WATER AVAILABILITY ANALYSIS (WAA)

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Introduction and Purpose

The County is required by the California Environmental Quality Act (CEQA) (Public Resources Code 21000–21177) and the CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000–15387) to conduct an environmental analysis of all discretionary permits submitted for approval. CEQA requires analysis of literally dozens of environmental aspects, including the following:

"Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?"

The purpose of this document, the Water Availability Analysis (WAA), is to provide guidance and a procedure to assist county staff, decision makers, applicants, neighbors, and other interested parties to gather the information necessary to adequately answer that question. The WAA is not an ordinance, is not prescriptive, and project specific conditions may require more, less, or different analysis in order to meet the requirements of CEQA. However, the WAA is used procedurally as the baseline to commence analysis of any given discretionary project.

A Water Availability Analysis is required for any discretionary project that may utilize groundwater or will increase the intensity of groundwater use of any parcel through an existing, improved, or new water supply system[1]. As such, it will most commonly be used for discretionary development applications using groundwater such as wineries and commercial uses. Since CEQA does not apply to non-discretionary ("ministerial") projects, it does not apply to projects such as building permits, single family homes, track II replants, etc. While discretionary vineyard projects are welcome to borrow from the WAA, such vineyard projects, due to their size and scope, generally receive a much more exhaustive analysis under longstanding processes managed by the Conservation Division of the Planning Building & Environmental Services (PBES) Department.

The WAA may also apply when a discretionary Groundwater Permit is required by the Groundwater Conservation Ordinance, Section 13.15.010 of the Napa County Code. The ordinance's provisions are summarized below. (Should there be any conflict between the summary below and the Ordinance, the Ordinance shall prevail).

Outside of Designated Groundwater Deficient Areas

Most non-discretionary development in any area of the county, except for designated groundwater deficient areas, is exempt from the need to secure any type of groundwater permit. This includes projects to develop an on-site or off-site water source serving agriculture, projects to construct or develop rainwater harvesting or graywater recycling systems and minor and convenience water supply system improvements (see definitions in 13.15.010). Other

[1] The Groundwater Conservation Ordinance (Section 13.15.010) defines a water supply system as "any system including the water source the purpose of which is to extract and distribute groundwater".

exemptions outside groundwater deficient areas include projects such as building permits, well and septic permits, lot line adjustments, track II replants, etc. The following, however, are not exempt:

- Projects to develop or improve a water supply to serve *more* than a single contiguous parcel (agricultural development for multiple contiguous parcels is eligible for an exemption under certain conditions) or
- Projects that can be served by a public water supply.

Within Designated Groundwater Deficient Areas

Most any type of development in groundwater deficient areas (as defined in Napa County Code, Section 13.15.010.C) will trigger the need for a discretionary groundwater permit unless specifically exempted or unless eligible for a ministerial groundwater permit (see 13.15.030C). Ministerial groundwater permits are specifically for (1) a single family residence with associated well and landscaping when no other uses exist on the property, or (2) for agricultural re-plants. Specific exemptions include applications to construct or develop rainwater harvesting or graywater recycling systems and minor and convenience improvements (see definitions in 13.15.010) which include:

- Changes to existing water supply systems for the purposes of repair or rendering a system more efficient or to add to or improve existing legal uses on a property such as swimming pools (if provided with a cover and initially filled with trucked in water),
- Replacement dwellings (when an existing legal dwelling unit had previously existed on the property),
- Additional potential bedrooms whether or not attached to the single-family dwelling, and replacement of a site's existing well (provided the old well is destroyed and the new well is drilled to the same or smaller diameter as the existing well) are all exempt.

WAA Procedure

The Water Availability Analysis (WAA) uses a screening process for discretionary permit applications (both for new projects and for project modifications that change groundwater use) and determines if a proposal may have an adverse impact on the groundwater basin as a whole or on the water levels of neighboring non-project wells or on surface waters.[2] The WAA also provides procedures for further analysis when screening criteria are exceeded. An important sidelight to the process is public education and awareness. The WAA is based on an application which requires the applicant to gather information about existing non-project groundwater wells and water uses at the applicant's site, to describe planned project well operations, to document existing uses of groundwater on the property, and to estimate future water

[2] For the purposes of this procedure, surface waters are defined to include only those surface waters known or likely to support special status species or surface waters with an associated water right; however, as with all of the procedures in this WAA, there may be unique circumstances that require additional site-specific analysis to adequately evaluate a project's potential impacts on surface water bodies.

demands associated with the proposed project. In addition, other information relating to the geology, proximity to surface water bodies (e.g., river, creeks, etc.), and the location and construction of existing non-project wells located near the applicant's property or project well(s) will also be important to evaluate, as warranted, for the potential for well interference and effects on surface water. County staff can provide assistance to the applicant in obtaining and reviewing the latter information as part of the application data collection process.

WAA Application Procedure

A WAA groundwater permit application may be prepared by the applicant or their agent. (NOTE TO PUBLIC: PBES WILL CREATE/UPDATE AN APPLICATION FORM BASED ON THIS DOCUMENT ONCE APPROVED). **It must be signed by the applicant. If prepared by the applicant's agent, it must contain the letterhead of the agent, the name of the agent, and the agent's signature.** The WAA application contains the following information:

1. The name and contact information of the property owner and the person preparing the application.

2. Site map of the project parcel and adjoining parcels. The map should include: Assessor's Parcel Number (APN), parcel size in acres, location of existing or proposed project well(s) and other water sources, general layout of structures on the subject parcel, location of agricultural development and general location within the county. Approximate locations of existing non-project wells on other parcels within 500 feet of the existing or proposed project well(s) should also be identified based on the applicant's knowledge and available public information. All surface waters within 1500 feet of the existing or proposed project well(s) should also be identified, based on the applicant's knowledge and available public information. County staff can provide assistance to the applicant in obtaining adjacent well location, APNs and parcel size information.

3. A narrative on the nature of the proposed project, including all land uses on the subject parcel, projected future water uses in normal and dry years, details of current and proposed operations related to water use, description of interconnecting plumbing between the various water sources and any other pertinent information.

4. Tabulation of existing water use compared to projected water use for all land uses current and proposed on the parcel. Should the water use extend to other parcels, they should be included in the analysis (see Appendix E for additional information on determining water use screening criteria when multiple parcels are involved). **These estimates should reflect the specific requirements of the applicant's operations.** Guidelines attached in **Appendix B** are an example of one way to calculate projected water demand. The applicant shall use these, other publicly available guidelines, other guidelines that may be provided by the Department of Planning, Building, and Environmental Services (PBES), or project specific estimates, whichever best approximate the proposed water use for the specific project and account for all other existing water uses at the subject parcel(s).

PBES and Public Works (PW) staff will review the application for completeness and reasonableness, review the County's groundwater data management system for additional information about the characteristics of the areas/basin and nearby wells, compare the analysis to the screening criteria, and determine if additional analysis is required. In reviewing available information, County staff will consider:

1. The characteristics of the groundwater area or basin (such as confined or unconfined aquifer system; alluvial or hard rock geological setting) and related aquifer properties; and,
2. The location and present use of all existing non-project wells that are within 500 feet of the project well(s), identifying well depths and construction information for existing wells, if known; and,
3. The distance to surface waters within 500 feet of any Very Low pumping capacity project well(s) or 1500 feet of project well(s) with a capacity greater than 10 gallons per minute (gpm). [3]

Screening Criteria

Applications will be evaluated based on project information, to be provided by the applicant, and available geologic and hydrologic information, to be provided by County staff. As shown in **Table 1,** projects on the Napa Valley Floor and the Milliken-Sarco-Tulucay (MST) that meet the Tier 1 criteria (water use) will generally not be subject to second tier criteria evaluation, unless substantial evidence[4] in the record indicates the need to do so. Parcels in all other areas will generally be required to conduct a Tier 2 evaluation. Projects will be subject to Tier 3 criteria and analysis only when substantial evidence in the record determines the need for such analysis. All criteria are based on information outlined in this procedure, as well as a detailed conceptualization of hydrogeologic conditions in the Napa Valley and substantial evidence in the form of monitoring and hydrologic data, past studies, and well drillers' logs. Procedures for three tiers of screening criteria will be used on each project as designated herein and as needed for projects with unique issues:

[3] For the purposes of this WAA, "very low pumping capacity wells" are defined as wells with a casing diameter of six inches or less and an installed pump capable of producing less than 10 gallons per minute (gpm). Pumping capacities referenced throughout this WAA were developed as part of a separate analysis of potential streamflow depletion in unconsolidated alluvial settings. Details of this analysis are provided in a separate Technical Memorandum (LSCE, 2013).

[4] Substantial evidence is defined by case law as evidence that is of ponderable legal significance, reasonable in nature, credible and of solid value. The following constitute substantial evidence: facts, reasonable assumptions predicated on facts; and expert opinions supported by facts. Argument, speculation, unsubstantiated opinion or narrative, or clearly inaccurate or erroneous information do not constitute substantial evidence.

Table 1: Project Screening Criteria Applicability

Tier	Criteria Type	Napa Valley Floor	MST	All Other Areas
1	Water Use	Yes	Yes	Yes
2	Well and Spring Interference	No[1]	No[1]	Yes
3	Groundwater/Surface Water Interaction	No[1]	No[1]	No[1]

1. Further analysis may be required under CEQA if substantial evidence, in the record, indicates a potentially significant impact may occur from the project.

The three tiers of screening criteria are discussed below. **Appendices B-F** provide additional detail.

Tier 1--Water Use Criteria

For projects on the Napa Valley Floor and in the MST, water use criteria will be compared to the water use estimate provided by the applicant in the WAA application. Water use criteria vary according to the location of the project parcel(s). As such, projects must meet the applicable water use criterion, through project revisions or water use estimate refinements, if necessary and reasonable, in order to be considered in compliance with this criterion.

Table 2A presents the water use criteria. Napa Valley Floor areas include all locations that are within the Napa Valley except for areas specified as groundwater deficient areas. Groundwater deficient areas are areas that have been so designated by the Board of Supervisors. PBES staff can assist the applicant with determining which area a project is located in.

Currently the only designated groundwater deficient area in Napa County is the MST Subarea. Areas of the county not within the Napa Valley Floor or the MST Groundwater Deficient Area are classified as All Other Areas. Public Works can assist applicants in determining the correct classification for project parcel(s). **Appendix B** contains a discussion of the origins of these water use criteria.

Table 2A: Water Use Criteria

Project parcel location	Water Use Criteria (acre-feet per acre per year)
Napa Valley Floor	1.0
MST Groundwater Deficient Area	0.3 or no net increase, whichever is less [1]
All Other Areas	Parcel Specific [2]

1. Does not apply to the Ministerial Exemption as outlined in the Groundwater Conservation Ordinance
2. Water use criteria for project shall be considered in relation to the average annual recharge available to project property, as calculated by the applicant or their consultant.

In general, the acceptable water use screening criterion for parcels located on the Napa Valley Floor is 1 acre-foot per acre of land per year (an acre-foot of water is the amount of water it takes to cover one acre of land to a depth of one foot, or 325,851 gallons). Therefore, a 40-acre parcel will meet this criterion if the projected groundwater use would not exceed 40 acre-feet per year.

Areas designated as groundwater deficient areas as defined in the Groundwater Conservation Ordinance will have criteria established for that specific area. For example, the MST Subarea screening criterion is 0.3 acre-feet per acre per year or "no net increase" over existing conditions, whichever is less (see **Appendices B and C**).

Water Use Criterion including Estimated Recharge

The water use criterion for parcels termed All Other Areas (i.e. not located in the Napa Valley Floor or a groundwater deficient area), will be determined on a parcel specific basis. No single criterion can be established for "All Other Areas" due to the uncertainty of the geology, and the increasingly fractured rock aquifer systems in the mountainous and non-Napa Valley areas, including Carneros, Pope Valley, Wooden Valley, and Capell Valley. The project applicant will need to estimate the average annual recharge occurring on the project parcel(s) and consider the amount of recharge relative to the estimation of project water use (e.g., all current and projected water demands for the property on which the planned project is located). The estimate of average annual recharge can be made by various methods including water balance methods. The selected method should be based on data from the parcel or watershed where the proposed project is located. The estimated project water use, including existing and proposed uses of water on the project parcel(s), shall include estimates for normal and dry water years. If an alternative water source will be used for dry years (e.g. trucked in water for non-potable uses), that information shall be provided by the applicant along with the alternate source location and estimated water volume.

Projects on the Napa Valley Floor and in the MST that meet the Tier 1 screening criteria are considered to be in compliance with the standards of the WAA, unless other substantial evidence in the record indicates the need for further evaluation. Projects in "All Other Areas" shall complete Tier 1, and then proceed to Tier 2.

Tier 2--Well and Spring Interference Criterion

When applicable (see **Table 1**), the Tier 2 well interference criterion is presumptively met if there are no non-project wells located within 500 feet[5] of the existing or proposed project well(s). For those projects with neighboring wells located within 500 feet of the project well(s), additional evaluation will be required to assess the potential drawdown in those existing wells resulting from project well operation relative to the Tier 2 criterion described below. Though highly recommended, if the neighboring well is located on a parcel that is also owned by the applicant, the Tier 2 evaluation for that well may be waived, however certain safeguards must be in place to ensure that the water allotment and transfer between parcels is clearly documented and

[5] Distance is measured horizontally from the well.

recorded, especially in cases where the water from more than one parcel will ultimately serve a use on a single parcel (see **Appendix E**).

The potential interference will be determined based on data including the distance between the project well(s) and the neighboring non-project well(s), the hydrogeologic setting, and well construction information and operational configurations for the project well(s). Well construction information and operational configurations provided by the applicant will include:

- the planned pumping rate of well(s)[6],
- well depth(s),
- well screen intervals and
- well seal locations.

Table 2B presents default well interference criteria that the County may apply in the determination of significant adverse effects. The minimum significant drawdown values presented in **Table 2B** are intended for use in cases where information about existing non-project wells is limited or non-existent. However, when the status and configuration of an existing non-project well are known, for example the depths of screen intervals, locations of any annular seals, and/or water levels in the well and the pump depth setting, then site-specific measures of significance should be used. Site-specific measures of significance should also account for known seasonal variations[7] in groundwater elevations in the vicinity of the proposed project and mutual well interference (i.e., interference between the planned project well usage (new and/or existing) and one or more neighboring wells. County staff shall inform the applicant of the site-specific Tier 2 well interference criteria that will be applied in the evaluation of a project before the applicant conducts a site-specific analysis.

Table 2B. Default Well Interference Criteria

Type of wells within 500 ft. screened within the same aquifer as project well	**Estimated Drawdown at Neighboring Non-Project Wells**
Wells with a casing diameter of six inches or less	10 feet
Wells with a casing diameter greater than six inches	15 feet

[6] Estimates of well yield shown on driller's logs are not sufficient for this purpose. The planned pumping rate should be determined based on the pump and related equipment installed, or planned to be installed, in the well and, if available, constant rate aquifer test data for tests conducted for a minimum of 8 hours.

[7] As used here, seasonal variations refer to typical changes over the course of a year.

Low pumping capacity project wells in unconfined aquifers will typically require a minimum amount of information due to the limited drawdown that they induce. [8]

Springs

Napa County enjoys the occurrence of many natural springs, and the potential for planned projects to affect spring flow has been considered. A spring is defined as: "A place where groundwater flows naturally from a rock or the soil onto the land surface or into a body of surface water. Its occurrence depends on the nature and relationship of rocks, esp. permeable and impermeable strata, on the position of the water table, and on the topography" (Jackson, J. 1997. *Glossary of Geology*. American Geological Institute). Springs can be formed by multiple causes, including the interception of groundwater by the land surface; permeability differences that can cause groundwater to emerge; flow from faults or fractures; and drainage from landslides. Springs are ephemeral geologic features which may cease to flow due to natural causes such as changes to flow paths, water level declines, porosity lost by mineral precipitation, or sediment plugging.

Because springs originate as groundwater, springs are eligible for WAA Tier 2 analysis. It is required that any proposed project wells within 1,500 feet[9] of natural springs that are being used for domestic or agricultural purposes be evaluated to assess potential connectivity between the part of the aquifer system from which groundwater is planned to be produced and the spring(s). Springs exist in complex hydrogeologic environments. Other substantial evidence in the record may result in the need for such an analysis even though the spring(s) is located a greater distance from the planned well site. Where evaluation of potential connectivity between the project well(s) and springs is required, site-specific spring interference criteria will be established as appropriate for the springs(s) under consideration.

Although the Tier 2 analyses described above relate to mutual well interference and the avoidance of significant interference, potential pumping effects on springs may result in spring flow depletion. Springs are also commonly observed in locations where little to no quantitative records have been kept relating to the spatial occurrence or temporal variability of spring flow. Therefore, projects located in the vicinity of springs, where potential impacts of pumping are possible but unknown, may require monitoring and further analysis.

Tier 3--Groundwater/Surface Water Interaction Criteria

Tier 3 analysis is only conducted when substantial evidence in the record determines the need for such an analysis.

The groundwater/surface water criteria are presumptively met if the distance standards and project well construction assumptions are met (see **Tables 3, 4, and 5).** The distance standards vary according to groundwater pumping capacity, well construction information and operational

[8] For the purposes of this WAA, low pumping capacity wells are defined as wells with a casing diameter of six inches or less and an installed pump capable of producing between 10 gpm up to 30 gpm. As shown in Appendix F, Table F-6, a well pumping 30 gpm continuously for one day in an unconfined aquifer, even in an aquifer with a low hydraulic conductivity, is expected to induce a drawdown of two feet or less at radial distances as small as 25 feet.

[9] Distance is measured horizontally from the well.

configurations for the project well(s), and aquifer properties as described in **Appendix F**. The criteria are also based on a 140-day period to account for the effect of groundwater withdrawal on surface waters throughout the dry season (typically late May through early October).

The distance standards and construction assumptions in **Tables 3, 4, and 5** are provided as examples of conditions that, if applicable, would be expected to preclude any significant adverse effects on surface waters. The distance standards and construction assumptions in **Tables 3, 4, and 5** were developed as part of a separate analysis of streamflow depletion for surface waters and wells in unconsolidated alluvial geologic settings (LSCE, 2013). Project wells located in other geologic settings, particularly consolidated formations more common in locations deemed All Other Areas, will be subject to other distance standards based on site-specific aquifer conditions. Distance standards for project wells completed in consolidated formations will generally be no more restrictive than those shown in **Tables 3, 4, and 5** for hydraulic conductivity values of 0.5 ft/day.

The distance standards and construction assumptions in **Tables 3, 4, and 5** are not intended to serve as absolute setback criteria. Instead, if the proposed project is located in an equivalent geologic setting but does not meet the distance standards and conform to the associated well construction assumptions (See **Tables 3, 4, and 5)**, then additional analysis will be required to determine project impacts relative to site-specific criteria. The site-specific groundwater/surface water interaction criteria will be established as appropriate for the surface water(s) under consideration[10] (see **Appendix F**).

Additional evaluation will be required to identify the potential for impacts of very low pumping capacity wells within 500 feet[11] of surface waters, low pumping capacity wells within 1000 feet of surface waters, and moderate to high pumping capacity wells within 1500 feet of surface waters, as described in **Appendix F**.[12] The potential impacts will be determined based on data including distance(s) between the project well(s) and the surface water features of concern, the hydrogeologic setting, the streambed (or equivalent feature) hydraulic properties, and well construction information and operational configurations for the proposed project wells. Well construction information and operational configurations provided by the applicant will include:

- the planned pumping rate of well(s) [13],
- well depth(s),
- well screen intervals and
- well seal locations.

[10] Site-specific criteria will be developed to address project impacts on beneficial uses of affected surface waters.

[11] Distance is measured horizontally from the well.

[12] For the purposes of this WAA, moderate to high pumping capacity wells are defined as wells with a casing diameter greater than six inches and an installed pump capable of producing more than 30 gpm

[13] Estimates of well yield shown on driller's logs are not sufficient for this purpose. The planned pumping rate should be determined based on the pump and related equipment installed, or planned to be installed, in the well and, if available, constant rate aquifer test data for tests conducted for a minimum of 8 hours.

Very low pumping capacity wells in unconfined aquifers will typically require a minimum amount of information due to the limited potential for surface water flow depletion. Other well types located at distances of 1500 feet or greater from surface waters will also likely require a minimum amount of information, particularly when it can be shown that the project well targets aquifer units not hydraulically connected to surface water.

Table 3. Well Distance Standards and Construction Assumptions; Very low capacity pumping rates (i.e., less than 10 gpm), constructed in unconsolidated deposits in the upper part of the aquifer system (unconfined aquifer conditions).

Aquifer Hydraulic Conductivity (ft/day)	**Acceptable Distance from Surface Water Channel**			**Minimum Surface Seal Depth (feet)**	**Depth of Uppermost Perforations (feet)**
	500 feet	1000 feet	1500 feet		
80	✓			50	100
50	✓			50	100
30	✓			50	100
0.5	✓			50	100

Table 4. Well Distance Standards and Construction Assumptions; Low capacity pumping rates (i.e., between 10 gpm and 30 gpm), constructed in unconsolidated deposits in the upper part of the aquifer system (unconfined aquifer conditions).

Aquifer Hydraulic Conductivity (ft/day)	**Acceptable Distance from Surface Water Channel**			**Minimum Surface Seal Depth (feet)**	**Depth of Uppermost Perforations (feet)**
	500 feet	1000 feet	1500 feet		
80			✓	50	150
50			✓	50	150
30			✓	50	100
0.5		✓		50	100

Table 5. Well Distance Standards and Construction Assumptions; Moderate to high capacity pumping rates (i.e., greater than 30 gpm), constructed in unconsolidated deposits in the upper part of the aquifer system (unconfined aquifer conditions).

Aquifer Hydraulic Conductivity (ft/day)	**Acceptable Distance from Surface Water Channel**			**Minimum Surface Seal Depth (feet)**	**Depth of Uppermost Perforations (feet)**
	500 feet	1000 feet	1500 feet		
80			✓	50	150
50			✓	50	150
30			✓	50	100
0.5			✓	50	100

If distance standards and construction criteria in **Tables 3, 4, and 5** above are not met, project approval may still be possible pending additional analysis (see below).

If the minimum surface seal depth is not met, and if available information does not indicate a hydraulic separation provided by geologic conditions at the site, then these cases would require additional analysis by the applicant. Shorter seals can allow for significant flow into the well from shallow portions of an aquifer, even if the screens are at greater depths.

Additional Analysis Required

If the proposed project exceeds one or more of the screening criteria and the applicant is unable to modify the project (i.e., different location, well construction, water usage, or operations) to meet the screening criteria, then further analysis will be required (see **Appendix F**). Additional analysis will also be required if insufficient information exists in the project application to evaluate conformance with the criteria.

The applicant or the applicant's agent should consult with County staff regarding the required scope of the analysis, which is likely to include consultation with a professional hydrologist, geologist, or engineer, and may include field testing. Projects requiring additional analysis regarding Tier 2 or Tier 3 criteria may be subject to state requirements for preparation by a California registered professional geologist or professional engineer. **Appendix F** describes the additional analyses that will be required if the project screening criteria are applicable and are not met or if substantial evidence in the record indicates that a potentially significant impact may result from the project.

The geology of many areas of Napa County is very complex (LSCE and MBK, 2013). Accurate determination of hydrologic parameters (See **Appendix F**) is important to the additional analyses that may be necessary to evaluate potential well interference or impacts on surface

water. Several approaches may be considered. One approach, applicable in areas with unconsolidated aquifer materials, is to estimate aquifer hydraulic conductivity values, based on evaluation and interpretation of lithologic data reported for wells drilled in the vicinity of project or well(s) and published hydraulic conductivity values for similar aquifer materials. This method may be applicable in areas of the Napa Valley Floor where the unconsolidated aquifer system has been previously characterized (LSCE and MBK, 2013). This method is not applicable in areas with consolidated or hard rock aquifer materials, including the MST subarea and All Other Areas, due to the increased likelihood of significant variations in aquifer characteristics over relatively small distances.

The County's preferred method for determining the aquifer hydraulic conductivity or other parameters is by conducting an aquifer test and analyzing aquifer test data. In some cases, pump test data may be recorded by a well driller at the time of well construction and included as part of the Well Completion Report submitted to the California Department of Water Resources. However, these tests are not always conducted to standards that result in meaningful aquifer parameters (i.e., the pumping rate may not be constant, the pumping rate may not be large enough to analyze aquifer parameters, the test may be of too short a duration, and groundwater level measurements may not have been made during the test in the pumped well and one or more observation wells, etc.). If adequate aquifer test data are not available, and there is substantial evidence in the record that the project (including the proposed location, construction and operation of any project wells) regarding potential impacts on neighboring non-project wells or nearby surface waters, then an aquifer test may be required of the applicant's project well(s). A constant rate aquifer test is generally required for projects in All Other Areas, if acceptable test data are not already available. Interpretation of pump test data provided in driller's logs is not intended for consolidated aquifers. Pending the proposed project details, the County may also require installation of a monitoring well or monitoring of a nearby existing non-project well.

As described in the Groundwater Conservation Ordinance, the County may require applicants in groundwater deficient areas to install a water meter to verify actual groundwater usage. In addition to the above screening criteria, if the actual usage exceeds the projected use, or the screening criteria, the applicant may be required to reduce groundwater consumption and/or find alternate water sources (See **Appendix D**).

WAA Application Submittals

WAA applications for all use permits and parcel divisions, as well as for all Groundwater Conservation Ordinance permits must be submitted to the Department of Planning, Building and Environmental Services (PBES), which will consult with the Department of Public Works, and be the conduit for communication between the County and the applicant. All subsequent communication should likewise pass through PBES. Any mitigation measures identified via the additional analysis will become either project modifications to, or conditions of approval for, the proposed project. Details of the use permit, land division, or groundwater ordinance can be obtained from PBES, along with mapping of groundwater deficient areas.

Conclusions

The Napa County Board of Supervisors has long been committed to the preservation of groundwater for agriculture and rural residential uses within the County. It is their belief that through proper management, the excellent groundwater resources found within the County can be sustained for future generations. Several conclusions can be drawn from application of the Water Availability Analysis process to date:

- In the process of conducting the analysis, applicants develop a greater awareness of water use by their project, providing a higher level of awareness and potentially leading to more efficient use of the resource.
- Information submitted by applicants has led to a broader database for future study and management.
- Groundwater use can vary widely depending upon its availability, local hydrogeologic constraints, and periodic hydrologic constraints which may affect the recharge and replenishment of the aquifer system.
- On the Napa Valley Floor and in the MST, the practice of evaluating an applicant's WAA by using screening criteria is an accepted method for making groundwater determinations. Based on the significant information available on Napa County groundwater basins, the screening criteria present a reasonable approach to the process. Because of the variability in parcel conditions in "All Other Areas", these parcels warrant a site-specific analysis, as discussed elsewhere in this document.
- The Water Availability Analysis is based upon the basic premise that each landowner has equal right to the groundwater resource below his or her property, so long as it doesn't significantly impact others. Furthermore, the WAA provides sufficient information and supporting documentation to enable the County to determine whether a proposed project may significantly affect groundwater resources and the reasonable and beneficial uses in the proposed area. By implementing policies to prevent wasteful or harmful use of groundwater, it is intended that sufficient groundwater will be available for both current and future property owners. Ensuring wells are located and constructed so as to avoid impacts on neighboring wells and surface water bodies will minimize neighbor disputes and avoid significant environmental impacts. In summary, this WAA implements a process that recognizes:
    - The current understanding of the occurrence and availability of the County's groundwater resources,
    - The hydrogeologic constraints that can locally affect the utilization of those resources, and
    - The periodic hydrologic constraints that may also affect the utilization of the resource and replenishment of the aquifer system.

Appendix A: Water Availability Analysis Background

At the height of the 1990 drought in Napa County, the Napa County Board of Supervisors and the Napa County Planning Commission became very concerned with the approval of use permits and parcel divisions that would cause an increased demand on groundwater supplies within Napa County. During several Commission hearings, conflicting testimony was entered as to the impact of such groundwater extraction on water levels in neighboring wells. The Commission asked the Department of Public Works to evaluate what potential impact an approval might have on neighboring wells and on the groundwater system as a whole. In order to simplify a very complex analysis, the Department developed a three phase Water Availability Analysis to provide a cost-effective answer to the question.

On March 6, 1991 an interim policy report, prepared by County staff, was presented to and approved by the Commission requiring use permit and parcel division applicants to submit a Water Availability Analysis with their application. The staff policy report provided a procedure by which applicants could achieve compliance with the Commission policy. Oversight of groundwater development within the County's jurisdiction was later refined by the Board of Supervisors approval of Napa County Ordinance No.1162 (Groundwater Conservation Ordinance) on August 3, 1999. A revised staff policy report was subsequently adopted by the Board of Supervisors in August 2007. The 2007 Policy Report updated the Water Availability Analysis procedure and restated the purpose and functionality of the analysis relative to the Groundwater Conservation Ordinance.

In January 2011, as part of the County's Comprehensive Groundwater Monitoring Program initiated in 2009, the County's technical consultant, Luhdorff & Scalmanini, Consulting Engineers, completed a review of the County's Groundwater Conservation Ordinance and procedures, and recommended updating the staff policy report and Water Availability Analysis procedure. The consultant's review found that the initial "phase one" analysis was valuable as a screening process, but that the pump test envisioned in "phase two" was not the best way to assess whether projects exceeding the screening criteria would have detrimental groundwater impacts.

On September 11, 2011, the Board of Supervisors appointed a Groundwater Resources Advisory Committee (GRAC) to assist with development of a groundwater monitoring program, and to recommend updates to the Groundwater Conservation Ordinance, as needed. As part of their work, the GRAC also reviewed changes to this Water Availability Analysis policy report in late 2013.

Appendix B: Estimated Water Use for Specified Land Use

Each project applicant is responsible for determining estimated water usage for their proposed project. While some guidelines are provided below, other industry standards exist, PBES may be able to provide data based on previous applications, and each project has its own unique characteristics. The most appropriate data should be used by the applicant to estimate water use for their specific project.

Guidelines for Estimating Residential Water Use:

The typical water use associated with residential buildings is as follows:

Primary Residence	0.5 to 0.75 acre-feet per year (includes minor to moderate landscaping)
Secondary Residence or Farm Labor Dwelling	0.20 to 0.50 acre-feet per year

Additional Usage to Be Added

1. Add an additional 0.1 acre-feet of water for each additional 1000 square feet of drought tolerant lawn or 2000 square feet of non-xeriscape landscaping above the first 1000 square feet.
2. Add an additional 0.05 acre-feet of water for a pool with a pool cover.
3. Add an additional 0.1 acre-feet of water for a pool without a cover.

Residential water use can be estimated using the typical water uses above. All typical uses are dependent on the type of fixtures and appliances, the amount and type of landscaping, and the number of people living onsite. If a residence uses low-flow fixtures and has appliances installed, is using xeriscape landscaping, and is occupied by two people, the water use estimates will be on the low side of the ranges listed above.

Examples of Residential Water Usage:

Residential water use can vary dramatically from house to house depending on the number of occupants, the number and type of appliances and water fixtures, the amount and types of lawn and landscaping. Two homes sitting side by side on the same block can consume dramatically different quantities of water.

Example 1:

Home #1 is 2500 square feet. Outside the house there is an extensive bluegrass lawn, a lot of water loving landscaping, and a swimming pool with no pool cover. Inside the house all the

appliances and fixtures, including toilets and shower-heads, are old and have not been upgraded or replaced by water saving types. The owners wash their cars weekly but they don't have nozzles or sprayers on the hose. They do not shut off the water while they are soaping up the vehicles, allowing the water to run across the ground instead. Water is commonly used as a broom to wash off the driveways, walkways, patio, and other areas. The estimated water usage for Home #1 is 1.2 acre-feet of water per year

Example 2:

Home #2 is also 2500 square feet. Outside of the house there is a small lawn of drought tolerant turf, extensive usage of xeriscape landscaping, and no swimming pool. Inside the house all of the appliances and fixtures, including toilets and showerheads, are of the low flow water saving types. The owners wash their cars weekly, but have nozzles or sprayers on the hose to shut off the water while they are soaping up the vehicles. Driveways, walkways, patios, and other areas are swept with brooms instead of washed down with water. Estimated water usage for Home #2 is 0.5 acre-feet of water per year.

The above are only examples of unique situations. The estimated water use for each project will vary depending on existing parcel conditions.

Guidelines For Estimating Non-Residential Water Usage:

Agricultural:

Vineyards	
Irrigation Only	0.2 to 0.5 acre-feet per acre per year
Heat Protection	0.25 acre-feet per acre per year
Frost Protection	0.25 acre-feet per acre per year
Irrigated Pastures	4.0 acre-feet per acre per year
Orchards	4.0 acre-feet per acre per year
Livestock (sheep or cows)	0.01 acre-feet per acre per year

Winery:

Process Water	2.15 acre-feet per 100,000 gal. of wine
Domestic and Landscaping	0.50 acre-feet per 100,000 gal. of wine
Employees	15 gallons per shift
Tasting Room Visitation	3 gallons per visitor
Events and Marketing, with on-site catering	15 gallons per visitor

Industrial:

Food Processing	31.0 acre-feet per employee per year
Printing/Publishing	0.60 acre-feet per employee per year

Commercial:

Office Space	0.01 acre-feet per employee per year
Warehouse	0.05 acre-feet per employee per year

Estimates of water use for other categories are available in the technical literature from sources such as the American Water Works Association's Water Distribution Systems Handbook (Mays, 2000).

Parcel Location Factors:

The water use screening criterion for each parcel is based on the location of the parcel. There are three different location classifications: Napa Valley Floor, MST Groundwater Deficient Area, and All Other Areas. Napa Valley Floor areas include all locations that are within the Napa Valley excluding areas designated as groundwater deficient areas. Groundwater deficient areas are areas determined by the Department of Public Works as having a history of insufficient or declining groundwater availability or quality. At present the only designated groundwater deficient area in Napa County is the MST Subarea. Areas of the County not within the Napa Valley Floor and MST Groundwater Deficient Area are classified as All Other Areas. Public Works can assist applicants in determining the appropriate classification for project parcel(s).

Project Parcel Location	Water Use Criteria
Napa Valley Floor	1.0 acre feet per acre per year
MST Groundwater Deficient Area	0.3 acre feet per acre per year or no net increase, whichever is less*
All Other Areas	Parcel Specific
* Does not apply to the Ministerial Exemption as outlined in the Groundwater Conservation Ordinance	

The criterion for the Napa Valley Floor Area was agreed to 1991 by the Board of Supervisors. The criterion of 0.3 acre feet per acre per year for the MST Groundwater Deficient Area was determined using data from the 1977 USGS report on the Hydrology of the MST Subarea (Johnson, 1977). The value is calculated by dividing the "safe annual yield," as determined by the USGS (Johnson, 1977), by the total acreage of the affected area (10,000 acres). The addition of the "no net increase" standard reflects the County's obligation to assess potential cumulative impacts under CEQA. In a groundwater deficient area, any discretionary project that increases groundwater use may contribute to the declining groundwater levels in the aquifer.

No single criterion can be established for "All Other Areas" due to the uncertainty of the geology, and the increased complexity of the fractured rock aquifer systems in the mountainous and non-Napa Valley areas, including Carneros, Pope Valley, Wooden Valley, and Capell Valley. The project applicant will need to estimate the average annual recharge occurring in the project area and consider the amount of recharge relative to the estimation of project water use (e.g., all current and projected water demands for the property on which the planned project is located). The estimated project water use shall include estimates for normal and dry water years for both current and proposed water uses. If an alternative water source will be used for dry years (e.g.

trucked-in water for non-potable uses), that information shall be provided by the applicant including the source and estimated water volume.

The criteria above were reviewed by the County's groundwater consultants in 2011-2013 and are considered to be reasonable indicators on a watershed scale of the levels below which significant environmental impacts would be unlikely to occur. The review was based on existing monitoring data and an updated hydrogeologic conceptualization of the Napa Valley aquifer system (LSCE and MBK, 2013) and is consistent with the County's experience since establishment of the water use criteria in 1991. In addition, these criteria have been successfully applied as part of the WAA procedure since their establishment.

Appendix C: Guidance for MST Subarea Permit Applications

Historical data collected from the monitoring of wells within the MST Subarea over many decades indicate that it may be in overdraft, leading to the conclusion that the existing water users within the basin historically pumped more water from the ground than is being naturally replaced each winter season. To offset the overdraft trend, a recycled water pipeline is being installed, and once operating, its beneficial effects will be measured. However, as no other reasonable water resources currently exist in the MST, to avoid a ban on all new construction, the County has permitted each property owner to develop their property with the uses involving ministerial approvals under Section 13.15.030(C) of the groundwater ordinance, which are limited to a "reasonable" level of water use that may reduce the rate at which the groundwater levels are being lowered.

Single Family Dwellings on Small Parcels In the MST Subarea: The average, single family dwelling will likely use between 0.5 and 0.75 acre-feet of groundwater per year. Using a criterion of 0.3 acre-ft/year/acre, the minimum parcel size able to support the above range is between 1.5 to 2.5 acres. However, in order to ensure that all property owners have viable use of their land, applications for the construction of a single family home in these instances can be approved ministerially if the owner agrees to the conditions outlined in the Groundwater Ordinance. If the conditions are not agreed upon, or if the project involves a secondary dwelling or other groundwater uses not consistent with a single family dwelling, then the project would be subject to the analysis outlined in the WAA report. The County cannot approve the groundwater permit unless the proposed use is off-set by reductions elsewhere, such that the "no net increase" and "fair share"[14] water use screening criterion is met.

Agricultural Development In the MST Subarea: Agriculture in the MST Subarea is not exempt from the groundwater permit process. In these cases, such development will require an application for a groundwater permit and a WAA detailing the existing and proposed water use(s) on the project parcel(s). All new agricultural development in the MST will be required to meter all wells supplying water to the property with periodic reports to the County. The County cannot approve the groundwater permit unless the proposed use is off-set by reductions elsewhere, such that the "no net increase" and "fair share" water use screening criterion is met.

Existing Vineyard, New Primary or Secondary Residence In the MST Subarea: On an application related to a new residence on a parcel with an existing vineyard or residence, the WAA shall include all water use on the property, both existing and proposed. Projects on parcels with an established vineyard will be required to meter all wells supplying water to the property with periodic reports to the County. The County cannot approve the groundwater permit unless the proposed use is off-set by reductions elsewhere, such that the "no net increase" and "fair share" water use screening criterion is met.

Wineries and Other Use Permits In the MST Subarea: On a use permit application, the applicant is required to provide a WAA. Should the application be approved, a specific condition

[14] The "fair share" allotment for water use is based on the parcel(s) location in the Napa Valley Floor, MST Groundwater Deficient Area or All Other Areas (see additional information in Appendix B).

of approval will be required to meter all wells supplying groundwater to the property with periodic reports to the County. It is also possible that water conservation measures will be a condition of approval. All new use permits must meet the criterion for water use for the project parcel. The County cannot approve the groundwater permit unless the proposed use is off-set by reductions elsewhere, such that the “no net increase” and “fair share” water use screening criterion is met.

Appendix D: Water Meters (in Groundwater Deficient Areas Only)

If required, water meters shall measure all groundwater used on the parcel. Additional meters may also be required for monitoring the water use of individual facilities or operations, such as a winery, residence, or vineyard located on the same parcel. If a meter(s) is installed, the applicant shall read the meter(s) and provide the readings to the County Engineer at a frequency determined by the County Engineer. The applicant shall also convey to the County Engineer, or his designated representative, the right to access and verify the operation and reading of the meter(s) at any time.

If the meters indicate that the water consumption of a parcel in the MST Subarea exceeds the fair share amount, the applicant will be required to submit a plan which will be approved by the Director of Public Works to reduce water usage. The applicant may be required to find additional sources of water to reduce their groundwater usage. Additional sources may include using water provided by the City of Napa, the installation of water tanks which are filled by water trucks, or other means which will ensure that the groundwater usage will not exceed the fair share amounts.

The readings from water meters may also be used to assist the County in determining trends in groundwater usage, adjusting baseline water use estimates, and estimating overall groundwater usage in the MST Subarea.

Appendix E: Determining water use numbers with multiple parcels

The Water Availability Analysis is based on the premise that each landowner has equal right to the groundwater resource below his or her property. There will be cases where one person or entity owns multiple contiguous parcels and requests that the total water allotment below all of his or her parcels be considered in the Water Availability Analysis. Determining the total water demand based on multiple contiguous parcels is acceptable; however, to protect future property owners, certain safeguards must be in place to ensure that the water allotment and transfer between parcels is clearly documented and recorded, especially in cases where the water from more than one parcel will ultimately serve a use on a single parcel.

When multiple parcels are involved, the parcels for which the total water usage is being based on must be contiguous and clearly identified on a site plan with the Assessor's parcel numbers noted. The transfer of water from these parcels to the parcel on which the requested use is located must be documented using the form provided by the Department of Public Works. The form must be approved by the County and subsequently recorded by the applicant prior to commencement of any activity authorized by the groundwater permit or other county permit or approval. A condition requiring such will be placed on the use permit, groundwater permit or other permit for approval.

Alternatively, if the method above is not feasible, the applicant may provide an additional analysis for each project parcel, with the understanding that the water use on each individual parcel must not exceed the water use screening criterion for that parcel (see additional information in Appendix B).

Appendix F: Water Availability Analysis Tiers 2 & 3 Screening Criteria & Additional Analysis

County staff will conduct, or require the applicant to conduct, additional analysis of the proposed project according to any screening criteria that are not met. Additional analysis is required for projects that are not located on the Napa Valley Floor or in the MST (i.e. “All Other Areas”). Additional analysis will also be required if insufficient information exists in the project application to judge conformance with one or more of the criteria.

Water Use Evaluation (Tier 1)

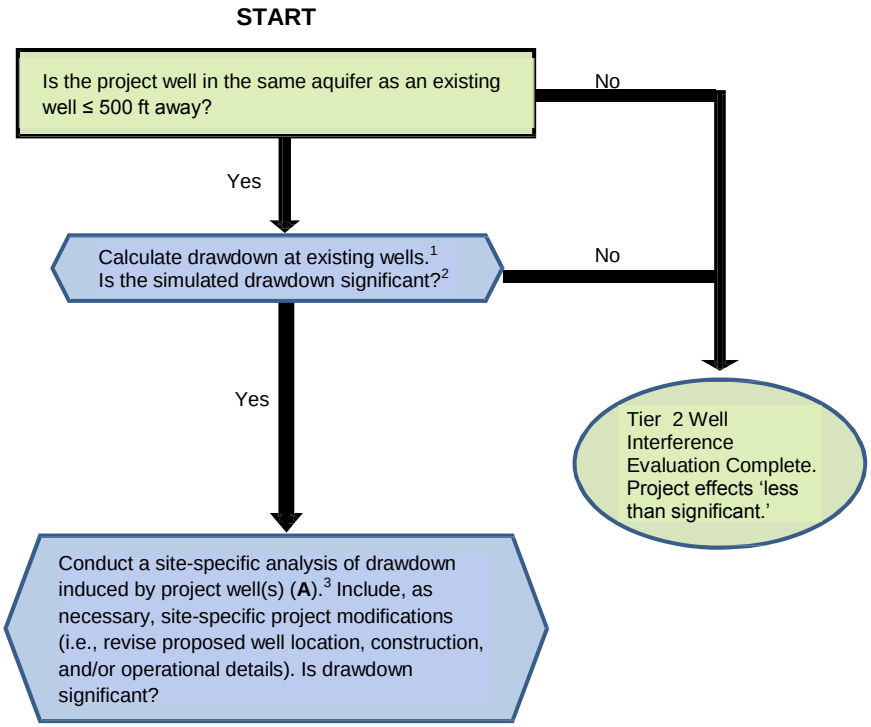
When the proposed project’s estimated water demand does not meet the applicable water use criterion, the applicant will be encouraged to first revise the project and/or refine the water use estimate based on project details not adequately reflected in the water use screening criterion. County staff will then review the revised estimate and determine if the acceptable water use criterion has been met.

Well and Spring Interference Evaluation (Tier 2)

The Tier 2 well interference criterion is presumptively met if there are no non- project wells located within 500 feet of the existing or proposed project well(s). When a project well is within 500 feet of a neighboring non-project well(s) additional analysis of well interference will be required (see **Figure F-1**) for projects located in “All Other Areas”. It may also be required for the Napa Valley Floor and the MST when substantial evidence in the record indicates the need to do so under CEQA. The analysis will first determine whether the existing or proposed project and non-project wells are, or are proposed to be, screened in the same aquifer unit and, if so, whether any drawdown induced in the non-project well(s) may constitute a significant adverse effect. **Table F-1** provides standard well interference criteria for induced drawdown in a non-project well that will be used in the absence of site-specific information regarding the susceptibility of existing non-project wells to drawdown induced by project well(s). Site-specific susceptibility information would include the pump depth setting and construction of project and non-project wells.

The Tier 2 spring interference criterion is presumptively met if no natural springs in use for domestic or agricultural purposes are located within 1,500 feet of any proposed project wells. When a project well is within 1,500 feet of a natural spring additional analysis of connectivity between the part of the aquifer system from which groundwater is planned to be produced and spring(s). When additional analysis is required, site-specific spring interference criteria will be established as appropriate for the springs(s) under consideration.

FIGURE F-1. WAA Additional Analysis Decision Tree (as shown, for well interference evaluation), where designated A = applicant responsibility, C = County staff responsibility



[1] Drawdown to be calculated using industry standard method(s) appropriate to the aquifer under consideration, such methods include the Theis Equation applicable for confined or unconfined aquifers (**A** or **C**).

[2] See Table F-1 or similar, superseding criteria provided by County staff (C).

[3] This site-specific analysis may include an aquifer test or an alternative study at the proposed well site to refine aquifer properties used in drawdown calculations and must include details of the project well(s) construction and operation relative to the site hydrogeology and any known information concerning the construction of any existing non-project wells under consideration (**A**).

The additional analysis will consider site-specific information including:

- the distance between the project well(s) and any existing non-project wells within 500 feet or natural springs within 1,500 feet;
- depth, screen intervals, and pump design flow rate for project well(s);
- depth, screen intervals, and pumping capacity/well type for the existing non- project well(s) or elevation and historical records of spring production;
- site hydrogeology (including aquifer units accessed by the project well and by existing non-project well(s) or natural springs and aquifer hydraulic properties (see **Tables F-2 and F-3**).

Data collected for the analysis will initially come from the WAA application, including information about existing non-project wells and site hydrogeology provided by County staff. These data will be used to calculate drawdown at any existing non-project wells, completed in the same aquifer unit, resulting from planned operation of the project well(s). Drawdown will be calculated using industry standard methods appropriate to the aquifer unit under consideration; such methods include the Theis Equation applicable for confined or unconfined aquifers (Theis, 1935).

If the initial calculated drawdown exceeds the Tier 2 well interference criteria, the applicant shall be required to submit a site-specific analysis prepared by a qualified professional demonstrating that the proposed project will not have an adverse effect (direct, indirect, or cumulative), on groundwater resources or neighboring non-project wells. This site-specific analysis may include an aquifer test or an alternative study at the proposed well site to refine aquifer properties used in drawdown calculations. The site-specific analysis may also demonstrate less than significant impacts by proposing modifications to the location, construction, or operation of project well(s).

If available data indicate a possible hydraulic connection between the project well(s) and any identified springs, an analysis of the hydraulic connection induced by the project well(s) will be conducted. Potential spring flow depletion induced by the project well(s) will be compared to site-specific spring interference criteria to determine if they constitute a significant adverse effect. The site-specific spring interference criteria will be established as appropriate for the spring(s) under consideration. Depending on site-specific concerns, more or less restrictive criteria may be required.

Table F-1 presents well interference criteria that the County may apply in the determination of significant adverse effects. The minimum significant drawdown values presented in **Table F-1** are intended for use in cases where information about existing non-project wells is limited or nonexistent. However, when the status and configuration of an existing non-project well are known, for example the depths of screen intervals, locations of any annular seals, and/or water levels in the well and the pump depth setting, then site-specific measures of significance should be used. Site-specific measures of significance should also account for known seasonal variations[15] in groundwater elevations in the vicinity of the proposed project and mutual well interference (i.e., interference between the planned project well usage (new and/or existing) and one or more neighboring wells). County staff shall inform the applicant of the site-specific Tier 2 well interference criteria that will be applied in the evaluation of a project before the applicant conducts a site-specific analysis.

[15] As used here, seasonal variations refer to typical changes over the course of a year.

Table F-1. Default Well Interference Criteria	
Type of wells within 500 ft. screened within the same aquifer as project well	**Estimated Drawdown at Neighboring Non-Project Wells**
Wells with a casing diameter of six inches or less	10 feet
Wells with a casing diameter greater than six inches	15 feet

Groundwater/Surface Water Interaction Evaluation (Tier 3)

When Tier 3 analysis is required[16], it shall be conducted as described below. The analysis will first determine whether the project well(s) are, or are proposed to be, screened in an aquifer unit hydraulically connected to the surface water(s) within the applicable distance specified by **Tables 3, 4, and 5** for unconsolidated aquifers (see also Figure F-2). If a hydraulic connection does exist, even one of limited temporal extent, then an analysis of the streamflow or surface water depletion induced by the project well(s) will be conducted. The streamflow depletion induced by the project well(s) will be compared to site-specific groundwater/surface water interaction criteria to determine if they constitute a significant adverse effect. The site-specific groundwater/surface water interaction criteria will be established as appropriate for the surface water(s) under consideration. Depending on the temporal extent of hydraulic connection and the special status species and/or surface water rights under consideration, more or less restrictive criteria may be required, up to and including no measurable streamflow depletion.

The additional analysis will consider site-specific information including:

- the distance between the proposed well and naturally-present surface water bodies within 1500 feet;
- depth, screened intervals, seal depths, and pumping capacity of applicant's well(s);
- site hydrogeology (including aquifer zones accessed by proposed well and existing wells and aquifer hydraulic properties (see **Tables F-2, F-3 and F-4**); and
- streambed (or equivalent feature) hydraulic properties.

Data collected for the analysis will initially come from the WAA application, including information about existing non-project wells and site hydrogeology provided by County staff. The evaluation will include calculation of streamflow depletion due to planned operation of the project well(s). Streamflow depletion will be calculated using industry standard methods appropriate to the

[16] Tier 3 analysis may be required under CEQA if substantial evidence, in the record, indicates a potentially significant impact may occur from the project.

aquifer under consideration; such methods include the Hantush Equation applicable for aquifers hydraulically connected with surface waters (Hantush, 1965).[17] If the initial calculated streamflow depletion exceeds the groundwater/surface water interaction criteria, the applicant shall be required to submit a site-specific analysis prepared by a qualified professional demonstrating that the proposed project will not have an adverse effect (direct, indirect, or cumulative), on surface water resources. This site-specific analysis may include an aquifer test or an alternative study at the proposed well site to refine aquifer properties used in streamflow depletion calculations. The site-specific analysis may also demonstrate less than significant impacts by proposing modifications to the location, construction, or operation of project well(s).

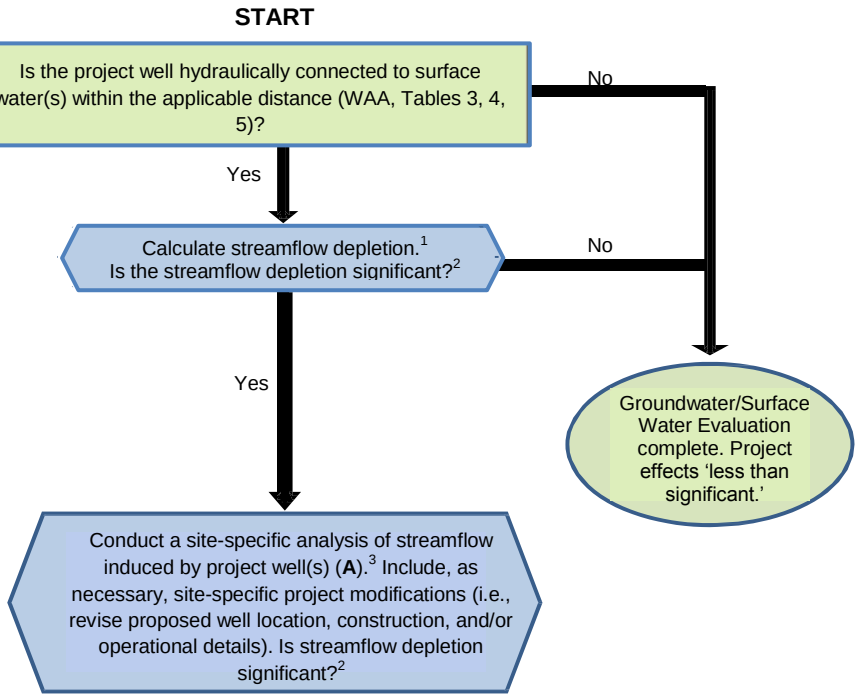
Modifications to the proposed project will be considered acceptable in satisfying the criteria where project well(s) can be shown to have a sufficient geologic or hydraulic separation from the surface water(s) that would prevent the well from causing streamflow depletion at least as much as would be expected at the minimum distance specified by the WAA Tables 3, 4, and 5. The California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (USBR) allow for similar exemptions when considering the potential effect on surface water flows of groundwater pumping proposed for water transfers involving groundwater substitution pumping in the Sacramento Valley. Some example circumstances for exception to the stated criteria (based on DWR and USBR, 2013) include:

- Sufficient information, including site-specific geologic or hydrologic data, is provided to demonstrate that the well does not have significant hydraulic connection to the surface water system;
- The well's uppermost perforations are planned to be deeper than recommended (see **Tables 3, 4, 5**) and there is demonstration of low permeability deposits overlying the zone from which extraction is proposed to occur (i.e., a confining unit at least 20 feet thick exists above the depth of the uppermost perforation). In this case a somewhat lesser distance from the surface channel may be considered, pending the well type and planned well operations;
- The well's uppermost perforations are planned to be shallower than recommended (see **Tables 3, 4, 5**) and there is demonstration of low permeability deposits overlying the zone from which extraction is proposed to occur (i.e., a confining unit at least 40 feet thick exists above the depth of the uppermost perforation). In this case a somewhat lesser distance from the surface channel may be considered, pending the well type and planned well operations;
- The project well is a moderate to high pumping capacity well and the uppermost perforations are located no shallower than 150 feet deep, the perforations may be shallower (e.g., 100 feet deep), if there is a total of at least 50 percent fine-grained

[17] Streamflow depletion is to be calculated using industry standard method(s) appropriate to the aquifer and surface water source under consideration, such methods include the Hantush Equation applicable for unconfined aquifers with a direct hydraulic connection to a surface water body (Hantush, 1965).

materials in the interval above 100 feet below ground surface (bgs), and at least one fine-grained layer that exceeds 40 feet in thickness in the interval above 100 feet bgs.

FIGURE F-2. WAA Additional Analysis Decision Tree (as shown, for groundwater/surface water evaluation), where designated A = applicant responsibility, C = County staff responsibility



[1] Streamflow depletion to be calculated using industry standard method(s) appropriate to the aquifer under consideration, such methods include the Hantush Equation applicable for aquifers hydraulically connected with surface waters (**A** or **C**).

[2] Streamflow depletion criteria will be determined according to site-specific conditions (C).

[3] This site-specific analysis may include an aquifer test or an alternative study at the proposed well site to refine aquifer properties used in drawdown calculations and must include details of the project well(s) construction and operation relative to the site hydrogeology and any known information concerning the surface water(s) under consideration (**A**).

Data Needs for Additional Analysis

Hydrogeologic information at or in the vicinity of the subject parcel may be available from previous activities, or may be reasonably estimated from prior work conducted by the County. Previous activities may include (but are not limited to) aquifer tests, well completion reports with lithologic logs, water level, and well yield data collected on the parcel, and water level data collected as part of other groundwater monitoring activities. County staff will determine whether and how to best include such data in the WAA evaluation process. If no geologic information exists in the vicinity of the subject parcel, additional analysis may be required of the applicant.

The hydrogeologic information needed for WAA evaluation may include the aquifer storage coefficient, specific yield, hydraulic conductivity, transmissivity, and aquifer thickness. The aquifer storage coefficient for confined aquifers, or storativity, is defined as the volume of water that can be drained from a unit area of aquifer materials per unit decline in head. The storage coefficient can be calculated by multiplying the aquifer thickness and specific storage. In unconfined aquifers a similar property is represented by the specific yield of the aquifer materials.[18] Specific yield is defined as the volume of water that can be drained from a unit area of an unconfined aquifer in response to a unit decline in the water table elevation. **Table F-2** presents a range of values for specific yield for a variety of potential aquifer materials. In a confined aquifer the specific storage of aquifer materials can be calculated as the storage coefficient multiplied by aquifer thickness, where the storage coefficient is the volume of water produced by a unit volume of aquifer material per unit decline in head. **Table F-3** presents a range of possible specific storage values for potential aquifer materials. Storage coefficients for confined aquifers typically range from $5x10^{-5}$ to $5x10^{-3}$ (Todd, 2005). Specific yield for unconfined aquifers typically range from 0.1 to 0.3 (Lohman, 1972).

Table F-2. Representative Specific Yield[1] Ranges for Selected Earth Materials
(adapted from Walton, 1970)

Sediment	**Specific Yield**
Clay	0.01 – 0.10
Sand	0.10 – 0.30
Gravel	0.15 – 0.30
Sand and Gravel	0.15 – 0.25
Sandstone (e.g., Great Valley formation)	0.05 – 0.15
Shale (e.g., Great Valley formation)	0.005 – 0.05

[1]Specific yield can be considered equivalent to the storage coefficient for unconfined aquifers where aquifer compressibility is negligible.

Table F-3. Representative Specific Storage Ranges for Selected Materials
(adapted from Batu, 1998)

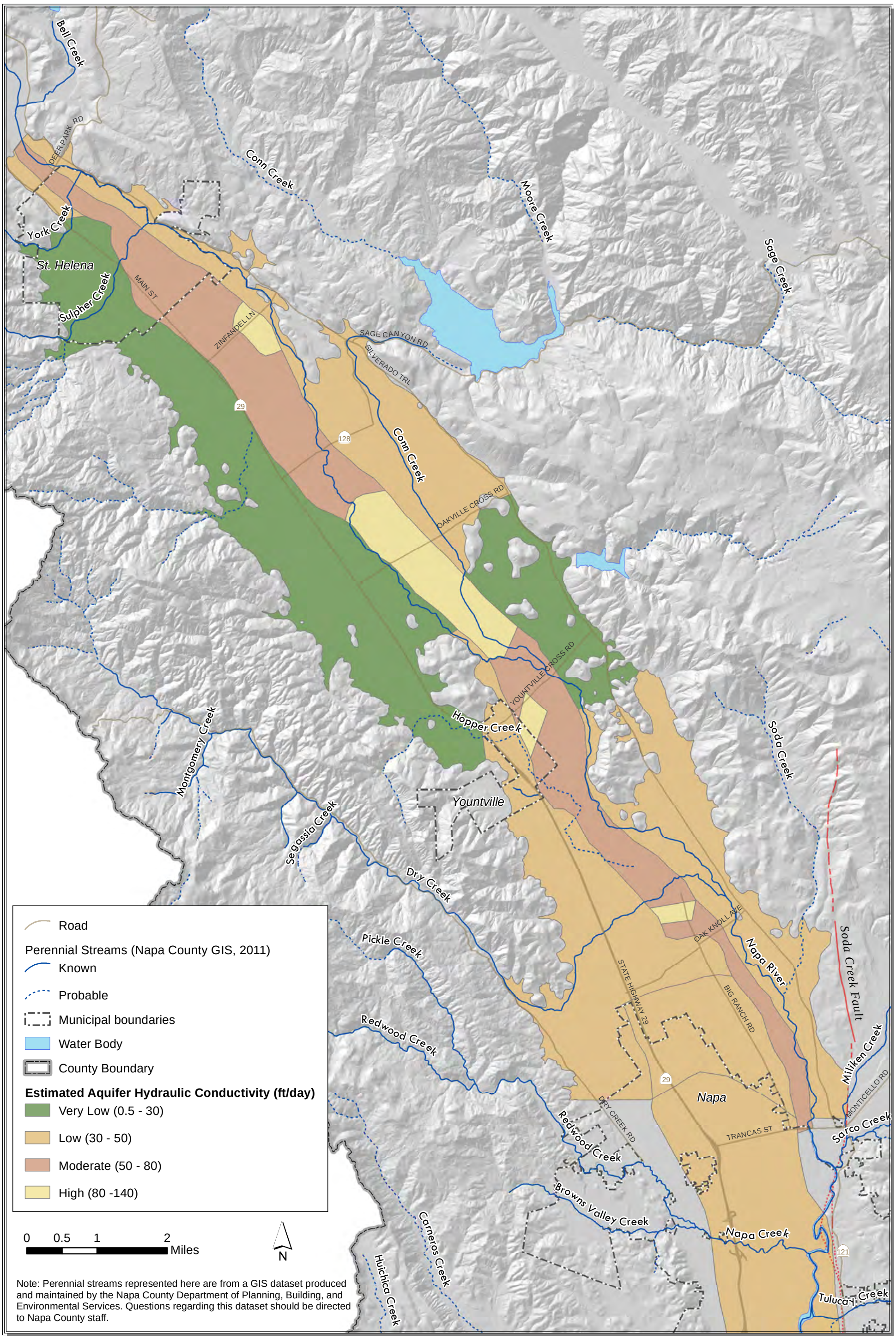
Material	**Specific Storage (ft^{-1})**		
Loose Sand	$1.5x10^{-4}$	to	$3.1x10^{-4}$
Dense Sand	$3.9x10^{-5}$	to	$6.2x10^{-5}$
Dense Sandy Gravel	$1.5x10^{-5}$	to	$3.1x10^{-5}$
Rock, fissured	$1x10^{-6}$	to	$2.1x10^{-5}$

[18] An unconfined aquifer is defined by a water table that occurs where pore space pressures coincide with atmospheric pressure and where water released from aquifer storage occurs in large part due to the draining of saturated pore spaces in the aquifer material.

Transmissivity is another frequently used aquifer parameter. Transmissivity is defined as the capacity of the aquifer to transmit water across its entire thickness, calculated as the product of the aquifer hydraulic conductivity and the aquifer thickness. **Table F-4** presents representative hydraulic conductivity values found in the literature. Hydraulic conductivity ranges for the alluvial aquifer system have been mapped in Napa Valley by the US Geological Survey (USGS) (Faye, 1973), with more recent interpretations provided here based on a review of well driller's logs and other geologic data available through 2011 (LSCE and MBK, 2013). These ranges for hydraulic conductivity are depicted in **Figure F-3** and described in **Table F-5**, as interpreted by the County's groundwater consultants. Recent hydrogeologic investigations performed for the County have also produced maps and cross sections of subsurface geologic conditions which may be consulted for the determination of aquifer thickness in the vicinity of a proposed project (LSCE and MBK, 2013).

Table F-4. Representative Hydraulic Conductivity Ranges for Selected Materials (adapted from Leap, 1999 and Batu, 1998)

Material	**Hydraulic Conductivity (ft/day)**		
Gravel (Alluvium)	10^{1}	to	10^{5}
Sand (Alluvium)	10^{-1}	to	10^{3}
Silty Sand (Alluvium)	10^{-2}	to	10^{2}
Silt (Alluvium)	10^{-4}	to	1
Sandstone (e.g. Great Valley formation)	10^{-5}	to	10^{-1}
Shale (e.g., Great Valley formation)	10^{-8}	to	10^{-4}
Fractured Basalt (e.g., Sonoma Volcanics)	10^{-2}	to	10^{2}



Note: Perennial streams represented here are from a GIS dataset produced and maintained by the Napa County Department of Planning, Building, and Environmental Services. Questions regarding this dataset should be directed to Napa County staff.

Path: X:\2011 Job Files\11-090\GIS\Task 4\Fig 7_2 Conductivity Zones.mxd

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Figure F-3
Estimated Alluvial Aquifer Hydraulic Conductivity Ranges, Napa Valley Floor

Table F-5. Representative Hydraulic Conductivity values for WAA analysis of Napa Valley Floor unconsolidated alluvial aquifer materials[3]

Hydraulic Conductivity, K, class	**Hydraulic Conductivity range[1], ft./day**	**Hydraulic Conductivity value, ft./day** (used for scenario results)
high	80 - 140	80
moderate	50 - 80	50
low	30 - 50	30
very low[2]	0.5 - 30	0.5, 10

[1] Hydraulic conductivity range have been developed from mapped values from Faye (1973) and interpretations based on a review of well driller's logs and other geologic data available through 2011 (LSCE and MBK, 2013).

[2] A hydraulic conductivity value of 0.5 ft./day was applied for calculations of groundwater and surface water interaction (Tables 3, 4 and 5). A hydraulic conductivity value of 10 ft./day was applied for calculations of well interference (Table 2B and F1).

[3]Representative hydraulic conductivity values shown here are applicable to the unconsolidated alluvial aquifer materials in the Napa Valley Floor and not aquifer zones beneath the Napa Valley Floor alluvium or outside of the Napa Valley Floor.

County staff will review well construction permits and records for wells within 500 feet of the proposed project. Information about existing wells within 500 feet of the proposed project site will include the following as available: the location of those wells relative to the project well(s), total depth, depth of screened intervals, annular seal depths, the geologic or lithologic record made as part of well construction, the elevation of the static water level in the well post-construction, the elevation of water levels while pumping, and the pump depth setting.

Tables F-6 to F-9 present, for comparison purposes, the results of scenarios intended to represent the groundwater drawdown experienced in the vicinity of a proposed project after a 24-hour continuous pumping period. The results in **Tables F-6 and F-7** indicate that drawdown in a confined aquifer would be greater than drawdown in an unconfined aquifer for a given pumping rate. These results also indicate that wells pumping at rates less than 30 gallons per minute (gpm) for periods of time less than 24-consecutive hours will likely have negligible drawdown effects at distances beyond 25 feet in a confined aquifer.

These scenarios are presented for comparison purposes. Actual drawdown due to well interference will have to be calculated using well construction information and site-specific hydrogeologic information and/or values from **Tables F-2, F-3, F-4 and F-5** that are applicable to site-specific conditions.

Table F-6: Simulated effect of a project well on water levels at an existing non-project well after one day of pumping at the stated flow rate in a confined aquifer

30 gpm Scenarios, calculated drawdown (ft)					
aquifer thickness = 75 ft. time = 1 day		distance between project well and existing non project well (ft)			
Specific Storage	Hydraulic Conductivity (ft./day)	**25**	**50**	**100**	**500**
0.0005	10	5.3	4.4	3.6	1.6
0.001	10	4.8	4.0	3.1	1.2

Table F-7: Simulated effect of a project well on water levels at an existing non-project well after one day of pumping at the stated flow rate in a confined aquifer

100 gpm Scenarios, calculated drawdown (ft)					
aquifer thickness = 75 ft. time = 1 day		distance between project well and existing non-project well (ft)			
Specific Storage	Hydraulic Conductivity (ft./day)	**25**	**50**	**100**	**500**
0.0005	10	13.6	11.5	9.4	4.5
0.001	10	12.5	10.4	8.3	3.5

Table F-8: Simulated effect of a project well on water levels at an existing non-project well after one day of pumping at the stated flow rate in an unconfined aquifer

30 gpm Scenarios, calculated drawdown (ft)					
aquifer thickness = 75 ft. time = 1 day		distance between project well and existing non-project well (ft)			
Specific Storage	Hydraulic Conductivity (ft./day)	**25**	**50**	**100**	**125**
0.1	80	0.4	0.3	0.2	n/a
0.1	50	0.6	0.4	n/a	n/a
0.1	30	0.9	0.6	n/a	n/a
0.1	10	2.0	n/a	n/a	n/a

"n/a" denotes cases where Theis equation results are not available due to mathematical constraints on valid parameter values.

Table F-9: Simulated effect of a project well on water levels at an existing non-project well after one day of pumping at the stated flow rate in an unconfined aquifer

100 gpm Scenarios, calculated drawdown (ft)					
aquifer thickness = 100 ft. time = 1 day		distance between project well and existing non-project well (ft)			
Specific Storage	Hydraulic Conductivity (ft./day)	**25**	**50**	**100**	**125**
0.1	80	1.1	0.8	0.6	0.5
0.1	50	1.6	1.2	n/a	n/a
0.1	30	2.4	1.7	n/a	n/a
0.1	10	5.5	n/a	n/a	n/a

"n/a" denotes cases where Theis equation results are not available due to mathematical constraints on valid parameter values.

Example Applications of Additional Analysis Methods

Example 1*: Addition of a commercial tasting room facility with 10 acres of new vineyard and landscaping to an existing winery in a non-groundwater deficient area. The project involves construction of a new well proposed to be 30 feet from an existing six-inch diameter non-project well.*

Is well proposed to be completed in the same aquifer as an existing well ≤ 500 ft. away?

Yes, County well construction records indicate that the existing non-project well was constructed to a total depth of 160 feet in an unconfined aquifer, with a total screened interval of 80 feet throughout the older alluvium that is also mapped in the vicinity of the proposed well.

Calculate drawdown at all existing wells within 500 ft. of the proposed well. Is the calculated drawdown significant?

Yes, 10.9 feet of drawdown is calculated at the existing non-project well, based on available information about the existing well and the hydrogeology of the site (see **Table F-10**). This amount of drawdown exceeds the default well interference criterion of 10 feet and represents a potentially significant impact on groundwater resources.

Table F-10. Example 1: Drawdown calculated at an existing non-project well as a result of pumping a proposed well at 300 gallons per minute, where hydraulic conductivity = 30 ft./day, storage coefficient = 0.02, and aquifer thickness = 80 feet.		
	Distance between Proposed Well and Existing Well (ft.)	**Calculated Drawdown in Existing Well (ft.)[1]**
Initial Project Well Location	30	10.9
Alternate Project Well Location A	50	9.0
Alternate Project Well Location B	70	7.7
[1] Drawdown at an existing non-project well as a result of pumping the project well calculated using the Theis Equation.		

Conduct a site-specific analysis of drawdown induced by project well(s). Include, as necessary, site-specific project modifications (i.e., revise proposed well location, construction, and/or operational details).

Is simulated drawdown significant (see Table F-1)?

No, after reviewing the site's existing and proposed infrastructure the project applicant modified the proposed well location to a location 50 feet away from the existing non-project well. Calculated drawdown values at the existing wells using the same available information about the existing wells, site hydrogeology, and the new proposed well location show less than significant drawdown at the existing non-project well (i.e., 9.0 feet). The applicant's groundwater use permit was approved on the condition of adherence to the revised well location and County standards for well construction.

Example 2*: Modification of an existing 40-year old irrigation well on a 12-acre parcel. The parcel also includes a primary, single-family residence with an existing (or available) connection to a public water supply system. The applicant proposes installing a new 80 gallon per minute pump to supply irrigation water for 10 acres of replanted winegrapes on lands which had not been actively farmed for several years. The applicant proposes operating the pump for 3 days at a time during the irrigation season. One existing non-project well is located 50 feet from the applicant's project well on one adjacent parcel and another existing non-project well is located 120 feet from the applicant's project well on another adjacent parcel. Both non-project wells are six-inch diameter wells.*

Is well proposed to be completed in the same aquifer as an existing well ≤ 500 ft. away?

Yes, well construction records provided by the applicant (or available from the County) indicate that the applicant's existing well is constructed to a total depth of 140 feet, with a total screened interval of 60 feet, in the older, unconsolidated alluvium.

County well construction records indicate that the existing non-project 50 feet from the project well was constructed to a total depth of 115 feet, with a total screened interval of 50 feet throughout the older alluvium.

Calculate drawdown at all existing wells within 500 ft. of the proposed well. Is the calculated drawdown significant?

No, 5.8 feet of drawdown is calculated to occur at the existing non-project well, based on available information about the existing well and the hydrogeology of the site (see **Table F-11**). This amount of drawdown does not exceed the default well interference criterion of 10 feet and represents a less than significant impact on groundwater resources. The applicant's groundwater use permit was approved contingent upon the proposed pumping duration.

Table F-11. Example 2: Drawdown calculated at an existing non-project well as a result of pumping the applicant's existing project well, where hydraulic conductivity = 10 ft./day, storage coefficient = 0.1, and aquifer thickness = 60 feet.

	Applicant's well pumping rate (gpm)	**Applicant's well seasonal pumping duration (days)**	**Calculated Drawdown in Existing Well (ft.)[1]**
Initial Proposal	80	3	5.8

[1] Drawdown calculated using the Theis Equation at an existing non-project well as a result of pumping the applicant's existing project well located 50 feet away.

Definitions

Aquifer – A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Aquifer Unit - One part of a number of units that comprise a larger aquifer system.

Hydraulic Conductivity – The capacity of subsurface materials to permit flow through interconnected pores, fractures, or other void spaces, subject to intrinsic properties of the fluid. As applied in this WAA, hydraulic conductivity is equivalent to saturated hydraulic conductivity.

Specific Storage– an aquifer hydraulic property which is the volume of water that can be drained from a unit volume of aquifer materials per unit decline in head.

Specific Yield – an aquifer hydraulic property which is the volume of water that can be drained from a unit area of an unconfined aquifer in response to a unit decline in the water table elevation.

Storage Coefficient (also Storativity) – an aquifer hydraulic property which is the volume of water released or added to aquifer storage per unit surface area of a confined aquifer per unit change in head.

Substantial Evidence - Defined by case law as evidence that is of ponderable legal significance, reasonable in nature, credible and of solid value. The following constitute substantial evidence: facts, reasonable assumptions predicated on facts; and expert opinions supported by facts. Argument, speculation, unsubstantiated opinion or narrative, or clearly inaccurate or erroneous information do not constitute substantial evidence.

Surface Water - For the purposes of this procedure, surface waters are defined to include only those surface waters known or likely to support special status species or surface waters with an associated water right; <u>however, as with all of the procedures in this WAA, there may be unique circumstances that require additional site-specific analysis to adequately evaluate a project's potential impacts on surface water bodies</u>.

Transmissivity – an aquifer hydraulic property which reflects the capacity of the aquifer to transmit water across its entire thickness, calculated as the product of the aquifer hydraulic conductivity and the aquifer thickness.

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