peaking Factors (PF)

Ratio	PF
MDD:ADD	2.0
MDD:MMAD	1.3
PHD:ADD	3.0

As an example on how to use the peaking factors in Table 5, if the applicant has a known ADD value, the MDD value can be determined by multiplying the ADD value by two. For peaking factors greater than described in Table 5, the applicant will need to provide a technical engineering discussion supporting the numbers. It is insufficient for an applicant to simply reference a published value or claim a value as a standard of engineering practice in defense of values greater than those presented in Table 5.

Storage and the Affects of Storage on Peaking Factors

Municipal water systems can apply a number of strategies to meet the system's peak demand. Some municipalities rely exclusively on the source (surface water diversions and/or wells and booster pumps) to meet peak demand, while other municipalities may rely on a combination of source and storage facilities to meet peak demand. Storage is a component of a municipal system consisting of tanks and reservoirs that physically store water to provide water pressure, equalize pumping rates, equalize supply and demand during periods of high consumption, and provide water for fire fighting and other emergencies during periods of power outages[8]. In some places, authorities overseeing water system design mandate that storage be included in a water supply system and that peak demands be met partially by storage. As an example, the Washington State Department of Health requires that demands in excess of the MDD (i.e. PHD and PID) be met by storage (WSDOH 2009). In Idaho, the Idaho Department of Environmental Quality (DEQ) requires storage if source capacity is less than PHD, in these instances storage is required such that the difference between source demand and PHD is made up by equalization storage[9]. Some references consider it poor engineering practice for a public drinking water system to provide no storage capacity whatsoever (Lindeburg 1999).

It is important for the Department to identify to what extent storage will be utilized by a municipality to meet demand. The diversion rate associated with a RAFN application should reflect whether source alone will meet PHD or whether a combination of source and storage will meet PHD.

Per Capita Demand Conclusion

In conclusion, the following steps can be used to forecast the residential water demand utilizing the per capita demand forecasting approach:

1. Establish the ADD per capita water demand unit (person or residence) and quantity, preferably from historical diversion records.
2. Select the design demand value, typically PHD when source alone will meet the demand or MDD when a combination of source and storage will meet demand.

[8] The storage being discussed should not to be confused with a seasonal storage component of a water right, which is water stored for use at some time in the future and is described on the water right as storage.

[9] Design File Note: Reservoir Sizing – Public Water Systems (April 30, 1998) states, *"The source capacity of a water supply must at least equal [MDD]…If the source capacity is equal to or greater [than] [PHD], then no storage is needed other than pressure tanks to prevent frequent cycling. If the source capacity lies between [MDD] and [PHD], then storage is required as defined in this Guidance."*

3. Multiply the ADD by the appropriate peaking factor to establish the per capita water demand design value.
4. Establish the projected future total population.
5. If needed divide the population projection by the "persons per home" value to arrive at the total number of residences to be served.
6. Multiply the total number of people or residences by the per capita water demand design value to determine the total system-wide residential demand.
7. Apply necessary unit conversions to obtain the permitted rate units of cubic feet per second (CFS)

Non-Residential Forecasting

For many municipal systems residential water demand makes up the vast majority of total demand. As such, many water supply systems, especially smaller systems, are designed mostly to serve single family residences. If non-residential water is identified as being a significant portion of total demand it can be taken into consideration when establishing RAFN. Described below are two methods for estimating this demand.

The first method utilizes the concept of an equivalent residential unit (ERU). An ERU is a unit of measure used to represent the amount of water consumed by a typical full-time single-family residence (WSDOH 2009). ERUs are synonymous with equivalent domestic units (EDU) as defined by the Idaho Department of Environmental Quality (IDAPA 58.01.08 033.42). ERUs can be used to equate non-residential uses and/or multi-family residential uses to the amount used by a single-family residence. ERUs associated with all non-residential uses are determined and added to the ERU count derived from actual single-family residences to arrive at a total demand.

The disaggregate requirements forecasting technique is another common approach to estimating non-residential water demand. In disaggregate forecasting the water user identifies the demand of water associated with any non-residential uses such as irrigation, commercial facilities, industrial facilities, public facilities, recreation uses, etc. and sums them to arrive at a total non-residential water use demand. Historical records are often the best source, and the source preferred by the Department, for estimating the demand associated with non-residential uses. A qualified analogous system can be another recognized source of information for estimating disaggregate water demands.

A tabular summary of average daily demands for a variety of disaggregate uses (Table 6) is presented in Appendix Item 4. Table 6 has been adapted from a number of sources and does not represent the final authority on the water demand values presented. It should be noted that the values in Table 6 are average daily values. It may be necessary to apply a peaking factor or multiplier to the values to obtain a MDD or PHD equivalent value.

Other sources of disaggregated water demand values that may provide additional guidance include individual engineering references, individual water demand studies, the Uniform Plumbing Code, the American Water Works Association, and the Idaho Department of Environmental Quality. When properly referenced and applied, all of the sources previously described can be used if historical or analogous data are missing.

Regarding RAFN demand for the irrigation of lawns within community open spaces, parks, golf courses, cemeteries, etc., and the evaporative loss of water associated with decorative and aesthetic ponds, demand can be established by the appropriate evapotranspiration (ET) values as published by ET_Idaho (Allen and Robison 2009). In recognition of the contribution of precipitation to irrigation requirement it is appropriate to use the precipitation deficit (P_{def}) values in place of actual ET (ET_{act}). Appropriate values would include utilizing data from the nearest ET_Idaho station and as available, using the categories of *"Precipitation Deficit (Grass – Turf (lawns) – Irrigated)"* for P_{def} associated with lawns and grass and *"Precipitation Deficit (Open water-*

shallow systems (ponds, streams))" for P_{def} associated with municipal ponds and water features. When estimating diversion rates associated with P_{def} it is appropriate to use the 20% exceedance (80th percentile) 3-day moving average rate from the month with the largest ET rates. In light of the conservative methods allowed in determining P_{def}, quantification of the demand associated with ET loss from lawns and open water bodies should not include the use of peaking factors or multipliers.

3. Permitting RAFN Water Rights

For an application for RAFN to be accepted by the Department it must include a current application correctly and completely filled out, a municipal water right application checklist[10] completely filled out, the appropriate fees, and a detailed narrative or report summarizing the methods used to determine RAFN. The report must specifically address the four fundamental components of RAFN as identified in section 2 of this document. Lastly, the application package must contain a summary of the applicant's existing municipal water rights portfolio and some form of gap analysis.[11]

Existing Municipal Water Rights Portfolio

In order for an applicant to formulate a requested RAFN proposal, understanding of the future demand is only half the equation. The applicant must also understand the existing supply of water available to it. Therefore, an evaluation or accounting of all existing municipal water right permits, licenses, decrees, and claims is needed to establish the water supply authorized on paper. This includes the review of water right permits and water rights designated municipal, as well as existing permits and rights with other designations that are beneficially used under the contemporary "municipal purposes" umbrella as defined in I.C. §42-202B (6).

Final Determination of RAFN Permit Diversion Rate (Gap Analysis)

An application for RAFN should contain completed analyses of the future water demand (residential, non-residential, and UAW) and the existing water right portfolio. The future water demand calculations should not include current or future fire flow requirements, as Idaho Code does not require a water right to engage in fire fighting activities (§42-201). Neither should the requirement of redundant groundwater points of diversion be used as justification for an additional increment of future beneficial use.[12] The final RAFN water right permit diversion rate is typically calculated by taking the combined projected demand of residential and non-residential water use, multiplied by a factor to account for UAW, less the total diversion rate of water already provided in the applicant's current water rights portfolio.[13]

$$(Municipal\ Demand\ in\ Ending\ Year)\ x\ (UAW\ Factor) - (Existing\ WR\ Diversion\ Rate) = (RAFN\ Permit\ Diversion\ Rate)$$

The municipal provider's water rights portfolio must include the water rights already held by the provider for municipal purposes and may also include any of the following:

- Rights held by the municipal provider for other purposes such as irrigation

[10] A copy of the municipal water right application checklist is included in the appendix as Item 5.

[11] Gap analysis is used in this instance to refer to the analysis of the difference (gap) between what will be needed and what is currently provided for by the existing water right portfolio.

[12] Each point of diversion, including alternate points of diversion to provide a redundant supply, requires authorization under a valid water right.

[13] Alternatively, some municipal water systems with mixed sources of water supply divert water under the authority of water rights with late water right priority dates. This leaves the municipal provider susceptible to curtailment, a regulation based on water right priority date. In such a case, when the curtailment of water rights associated with one source (ex. surface water) do not limit the exercise of water rights diverting from a second source (ex. ground water), the Department may find the municipal provider will use its RAFN water right as an alternative supply. This would result in combined flow limits between the existing municipal water rights and a RAFN permit.

- Rights held by other entities, such as homeowner's associations for municipal use within the proposed RAFN service area
- Rights held by other entities for non-municipal uses within the proposed RAFN service area

The RAFN applicant should explain the assumptions regarding the inclusion or exclusion of these rights in the gap analysis. If the rights will be used for future municipal demand within the proposed RAFN service area, regardless of ownership, the rights must be subtracted from the reasonably anticipated future needs projection or counted among the water rights available to meet the reasonably anticipated future needs.

Item 6 of the Appendix is a detailed example of the determination of RAFN for a hypothetical RAFN application including analysis of RAFN service area, planning horizon, population projection, water demand, and existing water right portfolio.

Final Determination of RAFN Permit Volume

RAFN water right permits should not be limited by volume except in those instances where a volume limitation is necessary to protect the water supply source.

RAFN Permit Approval Conditioning

When issuing a RAFN water right permit the Department will include standard approval conditional language that identifies the permit for reasonably anticipated future needs (X64). All permits that do not have a condition designating RAFN status will be deemed as non-RAFN permits by the Department. All RAFN permits shall include approval conditions requiring the following:

- Filing of the proof of beneficial use no sooner than 4.5 years after the permit is issued (standard condition 236)
- Full system capacity constructed by the date the permit holder submits proof of application of water to beneficial use (standard condition 909),
- Inclusion of an updated RAFN analysis with the submittal of the proof of beneficial use (standard condition 237),
- Capacity installed for redundancy or for fire protection should be excluded when quantifying the amount of water developed for municipal purposes (standard condition 926),
- Submittal of a field examination and report conducted and prepared by a Certified Water Rights Examiner (CWRE) with the proof of beneficial use (standard condition 910).

Amending a permit from non-RAFN to RAFN

Consistent with Application Processing Memo #18 (Administrative Memo adopted October 19, 2009) and Department policy, a permit issued to a municipal provider that does not provide for RAFN cannot be later amended to gain the benefits of a RAFN permit.

4. Licensing RAFN Water Rights

With the submittal of proof of beneficial use in association with a RAFN water right permit, the permit holder is required to submit a field examination report completed by a CWRE. As required by I.C.§42-217, the statement of completion for proof of beneficial use shall include a description of the extent of use and a revised estimate of RAFN, containing a revised description of the RAFN service area, a revised planning horizon, and appropriate supporting documentation. Appropriate supporting documentation means a revised analysis of the same RAFN support material submitted at the time of application reflecting the system as it exists at the end of the permit development period. Also included should be a revised gap analysis including an updated portfolio of existing water rights. If proof is not submitted by the proof due date and an extension to the permit development period has not been granted, as provided under Idaho Code §42-204, the permit shall lapse and be of no further force nor effect as required under Idaho Code 42-218a.

Review of the Description of the Extent of Use

At the time of licensing the Department must first review the "description of the extent of use", including accompanying evidentiary material, and make a determination of the extent of beneficial use that has occurred and whether the permit should be licensed in part or in full. If the permitted amount has been beneficially used already, because the provider experienced unexpected rapid growth, no further review is needed and the full permitted amount can be licensed.

Idaho Code §42-219(B) states *"A license may be issued to a municipal provider for an amount up to the full capacity of the system **constructed or used** in accordance with the original permit…" (emphasis added)*. IDWR interprets the restrictive language in §42-219 to limit the authority of the agency to only license RAFN permits up to the *full capacity of the system constructed or used*. Full capacity constructed means significant infrastructure has been constructed to accommodate delivery of water throughout the RAFN service area. Full capacity constructed entails more than engineering plans or in-place financing.

Components of significant infrastructure will always include at least the following:

- For ground water diversions a constructed well or series of wells and their associated capacities, for surface water diversions constructed diversion facilities and their associated capacities, or for mixed sources some combination thereof.
- Storage tanks when included as an integral part of the design.
- Trunk lines (major supply conduits) sized and constructed to anticipate service beyond the physically constructed limits of the delivery system at the time proof of beneficial use is submitted.

Significant infrastructure does not have to include the following:

- Service laterals (i.e. stub outs to lots that have not been built out)
- Main line and/or lateral line extensions beyond the physically constructed limits of the delivery system at the time proof of beneficial use is submitted.
- Water quality treatment facilities for diversions in excess of the demand at the time proof of beneficial use is submitted.
- Pumping capacity for diversion in excess of the demand at the time proof of beneficial use is submitted.

Significant infrastructure will never include the following:

- Diversion works and distribution system capacity available for fire protection and/or redundant supply. (The additional capacity provided does not require a water right, so licensing the additional capacity would unintentionally increase the estimated demand to provide for unsupported future growth.[14])

Therefore, when reviewing the "description of the extent of use" and accompanying documentation, Department staff must review the improvements that have been made, which will typically lie somewhere between full system build out and no system build out, to determine to what extent the RAFN permit should be licensed.

Review of Revised RAFN Characteristics Including Diversion Rate

With the proof of beneficial use submittal the permit holder should submit a revised description of the RAFN specifically addressing each of the four fundamental components of a RAFN package: (1) service area; (2) planning horizon; (3) population projections within the planning horizon; and (4) water demand. Department

[14] Small municipal systems may not be designed for peak demand and fire flow. In such a case, the available capacity might justify the full capacity of the system.

staff shall review the revised RAFN in a manner similar to the application review process as detailed in sections 2 and 3.

At the time of licensing, department staff can update the RAFN service area, the planning horizon, and diversion rate as appropriate based on the review of new material and the field examination report. Diversion rate and planning horizon can only be amended downward to reflect a revised lowered future water demand. If new RAFN analysis at the time of licensing indicates an increase in water demand the additional diversion rate and/or longer planning horizon associated with the increased demand must be pursued under a new application for permit or transfer.

Final Determination of RAFN License Volume

RAFN water right licenses should not be limited by volume except in those instances where a volume limitation is necessary to protect the water supply source.

RAFN License Approval Conditioning

When issuing a RAFN water right license the Department will include standard approval conditional language that identifies the license for reasonably anticipated future needs (X64). All licenses that do not have a condition designating RAFN status will be deemed as non-RAFN licenses by the Department. All RAFN licenses shall also include approval conditions requiring that all future needs must be constructed and used by the end of the planning horizon (109) and that the place of use (POU) associated with a RAFN water right shall not be changed to a location outside of the service area (110).

Nonuse of RAFN Water Rights

If sufficient proof of beneficial use is submitted before the end of the permit development period and the municipal water right is licensed for an amount of water for RAFN, the requirement that the system needed to provide water for the RAFN be fully constructed and used by the end of the municipality's planning horizon will continue as a condition of the license. If the municipal provider fails to construct and use the complete system by the end of the permit planning horizon, or the anticipated future needs do not materialize by the end of the planning horizon, the quantity of water under the license may be revised to reflect the needs that actually exist at the end of the planning horizon.

5. Transfer of RAFN Water Rights

The portion of any water right described with a beneficial use of RAFN cannot be transferred or modified to have a beneficial use other than RAFN. However, water rights with beneficial uses other than RAFN can be transferred or modified to a RAFN use.

Idaho Code §42-222 governs the transfer of water to and from RAFN status. When a transfer proposes changing the nature of use of a water right to municipal purposes for RAFN, the municipal provider shall provide to the Department sufficient information and documentation to establish the transfer applicant qualifies as a municipal provider at the time of application, is providing water to a municipality or municipalities, and that the RAFN, the service area, and the planning horizon are consistent with Idaho Code. Supporting documentation must be included with the transfer application including the same RAFN support material that would be submitted with an RAFN application as outlined and described in Section 2 of this document. As discussed in Section 3, gap analysis including a current portfolio of existing water rights must also be included with the transfer application. A transfer application proposing to use a RAFN water right as an alternate source in times of curtailment should include justification for the proposal with the application.

Water rights or portions of water rights that identify RAFN as the beneficial use shall not be changed to a place of use outside the RAFN service area or to a new nature of use (I.C. §42-222). The effect of this statutory

language eliminates the modification of a RAFN water right by transfer for anything other than the addition of a point or points of diversion.

Final Determination of RAFN Transfer Volume

RAFN water rights created by transfer from an existing non-RAFN municipal right should not be limited by volume except where a volume limitation existed in connection with the water right's use prior to the transfer. A transfer to change the nature of use of an established water right from non-municipal to municipal purposes for RAFN shall limit the volume of water to the historic consumptive use established prior to the change.

RAFN Transfer Approval Conditioning

When issuing a RAFN water right transfer the Department will include standard approval conditional language that identifies the water right for reasonably anticipated future needs (X64). All transfers that do not have a condition designating RAFN status will be deemed as non-RAFN water rights by the Department. All RAFN transfers shall also include an approval condition requiring that the system must be fully constructed and used by the end of the planning horizon (109). Finally, all RAFN transfers shall include an approval condition limiting the RAFN to use within the service area and restricting a change in the purpose of use (110).

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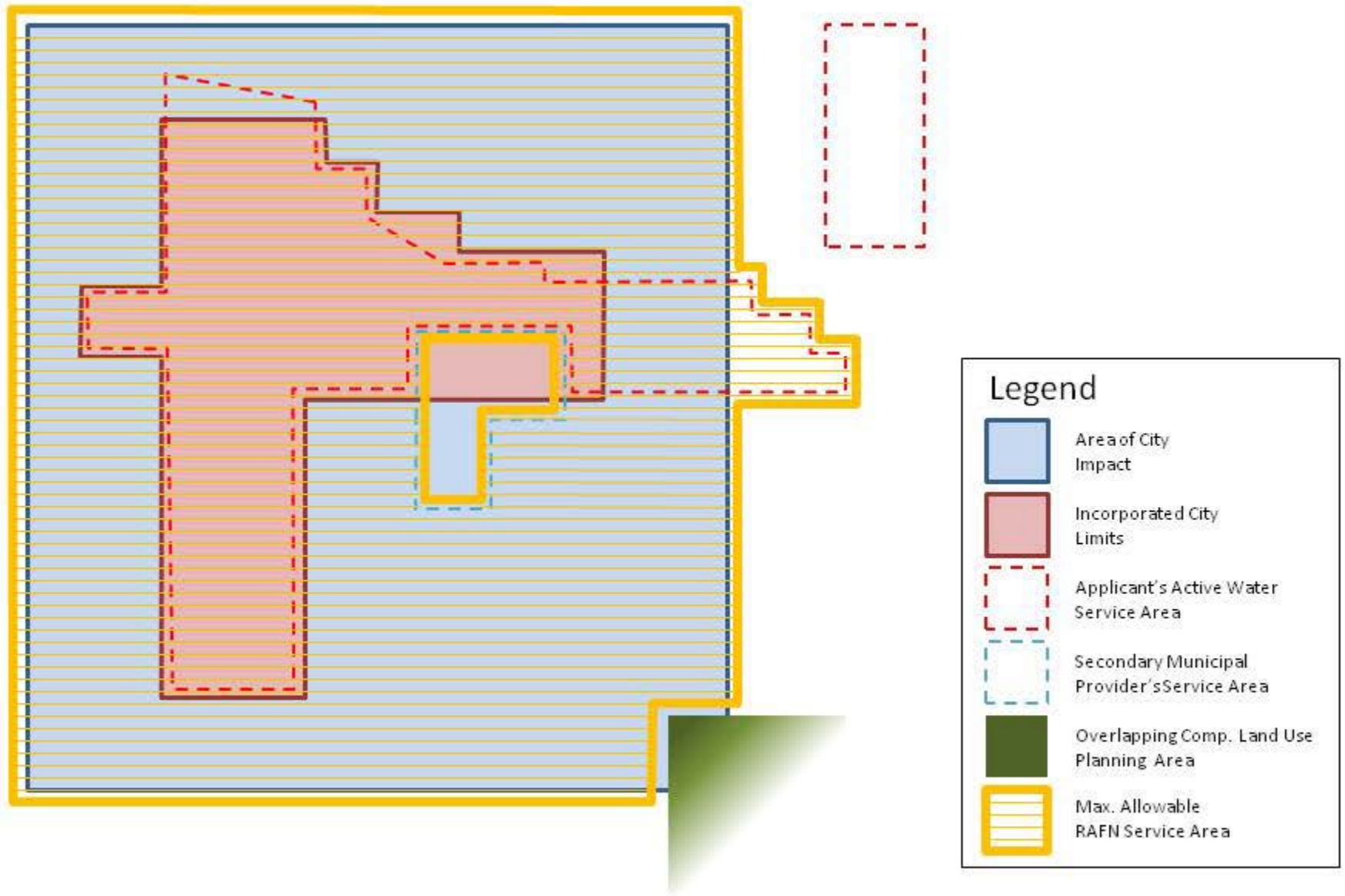


Appendix Item 2 - Illustrative Example of Delineation of Maximum Allowable RAFN Service Area

Appendix Item 3
Comparison of the Idaho Department of Water Resources and the Idaho Department of Environmental Quality Methodologies for Quantifying Residential In-Home Use

The Department's Administrative Memorandum Application Processing #22 (AP22) dated June 4, 1980, addresses the 'Definition of Domestic' and provides guidance, in the form of a chart (Figure 1), for quantifying the rate of flow necessary for the in-house culinary use for multi-household systems. The memo states, "*The flow identified on this graph should be used as a guideline in determining and reviewing domestic use rates of flow on applications for permit with more than one hookup. Greater flow can be accepted if justified."* Figure 1 is titled "Maximum Instantaneous Water Requirements for Domestic Use" and depicts a power function relationship between the number of houses served (N) and the water demand (Q) in cubic feet per second (CFS). The following equation represents the relationship depicted on Figure 1 of AP22 and allows for the calculation of Q strictly as a function of N.

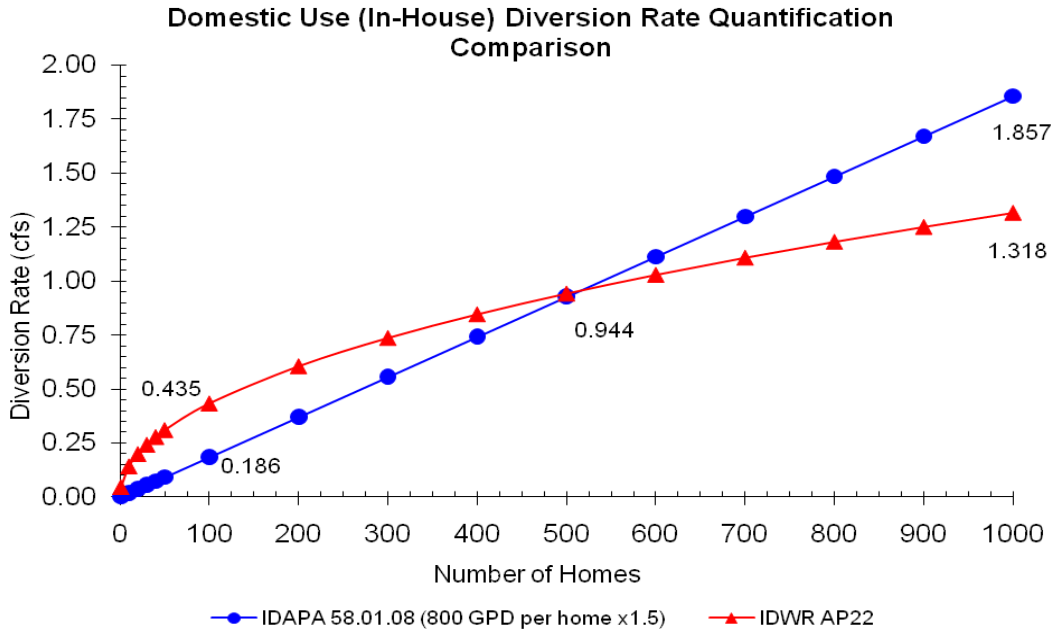
Eqn. 1: $Q\ (CFS) = 0.0473*(N)^{0.4817}$

AP22 does not make clear whether "maximum instantaneous water requirement" is equivalent to peak hour demand (PHD), peak instantaneous demand (PID), or some other value. Nonetheless, for communities ranging from 2 to 1,000 homes this has historically been the equation that Department staff used to quantify the permitted diversion flow rate specific to <u>in-home domestic use</u> when no other rate was justified. It does not account for demand associated with out-of-home uses, namely irrigation.

The Idaho Rules for Public Drinking Water Systems administered by DEQ mandate the capacity of public drinking water systems to be a minimum of 800 gallons per day (GPD) per residence (IDAPA 58.01.08 552-01(a)). This is equivalent to 0.6 gallons per minute (GPM) and 0.001 CFS. The rules define this amount as the "design maximum day demand" (MDD) exclusive of irrigation and fire flow requirements (IDAPA 58.01.08 552-01(a.i)). The rules go on to say that the MDD may be *"less than 800 GPD if the water system owner provides information that demonstrates to the [Department of Environmental Quality's] satisfaction the maximum day demand for the system, exclusive of irrigation and fire flows, is less than 800 GPD per residence"*. The value of 800 GPD per residence was likely initially derived from the Federal Housing Administration's minimum design standards (FHA 1965). The rules do not address peaking factors. However, if we use the standard values from Table 5 we can determine a PHD of 1,200 GPD per residence (PHD = 1.5*MDD). The following figure compares the water demand functions for 1 to 1,000 homes as derived from AP22 and the Idaho Rules for Public Drinking Water Systems.

At first glance it appears there is a conflict between AP22 and the Idaho Rules for Public Drinking Water Systems. This conflict could potentially lead to a deficient municipal water supply system with a combined water right diversion rate, less than the diversion rate mandated by the Idaho Rules for Public Drinking Water Systems. However, such a conflict does not exist for two reasons. First, the Idaho Rules for Public Drinking Water Systems address the concept of "storage" and the ability of equalization storage, in sufficient quantity, to compensate for differences between a water system's maximum pumping capacity and peak hour demand. Furthermore, the rules also address the ability of equalization storage plus fire suppression storage, both in sufficient quantity, to compensate for the difference between a water system's maximum pumping capacity and peak demand plus fire flow, in those systems that provide fire flow (IDAPA 58.01.08 003-71). Secondly, the 800 GPD in-home use value is only valid when MDD flows in the system are equal to or greater than 800 GPD. If actual MDD flows are less than 800 GPD they can be recognized as a valid demand for the system (IDAPA 58.01.08 552-01(a.iii)).

One obvious deficiency in both methods is their lack in quantifying an irrigation demand component, leaving the task of determining total residential demand only partially completed. Another deficiency in the Idaho Rules for Public Drinking Water System is their treatment of demand as a linear function, as it is commonly accepted that for larger communities, demand is not linear with respect to number of homes (Ameen 1965).



It is desirable for the Department to have a single recommended method for quantifying residential demand that addresses both in-home and out of home uses including irrigation. Such a method was developed by the U.S. Department of Housing and Urban Development (DHUD) in their publication titled *A Study of Residential Water Use* (Linaweaver 1967). This method has the added advantage of being currently adopted and under implementation by the Idaho Department of Environmental Quality (DEQ 2005). The DHUD method is presented below in detail and it is recommended that this method be used by applicants and the Department in determining residential demand for those communities for which actual historical demand data does not exist.

The DHUD method calculates the maximum daily demand (Q_{MDD}) and peak hourly demand (Q_{PHD}) as functions of average daily in-home use (Q_{ADD}), consumptive use associated with residential irrigation, and the variability associated with the magnitude of the input factors influencing the demand and the diversity effect associated with the number of dwelling units or residences. The following equations (equations 2 through 8) have been derived from the DHUD publication with some modifications specific to Idaho and the Department. The following equations express the steps necessary to determine values for Q_{MDD} and/or Q_{PHD}.

Eqn. 2: $Q_{MDD} = Q_{ADD} + C*(L_S)*(P_{def}) + 2*(\sigma_{MDD})$, where

Q_{MDD}: maximum daily demand (GPD)
Q_{ADD}: average daily in-home demand per residence (GPD)
C: unit conversion constant
L_S: average irrigable area in acres per unit

P_{def}: precipitation deficit for irrigated turf grass, i.e. lawn (inches)
σ_{MDD}: variability in magnitude of factors and the number of dwelling units

Equation 3 allows for the calculation of Q_{ADD} as a function of average home value from 1965. Equation 4 is used to adjust contemporary home values by inflation to determine historical home values from 1965. When desired for simplicity or lack of data, a Q_{ADD} value of 250 GPD can be substituted for the results of Equation 3 if desired by the applicant.

Eqn. 3: $Q_{ADD} = 3.46*V_{1965} + 157$, where

V_{1965}: average market value in $1000 per residential lot in 1965.

Eqn. 4: $V_{1965} = V_{2010}/(1.044)^{46}$, where
V_{2010}: average market value in $1000 per residential lot in 2010.

Equation 5 is used to calculate the average irrigable area term (L_S) and assumes that irrigation practices are uniform across the entire community. If a source other than the municipal water system is used for irrigation (i.e. surface water irrigation water rights) the L_s term should equal zero.

Eqn. 5: $L_S = 0.803*(W)^{-1.26}$, where

W = gross housing density in dwelling units per acre

Equation 6 is used to calculate the variability term, σ_{MDD}.

Eqn. 6: $\sigma_{MDD} = [(1{,}090 + 166{,}000*L_S^2) + (5{,}480{,}000/n)]^{1/2}$, where
n: number of residences or residential lots

The method presented herein also supports the calculation of a Q_{PHD} as a function of the Q_{MDD} value previously determined. The following equation allows for the calculation of Q_{PHD}.

Eqn. 7: $Q_{PHD} = 2.02*(Q_{MDD}) + 334 + 2*\sigma_{PHD}$, where
σ_{PHD}: variability in magnitude of factors and the number of dwelling units

Equation 8 is used to calculate the variability term, σ_{PHD}.

Eqn. 8: $\sigma_{PHD} = [(2.02*(1{,}090 + 166{,}000*L_S^2)) + (12{,}300{,}000/n)]^{1/2}$, where
n: number of residences or residential lots

The method presented and described above is automated in a spreadsheet tool prepared by the Department titled "ResidentialDemandCalculator.xlsx" and is available from the Department upon request.

Appendix Item 4

Table 6 - Summary of Average Daily Non-Residential Water Uses

Description of Water Use	Water Consumption	Units
Airport (per passenger)	3-5	GPD
Apartment, multiple family (per residence)	50	GPD
Bank (per SF)	0.05	GPD
Barbershop (per chair)	55	GPD
Bathhouse (per bather)	10	GPD
Beauty Salon (per station)	95	GPD
Boardinghouse (per boarder)	50	GPD
Camp:		
Construction, semi-permanent (per worker)	50	GPD
Day, no meals served (per camper)	15	GPD
Luxury (per camper)	100-150	GPD
Resort, day and night (per camper)	50	GPD
Tourist, central bath and toilet (per person)	35	GPD
Car Wash (per SF)	4.9	GPD
Cottage, seasonal occupancy (per resident)	50	GPD
Club		
Country (per resident member)	100	GPD
Country (per nonresident member present)	25	GPD
Highway Rest Area (per person)	5	
Hotel		
Private baths (2 persons per room)	50-68	GPD
No private baths (per person)	50	GPD
Institution other than hospital (per person)	75-125	GPD
Hospital (per bed)	200-400	GPD
Laundry/Laundromat		
Self-serviced (gallons per customer)	50	GPD
Self-serviced (gallons per machine)	400-500	GPD
Livestock Drinking (per animal)		
Beef, yearlings	20	GPD
Brood sows, nursing	6	GPD
Cattle or steers	12	GPD
Dairy	20	GPD
Dry cows and Heifers	15	GPD
Goat or sheep	2	GPD
Hogs/swine	4	GPD
Horse or mules	12	GPD
Livestock Facilities		
Dairy Sanitation (milk room)	500	GPD
Floor flushing (per 100 SF)	10	GPD
Sanitary Hog Wallow	100	GPD
Motel		
Bath, toilet, and kitchen (per bed space)	65-100	GPD
Bed and toilet (per bed space)	50	GPD

Table 6 Continued - Summary of Average Daily Non-Residential Water Uses

Description of Water Use	Water Consumption	Units
Parks		
Overnight, flush toilets (per camper)	25	GPD
Trailer, individual bath units, no sewer connection (per trailer)	25	GPD
Trailer, individual baths, connected to sewer (per person)	50	GPD
Picnic Ground		
Bathhouses, showers, and toilets (per picnicker)	20	GPD
Toilet facilities only (gallons per picnicker)	10	GPD
Poultry (per 100 birds)		
Chicken	5-10	GPD
Ducks	22	GPD
Turkeys	10-25	GPD
Restaurant		
Toilet facilities (per patron)	7-10	GPD
No toilet facilities (per patron)	2.5-3	GPD
Bar and cocktail lounge (add. quantity per patron)	2	GPD
Toilet facilities (per seat/chair)	24-50	GPD
School		
Boarding (per pupil)	75-100	GPD
Community college (per student and faculty)	15	GPD
Day, cafeteria, gym, and showers (per pupil)	25	GPD
Day, cafeteria, no gym or showers (per pupil)	20	GPD
Day, no cafeteria, gym, or showers (per pupil)	15	GPD
Service Station		
Service Station (per vehicle)	10	GPD
Service Station (per SF)	0.18	GPD
Store/Retail		
Department, no food service (per SF)	0.04	GPD
General (per bathroom stall)	400	GPD
General (per SF)	0.05	GPD
Shopping Center/Malls (per SF)	0.25	GPD
Swimming pool (per swimmer) maintenance (per 100 SF)	10	GPD
Theater		
Drive-in (per car space)	5	GPD
Movie (per auditorium seat)	5	GPD
Worker		
Construction (per person per shift)	50	GPD
Day (school or offices per person per shift)	15	GPD
Factory (gallons per person per shift)	15-35	GPD

Table 6 has been adapted from the following sources: Dewberry 2002, Prasifka 1988, and WSDOH 2009.

Appendix Item 5
Municipal Water Right Application Checklist

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

MUNICIPAL WATER RIGHT APPLICATION CHECKLIST
FOR AN APPLICATION TO APPROPRIATE WATER FOR MUNICIPAL PURPOSES

An application to appropriate water for municipal purposes must be prepared in accordance with the requirements listed below to be acceptable for processing by the Department. There are two types of permits for municipal water use. The first type of municipal permit provides water for reasonably anticipated future needs (**RAFN**) over a defined planning horizon.[1] The second type of municipal permit, called non-RAFN, provides water solely for use to meet needs that will arise in the near-term (five years).[2] A **non-RAFN** permit may have an annual volume limitation associated with it. Each type of municipal water use has a distinct set of review requirements.

Applicant Name: _____

1. Type of Municipal Provider. Applicant must qualify as a Municipal Provider to obtain a municipal water right. See Idaho Code § 42-202B (5). Check one:

   ☐ Type 1 – Municipality
   ☐ Type 2 – Franchise or political subdivision supplying water to a municipality
   ☐ Type 3 – Corporation or association regulated as a "public water supply" system by IDEQ

   ☐ Attach documentation of qualification as a Municipal Provider. See Idaho Code § 42-202(2).

2. List existing Water Rights (permits, licenses, decrees, and beneficial use claims) available to the applicant for municipal needs. These rights may or may not have a purpose of use expressly defined as "municipal". Include a separate attachment as needed.

Right Number	Nature of Use	Diversion Rate (cfs)	Annual Vol. (acre-feet)	Service Area

3. List the total diversion rate from Item 2. Be sure to account for any combined diversion rate limits in the approval conditions of each right listed. _____ CFS (total from 2)

4. List the total volume from Item 2. Be sure to account for any combined volume limits in the approval conditions of each right listed _____ AF (total from 2)

[1] For a thorough discussion of RAFN water rights, see IDWR's *Recommendations for the Processing of Reasonably Anticipated Future Needs (RAFN) Municipal Water Rights at the Time of Application, Licensing, and Transfer.*
[2] For a thorough discussion of non-RAFN water rights, see IDWR's Application Processing Memorandum No. 18.

5. Planning Horizon. See Idaho Code § 42-202B (7). Check one:

☐ RAFN. Specify planning horizon: ___ years. Ending year: 20___. Go to Item 6.
☐ Non-RAFN (≤5 years). Go to Item 7.

6. If application is for RAFN:

☐ Attach justification for planning horizon. See Idaho Code § 42-202(2) and § 42-202B(7).
☐ Attach description of service area. See Idaho Code § 42-202(2) and § 42-202B(9).
☐ Attach population projection within the service area over the planning horizon. See Idaho Code § 42-202(2) and § 42-202B(8).
☐ Attach evaluation for demand within the service area over the planning horizon. See Idaho Code § 42-202(2) and § 42-202B(8).
☐ Attach any supporting documentation relevant to the RAFN application, such as comprehensive plans or other planning documents.

Does demand exceed the totals listed in Items 3 and 4?

Y	N	
☐	☐	Rate?
☐	☐	Volume?

If the answer is "No" to both rate and volume and a new point of diversion is needed, file a transfer application pursuant to Idaho Code § 42-222(1).

7. If application is for non-RAFN:

When submitting proof of beneficial use, non-RAFN permit holders will be required to show that water was diverted for an additional increment of beneficial use over existing water rights during the authorized development period, which may be up to five years from the date of approval. Do existing demand and short term needs exceed the combined authorizations from the existing water rights listed in Items 3 and 4?

Y	N	
☐	☐	Rate?
☐	☐	Volume?

If the answer is "No" to both rate and volume and a new point of diversion is needed, file a transfer application pursuant to Idaho Code § 42-222(1).

Appendix Item 6
Example Determination of RAFN for a Small Rural Municipality

Description of Municipality

Gem City is in the process of acquiring grant money to create a master water plan and expand their existing municipal water system. It has taken this opportunity to apply for a permit for RAFN water rights by conducting a thorough analysis of the future projected demands and their existing water right portfolio. Gem City is located in Benewah County. Gem City currently uses storage to meet demands in excess of their maximum day demand (MDD) and plans to continue this practice into the future. Gem City has recently updated their comprehensive plan (comp plan) including updates to their incorporated city limits and their area of city impact as depicted in Appendix Item 3. The planning horizon associated with the recently adopted comp plan is 20 years. Gem City does not have a current master water plan.

Gem City has rigorously defined their non-residential water use as follows: one hospital (20 beds), one barber shop (5 chairs), one beauty salon (5 stations), one car wash (1,000 square feet (SF)), one Laundromat (10 wash machines), one motel (30 bed spaces), three restaurants (combined seating 80), one elementary school with cafeteria and no gym or showers (100 students), one middle school with cafeteria, gym, and showers (60), and one high school with cafeteria, gym, and showers (60 students), one service station (1,000 SF), and 45,000 square feet of existing retail space. For the next 20 years Gem City has projected an additional development of 30,000 SF of retails space and two factories employing 30 people per shift per day apiece. Gem City has a single 2-acre park within the city limits and a 10-acre cemetery outside the city limits.

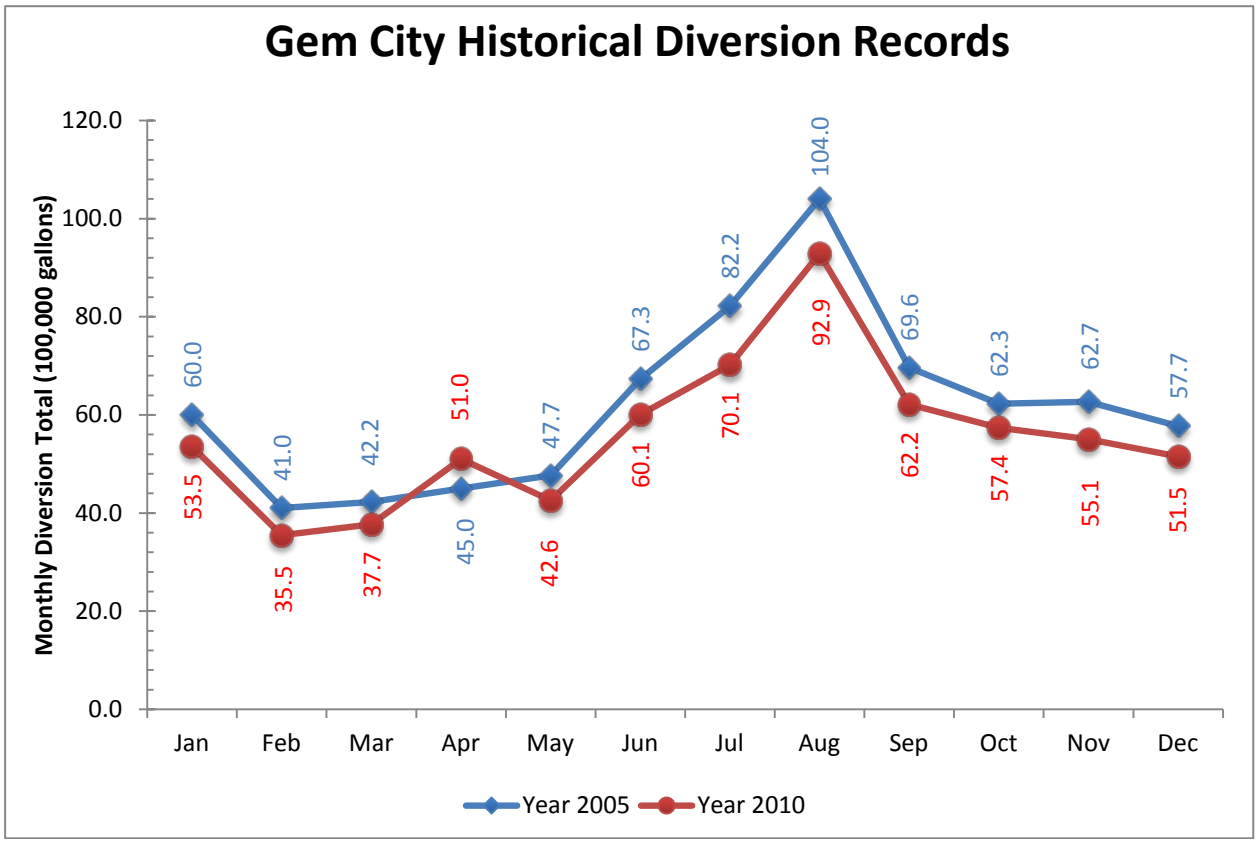
U.S. Census Bureau data for Gem City for the last four censuses conducted is summarized in the following table. The U.S. Census Bureau also reports average persons per household for Gem City at 3.14 in the year 2000 and 2.81 in the year 2010.

Gem City, ID

Year	Population*
1980	610
1990	804
2000	990
2010	1044

*US Census Data

Gem City's monthly municipal water system diversion volumes for years 2005 and 2010 are summarized in the following figure. Gem City does not have a separate irrigation utility and all residential irrigation is provided for by the municipal water system. Gem City does not have diversion data with a finer recording interval than monthly. They have no understanding of their MDD:ADD or PHD:ADD peaking factors, nor adequate data to support the analysis and derivation of these values.



The following table summarizes Gem City's existing water rights portfolio.

Gem City Water Right Portfolio

WR No.	Beneficial Use Desc.	Diversion Rate (cfs)	Annual Diversion Vol. (AF)
95-123	Municipal	0.20	N/A
95-1234	Municipal	0.20	N/A

Analysis – Service Area

Gem City's proposed RAFN service area can include all areas within the existing area of city impact (largest planning boundary that has been adopted by the City). It can include areas outside of the city's area of impact where water service is currently provided through interconnection. It cannot include proposed service areas outside the area of city impact where water service is not already provided. In addition, it cannot include the service area of other municipal water providers and it cannot include areas included in an overlapping comprehensive land use planning area as adopted by another municipality. For the sake of the example we will assume that appendix Item 2 illustrates the service area for the RAFN.

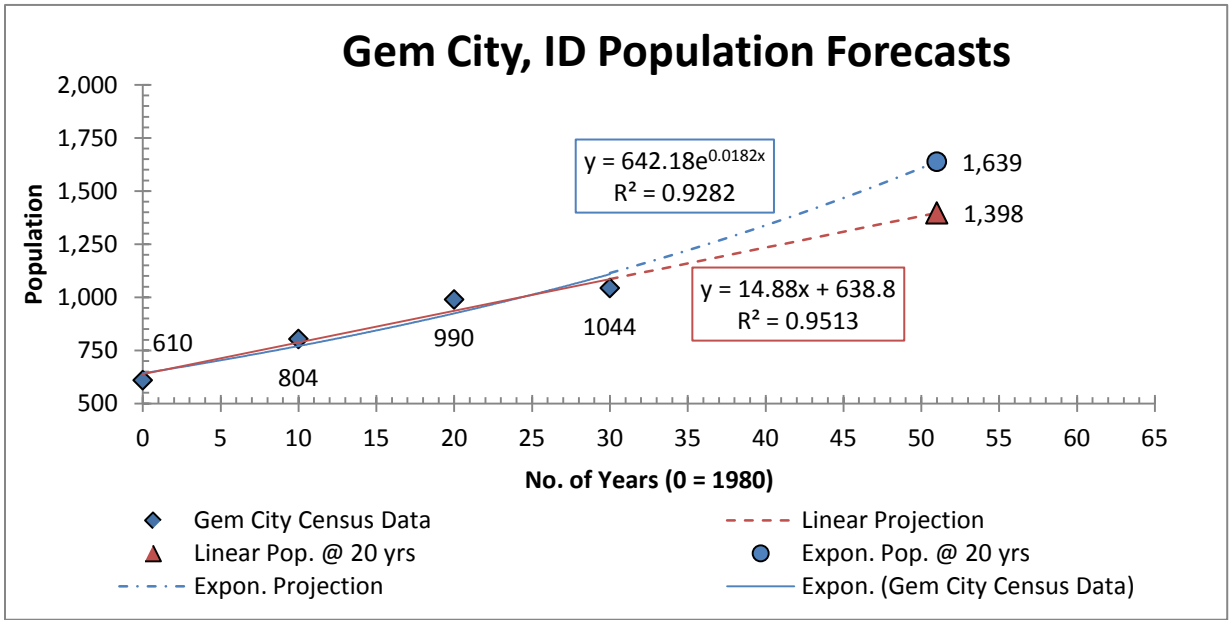
Analysis – Planning Horizon

Gem City has recently adopted a new comp plan with a 20 year planning horizon associated with the document. There are no other appurtenant planning documents such as a master water plan from which to reference an alternative planning horizon. Since a RAFN planning horizon cannot be inconsistent with comprehensive land use plans adopted by the City, the planning horizon is limited to 20 years. In addition, 20 years is consistent with the values presented in Tables 2 and 3 further confirming it as an appropriate value for

use with this RAFN proposal.

Analysis – Population Projections within the Planning Horizon

Gem City does not have any studies of population growth or demographics specific for their community. Therefore, U.S. Census Data represents the only available data regarding the population and demographics of Gem City. To avoid skewing population predictions to ephemeral trends within the census data, it is appropriate to look at a minimum of three decades worth of census data. The following figure is an x-y scatter plot of Gem City population data and years (blue diamonds). Exponential (blue line) and linear (red line) relationships have been molded to the census data and are depicted on the figure illustrating two different models between population and time.



Statistically speaking both models can be considered highly significant with coefficient of determination (R^2) values of 0.9513 for the linear model and 0.9282 for the exponential model. Presented independently either model could be considered reasonable. However, when the two models are presented together, allowing for comparison, the linear model establishes a better fit. As such, the linear relationship should be selected to forecast future populations. Since application for RAFN is being made in 2011 and the planning horizon has been established at 20 years, we are interested in forecasting the population for the year 2031 (or year 51 when 1980 = year 0). The following calculation establishes the future population at the end of the planning horizon.

P_{2031} = 14.88*(51) + 638.8 = 1,398 people

Analysis – Water Demand

Gem City has presented data for two different water service years, 2005 and 2010. Consistent with state wide and national trends, even though the service population of the town went up from 2005 to 2010, the demand went down, slightly. Since 2010 best captures existing demand characteristics, which are most likely to translate forward in time, it is appropriate to use data from 2010 to establish water demand.

Gem City has presented total diversion records and a breakdown of non-residential demand. They have not provided a breakdown of residential demand exclusive of non-residential demand nor have they presented

data on unaccounted for water (UAW). Without a breakdown of residential demand it is hard to make use of the non-residential demands. From the total diversion data it is possible to derive a per capita water use, but this value will incorporate or carry with it the non-residential demand component. Because of the lack of data exclusive to residential demand the applicant should not utilize the non-residential data in forecasting water demand.

The following table summarizes monthly water demand diversions for 2010. It also summarizes per capita monthly average daily demand, which was calculated by assuming a static population over the entire course of the year of 1,044 people.

Gem City 2010 Municipal Water Supply System Diversion Records

Month	No. Days	2010 Monthly Div. (gal)	Monthly ADD (GPD)	Monthly ADD per Capita (GPD)
Jan	31	5,354,690	172,732	165
Feb	28	3,547,730	126,705	121
Mar	31	3,771,120	121,649	117
Apr	30	5,102,560	166,752	160
May	31	4,259,420	137,401	132
Jun	30	6,009,070	200,302	192
Jul	31	7,014,390	226,271	217
Aug	31	9,285,620	299,536	**287**
Sep	30	6,216,640	207,221	198
Oct	31	5,737,530	185,082	177
Nov	30	5,507,040	183,568	176
Dec	31	5,151,590	166,180	159
Annual	365	66,957,400	--	**--**

From this data we can calculate the average daily demand (ADD) per capita by dividing the total diversions (66,957,400 gallons) by 365 days by 1,044 people. For 2010 ADD equals 176 gallons per day (GPD) per capita. We can also determine the maximum monthly average daily demand (MMAD) per capita by dividing monthly total diversions by the number of days in the month by 1,044 people and selecting the largest value. For 2010 we can see that the MMAD is equal to 287 GPD per capita and this value occurred in August, which is logical, as this is the month likely to necessitate the greatest irrigation demand on the system. Sufficient data does not exist to calculate maximum day demand (MDD) or peak hourly demand (PHD). Therefore, to determine these values, in consideration of the fact that historical data and analogous systems are insufficient to derive actual values for this example, we will rely upon the peaking factor values presented in Table 3. Utilizing values from Table 3 we can calculate MDD from MMAD by multiplying MMAD by 1.3, this calculation yields a MDD per capita value of 373 GPD. Alternatively we could calculate MDD from ADD by multiplying ADD by 2.0, this calculation yields a MDD per capita value of 352 GPD.

To calculate the total projected future water demand we must multiply the future population at the end of planning horizon (1,398 people) by the selected per capita demand value. Since Gem City relies on storage to meet peak hourly demand, the maximum day demand represents the design demand value for forecasting future water demand. Since estimations of MDD from ADD and MMAD are both valid approaches it is appropriate to use the larger of the two values. With these considerations in mind the projected future MDD water demand is equal to 362 gallons per minute (GPM) or 0.81 cubic feet per second (CFS). Gem City does not have any data on UAW. In this event we can use a maximum UAW value of 10% of total diversions.

Therefore, after accounting for UAW the projected future MDD water demand can be adjusted to 0.91 CFS (0.83 + 0.10*0.83).

Review of Gem City's existing water right portfolio indicates that the city already has 0.40 cfs of diversion rate. This value must be subtracted from the projected future MDD water demand to determine the diversion rate value that will be included on the new RAFN water right, in this instance the final RAFN diversion rate value will be 0.51 CFS (0.91 – 0.40).

Gem City's proposed RAFN service area will include a municipal water right for 0.20 cfs currently owned by a homeowner's association within the proposed service area. The disposition of this water right should be addressed in the RAFN application.