APPENDIX B

Initial Study

Modified Initial Study
for the Roberts' Ranch Specific Plan Project

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APPENDICES

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1 INTRODUCTION

This Initial Study has been prepared to identify and assess the anticipated environmental impacts of the Roberts' Ranch Specific Plan project (proposed project). This document relies on the City of Vacaville General Plan approved by the City of Vacaville City Council on August 11, 2015 and its accompanying Environmental Impact Report (SCH#2011022043), also certified on August 11, 2015 (Resolution 2015-074) (General Plan EIR).

This document has been prepared to satisfy the California Environmental Quality Act (CEQA), (Public Resources Code, Section 21000 et seq.) and the State CEQA Guidelines (14 CCR 15000 et seq.). CEQA requires that all state and local government agencies consider the environmental consequences of projects over which they have discretionary authority before acting on those projects. The environmental analysis in this Initial Study is based on Sections 15168 and 15183 of the CEQA Guidelines, which governs program EIRs and projects consistent with a general plan or community plan. Under these sections, the program EIR, in this case the City's General Plan EIR, serves as a basis for the Initial Study to determine if project-specific impacts would occur that are not adequately covered in the previously certified EIR. The proposed project's land uses and development assumptions are consistent with the City's General Plan. The Lead Agency (City of Vacaville) is not required to examine environmental impacts that have been evaluated in a previously certified EIR if the project would not lead to new or substantially greater environmental impacts.

The Initial Study is a public document used by the lead agency to determine whether a project may have a significant effect on the environment. If the lead agency finds substantial evidence that any aspect of the project, either individually or cumulatively, may have a significant effect on the environment, regardless of whether the overall effect of the project is adverse or beneficial, the lead agency is required to prepare an EIR. Where the lead agency determines that some impacts may be significant while others will not be significant or can clearly be mitigated to less-than-significant levels through mitigation measures to which the project proponent has agreed, the agency may prepare an EIR focused on the potentially significant impacts. Under this last approach, a lead agency may use an Initial Study to satisfy the requirements of CEQA Guidelines section 15128, which requires that an EIR "shall contain a statement briefly indicating the reasons that various possible significant effects of a project were determined not to be significant and were therefore not discussed in detail in the EIR. Such a statement may be contained in an attached copy of an Initial Study."

Since the certification of the General Plan EIR in 2015, there have been no significant changes in the physical environment that could result in new or substantially increased impacts related to the project. For example, the Brighton Landing Specific Plan project continues to be under construction and will remain within the density limits anticipated by the General Plan EIR.

This Modified Initial Study serves to evaluate whether the environmental impacts of the proposed project are addressed in the General Plan EIR. This Modified Initial Study indicates whether the proposed project would result in significant impact that: (1) is peculiar to the project or the project site; (2) was not identified as a significant effect in the General Plan EIR; or (3) are previously identified significant effects which as a result of substantial new information that was not known at the time that the General Plan EIR was certified, and are determined to have a more severe adverse impact than discussed in the General Plan EIR. Such impacts will be evaluated in the EIR (CEQA Guidelines Section 15183).

1.1 Project Overview and Project Background

The Roberts' Ranch Specific Plan includes approximately 785 single-family residences with an average density of 3.2 dwelling units/acre (du/ac), parks, 25 acres of open space and trails, and a future 16-acre school site. The proposed project includes four neighborhoods (or villages) that each contain one or two small "stroller parks" connected by a multipurpose trail system designed to link all the parks together. Additional information on the project, including figures are provided in Chapter 3, Project Description, of the EIR.

The proposed project is located in northern Solano County adjacent to the southeastern corner of the City of Vacaville approximately four miles from Downtown Vacaville and is surrounded by single-family residential development to the west and north, undeveloped agricultural land to the south, and undeveloped agriculture land and the Union Pacific railroad tracks to the east. The topography of the project site is flat and located approximately 85 feet above mean sea level. The site is currently used to grow row crops and historically crops grown include alfalfa and tomatoes. There is an existing PG&E easement in the eastern portion of the site for 500 kV and 230 kV overhead transmission lines that are part of the statewide electrical system. In addition, a Solano Irrigation District (SID) irrigation canal traverses the site from east to west. There are no trees or buildings present on the site.

The project site is part of the East of Leisure Town Road Growth Area, included in the City's General Plan. This is one of two Growth Areas identified in the General Plan for future development. The land uses and general infrastructure assumptions of the proposed project are consistent with the City's General Plan have been evaluated in the General Plan EIR as part of the projected growth allowed in the East of Leisure Town Road Growth Area.

1.2 California Environmental Quality Act Compliance

This Initial Study provides the evidence required that the General Plan environmental determinations are applicable to this project.

The following is an overview of the steps followed for the environmental review of the proposed project.

- Review the proposed project against the impact analysis and mitigation measures contained in the City's General Plan EIR.
- Identify any previously adopted mitigation measures from the General Plan EIR that apply to the proposed project.

The primary source reviewed for the preparation of this Modified Initial Study is the City's General Plan EIR and associated technical studies, available at the City's Community Development Department office and online at http://www.cityofvacaville.com/index.aspx?page=878.

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2 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

In reviewing the site specific information provided for this project, the City of Vacaville has analyzed the potential environmental impacts created by this project and determined that at least one impact is considered to be potentially significant. Therefore, on the basis of the following initial evaluation, we find that the proposed project may have a significant effect on the environment, and an Environmental Impact Report (EIR) will be required. Because many impacts will be less than significant or can be clearly mitigated to a less-than-significant level, the EIR will be focused on those impacts that are determined to be potentially significant. Based on the findings of this IS, both project-specific impacts and cumulative impacts in the following issue areas will be further evaluated in the EIR:

☐ Aesthetics	☐ Agriculture and Forestry Resources	☒ Air Quality
☒ Biological Resources	☒ Cultural Resources	☐ Geology and Soils
☐ Greenhouse Gas Emissions	☐ Hazards and Hazardous Materials	☒ Hydrology and Water Quality
☒ Land Use and Planning	☐ Mineral Resources	☐ Noise
☐ Population and Housing	☐ Public Services	☐ Recreation
☒ Transportation and Traffic	☒ Utilities and Service Systems	☐ Mandatory Findings of Significance

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☒ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature

11-16-16
Date

3 EVALUATION OF ENVIRONMENTAL IMPACTS

The following contains the environmental checklist form presented in Appendix G of the CEQA Guidelines. The Checklist is used to describe the impacts of the proposed project. A discussion follows each environmental issue identified in the checklist. Included in each discussion are project-specific mitigation measures, if required and recommended as appropriate for the proposed project.

For this Checklist, the following designations are used:

Significant Impact Peculiar to the Project or Project Site: An impact that could be significant due to something peculiar to the project or the project site that was not previously identified in the prior EIR. If any potentially significant impacts are identified, an EIR must be prepared.

Significant Impact due to New Information: Any impact that would be considered significant based on new information which was not known at the time the prior EIR was prepared. If any significant impacts are identified, an EIR must be prepared.

Impact Adequately Addressed in General Plan EIR: Impacts previously evaluated in the City's General Plan EIR that would not change from what was evaluated previously.

	Significant Impact Peculiar to the Project or the Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
I. AESTHETICS – Would the project?			
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒
b) Substantially damage scenic resources including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☒

Environmental Setting

The project site is located in Solano County immediately adjacent to the City of Vacaville's eastern boundary. Downtown Vacaville is located approximately four miles northwest of the project site. The site is bounded by Leisure Town Road on the west, Alamo Drive extension and Fry Road on the south, the Union Pacific Railroad right-of-way on the east, and the approved Brighton Landing project to the north. Surrounding land uses include single-family residential

development to the north and west and undeveloped agricultural land to the south and east. Existing sources of light from street lights and building lights is visible at night from the residential uses to the north and west. The project site is entirely cultivated and planted with row crops. There are no trees or buildings on the site.

The City of Vacaville General Plan does not designate areas as "scenic vistas", however, a number of scenic vistas within the City could be considered scenic and worthy of preservation (City of Vacaville 2014a, p. 4.1-3). These vistas contain portions of the Inner Coast Range including the English Hills north of the City, hills surrounding Lagoon Vallejo in the southwest, and westward views of the Vaca Mountains and views of the Inner Coast Range hillsides within the City. These views are visible throughout the city, but in many areas are partially or fully blocked by existing buildings and trees. Uninterrupted views of these vistas are visible along roadways in the Lagoon Valley and English Hills areas such as Dobbins Road/Gibson Canyon Road, Vine Street, Brown Street, Browns Vallejo Road and along roadways in rural residential and agricultural areas including Hawkins Road, Elmira Road and Fry Road in eastern Vacaville (City of Vacaville 2014a, p.4.1-6). There are no State Scenic Highways in Vacaville (City of Vacaville 2015a, p. COS-24).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy LU-P1.1:** Maintain Vacaville as a freestanding community surrounded by foothills, farmland and other open space.
- **Policy LU-P1.2:** Protect Vacaville's natural environment. Integrate creeks, hills, utility corridors, and other significant natural features into major development plans.
- **Policy LU-P1.3:** Preserve the predominant single-family residential character of Vacaville while providing other housing opportunities.
- **Policy COS-P8.1:** Preserve scenic features and the feel of a city surrounded by open space, and preserve view corridors to the hills and other significant natural areas**.**
- **Policy COS-P8.2:** Retain major ridgelines and hillsides as open space.

Discussion

a) As discussed in the environmental setting above, The City's General Plan does not designate official scenic vistas, but recognizes that views of and from the city comprise an important element of the City's quality of life (City of Vacaville 2015a, p. COS-24). The General Plan EIR evaluated future development in the area East of Leisure Town, which includes the project site. This area currently contains large open spaces and provides expansive views of the hillsides to the west. The General Plan EIR determined that new development in this area would be expected to significantly alter these views. The General Plan includes relevant goals and

policies that would preserve scenic views including policies requiring protection of the city's natural environment and preserving scenic features and view corridors to the hills and other natural areas. The proposed project has been designed to comply with policies COS-P8.1, LU-P1.2 and P1.3 by integrating open spaces, including the agricultural buffer area and the detention basin, into the community and offering a range of home options that retain the predominant single-family character of the community. The General Plan EIR concluded that new development designed consistent with General Plan policies would minimize impacts to scenic vistas to a level that is less than significant. The project applicant will comply with the City's General Plan policies to minimize impacts to scenic vistas; and the impact would not change from what was identified in the General Plan EIR.

b) There are no designated State Scenic Highways within the City of Vacaville. The General Plan EIR concluded the impact was less than significant. The proposed project would have no impact on scenic resources along a State Scenic Highway. The impact would not change from what was identified in the General Plan EIR (City of Vacaville 2013, p. 4.1-8).

c) As stated in the General Plan, most of Vacaville's scenic resources are associated with open space, natural resources and agricultural uses and include riparian corridors throughout the city and views of the rural and undeveloped lands (City of Vacaville 2015a, p. COS-24). The General Plan designates some of these undeveloped and open lands for residential, commercial, and business/industrial uses. Compliance with the General Plan policies described in section (a) above, would reduce the aesthetic impact of development on currently undeveloped lands. The General Plan EIR concluded that future development, including development of the project site, would alter the existing rural and agricultural appearance of these undeveloped areas, which would result in a substantial change that cannot be mitigated except by foregoing development. The General Plan EIR found future development would substantially degrade the existing visual character or quality of these undeveloped areas and the impact would be significant and unavoidable.

   The proposed project would be designed to complement the backdrop of agricultural lands by creating interrelated landscaping without strong boundaries or transitions. Boundaries between open space, agricultural buffers, and the detention basin to the east would not be fenced or marked to reinforce a connection between the areas. Open space and parks would be integrated throughout the project site, and the project proposes a variety of historic and modern architecture in order to retain the unique character of the City. The project design would comply with the City's General Plan policies to minimize impacts to visual character; therefore, the project would not result in a significant impact not already identified in the General Plan EIR.

d) The General Plan EIR determined that lighting associated with new development, including the project site, would have the potential to increase light and glare levels (City of Vacaville 2013, p. 4.1-11). All new development would be required to comply with standards for light and glare established in Section 14.09.127 of the City's Land Use Development Code. Specifically, in compliance with Section 14.09.127.110, all lighting would be shielded and directed to avoid hazards or nuisance to other properties or impact traffic on adjacent streets, exterior lighting would be installed to identify building entrances and promote safety, and parking lot lighting would comply with the Off-Street Parking and Loading Design Guidelines (City of Vacaville 1996a). The Off-Street Parking and Loading Design Guidelines provisions include, but are not limited to, limiting exterior lighting to a minimum of one foot candle and a maximum of six foot candles, creation of a photometric plan demonstrating compliance with lighting standards and a site plan showing location and design of exterior fixtures. The General Plan EIR concluded that implementation of these standards by future development would prevent the creation of sources of light and glare that would adversely affect views and impacts would be less than significant (City of Vacaville 2013, p. 4.1-11).

The project would include lighting along Leisure Town Road, Fry Road and Alamo Drive Extension that is compatible with the Jepson Parkway Concept Plan. The proposed Specific Plan addresses lighting throughout the project and includes lighting that contributes to safety and visual continuity and would meet the City's standards, as noted in Section 5.4.11 of the Draft Roberts' Ranch Specific Plan (City of Vacaville 2015d). The project complies with the General Plan policies as well as the City's Land Use Development Code; therefore, the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
II. AGRICULTURE AND FORESTRY RESOURCES – Would the project?			
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☒

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☒

Environmental Setting

Solano County and the City of Vacaville contain land designated by the California Department of Conservation Farmland Mapping Program as Prime Farmland, Farmland of Statewide Importance, Unique Farmland and grazing land (DOC 2014). Areas in northern and southern Vacaville are predominantly grazing land, with the exception of areas of Prime Farmland and Farmland of Statewide Importance near the southeastern boundary of the City and an area of Prime Farmland in the Gibson Canyon area (City of Vacaville 2013, p. 4.2-11). The eastern side of Vacaville contains most of the Prime Farmland. According to the General Plan EIR, the City has approximately 199 acres of Prime Farmland and 1,079 acres of non-prime farmland under active Williamson Act contracts and approximately 147 acres of Prime Farmland and 133 acres of non-prime farmland under Williamson Act contracts that are in non-renewal status (City of Vacaville 2013, p. 4.2-9).

According to 2002 mapping data from the California Department of Forestry and Fire Protection (Cal Fire), isolated woodlands are located in the southwestern and northern portions of the City primarily on hillsides and vacant and agricultural lands (City of Vacaville 2013, p.4.2-14).

The project site is actively farmed and a majority of the site is designated as Prime Farmland, with smaller portions designated as Farmland of Statewide Importance and Unique Farmland (DOC 2014). The project site is zoned A-40, Exclusive Agricultural 40 acres in the Solano County General Plan (Solano County 2008). The project site is not under an active Williamson Act contract or a Farmland Security Zone contract (City of Vacaville 2013, Figure 4.2-2).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy LU-P2.4:** Require that development on any prime farmland, farmland of statewide importance, or unique farmland (as classified by the California Department of Conservation) purchase conservation easements to permanently protect agricultural lands of equal or greater value at a ratio of 1 acre of conserved agricultural land per 1 acre of developed agricultural land.

- **Policy LU-P5.2:** Lands East of Leisure Town Road: In conjunction with approval of any new urban development on lands shown as "Area B" on Figure LU-3, which consists of lands that are inside the Urban Growth Boundary but east of Leisure Town Road and between the Locke Paddon Community areas on the north and New Alamo Creek on the south, the City shall require such development to mitigate its impact on agricultural and open space lands by preserving, to the extent consistent with applicable law, for each acre of land developed, at least 1 acre of land outside the Urban Growth Boundary but within Pleasants Valley, Upper Lagoon Valley, or Vaca Valley, or any other location that is within 1 mile of the Urban Growth Boundary. Alternatively, to the extent consistent with applicable law, such development may pay an equivalent in-lieu fee as determined by the City in consultation with the Solano Land Trust. Lands acquired directly or with fees collected pursuant to this requirement shall first be offered to the Solano Land Trust. Any such fees transferred to the Solano Land Trust may only be used to acquire or protect lands outside of the Urban Growth Boundary but within 1 mile of the Urban Growth Boundary, or within Pleasants Valley, Upper Lagoon Valley or Vaca Valley. Acquisitions pursuant to this requirement shall be coordinated with the Solano Land Trust.

If for any reason adequate land to meet the conservation goals described in the Vacaville General Plan, and in particular this section, cannot be identified or acquired, the City and the Solano Land Trust, or if the Solano Trust declines to participate, the City and another land conservation entity shall meet and confer to identify other areas where conservation acquisitions can occur at a reasonable cost and to satisfy the conservation goals described in this section.

- **Policy LU-P5.3:** Coordination with Future Solano County LAFCO Open Space or Agricultural Land Mitigation Program: If the Solano County Local Agency Formation Commission (LAFCO) adopts an open space or agricultural land mitigation program applicable to the area defined in Policy LU-P5.2, lands defined therein shall be subject only to the requirements of the LAFCO mitigation program, provided that if the requirement described in Policy LU-P5.2 provides greater mitigation than the LAFCO requirement, the incremental difference between the two programs shall be imposed in addition to the LAFCO requirement to the maximum extent permitted by State law. To the extent the LAFCO requirement and this requirement overlap, development shall be subject to only the LAFCO requirement.
- **Policy COS-P4.1:** Within the area east of Leisure Town Road, south of the Locke Paddon Community, and north of the railroad tracks, as shown in Figure LU-6 in the Land Use Element, require new development to maintain a 300- to 500-foot wide agricultural buffer along the eastern boundary of all residential development and existing agricultural lands. Require that uses within the agricultural buffer be limited to passive

open space uses that are not accessed by a large number of employees or the general public at one time. Permitted uses within the buffer shall be limited as described below:

- Any portion of the buffer located inside the Urban Growth Boundary, adjacent to the Pacific Gas & Electric Company easement, shall contain substantial landscaping to discourage unlawful access onto the agricultural lands, and to lessen the potential impacts of typical agricultural activities on residential uses. Passive recreational uses such as pedestrian and bicycle trails are permitted.
- Uses located outside of the Urban Growth Boundary, within the 385-foot wide Pacific Gas & Electric Company easement, shall be limited to public infrastructure improvements necessary or appropriate to serve or protect existing and new permitted uses within the Urban Growth Boundary, including but not limited to, alternative energy facilities, stormwater detention basins, water tanks (reservoirs), and sewer and water lines to accommodate buildout of the Vacaville General Plan.

- **Policy COS-P4.2:** For interim residential development in areas east of Leisure Town Road, as described in Policy COS-P4.1, while adjacent agricultural operations are still on-going, require a disclosure to residents that agricultural operations happen nearby and that they will be exposed to impacts from such operations, such as dust, noise and odors.

Discussion

a) The General Plan EIR evaluates the conversion of agricultural land to non-agricultural uses in the area east of Leisure Town Road, which includes the project site. General Plan Policy LU-P2.4 requires development or conversion of any Prime Farmland, Farmland of Statewide Importance, or Unique Farmland (as classified by the California Department of Conservation) to developed uses to purchase conservation easements. The conservation easements are designed to permanently protect lands of equal or greater value at a ratio of one acre of conserved agricultural land per one acre of developed agricultural land. The General Plan EIR noted that compliance with policies implemented by the City to protect agricultural lands and minimize loss of agricultural resources would not mitigate the conversion of agricultural land to non-agricultural uses and the impact would be significant and unavoidable.

   The proposed project would develop 248-acres of Prime Farmland, Farmland of Statewide Importance and Unique Farmland. The project applicant proposes to protect lands of equal or greater value through the mitigation strategies identified in the General Plan. These strategies would be implemented through a Development Agreement between the applicant and the City. The project would either purchase conservation easements to permanently protect agricultural lands of equal or greater value at a ratio of 1 acre of conserved agricultural land per 1 acre of developed agricultural land to preserve 248 acres of Prime

Farmland, Farmland of Statewide Importance, or Unique Farmland, in compliance with Policy LU-P2.4, or fund the creation of new irrigated farmland that includes Prime Farmland, Farmland of Statewide Importance, or Unique Farmland. The project would not result in a significant impact not already identified in the General Plan EIR.

b) Solano County's Uniform Rules require lands under Williamson Act contracts to be under agricultural land use and zoning designations (City of Vacaville 2013, p. 4.2-20). The General Plan EIR determined that future development allowed by the proposed non-agricultural land use designations on 206 acres of Williamson Act contract lands would conflict with the Uniform Rule requirements. The General Plan EIR concluded that this impact would be significant and unavoidable.

The project site is currently designated in the Solano County General Plan for agriculture and zoned A-40 Exclusive Agriculture 40 acres (Solano County 2008, 2015). As part of the project the applicant is proposing to annex the project site into the City of Vacaville and rezone the site for residential uses consistent with the City's General Plan. The project site is not under any Williamson Act contracts (DOC 2013); therefore, implementation of the proposed project would not conflict with any existing contracts. This impact has been adequately addressed in the General Plan EIR and the project would not have any additional impacts.

c,d) The Solano County Zoning Code does not contain a zoning district for forest or timberland (Solano County 2015a). As discussed the Setting above, Cal Fire mapping shows that forest and timberland areas exist in southwestern and northern portions of the City. The project site is not located in one of these areas where forest and timberland were shown to exist. There are no trees, forest or timberland located on the project site and the project would not conflict with forestland zoning or result in the loss or conversion of forestland to non-forest uses. The General Plan EIR concluded that there would be no impact to forest and timberland resources due to buildout of the General Plan. This impact would not change from what was identified in the General Plan EIR.

e) The project site is surrounded by single-family residential development to the west, the recently approved Brighton Landing Subdivision to the north, undeveloped agricultural land to the south, and undeveloped agriculture land and the Union Pacific railroad tracks to the east. Land to the north and west of the project is located within the City of Vacaville and land to the south and the east is located in Solano County. The General Plan allows for development that could result in potentially incompatible urban uses for farms and ranches, which could impair productivity and profitability of agricultural operations (City of Vacaville 2013, p. 4.2-22). The General Plan includes policies COS-P4.1, 4.2 and 4.5 and actions COS-A3.1 and 4.1 which requires development east of Leisure Town Road to maintain a

300- to 500-foot agricultural buffer, provide a disclosure to residents east of the Leisure Town area that residents will be exposed to impacts from agricultural operations, prohibits conversion of buffer lands to developed urban uses, and directs the City to adopt an Agricultural Preservation Policy and an Agricultural Buffer Policy. Compliance with these policies would help to minimize potential conflicts between agricultural and urban uses. The Specific Plan land use plan incorporates the adopted 500-foot agricultural buffer and proposes land uses in compliance with General Plan policies COS-P4.1, 4.2 and 4.5.

The Solano County "Right-to-Farm" ordinance requires that property buyers be notified of potential inconveniences or discomforts resulting from nearby agricultural activities in order to protect agricultural operations from nuisance complaints. Action COS-A4.2 directs the City to adopt a right-to-farm ordinance as well.

There are no forestlands in the project vicinity or on the project site. Forestlands in the project region are not actively used for timber harvesting; therefore, it is unlikely that adjacent urban development would be incompatible or result in the conversion of forest land to non-forest uses. The General Plan EIR concluded that implementation of General Plan policies and actions and compliance with the County's "Right-to-Farm" ordinance would reduce the potential for conversion of agricultural land to non-agricultural uses to less than significant (City of Vacaville 2013, p. 4.2-23-24). The project applicant will comply with General Plan policies identified above and the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
III. AIR QUALITY – Would the project?			
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☒	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒

Environmental Setting

The City is located primarily within the boundaries of the Sacramento Valley Air Basin (SVAB), but a small portion, Lagoon Valley, is located within the San Francisco Bay Area Air Basin (City of Vacaville 2015a, p. COS-30). Mountains surrounding the SVAB create a barrier to air flow, which can trap air pollutants under certain meteorological conditions. These stagnant conditions occur with the highest frequency during autumn and early winter (City of Vacaville 2013, p. 4.3-10). Air quality in a majority of the City is monitored and managed by the Yolo Solano Air Quality Management District (YSAQMD) (City of Vacaville 2015a, p. COS-30). The YSAQMD is responsible for establishing programs, plans and regulations enforcing air pollution controls in order to attain all state and federal ambient air quality standards.

Air pollutants of concern in the City include ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_2 and NO), sulfur dioxide (SO_2), and particulate matter (PM) (City of Vacaville 2015a, p. COS-30). Vehicle use is the primary source of pollutants in the City, which contributes both directly and indirectly to air pollution (City of Vacaville 2015a, p. COS-30). Additional sources of air pollutants include wood smoke from residential fireplaces, construction activities, consumer productions, architectural coatings, fertilizers, asphalt paving, and agriculture operations (City of Vacaville 2013, p. 4.3-15).

Sensitive receptors refer to those segments of the population most susceptible to poor air quality and typically include children, elderly people and sick people, as well as sensitive land uses such as schools, hospitals, parks, and residential communities (City of Vacaville 2015a, p. COS-31).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P12.3:** Encourage project designs that protect and improve air quality and minimize direct and indirect air pollutant emissions by including components that reduce vehicle trips and promote energy efficiency.
- **Policy COS-P12.4:** Require that development projects implement best management practices (BMPs) to reduce air pollutant emissions associated with the construction and operation of the project.
- **Policy COS-P12.5:** Require dust control measures as a condition of approval for subdivision maps, site plans, and all grading permits.
- **Policy COS-P12.6:** Consistent with the Yolo Solano Air Quality Management District's standards, require that any fireplaces in new and significantly renovated residential projects, or commercial projects are pellet-fueled heathers, U.S. EPA Phase II-certified wood burning heaters, or gas fireplaces.
- **Policy COS-P12.10:** Encourage the use of roadway materials that minimize particulate emissions.

Discussion

a) Air plans applicable to the project include the Sacramento Regional 8-Hour Ozone Attainment Plan and Reasonable Further Progress Plan and the 2006 and 2009 Triennial Assessment and Plan Update (City of Vacaville 2013, p. 4.3-18).

The Sacramento Regional 8-Hour Ozone Attainment Plan and Reasonable Further Progress Plan was prepared using population and employment data assumptions based on the City's General Plan adopted in 1990 and amended in 2007 (City of Vacaville 2013 p. 4.3-18). The City's current General Plan did not increase the 2035 population or employment forecast. Therefore, the General Plan EIR found that implementation of policies in the City's Energy Conservation Action Strategy (ECAS) would reduce the total vehicle miles traveled (VMT) below assumptions in the 2007 General Plan. This would ensure future development, including the proposed project would not conflict with air quality assumptions in any of the plans adopted for the purpose of reducing air quality emissions (City of Vacaville 2013, p. 4.3-18).

The 2006 and 2009 Triennial Assessment and Plan Update includes rules and regulations to reduce emissions from sources that are regulated by YSAQMD including agricultural sources, industrial sources and vehicle emissions (City of Vacaville 2013 p. 4.3-19). The Plan includes commitments to implementing feasible measures to attain emissions reductions including controls on architectural coatings, industrial and commercial boilers, steam generators and heaters, graphic arts, internal combustion engines, and large water heaters (YSAQMD 2010). The General Plan EIR determined that the General Plan and ECAS would not conflict with the fulfillment of these commitments and would contribute to a reduction in air quality emissions by implementing measures to reduce regional VMT (City of Vacaville 2013, p. 4.3-19). The General Plan EIR determined that buildout under the General Plan would not conflict with plans adopted for the purpose of reducing air emissions and the impact would be less than significant. The project applicant will comply with applicable General Plan policies and the impact would not change from what was identified in the General Plan EIR.

b) The General Plan EIR evaluated potential impacts from violations of air quality standards for criteria air pollutants, construction emissions and carbon monoxide hotspots resulting from future development anticipated under the General Plan. The General Plan EIR determined that future development would exceed the thresholds for PM_{10} due to the increase in traffic that would occur in 2035 compared to existing conditions, which would result in a significant and unavoidable impact (City of Vacaville 2013, p. 4.3-20). Construction of future development could contribute to short-term degradation of air quality and the release of particulate emissions; however, compliance with General Plan policies COS-P12.4 and 12.5 would reduce construction-related air quality impacts to a less-than-significant level (City of

Vacaville 2013, p. 4.3-21). The City is currently in attainment for State and federal CO standards and the General Plan EIR calculations for 2035 CO concentrations shows that future traffic conditions under the General Plan are not expected to exceed the 1-hour or 8-hour State CO standards and impacts would be less than significant (City of Vacaville 2013, p. 4.3-22). However, project-specific emissions associated with construction and operation of the proposed project may exceed PM_{10}, CO and O_3 and would be quantified and mitigation included if the project would violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, this would be considered a potentially significant impact and will be further evaluated in the EIR.

c) The YSAQMD has prepared an air quality attainment plan to address attainment of State and federal O_3 standards, which addresses growth anticipated under the General Plan (City of Vacaville 2013, p. 4.3-27). Since future development would not exceed acceptable levels of O_3 precursors, or ROG and NOx, above individual thresholds emissions buildout of the General Plan would not conflict with the air district's air quality attainment plan. Implementation of Goal COS-12 includes policies aimed at reducing air pollutant emissions, which would have a beneficial effect on the cumulative increase in criteria air pollutants. However, since future development would exceed individual thresholds for $PM_{10,}$ as discussed in item (b) above, impacts would also be considered cumulatively significant. The project's contribution to cumulative air quality conditions is considered potentially significant and will be further evaluated in the EIR.

d) As discussed in item (b) above, future development under the General Plan would not result in the generation of a substantial concentration of CO or other emissions (City of Vacaville 2013, p. 4.3-27). Toxic Air Contaminants (TACs) would be the primary pollutant of concern and YSAQMD reviews the potential for TAC emissions from new and modified stationary sources through the permitting process. The General Plan EIR concluded that General Plan policies COS-P12.7, 12.8 and 12.9 and action COS-A12.1, in conjunction with existing YSAQMD regulatory programs would ensure impacts related to increase in exposure of sensitive receptors to TACs from future development would be less than significant (City of Vacaville 2013, p. 4.3-30). However, the exposure of sensitive receptors to substantial pollutant concentrations is considered a potentially significant impact that will be further evaluated in the EIR.

e) Odors impacts from future development could result from either new sources of odor locating near existing receptors, or new receptors locating near existing odor sources. Provisions of the California Health and Safety Code Section 41700 prohibits the discharge of anything that could endanger the comfort or health of the public and is enforced by the YSAQMD (City of Vacaville 2013, p. 4.3-30). According to YSAQMD, odor complaints in Vacaville have been minimal and included only the Easterly Wastewater Treatment Plant

(WWTP) in 2007, a previously unpermitted auto body shop in 2008, and paint odors from a residential garage in 2009. The YSAQMD was contacted on September 13, 2016 for any odor complaints received in the last 3 years for the existing detention basin or the Easterly Waste Water Treatment Plant. The YSAQMD indicated that they have not received any odor complaints for either of these locations in the last three years (email from Kenny Doss, September 2016).

The General Plan EIR determined that there is not enough evidence from YSAQMD to suggest that there are existing significant impacts from odors from any one source or that any mitigation action should be taken based on these previous complaints. The General Plan EIR concluded that future development, including development of the project site, would not introduce new people into an area significantly impacted by existing odors (City of Vacaville 2013, p. 4.3-31). Therefore, impacts related to odors would be less than significant. The proposed project would not be located in an area where existing odors are a concern, as evaluated in the General Plan EIR. The proposed project would also not introduce a new source of odors. Therefore, the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
IV. BIOLOGICAL RESOURCES – Would the project?			
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☒	☐	☐

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☒	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☒

Environmental Setting

In addition to agricultural lands, the City of Vacaville has three main natural community types: valley floor grassland and vernal pool natural community, inner coast range natural community, and riparian, stream, and freshwater marsh natural community (City of Vacaville 2015a, p. COS-4). Vacaville is a member agency for the Solano Habitat Conservation Plan (HCP), which implements conservation measures to ensure the protection of threatened and endangered species and their habitat. The Administrative Draft HCP was completed in October 2012; however, the HCP has not yet been formally adopted (Solano County Water Agency 2016). The Solano HCP addresses 37 threatened and endangered species and 35 species identified as Special Management Species (City of Vacaville 2015a, p. COS-5). The Solano HCP also identifies six key wildlife corridors throughout Solano County, one of which is located in southern portion of the City in the Vacaville-Fairfield Greenbelt. The Vacaville-Fairfield Greenbelt provides connectivity for a variety of wildlife species between the lowlands of the Jepson Prairie and the uplands of the Vaca Mountains. A portion of the Vacaville-Fairfield Greenbelt is located within the City's Urban Growth Boundary and the General Plan Planning Area in southern Vacaville.

The project site is entirely cultivated and planted with row crops. There are no trees or buildings on the project site. Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P1.5:** Require new development proposals to provide baseline assessments prepared by qualified biologists. The assessment shall contain sufficient detail to characterize the resources on, and adjacent to, the development site. The assessment shall also identify the presence of important and sensitive resources, such as wetlands, riparian habitats, and rare, threatened, or endangered species affected by the development.
- **Policy COS-P1.6:** Require new development to minimize disturbance of natural habitats and vegetation. Require revegetation of disturbed natural habitat areas with native or non-invasive naturalized species.

- **Policy COS-P1.7:** Encourage new development to incorporate native vegetation into landscape plans.
- **Policy COS-P1.8:** Prohibit the use of invasive, non-native species, as identified by the State or County Department of Agriculture or other authoritative sources, in landscaping on public property or in common areas in private development.
- **Policy COS-P1.11:** Require that, as appropriate, new policy plans or specific plans contain a resource management component and associated funding mechanisms that include policies to protect preserved natural communities.
- **Policy COS-P1.12:** Until the Solano Habitat Conservation Plan (HCP) is adopted, comply with all of the Avoidance, Minimization, and Mitigation Measures listed in the Draft Solano HCP (see Appendix A for a list of the Avoidance and Minimization Measures that are applicable to Vacaville). In addition, require that development projects provide copies of required permits, or verifiable statements that permits are not required, from the California Department of Fish and Wildlife (2081 Individual Take Permit) and US Fish and Wildlife Service (Section 7 Take Authorization) prior to receiving grading permits or other approvals that would permit land disturbing activities and conversion of habitats or impacts to protected species. In cases where environmental review indicates that such permits may not be required, the Community Development Director may establish time limits of not less than 45 days from the submission of an adequate request for concurrence response from an agency. If the agency has not responded, or requested a time extension of no more than 90 days to complete their assessment, within the established timeframe, applicable grading permits or other authorizations may be provided, subject to other City requirements and review. However, the City's issuance of grading permits or other authorizations does not absolve the applicant's obligations to comply with all other State and federal laws and regulations.
- **Policy COS-P1.13:** Require that new development avoid the loss of special-status bat species as feasible.

Discussion

a–c) The General Plan EIR determined that future development would have a less-than- significant impact on special-status species with implementation of General Plan policies, the Solano HCP, and federal and state laws (City of Vacaville 2013, pp. 4.4-55-58). There is the potential for project specific impacts to special-status species, riparian areas and other sensitive natural communities and wetlands associated with development of the project site; therefore impacts are considered potentially significant and will be further evaluated in the EIR.

d) A portion of the Vacaville-Fairfield Greenbelt is located within the City's Urban Growth Boundary and the General Plan Planning Area in the southern portion of the City. This is the only area identified in the General Plan EIR where wildlife corridors are known to exist. The General Plan EIR concluded that implementation of the Solano HCP, General Plan policies and actions, and federal and state regulations would reduce potential impacts to wildlife corridors to a less-than-significant level (City of Vacaville 2013, p. 4.4-67). The project site is not located within the boundaries of the Vacaville-Fairfield Greenbelt; however, there is the potential for wildlife corridors to be present on the project site. This is considered a potentially significant impact and will be further evaluated in the EIR.

e) The General Plan EIR concluded that future development would not conflict with any policies or ordinances protecting biological resources and that all biological resource requirements in various federal, state and local regulations and policies would remain intact and the impact is less than significant (City of Vacaville 2013, p. 4.4-67). However, the EIR will identify and evaluate applicable City and County goals and policies as well as other federal and state regulations to confirm there are no project level impacts. Therefore, this is considered a potentially significant impact that will be further evaluated in the EIR.

f) Although the Solano HCP is not an adopted conservation plan, the City's General Plan has used the draft HCP to develop goals, policies and actions consistent with the HCP (City of Vacaville 2013, p. 4.4-67). The General Plan includes policies to support the efforts to prepare and implement the HCP, specifically, action COS-A1.1, which directs the City to adopt and implement the requirements of the HCP. Future development would not conflict with the HCP since the General Plan was designed to be consistent with HCP policies and the impact would be less than significant. The project applicant will comply with applicable General Plan policies and the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
V. CULTURAL RESOURCES – Would the project?			
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☒	☐	☐

Environmental Setting

A constraints level archeological review of the project site was conducted in March 2016 to determine the cultural sensitivity of the project site. A copy of the *Cultural Resources Constraints for the Roberts' Ranch Project, Solano County, California* is included in Appendix A. Based on the findings there is the potential for construction activities to encounter subsurface archeological resources.

Historic Resources

The City of Vacaville contains over 200 historic resources and the City has identified six historic districts including: Pleasants/Hoskins Ranch district, Buck Avenue district, Monte Vista Avenue district, 100/200 block of Kendal Street, the 300/400 block of Kendal Street, and Parker Addition. The Pena Adobe, Will H. Buck House, Vacaville Town Hall, the site of the First Vacaville Buddhist Church, Pleasants/Hoskins Ranch district, and Vaca Adobe are all listed in the National Register (City of Vacaville 2015a, p. COS-21).

Archaeological Resources

In prehistoric times, the Patwin peoples resided in the area west of the Sacramento River to the crest of the Coast Ranges. Remnants of the inhabited semi-permanent villages of the Patwin people have been found in the hills around Vacaville. Dozens of prehistoric archaeological resources in the Vacaville area, including habitation sites, burial sites and isolated tools have been identified (City of Vacaville 2015a, p. COS-20).

Native American Cultural Resources

Native American cultural resources are not limited to physical archaeological resources with scientific significance, but could also include cultural landscapes, tribal cultural resources, and non-unique archaeological resources. The Vacaville area was a part of the ancestral territory of Native Americans, and there is the potential for unrecorded cultural resources to be present in the area (City of Vacaville 2015a, p. COS-21-22).

Paleontological Resources

The Vacaville area lies within a transition zone between the Sacramento Valley to the east and the Coast Range to the west and is comprised of a variety of rock types dating from various geologic periods. Certain formations in these rocks types may contain fossils that are paleontologically significant (City of Vacaville 2015a, p. COS-20). The project site is underlain by Holocene and Pliestocene Alluvium soils (Solano County 2008, Figure 4.7-1). Holocene alluvial deposits generally contain vertebrate and invertebrate fossils of extant modern taxa,

which are generally not considered paleontologically significant. Pleistocene alluvial deposits generally contain fossils from the Rancholabrean land mammal age from which many taxa are now extinct and these deposits are considered highly sensitive for paleontological resources (Solano County 2008). However, according to a study completed for the CPV Vaca Station project, the project site does not contain any rock formations and is not located in an area of the County known to contain paleontological resources (CPV Vacaville, LLC. 2008, Figure 5.8-1).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P6.2:** Require that a records search of California Historical Resources Information System be conducted and reviewed by cultural resources professional for proposed development areas to determine whether the site contains known prehistoric or historical cultural resources and the potential for as-yet undiscovered cultural resources.
- **Policy COS-P6.3:** Require that areas found to contain significant historic or prehistoric artifacts be examined by a qualified consulting archaeologist or historian for appropriate protection and preservation.
- **Policy COS-P6.4:** Require that if cultural resources, including archaeological or paleontological resources, are uncovered during grading or other on-site excavation activities, construction shall stop until appropriate mitigation is implemented.
- **Policy COS-P6.5:** Require that any archaeological or paleontological resources on a development project site be either preserved in their sites or adequately documented as a condition of removal. When a development project has sufficient flexibility, avoidance and preservation of the resource shall be the primary mitigation measure, unless the City identifies superior mitigation. If resources are documented, coordinate with descendants and/or stakeholder groups, as warranted.
- **Policy COS-P6.6:** Treat human remains discovered during implementation of public and private projects within the city with respect and dignity.

Discussion

a,b) The two common types of historical resources that may be impacted by future development are historical archaeological deposits and historical architectural resources (City of Vacaville 2013, p. 4.5-31).

It is probable that archaeological deposits associated with the historic period in Vacaville exist and could be impacted by future development. The General Plan EIR concluded that implementation of policies under goal COS-P6, as well as compliance with federal and state laws, would reduce impacts to historical archeological and architectural resources to a less-than-significant level (City of Vacaville 2013, p. 4.5-32-33). However, since there is a potential for site-

specific resources to be present, which could be disturbed by construction on the project site, this impact is considered potentially significant and will be further evaluated in the EIR.

The project site does not contain any buildings; therefore, there would be no potential impacts to architectural resources. The proposed project would have no impact associated with removal of historically significant properties and/or the integrity of such resources.

c) Future development has the potential to reach significant depths below ground surface and subsequently damage or destroy paleontological resources (City of Vacaville 2013, p. 4.5-34). The project site contains Pleistocene soils, which are generally designated as sensitive for paleontological resources. According to the CPV Vaca Station project study, the project site is not located in an area containing paleontological resources (CPV Vacaville LLC 2008). Specific General Plan policies COS-P6.3 and 6.4 require on-site activities to stop if any paleontological resources are encountered and proper mitigation be implemented, which require resources either are preserved in situ or adequately documented as a condition of removal. The General Plan EIR concluded that implementation of policies contained in Goal COS 6 and compliance with federal and state regulations would reduce potential impacts to paleontological resources to a less-than-significant level (City of Vacaville 2013, p. 4.5-34-35). The project site does not contain any rock formations, nor is it in an area of the City or County sensitive for paleontological resources; therefore, the impact would not change from what was identified in the General Plan EIR.

d) Future development has the potential to uncover and impact previously unrecorded human remains during construction and ground-disturbing activities (City of Vacaville 2013, p. 4.5-35). With implementation of General Plan policies and compliance with applicable federal and state regulations, the General Plan EIR concluded that impacts to human remains from future development, including the project site, would be less than significant. However, since there is a potential for construction activities on the project site to uncover previously unrecorded human remains, this impact is considered potentially significant and will be further evaluated in the EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
VI. GEOLOGY AND SOILS - Would the project:			
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☒
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
ii) Strong seismic ground shaking?	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒
iv) Landslides?	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☒

Environmental Setting

One fault system, the Vaca-Kirby Hills Fault system, passes through the City of Vacaville. The Vaca fault has not experienced displacement for the past 11,700 years and the Kirby Hills Fault has no evidence of displacement in the last 700,000 years. The California Geologic Survey does not include Vacaville on its list of cities that are affected by Alquist-Priolo Fault Zones (DOC 2010). The nearest active faults are the Great Valley Fault, the Cordelia Fault, the Green Valley Fault, and the West Napa Fault located approximately 2.6 miles east, 11.6 miles west, 13.8 miles west and 21.0 miles west of the site, respectively (KC Engineering 2016). The City is located within a seismically active region and earthquakes have the potential to cause ground shaking or liquefaction. Generally, Vacaville is characterized by low liquefaction potential; however, areas near Ulatis and Alamo Creeks are susceptible to high levels of liquefaction. The foothills of the Vaca Mountains have the potential to cause landslides and areas along the northern and western edges have experienced landslides in the past (City of Vacaville 2015a, p. SAF-3). Soils within the City are silty, sandy and clay loams with a small portion of purely clay soils, which are more prone to expansion. Subsidence can occur throughout the City in areas where groundwater has been extracted (City of Vacaville 2015a, p. SAF-7).

As required by the state Subdivision Map Act (Government Code Title 7 Division 2) and the City's Subdivision Ordinance (Vacaville Municipal Code Chapter 14.11) a soils and geotechnical report has been prepared for the proposed project site by KC Engineering Company (included as Appendix B).

The project site is located in area of medium liquefaction potential (City of Vacaville 2015a, Figure SAF-2). The results of the field investigations conducted on March 2-4, 23 2016, by KC Engineering Company found evidence of loose to medium dense sandy deposits which may be susceptible to liquefaction in three out of 24 test borings; two located along the southern boundary of the project site in the western and eastern corners with the third located in the northern central region of the project site (KC Engineering Company 2016). The topography of the project site is flat with a less than 5% slope and is not mapped in an area where landslides are known to occur (City of Vacaville 2015a, Figure SAF-3, 4). The geologic subunits of the project site are alluvium and terrace and soils in the project site consist of Reiff fine sandy loam, Rincon clay loams, Riverwash, Capay silty clay loams, Capay clay, Clear Lake clay and Corning gravelly loam (City of Vacaville 2013, Figure 4.6-2 and 4.6-3). Soils on the site include soft to very stiff, highly expansive sandy and silty clays in the upper 2-7 feet, underlain by variable layers and thicknesses of moderately to highly expansive stiff to hard sandy clays and clayey silts, and loose to medium dense clayey and silty sands (KC Engineering Company 2016). Groundwater was encountered in the borings at depths ranging from 10.0 to 17.5 feet below the ground surface (KC Engineering Company 2016).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy SAF-P1.4:** Determine the geologic suitability of proposed development sites during the earliest stages of the planning process. Such analyses should consider the potential structural engineering needs of the project and the impacts development activities may have on adjacent lands.
- **Policy SAF-P1.5:** Require geotechnical studies prior to approving rezoning requests, specific plans, or subdivision maps in areas that have experienced landslides in the past, as shown in Figure SAF-3, and that are within ¼ mile of a fault.
- **Policy SAF-P1.6:** Require preparation of a soils report prior to issuing a building permit, except where the Building Official determines that a report is not needed.
- **Policy SAF-P1.11:** Require contour rounding and revegetation to preserve natural qualities of sloping terrains, mitigate the artificial appearance of engineered slopes, and control erosion. Encourage the use of native trees and shrubbery in revegetation areas.
- **Policy COS-P14.5:** Require the implementation of Best Management Practices (BMPs) to minimize erosion, sedimentation, and water quality degradation resulting from construction or from new impervious surfaces.

Discussion

a i–iv) As discussed in the Setting above, the United States Geologic Survey (USGS) has indicated that faults in the area have not been active in the past 11,700 years and the City is not included in the California Geologic Survey's list of cities affected by Alquist-Priolo Fault Zones. General Plan policies under Goal SAF-1 require that the potential risks associated with fault rupture, ground shaking, liquefaction and landslides are minimized through compliance with the California Building Code (CBC) design requirements. The General Plan EIR concluded that with the implementation of the policies under Goal SAF-1 and compliance with the CBC, hazards associated with earthquakes, ground shaking, liquefaction and landslides would be less than significant (City of Vacaville 2013, p. 4.6-14-18).

The project site is not located within an Alquist-Priolo Earthquake Fault Zone and KC Engineering Company observed no evidence of active faulting during the site reconnaissance. The project site has a low potential for fault-related surface rupture. However, the project site is located in a seismically active region and may experience ground shaking as a result from seismic activity in the region. As discussed in the Setting above, the project site is relatively flat and is not located in an area that would be subject to landslides. Although soils potentially susceptible to liquefaction were found on the project site, the potential for surface manifestation is very low due to the thickness of the non-liquefiable clay soils that overlay the potentially liquefiable soils (KC Engineering Company 2016). The project applicant will be required to comply with General Plan policies, the CBC, and recommendations contained in the Geotechnical Report (Appendix B) prepared for the project to reduce risks from seismic shaking, ground shaking, liquefaction and landslides. This impact has been adequately addressed and would not change from what was identified in the General Plan EIR.

b) The City's General Plan EIR notes that construction of future development would have the potential to result in the loss of topsoil and cause erosion (City of Vacaville 2013, p. 4.6-18). Section 14.26.030.020 of the Vacaville Land Use Development Code establishes Best Management Practices (BMPs) to control erosion including a post-construction BMP design plan, which provides BMPs to control volume, rate and potential pollutant load of stormwater runoff and a stormwater facilities operation and management plan (City of Vacaville 2015b). Grading standards describing required control erosion techniques are included in Section 14.19.244.010 of the City's Land Use and Development Code. These control techniques include use of filter materials, approved erosion control such as sedimentation basins or check dams, and measures described in the Post-Construction Erosion and Sediment Control Plan outlined in Section 14.19.242.020 of the City's Code (City of Vacaville 2008a). General Plan policies SAF-P1.11 and COS-P14.5 require contouring and revegetation to preserve natural sloping and control erosion and use of BMPs to minimize erosion resulting

from construction of new impervious surfaces. The General Plan EIR concluded that compliance with applicable sections of the Land Use and Development Code and General Plan policies would reduce erosion impacts associated with new development to a less-than-significant level (City of Vacaville 2013, p. 4.6-18). The project applicant will be required to comply with General Plan policies and the City's Land Use Development Code regulations to reduce risks of erosion and loss of topsoil; and the impact would not change from what was identified in the General Plan EIR.

c, d) Unstable soils could create hazards for future development. This includes the potential for lateral spreading to occur where liquefiable layers are present and subsidence in areas underlain by soft water-saturated and low density alluvial materials (City of Vacaville 2013, p. 4.6-18-19). Expansive soils have a high shrink swell potential and generally, soils with a clay component are more prone to expansion. General Plan policies SAF-P1.5 and P1.6 require soils and geotechnical studies for future development to determine geologic suitability. Implementation of General Plan policies would ensure the site-specific potential for hazards due to lateral spreading, liquefaction, subsidence, and expansive soils are properly considered when issuing a permit for development. Additionally, future development would be required to comply with CBC criteria and standards designed to reduce geologic risks to acceptable levels. The General Plan EIR found that implementation of General Plan policies and compliance with CBC standards would reduce impacts associated with unstable geologic conditions and expansive soils to a less-than-significant level (City of Vacaville 2013, p. 4.6-19).

A Geotechnical Report was prepared for the project by KC Engineering Company in compliance with General Plan policies SAF-P1.5 and P1.6. The report indicated the presence of moderate to highly expansive soils on the project site, with the upper 1.5 to 2 feet of loose, soft near surface soil resulting from agricultural farming and disking operations on the project site. Recommendations for proper grading, drainage and foundation to support structures on the project site are provided in the Geotechnical Report including, but not limited to: over-excavation, processing and compaction of soils; use of thickened post-tensioned slab foundation systems; review by KC Engineering Company of all grading and foundation plans prior to contract bidding; and field observations and testing by KC Engineering Company during grading and foundation operations. The project applicant will comply with CBC standards and recommendations provided in the Geotechnical Report (Appendix B) to reduce risks associated with expansive soils and unstable geologic conditions; and impacts would not change from what was identified in the General Plan EIR.

e) The Easterly Wastewater Treatment Plant (WWTP) and associated wastewater collection system are owned and operated by the City of Vacaville (City of Vacaville 2013, p. 4.6-20). Under General Plan policy PUB-P13.1, the City would maintain adequate wastewater

collection and treatment services to serve existing and new development and will maintain wastewater infrastructure in good working condition. Future development would be required to connect to the City's public sewer system, septic tanks or alternative wastewater systems would not be permitted. The General Plan EIR determined that this impact would be **l**ess than significant (City of Vacaville 2013, p. 4.6-20).

The proposed project is designed to connect to the City's existing sewer system and provide on-site sewer service. The project does not include any septic tanks or alternative wastewater disposal systems, therefore, the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
VII. GREENHOUSE GAS EMISSIONS - Would the project:			
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒

Environmental Setting

The 2006 California Assembly Bill (AB) 32 requires that California reduce its greenhouse gas (GHG) emissions to 1990 levels by 2020. Under this legislation, the California Air Resources Board (CARB) is required to establish a program for statewide GHG emissions reporting, as well as monitoring and enforcement for the reporting program. The AB 32 Scoping Plan, approved December 12, 2008, includes a range of GHG reduction actions including a cap and trade program that covers 85% of the State's emissions (City of Vacaville 2015a, p. COS-25). In addition, Senate Bill (SB) 375 requires the automobile and light truck industry to produce reduced-emission vehicles and requires metropolitan planning organizations to prepare sustainable communities strategies to demonstrate how a region will meet CARB's GHG reduction targets by reducing the amount of vehicle miles traveled (City of Vacaville 2015a, p. COS-25).

The Association of Bay Area Governments and the Metropolitan Transportation Commission are preparing a sustainable communities strategy for the Bay Area, Plan Bay Area, which includes the City of Vacaville. A 2008 GHG emissions inventory for the City was prepared to use as a baseline against which to measure future GHG emissions reductions. The results showed that transportation accounted for the highest percentage of GHG emissions (63%), followed by non-residential (17%) and residential (16%) energy use, solid waste disposal (2%), moving and

treating water/wastewater (1%) and other off-road emissions (1%) (City of Vacaville 2015a, Figure COS-3). The City's Energy Conservation Action Strategy (ECAS) includes the 2008 GHG emissions inventory, a 2020 Business as Usual (BAU) forecast model, targets for GHG emissions reduction and measures to meet those reduction targets (City of Vacaville 2015a, p. COS-26).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P9.2:** Promote land use patterns that reduce the number and length of motor vehicle trips.
- **Policy COS-P9.8:** Promote green building practices in new development.
- **Policy TR-P8.4:** Require that new development applications include bike paths or bike lanes, when appropriate.
- **Policy TR-P8.9:** Require that new multi-family and non-residential developments provide adequate public and private bicycle parking and storage facilities.

Discussion

a) The General Plan EIR states that the generation of GHGs, either directly or indirectly, that may result in a significant impact on the environment would be less than significant if it complies with a qualified GHG emissions reductions strategy or results in less than 6.6 $MTCO_2e$ per service population per year (City of Vacaville 2013, p. 4.7-22). The General Plan EIR concluded that the proposed ECAS is a qualified GHG emissions reduction strategy because it contains the elements required by the BAAQMD, including a GHG emissions inventory and BAU projection, a GHG emissions reduction target consistent with AB 32, a review of relevant local and state policies, quantitative emissions projections demonstrating target achievement, and strategies for implementation, monitoring and environmental review (City of Vacaville 2013, p. 4.7-23-24). Since the General Plan contains policies and actions aimed to reduce GHG emissions in the City and promotes the concepts of the ECAS, future development, including the proposed project would not conflict with the ECAS. The proposed Specific Plan includes design and operational measures, incorporated into the project design features and/or the project's development standards, that encourage sustainable design in the proposed community (City of Vacaville 2015d, pp.10-7, 8). Additionally, through General Plan action COS-A9.1, the City is required to monitor the effectiveness of the ECAS every five years by conducting a GHG emissions inventory. This monitoring would be done through the City's evaluation of all future development proposals as the project builds out. This on-going process would require each phase of the project to implement the relevant environmental design standards applicable to the phases, and will allow the City to identify the project's attainment of the ECAS goals. The General Plan EIR concluded that the future development within the City, including the proposed project, would

have a less-than-significant impact on the generation of GHGs because it would be consistent with the ECAS, which aims to reduce GHG emissions in the City (City of Vacaville 2013, p. 4.7-36). As noted above, the ECAS is a qualified GHG reduction strategy containing the elements required by the BAAQMD. The project applicant will comply with General Plan policies and the ECAS and will implement the measures incorporated into the Specific Plan, through the use of the City's checklist for documenting compliance with the ECAS and the measures listed in the Air Quality mitigation section Therefore, impacts would not change from what was identified in the General Plan EIR.

b) Based on an updated statewide GHG emissions inventory data, the State would need to reduce emissions by 21.7% from 2020 BAU in order to reach 1990 levels (AEP 2012). In addition to the 2020 target for statewide GHG emissions reductions, Executive Order S-03-05 establishes a target to reduce GHG emissions by 80% below 1990 levels by 2050. The timeframe for the General Plan and ECAS do not go up to year 2050. GHG emissions in the City through buildout of the General Plan (2035) are projected to be 1,519,040 $MTCO_2e$ including state and federal measures to reduce GHG emissions the amount would be reduced to 1,131,010 $MTCO_2e$ (City of Vacaville 2013, p. 4.7-27). There are no adopted State plans to achieve reductions beyond 2020 and it is likely that additional measures would be required to meet the 2050 goal. The General Plan EIR concluded that buildout of the General Plan including application of measures contained in the ECAS would conflict with the State's 2050 goal to reduce emissions by 80% below 1990 levels and the impact would be significant. It is assumed that a majority of the reductions needed to reach the 2050 goals would come from State measures. All feasible GHG emission reduction measures considered during the ECAS process have already been included in the ECAS. The project would comply with these actions through mitigation measures adopted to incorporate ECAS measures into the project design. Since no additional mitigation is available, the General Plan EIR determined this impact to be significant and unavoidable.

GHG emissions are cumulative in nature and potential GHG emissions generated by the land use assumed for the project site were included in the City's General Plan GHG forecast that was analyzed in the General Plan EIR. Tables VII-1 and VII-2 show the project's unmitigated and mitigated GHG emissions. The project applicant will comply with General Plan policies, ECAS policies and federal and State regulations. The project would not result in a significant impact not already identified in the General Plan EIR.

Table VII-1
Estimated Annual Unmitigated Operational Greenhouse Gas Emissions

Emission Source	CO_2E (MT/yr)
Area	335.9

Table VII-1
Estimated Annual Unmitigated Operational Greenhouse Gas Emissions

Emission Source	CO_2E (MT/yr)
Energy	2,151.2
Mobile	15,215.3
Solid Waste	103.1
Water Supply and Wastewater	143.6
Total	17,949.1
Amortized Construction Emissions	334.1
Operation + Amortized Construction Total	**18,283.2**

Notes: Emissions were modeled with CalEEMod and are based on the "Mitigated" CalEEMod outputs in order to incorporate the 2016 Title 24 standards (i.e., approximately a 46% reduction versus 2008 Title 24 for single family residential), 20% indoor and outdoor water conservation per CalGreen, and 75% waste diversion pursuant to AB 341 even though compliance with these standards would not be considered actual mitigation. Construction emissions were summed for all phases, then divided by 30 to account for amortization based on the potential project life.
CO2E = carbon dioxide-equivalent; MT/year = metric tons per year

Table VII-2
Estimated Annual Mitigated Operational Greenhouse Gas Emissions

Emission Source	CO_2E (MT/yr)
Area	202.6
Energy	2,151.2
Mobile	14,469.5
Solid Waste	103.1
Water Supply and Wastewater	143.6
Total	17,069.9
Amortized Construction Emissions	334.1
Operation + Amortized Construction Total	**17,404.0**

Notes: Emissions were modeled with CalEEMod and are based on the "Mitigated" CalEEMod outputs in order to incorporate the 2016 Title 24 standards (i.e., approximately a 46% reduction versus 2008 Title 24 for single family residential), 20% indoor and outdoor water conservation per CalGreen, and 75% waste diversion pursuant to AB 341 even though compliance with these standards would not be considered actual mitigation. Additionally, the CalEEMod measures "Only Natural Gas Hearth", "Improve Pedestrian Network – Project Site and Connecting Off-Site", and "Provide Traffic Calming Measures – 50% Roadways and 50% Intersections" were selected in the model to account for Mitigation Measure 4.1-2. Construction emissions were summed for all phases, then divided by 30 to account for amortization based on the potential project life.
CO2E = carbon dioxide-equivalent; MT/year = metric tons per year

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
VIII. HAZARDS AND HAZARDOUS MATERIALS – Would the project:			
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒
d) Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒

Environmental Setting

Hazardous waste that is common in the City is generated by gasoline service stations, dry cleaners, automotive mechanics, auto body repair shops, machine shops, printers, photo processors and agricultural operations (City of Vacaville 2015a, p. SAF-23). Hazardous materials and hazardous wastes are heavily regulated by federal, State and local agencies including the California Environmental Protection Agency (EPA) and the California Department of Toxic Substances Control (DTSC). There are 82 sites in the City that are known to contain, or have previously contained hazardous materials (City of Vacaville 2013, Table 4.8-1). The nearest location to the project site is the High School B site, approximately 0.61 mile north at the corner of Leisure Town Road and Elmira Road. A Phase I Environmental Site Assessment (ESA) was prepared for the project and concluded that there are no recognized environmental conditions present on the site and no hazardous substances, pollutants, contaminants, petroleum or petroleum products were identified on the project site (see Appendix C).

Solano County has adopted a Hazardous Waste Management Plan for all waste projected to be generated within the county (City of Vacaville 2015a, p. SAF-23). The Hazardous Materials Business Plan regulates all businesses that handle hazardous materials in quantities greater than or equal to 55 gallons of liquid, 500 pounds of solids, or 200 cubic feet of gas and addresses the preparedness for emergency response to incidents involving hazardous materials (Solano County 2016). The City has adopted the Association of Bay Area Governments (ABAG's) regional hazard mitigation plan, *Taming Natural Disasters: Multi-Jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area*, as the local hazard mitigation plan for natural disasters and emergency response (City of Vacaville 2015a, p. SAF-24-25).

There is a high potential for wildland fires and there are 2,635-acres of land within the City classified by Cal Fire as High Fire Hazard Severity Zones and 5,717 acres classified as Moderate Fire Hazard Severity Zones (City of Vacaville 2013, p. 8.4-24). The nearest High Fire Severity Zone is located 2.62 miles southeast of the project site and the nearest Moderate Fire Severity Zone is located 1.63 miles south. The City adopted Chapter 14.20.290 of the Municipal Code, to reduce risks from wildland fires for new development adjacent to permanent open space or other lands where no development is anticipated in the near future (City of Vacaville 2015a, p. SAF-20).

The proposed project would be expected to generate limited amounts of household hazardous waste and would not generate hazardous waste equal to the quantities listed above regulated by the Solano County Hazardous Waste Management Plan. The project site is not included in the Cortese List for hazardous waste and substances (DTSC 2007). The nearest school to the project site is Callison Elementary School, approximately 0.52 mile west. The proposed project designates a 16-acre future school site in the northern portion of the site.

The project site is not included in the area of influence for Nut Tree Airport (City of Vacaville 2013, Figure 4.8-2) and is located within Compatibility Zone D for Travis Air Force Base. Compatibility Zone D does not limit residential development or other uses, but would require airspace review for objects greater than 200-feet tall and to ensure that no wildlife attractant hazards are created by the project (Solano County, 2015b). The project site is not mapped in an area of moderate or high wildland fire risk; however, open space agricultural lands in eastern Vacaville pose a threat related to grass fires (City of Vacaville 2015a, Figure SAF-9).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy SAF-P7.3 and 7.4:** Require review of development projects to ensure preparedness for emergency response and that emergency access routes be kept free of traffic impediments.
- **Policy SAF-P5.2:** Require that all development in areas of potential wildland fire hazards, including agricultural areas east of Leisure Town Road, include the following:
  - Fire breaks adjoining open space areas;
  - Adequate emergency access to adjoining open spaces;
  - Clearance around structures;
  - Fire-resistant ground cover;
  - Fire-resistant roofing materials; and
  - Adequate emergency water flow.
- **Policy SAF-P5.3:** Require that all development adjacent to open agricultural lands comply with State law regarding defensible open space, even if the agricultural lands are designated for future development.
- **Policy SAF-P5.4:** Incorporate drought-resistant and fire-resistant plants in public works projects in areas subject to wildland fires.
- **Policy SAF-P5.6:** Require all development applications to be reviewed and approved by the Fire Department prior to project approval.

Travis Air Force Base, Airport Land Use Compatibility Plan

The Travis Air Force Base Airport Land Use Compatibility Plan sets forth land use compatibility policies applicable to future development in the vicinity of the base. The policies are designed to ensure that future land uses in the surrounding area will be compatible with existing and future aircraft activity at the base, including the potential for bird strike hazards to be created. The following policy is applicable to the project.

- **Section 5.8.2.c:** All discretionary projects located within the Bird Strike Hazard Zone and Outer Perimeter are required to consider the potential for the project to attract hazardous wildlife, wildlife movement, or bird strike hazards as part of environmental review process required by the California Environmental Quality Act (CEQA).

Discussion

a, b) As noted in the General Plan EIR, future development could involve the routine use and handling of hazardous materials, which could also lead to reasonably foreseeable upset and accident conditions involving the release of hazardous materials (City of Vacaville 2013, p. 4.8-21). The Union Pacific rail lines that traverse the east side of the City and are adjacent to the eastern side of the project site, are used for the transport of some hazardous materials. The transport of hazardous materials on rail lines is governed by the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration rules and regulations (City of Vacaville 2013, p. 4.8-22) Future development, including construction activities would be subject to existing regulations related to transport, use and disposal of hazardous materials. The General Plan EIR concluded that implementation of General Plan policies in coordination with existing programs would reduce impacts from future development related to the release of hazards through use, transport and disposal as well as reasonably foreseeable accident conditions to be less than significant (City of Vacaville 2013, p. 4.8-21-22).

As a residential development, the proposed project would only be expected to generate small amounts of household hazardous waste and would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. In addition, the proposed project will comply with existing programs and General Plan polices and the impact would not change from what was identified in the General Plan EIR.

c) Future development, as noted on the General Plan EIR is not expected to result in significant land use changes in the vicinity of existing schools, including the east of Leisure Town Road area. As future development occurs new schools would be located in residential neighborhoods (City of Vacaville 2013, p. 4.8-22). Future development occurring near existing or proposed schools would be required to comply with federal, state and local agencies include the DTSC's Hazardous Waste Management Program and the California Accidental Release Prevention Program. General Plan policies require adequate separation between hazardous materials sites and sensitive uses such as schools and specify development standards for properties where hazardous materials are present. The General Plan EIR concluded that compliance with federal, State and local regulations and implementation of General Plan policies would reduce impacts to schools from hazardous materials to a less-than-significant level (City of Vacaville 2013, p. 4.8-23).

The proposed project is a residential development that would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste. The nearest school to the project site is Callison Elementary School, approximately 0.52 mile to the west. The proposed project also designates land for a future 16-acre school site. As a residential development, the proposed project would only be expected to generate small amounts of

household hazardous waste and will comply with General Plan policies and federal, State and local regulations. This impact would not change from what was evaluated in the General Plan EIR and would not result in a significant impact not identified in the General Plan EIR.

d) As discussed in the Setting above, there are a number of sites in Vacaville that are known to contain or have previously contained hazardous materials. Most of these sites have been remediated to the satisfaction of the State's Regional Water Quality Control Board and are listed as closed. The closest site identified as containing or has previously contained hazardous materials is the High School B site, approximately 0.61 mile north of the project site at the corner of Leisure Town Road and Elmira Road (City of Vacaville 2013, Table 4.8-1) General Plan policies would reduce risks associated with hazardous materials sites by requiring that areas historically used for commercial or industrial uses complete environmental investigation to ensure that soils, groundwater and buildings affected by previous hazardous materials releases would not negatively impact the environment or health and safety of property owners and residents. The General Plan EIR determined that with U.S. EPA oversight and implementation of General Plan policies, future development would result in a less than significant impact.

   As mentioned in the Setting above, the project site is not included on the Cortese List for hazardous waste and substances and is not known to contain any hazardous materials (City of Vacaville 2013, Table 4.8-1). This impact has been adequately addressed in the General Plan EIR and the project would not have any additional impacts.

e, f) As discussed in the Setting above, the project is not located within the Land Use Airport Compatibility plan for Nut Tree Airport and is located within Compatibility Zone D for the Travis Air Force Base. The General Plan EIR determined that only one area, southeast of Elmira, would fall within Land Use Compatibility Zone C. Since only public/institutional uses would be allowed in this area there would be no conflict with Zone C requirements and the impact would be less than significant.

   There are no private airstrips in Vacaville and there would be no impact associated with risks in the vicinity of a private airstrip (City of Vacaville 2013 p.4.8-30).

   The project site falls within the Travis Air Force Base ALUCP Zone D, which does not limit residential development and only requires airspace review for objects over 200-feet tall. The project would not contain any buildings or structures that would exceed 200-feet and require airspace review. Therefore, the project would be consistent with the Zone D requirements and the impact would not change from what was evaluated in the General Plan EIR. However, the ALUCP was updated in October 2015 to incorporate standards related to potential wildlife hazards associated with land uses that could attract wildlife in areas that

conflict with aircraft movement. A Wildlife Hazard Assessment is required to assess this potential hazard and is addressed further in Section X. Land Use and Planning of this IS.

g) As discussed in the Setting above, the City's emergency response plan is the ABAG's Taming Natural Disasters report. General Plan policies under Goal SAF-7 would reduce risks associated with emergencies and natural disasters by promoting public awareness, providing education for disaster preparedness, requiring emergency access routes be kept free from traffic impediments, and requiring the Fire Department review all development applications. The General Plan EIR concluded that implementation of General Plan policies would reduce interference with an emergency response plan to a less-than-significant level. The project applicant is coordinating with the City's Fire Department to ensure there are two points of access provided as each phase of the project is developed. The project would not impair emergency access in the event of an evacuation. The proposed project will comply with General Plan policies related to reducing interference with adopted emergency response plans; and the impact would not change from what was identified in the General Plan EIR.

h) As discussed in the Setting above, the City contains areas designated by Cal Fire as High and Moderate Fire Severity Zones. The nearest High Fire Severity Zone is located 2.62 miles southeast of the project site and the nearest Moderate Fire Severity Zone is located 1.63 miles south. The area east of Leisure Town Road, including the project site, is classified as Non-Wildland/Non-Urban and Urban Unzoned, but is at risk for grass fires (City of Vacaville 2013, p. 4.8-24). General Plan Policy SAF-5.2 requires all development in areas for potential wildland fire hazards to include firebreaks adjoining open areas, adequate access to open space, clearance around structures, fire-resistant ground cover and roofing materials, and adequate emergency water flow. Section 14.20.290 of the City's Land Use Development Code provides development standards for new construction adjacent to open space where there is a threat of wildfire such as use of fire buffer zones, fire access roads, use of a fire protection greenbelt, drainage ditches, rear/side yard setbacks, non-combustible fencing, and sprinkler systems (City of Vacaville 2005). The General Plan EIR concluded that implementation of General Plan policies and compliance with existing Land Use Development regulations would reduce impacts from wildland fires to less than significant.

   The project has been designed to include a 100-foot-wide defensible fire protection zone from the edge of houses along the eastern boundary of the site to reduce the risk from potential wildland fires. During each phase of project construction 100-foot wide fire breaks would be provided along the boundary of developed and undeveloped lands. An Emergency Access and Evacuation Plan would also be prepared for each phase of development and roads would be sized to adequately accommodate fire trucks. The project will comply with General Plan policies and Section 14.20.290 of the Land Use Development Code. Therefore, impacts would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
IX. HYDROLOGY AND WATER QUALITY – Would the project?			
a) Violate any water quality standards or waste discharge requirements?	☒	☐	☐
b) 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)?	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☒	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☒	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☒	☐	☐
f) Otherwise substantially degrade water quality?	☒	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☒

Environmental Setting

The City is permitted under National Pollution Discharge Elimination System (NPDES) permit number CA0077691 issued by the Central Valley Regional Water Quality Control Board (CVRWQCB) (RWQCB 2014) to permit the disposal of treated wastewater. Wastewater is treated at the Easterly Wastewater Treatment Plant (WWTP) in accordance with the requirements in the NPDES and released into Alamo Creek where it travels to Cache Slough and eventually out to the Delta (City of Vacaville 2016). There are four major stream courses within the City: Alamo creek and tributaries Laguna creek and Encinosa creek, Ulatis creek,

Horse creek and tributary Pine Tree creek, and Gibson Canyon creek. The City has two existing reservoirs, Lagoon Valley Lake that drains a portion of Lower Lagoon Valley and Basherini Reservoir, which is owned and operated by the Solano Irrigation District. Generally, the natural and unaltered creeks do not have the capacity to convey a 100-year storm event and some areas cannot accommodate a 10-year storm event (City of Vacaville 2015a, p. SAF-9).

Per the City's Groundwater Management Plan, all of the City's 17 existing and three proposed groundwater wells are located in the Solano Subbasin (City of Vacaville 2011b). In 2010, the City produced only 5,068 acre-feet of groundwater, which represented 31% of the total water used that year (City of Vacaville 2011b). The General Plan EIR determined that the total water demand through 2035 from future development would be approximately 26.2 million gallons per day (mgd). The City will need to replace five existing groundwater wells and add three new wells, in the northeastern section of the City, in order to meet 2035 production capacity demands (City of Vacaville 2013, p. 4.9-22). There is an existing drainage facility, Brighton Landing, located near the northeastern border of the project site (City of Vacaville 2013, Figure 4.9-2). This drainage basin has been sized to serve the build-out of the Brighton Landing and Roberts' Ranch projects (approximately 400 acres). The southwest corner of the project site is located in the 500-year Flood Zone and the remainder of the project site is not located within the a 100- or 500-year Flood Zone or an area mapped as an "Awareness Floodplain Area" (City of Vacaville 2013, Figure 4.9-1, 2015a, Figure SAF-8). Monticello Dam is the only dam near the City that could pose a threat of inundation to existing and future developments. The project site is not mapped within the dam inundation area for Monticello Dam (City of Vacaville 2013, Figure 4.9-4).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P14.3:** Encourage pest-tolerant landscapes using native plants to minimize need for pesticides.
- **Policy COS-P14.5:** Require the implementation of Best Management Practices (BMPs) to minimize erosion, sedimentation, and water quality degradation resulting from construction or from new impervious surfaces.
- **Policy COS-P14.6:** Protect existing open spaces, natural habitat, floodplains and wetland areas that serve as groundwater recharge areas.
- **Policy COS-P14.7:** Protect groundwater recharge and groundwater quality when considering new development projects.
- **Policy SAF-P2.2:** Asses the adequacy of storm drainage utilities in existing developed areas, and program any needed improvements in coordination with new infrastructure that will serve developing areas.

- **Policy SAF-P2.4:** Design storm drainage infrastructure to serve dual purposes to the extent possible. This includes the following:
  - Drainage facilities integrated into recreational corridors with bike paths, sidewalks and landscaping.
  - Drainage channels integrated with transportation and environmental corridors.
  - Active and passive recreation areas incorporated into detention basins where feasible.
- **Policy SAF-P3.1:** Evaluate the storm drainage needs for each project, this evaluation should account for projected runoff volumes and flow rates once the drainage area is fully developed. In the Alamo Creek watershed upstream of Peabody Road (including Alamo, Laguna, and Encinosa creeks), require post-development 10-year and 100-year peak flows to be reduced to 90% of predevelopment levels. In the remainder of Vacaville, for development involving new connections to creeks, peak flows shall not exceed predevelopment levels for 10- and 100-year storm events.
- **Policy SAF-P3.3:** Require a Storm Drainage Master Plan to be prepared for new development projects to ensure new development adequately provides for on-site drainage facilities necessary to protect the new development from potential flood hazards and ensure that potential off-site impacts are fully mitigated.
- **Policy SAFP4.4:** Require that new development mitigate its additional runoff and mitigate removal of any floodplain areas.

Discussion

a, f) Construction of future development and conversion of agricultural lands to urban uses has the potential to increase erosion and discharge of sediments and create new sources of water pollution (City of Vacaville 2013, p. 4.9-21). Future development that disturbs one-acre or more of land is required to comply with the CVRWQCB's NPDES permit, which requires development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must list BMPs to protect stormwater runoff, prevent or reduce erosion, improve sediment control, control run-on and runoff and prevent pollutants from entering runoff (City of Vacaville 2013, p. 4.9-21). General Plan Goal COS-14 and associated policies would protect water quality by minimizing point and non-point source pollutants, minimizing pesticides use and requiring BMPs to protect water quality from construction and new impervious surfaces. The General Plan EIR concluded that the NPDES permit BMP requirements to prevent erosion, control sediment and runoff and prevent pollutants from entering runoff and implementation of the General Plan policies would reduce impacts to water quality to a level that is less than significant (City of Vacaville 2013, p. 4.9-21).

The proposed project would convert approximately 248-acres of agricultural land to urban uses, which would increase impervious surface area and could generate a new source of water pollution. The project would be required to comply with all standards listed above; however, to confirm that the project-specific impacts can be adequately addressed by existing and planned drainage infrastructure for this area, a drainage report would be prepared. This is considered a potentially significant impact and will be further evaluated in the EIR.

b) As discussed in the Setting above, groundwater in the City is extracted from the Solano Subbasin of the Sacramento Valley groundwater basin and the City is the primary user of groundwater in the area. Per the City's Urban Water Management Plan (UWMP) the Solano Subbasin is not expected to become overdrawn and is not listed as in "critical condition of overdraft" (City of Vacaville 2011a). The City has identified the need to construct three new groundwater wells and the replacement of other wells in order to meet the 2035 demand for water consistent with water supply planned for in the City's 2010 UWMP (City of Vacaville 2013, p. 4.9-23). General Plan policies under Goal COS-13 and the ECAS include measures to promote water conservation and encourage the use of non-potable water, which would reduce demand on water supply, including groundwater resources. Groundwater recharge would be protected through General Plan policies requiring protection of existing open spaces, natural habitat, floodplains and wetlands, which are areas of groundwater recharge, as well protection of groundwater quality and recharge when considering new development. The General Plan EIR concluded that implementation of General Plan and ECAS policies would protect groundwater recharge areas and promote conservation; and the impact would be less than significant.

The Solano Subbasin covers 425,000 acres of Solano, Yolo and Sacramento counties including the cities of Vacaville and Dixon (DWR 2004). The proposed project would increase impervious surface area and reduce open space used for groundwater recharge. The 248-acre project site represents 0.06% of the total subbasin area. Conversion of the project site from agricultural to urban uses would not significantly reduce the area available for groundwater recharge. The project includes 23-acres of open space and a 500-foot wide agricultural buffer, both of which could be used for groundwater recharge. The project would connect to the City's water system and would promote water conservation consistent with General Plan policies. This impact has been adequately addressed and would not change from what was identified in the General Plan EIR.

c–e) Conversion of agricultural lands to residential, commercial, industrial, public and park uses associated with buildout of the City's General Plan would alter the existing drainage patterns and could cause an increase in peak flows and volumes discharged from developed lands (City of Vacaville 2013, p. 4.9-23). General Plan policies under Goal COS-14 and SAF-3

would require BMPs to minimize erosion, sedimentation and water quality degradation, evaluation of drainage needs at the project-level, and preparation of a Storm Drainage Master Plan for new development. Future development would also comply with NPDES permit requirements by preparing a SWPPP, as discussed above in items (a, f). Additionally, Section 14.19.242 of the City's Land Use and Development Code regulates grading and earth moving. Grading permits are issued for construction activities subject to the NPDES permitting requirements providing an Erosion and Sediment Control Plan is submitted, which shows that the Plan will comply with the Clean Water Act. The General Plan EIR concluded that implementation of General Plan policies and compliance with NPDES permitting requirements would reduce drainage impacts to a less-than-significant level.

The proposed project will alter the existing drainage on-site and could cause an increase in peak flows and volume discharged. This is considered a potentially significant impact and will be further evaluated in the EIR.

g–i) As mentioned in the Setting above, the project site is not located within a 100-year floodplain with the exception of the southwest corner of the site which is located within a 500 year floodplain. General Plan policies to reduce risk to future development related to flooding include comprehensive drainage and prohibit development within mapped flood-prone areas unless mitigation of flood risk is assured. General Plan policies related to protecting future development from flooding risks includes maintenance of open space areas, preparation of Storm Drainage Master Plans, mitigation for additional runoff created by development and mitigation for removal of floodplain areas. The General Plan EIR concluded that risks from placing structures within a 100-year floodplain would be less than significant. The proposed project will comply with General Plan policies and therefore the impact would not change from what was identified in the General Plan EIR.

There are places in the City mapped within the inundation zone by the Monticello Dam, which could expose people or structures to a risk of flooding. Since the Monticello Dam and other levees are owned and operated by other agencies, it is not feasible for the City to address maintenance or improvements necessary to eliminate the risks from dam or levee failure. Therefore, the General Plan EIR concluded that this impact would be significant and unavoidable. The project site is not mapped within the inundation zone for Monticello Dam. Therefore, there would be no risk to people or property on the project site from dam or levee failure. This impact has been adequately addressed and would not result in more severe impacts than those identified in the General Plan EIR.

j) A seiche could form on Lake Berryessa, which is located approximately 10 miles from the City (City of Vacaville 2013, p. 4.9-29). Due to the distance, the City is not at risk from inundation if a seiche did occur, and the City would not be at risk of tsunamis since it is located more than 10

miles inland from Suisun Bay. The General Plan EIR concluded that with incorporation of General Plan policies and consistency with the California Building Code, impacts would be less than significant. The project site is flat and is not located in an area where landslides have occurred in the past. The project site is also not at risk of a tsunami from Suisun Bay or a seiche from Lake Berryessa due to its distance from these sources. There would be no impact to the project related to inundation from seiche, tsunami or mudflow and the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
X. LAND USE AND PLANNING – Would the project?			
a) Physically divide an established community?	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☒	☐	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☒

Environmental Setting

The City's General Plan is the primary planning document that sets forth a vision for future development (City of Vacaville 2013, p. 4.10-20). The General Plan EIR evaluated consistency with the preferred land use scenario included in the ABAG Sustainable Communities Strategy (SCS) Plan. ABAG and the Metropolitan Transportation Commission (MTC) adopted the Plan Bay Area in July 2013. The Plan Bay Area is updated every four years and a current update called Plan Bay Area 2040 is in progress (ABAG & MTC 2016). In the 1995 Master Water Agreement, effective until 2050, the City and the Solano Irrigation District (SID) committed to accommodate and support urban development within the Urban Service Area Boundary and committed to not support urban development outside of this boundary, which is considered SID's agricultural service area (City of Vacaville 2015a, p. LU-10). The General Plan designates two growth areas, East of Leisure Town Road Growth Area and the Northeast Growth Area, both within the City's Urban Growth Boundary (City of Vacaville 2015a, p. LU-10). Vacaville is a member agency for the Solano Habitat Conservation Plan (HCP), which implements conservation measures to ensure the protection of threatened and endangered species and their habitat. The Administrative Draft HCP was completed in October 2012; however, the HCP has not yet been formally adopted (Solano County Water Agency 2016).

The project site is designated as a future Specific Plan in the City's General Plan and is also designated as part of the East of Leisure Town Road Growth Area (City of Vacaville 2015a, Figure LU-2). The General Plan land use diagram (City of Vacaville 2015a, Figure LU-6) designates the site as Residential Low Density (3.1-5 units/acre), Residential Low-Medium Density (5.1-8.0 units/acre), Schools, Agricultural Buffer, and Public Open Space. The project site does not include zoning because it is located outside of the City limits. The Solano County General Plan designates the site as Agriculture and the site is zoned A-40, Exclusive Agriculture 40 acres (Solano County 2008, Solano County 2015a). The project site is not located within the area of influence for Nut Tree Airport, but is located within Land Use Compatibility Zone D for the Travis Air Force Base Airport Land Use Compatibility Plan (City of Vacaville 2013, Figure LU-4 and LU-5). The Travis ALUCP was updated in October 2015, to incorporate requirements for a wildlife hazard assessment for uses located within a certain distance of the base runway. The proposed project is located within the distance requiring this assessment (Solano County, 2015) and the EIR will incorporate an assessment of the project's potential to result in a significant hazard to aircraft overflight as a result on attracting wildlife across the base flight patterns.

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy LU-P2.1:** Require lands outside, but adjacent to, the current City limits to annex to the City of Vacaville as a prerequisite to development. Do not provide City utility services, water, and sanitary sewer to new development outside the City limit (with the exception of sanitary sewer for infill in the Elmira area) unless the City Council with the approval of the Local Agency Formation Commission (LAFCO), approves exceptions in situations where the following three conditions are met:
    - The area in question cannot annex into the City immediately, because it is not currently contiguous to the City limit.
    - The property owner signs a recorded, irrevocable agreement to annex the property to the City when such annexation is requested by the City.
    - The development is consistent with this General Plan and is found to meet all appropriate City development standards.
- **Policy LU-P2.2:** Require that specific plans be prepared for new areas brought into the city for development. Such specific plans must provide a coordinated plan for land use, public facilities, and public services. Prohibit individual, piecemeal developments within these outlying areas.
- **Policy LU-P3.6:** Require that new development or new Specific Plan areas be located immediately adjacent to existing development or infrastructure.

- **Policy LU-P17.5:** Require that specific plans be prepared for development in the East of Leisure Town Road Growth Area to ensure that coordinated plans for land uses, public facilities, and public services are created for such area, and require that these specific plans are consistent with the City's updated infrastructure master plans that account for development in the East of Leisure Town Road Growth Area.
- **Policy LU-P17.6:** Require that specific plans for the East of Leisure Town Road Growth Area include a diagram showing the distribution of land uses and define permitted and conditionally permitted land uses, major public facilities (including schools, parks, roads, water, sewer, and drainage facilities) phasing, infrastructure financing mechanisms, interim fire protection measures, and any other elements that may be needed to ensure an orderly development process with minimal adverse impacts to the existing community. The specific plans shall be consistent with the City's master infrastructure plans prepared of the East of Leisure Town Road Growth Area.

Travis Air Force Base, Airport Land Use Compatibility Plan

The Travis Air Force Base Airport Land Use Compatibility Plan sets forth land use compatibility policies applicable to future development in the vicinity of the base. The policies are designed to ensure that future land uses in the surrounding area will be compatible with existing and future aircraft activity at the base, including the potential for bird strike hazards to be created. The following policy is applicable to the project.

- **Section 5.8.2.c:** All discretionary projects located within the Bird Strike Hazard Zone and Outer Perimeter are required to consider the potential for the project to attract hazardous wildlife, wildlife movement, or bird strike hazards as part of environmental review process required by the California Environmental Quality Act (CEQA).

Discussion

a) The project site is currently undeveloped and in active agricultural use. The recently approved Brighton Land Subdivision project is located adjacent to the northern boundary of the site, Fry Road borders the southern boundary, Leisure Town Road borders the western boundary, and the Union Pacific railroad tracks and a small area of agricultural land borders the eastern boundary of the site. Residential development exists across Leisure Town Road to the west. Development of the proposed project would not divide established communities because the site does not contain any development. The closest developed land uses are located west of the project site (City of Vacaville 2013, p. 4.10-19). The General Plan EIR concluded that future development would not divide existing residential communities and new development would follow General Plan policies to encourage cohesive and connected communities. Therefore, this

impact would be less than significant. The proposed project will implement General Plan policies; and the impact would not change from what was identified in the General Plan EIR.

b) The General Plan EIR evaluated General Plan consistency with the ABAG SCS Plan preferred land use scenario, Solano County General Plan, Nut Tree and Travis Airforce Base Land Use Compatibility plans and the SID Master Water Agreement. The General Plan EIR concluded that future development consistent with the General Plan would not conflict with these land use plans and the impact would be less than significant; however, the project-level consistency with applicable City and County plans, and the airport land use compatibility plans, policies and regulations will be further evaluated in the EIR. In addition, because the Travis ALUCP was updated following the adoption of the City's General Plan, analysis of the potential for the project land use plan to result in wildlife hazard attractants affecting the air force base will be further evaluated in the EIR.

c) As discussed in the Setting above, the Solano HCP is not an adopted conservation plan. The Draft HCP was reviewed to develop goals, policies and actions of the General Plan so that, once adopted, the General Plan would be consistent with the HCP (City of Vacaville 2013, p. 4.10-26). The project site is located within the boundaries of the Solano HCP. The General Plan EIR concluded that implementation of this policy and action would reduce potential impacts to conflicts with the HCP to a less-than-significant level. Development of the proposed project will be consistent with General Plan policies to ensure that the project is consistent with the HCP when adopted. This impact was adequately addressed and would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XI. MINERAL RESOURCES - Would the project:			
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☒

Environmental Setting

According the General Plan, there is one limestone deposit with some evidence of historic use in the vicinity of Cement Hill and stone quarries in the Vaca Mountains. The western hills contain sandstone and conglomerates that may be used for sands, gravel and stone, but none of these

resources are currently being mined (City of Vacaville 2015a, p. COS-35). The project site is not located near Cement Hill or the western hills where mineral resources are known to occur. Vacaville is not mapped in an area containing aggregate mines by the California Geologic Survey (2012 Map Sheet 52). The are no mapped Mineral Resource Zone (MRZ)-2 zones in the City (City of Vacaville 2015b, p. 4.6-12). MRZ-2 zones are defined as those "areas where adequate information indicates that significant mineral resources (aggregate) deposits are present or where it is judged that there is a high likelihood for their presence" (City of Vacaville 2013, p. 4.6-20).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P16.1:** When reviewing land use proposals, take into account potentially available mineral resources on the property or in the vicinity of the project site.

Discussion

a, b) The project site is not located in an area known to contain mineral resources or have active or historic mineral resource recovery sites. The lack of MRZ-2 zones in the City indicates that there are no known mineral resources that would be of value to the region or the state. The General Plan EIR concluded that the lack of MRZ-2 zones and delineated locally important resource recovery sites along with implementation of Policy COS-P16.1 would result in a less than significant impact to mineral resources. Development on the project site would not result in the loss of availability of a known mineral resource or a mineral resource recovery site. Therefore, the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XII. NOISE – Would the project:			
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒

Environmental Setting

Noise monitoring conducted by LSA in 2010 indicates that existing daytime noise levels throughout the City range from 54 to 70 dBA L_{eq}, which is typical of urban or suburban settings (City of Vacaville 2013, p. 4.11-18). Documented sources of audible noise include vehicle traffic, aircraft overflights, heavy equipment operations, construction activity, loading and unloading operations, commercial activities, dogs barking, birds chirping, wind blowing and people conversing (City of Vacaville 2013, p. 4.11-18). The City's Municipal Code Section 8.10.030 limits operation of construction or grading equipment within 500 feet of an occupied residence to between 7:00 a.m. and dusk (one-half hour after sunset) Monday through Saturday and prohibits construction activities on Sunday (City of Vacaville 2008b).

The project site is surrounded by undeveloped agricultural lands to the south and east and residential development to the west and to the north. The Union Pacific railroad tracks are located to the east of the site and the eastern edge of the project site is located within the railroad's 60-65 dBA L_{dn} noise contour (City of Vacaville 2015a, Figure NOI-1). The roadway segment of Leisure Town Road from Elmira Road to Alamo Drive, which includes the project site, has existing noise contours of 60 dBA less than 50 feet from the centerline, 65 dBA 83 feet from the centerline, 60 dBA 178 feet from the centerline and 67.6 dBA 50 feet from the centerline of the outermost lane (City of Vacaville 2013, Table 4.11-5). Future buildout of the General Plan would cause an increase in noise levels on the segment of Leisure Town Road from Elmira Road to Alamo Drive by 2035. This is an increase of 3.6 dBA above existing conditions (City of Vacaville 2013, Table 4.11-9). The General Plan EIR identified noise environments normally acceptable, conditionally acceptable, normally unacceptable and clearly unacceptable for various land uses. For Residential Low Density (RL), 60 dBA L_{dn} is the normally acceptable limit and 65 dBA L_{dn} is the acceptable limit for Residential Multifamily (RLM), 70 dBA L_{dn} is the conditionally acceptable limit and 70-75 dBA L_{dn} in the normally unacceptable limit, and noise over 75 dBA L_{dn} is clearly unacceptable for both RL and RLM (City of Vacaville 2013, Table 4.11-8).

The project site does not lie within a noise contour from the Nut Tree Airport or the Travis Airforce Base (City of Vacaville 2013, p. 4.11-14).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy NOI-P1.1:** Require an acoustical analysis for all proposed projects that would located noise sensitive land uses where projected ambient noise level is greater than the respective "normally acceptable" noise level as indicated on Table NOI-3, and require mitigation of noise impacts that exceed the land use compatibility standards.
- **Policy NOI-P1.2:** Require that noise created by new transportation and non-transportation noise sources be mitigated, to the extent that is technically and economically feasible, to comply with noise level standards of Table NOI-3.
- **Policy NOI-P2.3:** Design subdivisions to minimize the transportation-related noise impacts adjacent to residential areas.
- **Policy NOI-P2.5:** Encourage the use of open space, earthen berms, parking, accessory buildings, and landscaping to buffer new and existing development from noise. Use sound walls only when other methods are not practical or when recommended by an acoustical expert as part of a mitigation program.
- **Policy NOI-P2.7:** Require that vibration-sensitive buildings (e.g., residences) are sited at least 100 feet from the centerline of railroad tracks whenever feasible. Require a study demonstrating that groundborne vibration issues associated with rail operations have been adequately addressed prior to allowing the development of vibration-sensitive buildings within 100 feet of the centerline of railroad tracks.
- **Policy NOI-P4.2:** Require the following construction noise control measures:
    - Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for equipment.
    - Location stationary noise-generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a construction area.
    - Utilize "quiet" air compressors and other stationary noise sources where technology exists.
    - Limit hours of operation of outdoor noise sources through conditions of approval.

Discussion

a) According to measurements conducted in 2009 adjacent to Leisure Town Road between Elmira and Marshall Roads, the ambient noise level near the project site is 74.8 L_{dn} (City of Vacaville 2013, Table 4.11-7). Policies in the General Plan require new development projects to mitigate

any noise impacts and to comply with the City's Land Use Compatibility Requirements, as defined in Table 4.11-8 of the General Plan EIR (City of Vacaville 2013, p. 4.11-21). Buildout of the City under the General Plan is not anticipated to increase railroad operations within the City and noise impacts from railroads are anticipated to remain similar to the existing conditions (City of Vacaville 2013, p. 4.11-22). General Plan policies require setbacks, use of noise barriers if applicable and mitigation to ensure that noise impacts for new development projects comply with the Land Use Compatibility Standards. Additional General Plan policies require design and maintenance of street networks to minimize transportation related noise impacts to noise-sensitive land uses, setbacks for commercial and office developments along freeways, discouraging residential development near freeways, and enforcing truck routes through the City. The General Plan EIR concluded that implementation of General Plan policies would reduce impacts related to exposing sensitive receptors to noise impacts from stationary sources, rail sources and transportation sources to a less-than-significant level.

As discussed in the Setting above, the project site is surrounded by residential development and agricultural lands. The Union Pacific Railroad tracks adjacent to the east would expose land uses in this area to noise levels of 60-65 L_{dn} (City of Vacaville 2013, Figure 4.11-1). The maximum noise impact from Leisure Town Road is 67.6 L_{dn} 50 feet from the centerline of the outermost lane (City of Vacaville 2013, Table 4.11-5). As shown in Table 4.11-9 on page 4.11-25 of the General Plan EIR, under 2035 conditions this would increase to 71.2 L_{dn}. A majority of the project development would be located further than 50 feet from Leisure Town Road. The project will comply with all General Plan policies to reduce noise impacts to sensitive receptors; and the impact would not change from what was identified in the General Plan EIR.

b) Future construction activities could result in disturbances to residences from groundborne vibration and noise associated with construction equipment as well as from proximity to the Union Pacific Railroad tracks (City of Vacaville 2013, p. 4.11-29). Consistency with the City's Land Use Compatibility Standards (City of Vacaville 2013, Table 4.11-8) would ensure that groundborne vibration and noise impacts from railroad sources are minimized. General Plan policies require the use of noise barriers, minimum railroad setbacks, and control measures that reduce exposure of noise sensitive land uses to construction-related groundborne vibration and noise. The General Plan EIR determined that implementation of General Plan policies would reduce impacts to sensitive receptors to excessive groundborne vibration or noise levels associated with future development to a less-than-significant level (City of Vacaville 2013, p. 4.11-30). The proposed project does not include any pile driving or use of other types of construction equipment that typically generates groundbourne vibration. The project will comply with all General Plan policies to reduce groundborne vibration and noise; and the impact would not change from what was identified in the General Plan EIR.

c) The General Plan EIR found that three roadway segments would experience an increase greater than 5 dBA compared to existing traffic noise levels. The three roadway segments are Vaca Valley Parkway from Interstate 505 northbound to Leisure Town Road (5.1 dBA), Leisure Town Road from Alamo Drive to Vanden Road (5.8 dBA), and Ulatis Drive from Nut Tree Road to Leisure Town Road (5.4 dBA) (City of Vacaville 2013, p. 4.11-30-31). The General Plan EIR concluded that although implementation of policies stated in Section (a) above would mitigate the severity of the effects of traffic noise, they would not prevent all of the anticipated traffic noise to occur along these roadway segments (City of Vacaville 2013, p. 4.11-32). General Plan Mitigation Measure NOI-1 requires the City to re-surface these roadways with quiet pavement, which would reduce traffic noise levels to below the 5 dBA significance threshold. With the implementation of Mitigation Measure NOI-1, this impact would be less than significant.

   Traffic volumes used to analyze future noise impacts in the General Plan EIR assumed development of the project site with residential uses. The roadway segment of Leisure Town Road that would exceed 5 dBA before mitigation is located immediately south of the project site at Alamo Drive and extends approximately 1.56 miles south to Vanden Road. The City is required to construct the roadway improvement to Leisure Town Road, per Mitigation Measure NOI-1. The project site is not adjacent to the segment of Leisure Town Road affected by Mitigation Measure NOI-1. The proposed project would comply with all General Plan policies related to reducing traffic related noise impacts. Therefore, the project would not result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, and the impact would not change from what was identified in the General Plan EIR.

d) Short term noise increases that could occur from future development include construction-related noise, an increase in traffic on local streets associated with construction activities, and an increase in noise from equipment and activities associated with demolition, site preparation and construction. Maximum noise levels generated during the site preparation phase of construction can range up to 91 dBA L_{max} at 50 feet from multiple pieces of operating equipment (City of Vacaville 2013, p. 4.11-33). General Plan policies NOI-P1.1 and P1.2 would ensure short-term noise impacts would be minimized by requiring consistency with the City's Land Use Compatibility Standards and policies. The General Plan EIR concluded that with implementation of these policies, the exposure of sensitive receptors to noise generated from future development construction activities would be less than significant.

   Construction of the proposed project would require site clearing, grading, trenching for utilities and building construction. The nearest sensitive receptors to the project site are existing residences located approximately 150 feet east across Leisure Town Road. The project would implement all General Plan policies related to minimizing construction related

noise and will comply with construction times specified in Section 8.10.030 of the City's Municipal Code. The impact would not change from what was evaluated in the General Plan EIR and would not result in a significant effect not identified in the General Plan EIR.

e, f) Portions of the City are within the 60 dBA CNEL noise contour for the Nut Tree Airport. According to the General Plan EIR, all proposed land use designations within this area are compatible with the 60 dBA contour (City of Vacaville 2013, p. 4.11-33). No portion of the City lies within the 60 dBA CNEL noise contour of Travis Airforce Base (City of Vacaville 2013, p. 4.11-35). The project site is located 5.35 miles from Travis Airforce Base and 2.67 miles from the Nut Tree Airport. The project site not located within a noise contour for the Travis Airforce Base (Solano County 2002) or the Nut Tree Airport (City of Vacaville 2013, Figure 4.11-2) and there are no private airstrips in the project vicinity. Compliance with General Plan policies would ensure any potential aircraft noise impacts associated with future development would be minimized. The General Plan EIR concluded that with implementation of General Plan policies, the impact of exposure of sensitive receptors to excessive noise from aircraft sources would be less than significant. There would be no impact on the project related to exposure to excessive noise levels from aircraft noise sources and the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XIII. POPULATION AND HOUSING – Would the project?			
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☒

Environmental Setting

The City's most recent Housing Element was adopted on May 12, 2015, and includes a housing needs assessment that identifies current and projected housing needs, as well as policies to accommodate affordable housing development for a range of income and household types (City of Vacaville 2015c). The latest Department of Finance (DOF) population estimate lists the population, as of January 1, 2015, for Solano County as 429,552 and for the City as 94,702 (DOF 2015). In 2015, DOF estimated 33,564 housing units in Vacaville, which was approximately 22%

of all units in Solano County (155,440 units). The average household size (persons per household) in the City in 2015 was 2.78, which was slightly below the Solano County average of 2.89. Single-family detached homes accounted for approximately 72% of Vacaville's housing stock (DOF 2015). The 2035 projections under the General Plan include 9,680 new dwelling units, 26,500 new residents, 9,720 new jobs, 1 million square feet of new commercial space, 1.1 million square feet of new office space, and 2.1 million square feet of new industrial space (City of Vacaville 2013, Table 4.12-3). ABAG projections for development by 2035 in the City includes 4,550 new households, 11,400 new residents and 13,730 new jobs between 2010 and 2035 (City of Vacaville 2013, p. 4.12-6). The City's 2035 projections were based on actual development trends in the City instead of the ABAG's projections. The City did not use the ABAG projections because they did not accurately reflect past development trends and reflected a more limited amount of residential development through 2035 (City of Vacaville 2013, p. 3-42).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy LU-P1.3:** Preserve predominantly single-family residential character of Vacaville while providing other housing opportunities.
- **Policy LU-P1.4:** Protect established neighborhoods from incompatible uses.
- **Policy LU-P2.2:** Require that specific plans be prepared for new areas brought into the city for development. Such specific plans must provide a coordinated plan for land use, public facilities, and public services. Prohibit individual, piecemeal developments within these outlying areas.
- **Policy LU-P3.2:** Manage growth so that the quantity and quality of public services and utilities provided to existing businesses and residents will not drop below required levels of service because of new development, except when required findings related to levels of service are made. While existing development bears some responsibility to fund improvements that will resolve such deficits, ensure that new development also funds its fair share of the cost of maintenance and depreciation of facilities.
- **Policy LU-P3.4:** Do not approve new development unless there is infrastructure in place or planned to support growth.
- **Policy LU-P3.6:** Require that new development or new Specific Plan areas be located immediately adjacent to existing development or infrastructure.

Discussion

a) Future buildout of the City's General Plan includes 9,680 new dwelling units, 26,500 new residents, 9,720 new jobs, 1 million square feet of new commercial space, 1.1 million square feet of new office space, and 2.1 million square feet of new industrial space (City of Vacaville

2013, Table 4.12-3). As discussed in the Setting above, the City did not use ABAG projections for estimating growth through 2035 because the City anticipated growth would exceed the ABAG projections for the region (City of Vacaville 2013, p. 4.12-7). General Plan policies require that development in new urban areas should be planned and new growth should only occur in areas served by existing utilities and public services. The City's UGB would continue to protect agricultural lands from conversion to non-agricultural uses. General Plan and ECAS policies would require orderly, planned growth within the UGB in areas already served, or planned to be served, by urban services. However, the General Plan EIR concluded that because buildout of the General Plan by 2035 would significantly exceed development projected by ABAG's existing and expected future 2035 projections, this impact would be significant. In order to reduce the anticipated population growth by 2035 to a level that would not exceed ABAG projections, the City would have to limit housing opportunities to less than half of what is projected under the General Plan. Additionally, the City has already approved projects accounting for 4,900 new units which would already exceed ABAG projections (City of Vacaville 2013, p. 4.12-9). The City cannot rescind existing development entitlements so it would be infeasible to reduce development capacity to meet ABAG projections. It is not feasible to mitigate population growth to a level that is not substantial; therefore, this impact was determined to be significant and unavoidable.

The project site is located east of existing residential development and south of the recently approved Brighton Landing project. The area south of the project site is designated primarily as "Urban Reserve" with a small area adjacent to the Union Pacific Railroad tracks designated as "Commercial Service" in the General Plan (City of Vacaville 2015a Figure LU-6). The Urban Reserve designation provides flexibility for future planning while demonstrating that the City eventually expects urban development in this area (City of Vacaville, 2015a LU-23). The proposed project would not be a catalyst for development in an area not served by existing utilities since expansion of the roadway network and water and sewer infrastructure is included in the approved Brighton Landing project and future urban development is also planned for the area south of the project site. The project applicant will follow all General Plan policies related to orderly, planned growth; and the project would not result in a significant impact not already identified in the General Plan EIR

b, c) Much of the City's future development would occur as residential or non-residential uses developed on agricultural, vacant or underutilized parcels (City of Vacaville 2013, p. 4.12-9). The General Plan EIR concluded that impacts related to displacing housing or peoples would be less than significant. The project site is currently vacant and does not contain housing or people and development of the project site would not require demolition of housing or displacement of people. Therefore, the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XIV. PUBLIC SERVICES			
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:			
Fire protection?	☐	☐	☒
Police protection?	☐	☐	☒
Schools?	☐	☐	☒
Parks?	☐	☐	☒
Other public facilities?	☐	☐	☒

Environmental Setting

The Vacaville Fire Department (VFD) provides fire and emergency medical services to approximately 28 square miles within the City, as well as emergency medical services to approximately 160 square miles of unincorporated county land surrounding the City (City of Vacaville 2015a, p. PUB-1-2). The VFD has administrative offices at City Hall, as well as four existing stations in the City; Station 72 located at 2001 Ulatis Drive is the closest station to the project site located approximately 1.46 miles northwest (City of Vacaville 2013, Table 4.13-1). The VFD currently employs 93 fire prevention, suppression, investigation, and administration personnel (VFD 2016). A 2003 Standard of Response Coverage evaluation indicated that staffing levels were just meeting the City's needs and as the City expands along its outer areas, additional fire staff and stations would be required in order to maintain adequate service (VFD 2003). VFD plans to develop three new fire stations and relocate one existing fire station. The three new locations are planned for the Southtown area (Station 75) at Vanden and Cogburn Circle, Lower Lagoon Valley (Station 76), and Orange Drive just east Leisure Town Road (Station 77). Construction of Station 77 would be contingent on the relocation of Station 73 (City of Vacaville 2013, p. 4.13-11). VFD's adopted standard response time and success rate is 7 minutes for 90% of calls, which refers to the time period between VFD notification and arrival on the scene of the incident within the City limits (City of Vacaville 2013, p. 4.13-12). VFD has mutual aid agreements with Dixon, Fairfield and the Vacaville Fire Protection District for provision of automatic aid response in designated areas.

The Vacaville Police Department (VPD) provides law enforcement services to the City and includes a 24/7 communications center, crime suppression and prevention, investigations, traffic patrol and emergency services. The single main VPD police station is located at 660 Merchant Street, adjacent to Vacaville City Hall, and is approximately 3.40 miles northwest

of the project site. VPD employs 103 sworn officers and 58 non-sworn full-timer personnel, and due to budget constraints 13 sworn and 12 non-sworn personnel positions are unfulfilled (City of Vacaville 2013, p. 4.13-2). VPD standards for average response time are 6 minutes and 1 second for Priority I calls and 16 minutes and 28 seconds for Priority II calls. Currently, the VPD has an average response time of exactly 6 minutes for Priority I calls and 15 minutes for Priority II calls (City of Vacaville 2013, p. 4.13-3). Vacaville receives assistance with police services from the Solano County sheriff's office approximately 10-15 times per year (City of Vacaville 2015a, p. PUB-5).

The project site is located with the Vacaville Unified School District (VUSD) and students would attend Callison Elementary School, located approximately 0.52 mile west, Vaca Pena Middle School located approximately 1.11 miles northwest, and Will C. Wood High School located approximately 2.40 miles west. The current remaining capacity for VUSD schools is 1,623 students grades K-6, 507 students grades 7-8, and 793 students grades 9-12 (City of Vacaville 2013, Table 4.13-8).

The City is currently served by two libraries, the Town Square Branch Library, located at 1 Town Square Place and the Cultural Center Branch Library, located at 1020 Ulatis Drive (City of Vacaville 2013, p. 4.13-33).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy PUB-P1.1:** Prohibit any development that will not, even with identified mitigation measures, maintain standards for fire, rescue and emergency medical service. All service standards shall be met prior to project occupancy. Allow exceptions to these service standards only when there are overriding findings of special circumstances or economic or social benefits.
- **Policy PUB-P1.2:** Ensure that new development pays a fair and equitable amount to offset the costs for fire, rescue, and emergency medical response services by collecting impact fees, requiring developers to building new facilities, and requiring the new areas to create or annex into a Community Facilities District.
- **Policy PUB-P2.2:** Prohibit any development that will not, even with identified mitigation measures, maintain standards for law enforcement service. All service standards shall be met prior to project occupancy. Allow exceptions to these service standards only when there are overriding findings of special circumstances or economic or social benefits.
- **Policy PUB-P2.3:** Ensure that new development pays a fair and equitable amount to offset the costs for law enforcement services by collecting impact fees and requiring the creation of or annexation into a Community Facilities District.

- **Policy PUB-P4.4:** If planned school sites, as shown in Figure PUB-3, are not required or are needed in an alternate location, as determined by the school districts, the land use designation of the site will revert to the predominant land use in the area through a General Plan Amendment process.

Discussion

a) i. Fire Protection

Future development within the City by 2035 is projected to add 9,680 new dwelling units and 26,500 new residents and it is likely that new or expanded facilities would be required to support additional staff and serve new development (City of Vacaville 2013, p. 4.13-14). Land outside of the City limits is currently served by four fire protection districts, but any land developed under the General Plan outside the City limits would first be annexed into the City (City of Vacaville 2013, p. 4.13-14). Upon annexation into the City, VFD would be the service provider for new development. General Plan policies would be implemented to reduce fire protection services by minimizing fire risks and ensuring the adequate provision of fire protection and emergency medical response services to existing and future development. New development would be required to pay a fair and equitable impact fee to offset for the cost of fire and emergency medical services, in compliance with General Plan policy PUB-P1.2. The General Plan EIR concluded that future development would have a less than significant impact on the provision of fire and emergency medical services. The proposed project would create or annex into the existing Communities Facilities District (CFD) and would comply with all General Plan policies related to reducing fire risks including payment of developer impact fees. In addition, in compliance with the City's Fire requirements the project's proposed phasing plan provides for secondary emergency access. The Phasing Plan allows this access to be placed at various points to allow secondary access into and out of the project area, depending on the timing of adjacent streets and developments. The City's development review process would allow the Fire Department to place access points as-needed as the project is built out This impact has been adequately addressed and would not change from what was identified in the General Plan EIR.

ii. Police Protection

Upon annexation into the City, VPD would be the service provider for new development. The General Plan EIR determined that in order to maintain the City's existing staffing ratio and adopted response standards, the VPD would need to add 30 officers, with associated equipment and vehicles. The existing VPD facilities would be sufficient to support additional officers and serve future development (City of Vacaville 2013, p. 4.13-

4). Compliance with General Plan policies would ensure adequate police staffing is available to serve existing and future growth. New development would be required to pay a fair and equitable impact fee to offset the cost of law enforcement services under General Plan policy PUB-P2.3. The General Plan EIR concluded that future development would have a less than significant impact on the provision of police protection services. The proposed project would create or annex into the existing CFD and will comply with all General Plan policies related to reducing police risks including payment of developer impact fees. This impact has been adequately addressed and would not change from what was identified in the General Plan EIR.

iii. Schools

The General Plan projected that new housing within the VUSD could generate over 3,000 new students, which would exceed the existing capacity (2012/13) in VUSD schools (City of Vacaville 2013, p. 4.13-28). VUSD has plans for future school sites in the North Village and Rice McMurtry areas, and the General Plan identifies three new school sites, two elementary schools and one private high school, in the area east of Leisure Town Road, including the future school site designated on the north portion of the project site. VUSD does not have current plans to develop these school sites, but once built these new schools would increase VUSD's total capacity by 1,300 students, which would accommodate new students generated by future development (City of Vacaville 2013, p. 4.13-29). All new residential and commercial development would be required to pay a developer impact fee to fund school improvement projects (City of Vacaville 2013, p. 4.13-30). The General Plan EIR concluded that impacts to the VUSD would be less than significant since payment of development fees is deemed to fully mitigate the impacts of new development on school facilities under Section 65996 of the California Government Code. The project site includes one of the two elementary school sites discussed above in the area east of Leisure Town Road. The project would pay required developer fees to mitigate impacts to schools facilities. Therefore, the impact would not change from what was identified in the General Plan EIR.

iv. Parks

Impacts to parks and the provision of parkland is evaluated in Section XV Recreation, below.

v. Other Public Facilities

Future development within the City could impact other public services including libraries (City of Vacaville 2013, p. 4.13-35). It is expected that availability of school library facilities would decrease the potential impact on City and County library facilities.

Compliance with General Plan policies would ensure that adequate public services and facilities are funded to meet increasing demand. The General Plan EIR concluded that impacts to library facilities would be less than significant. The project would comply with General Plan policies related to ensuring adequate provision of other public facilities including library facilities; and the impact would not change from what was identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XV. RECREATION – Would the project?			
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☒

Environmental Setting

The General Plan classifies park and recreational facilities into six categories: Neighborhood parks, community parks, regional parks, accessible open space, special purpose facilities, and bikeways, multi-use trails and nature trails (City of Vacaville 2015a, p. PR-1-3). Development of parks, recreation and open space facilities in the City is guided by the City's *Comprehensive Parks, Recreation, and Open Space Master Plan* adopted in 1992. Funding for acquisition and development of parks is primarily derived from park development impact fees. Operation of City parks is provided by the Community Services Department and funded through the City's General Fund and user fees, while maintenance of City parks is provided by the City's Public Works Department and funded primarily through the General Fund and numerous maintenance districts (City of Vacaville 2015a, p. PR-9).

The City standards for provision of park and open space is 4.5 acres of developed parkland per thousand residents, which is further divided into 1.8 acres per 1,000 people for neighborhood parks, 1.7 acres per 1,000 people for community parks, and 1.0 acre per 1,000 people for regional parks (City of Vacaville 2015a, p. PR-13). Currently the City provides 1.3 acres of neighborhood park per 1,000 people, 1.6 acres of community park per 1,000 people, and 3.7 acres of regional parkland per 1,000 people for a total of 6.6 acres of parkland per 1,000 people (City of Vacaville 2013, p. 4.13-47). The General Plan states that new neighborhood parks must be a minimum of 6 acres in size and can be as large as 9 acres, as needed, to serve the local

area, while new community parks must be a minimum of 10 acres in size and can be up to 40 acres as needed to serve the area. The service area standard for neighborhood parks is a 0.5 mile maximum, approximately a 10 minute walk, and a 1.5 mile maximum for community parks (City of Vacaville 2015a, p. PR-15).

Currently, the City meets service standard ratios for baseball/softball fields, neighborhood centers and swimming pools, but is deficient in facility ratios for the other eight recreational facility types (City of Vacaville 2013, p. 4.13-53).

The nearest existing neighborhood park to the project site is Normandy Meadows Park located approximately 0.34 mile southwest and the nearest existing community park is Nelson Park, located approximately 1.0 mile northwest. The only regional park in the project area is Lagoon Valley Regional Park, located approximately 4.40 miles generally west of the project site (City of Vacaville 2015a, Figure PR-1). A new neighborhood park, East of Leisure Town Road Park, and a new community park, Elmira Park, are planned just north of the project site (City of Vacaville 2015a, Figure PR-4).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy PR-P1.1:** Provide new parks according to the standards established in this Element to ensure adequate distribution, size and access.
- **Policy PR-P1.8:** Make designated open spaces more accessible to the public with a linked park and trail system that takes advantage of surrounding open space.
- **Policy PR-P2.1:** All parks and recreational facilities required by the park standards in this Element shall be publicly owned, operated, and maintained, except as otherwise allowed by the Quimby Act.
- **Policy PR-P2.2:** New parks and recreation facilities shall be funded, at least in part, by fees paid by new development, or as turn-key facilities with new development, as described in Policy PR-P2.5.
- **Policy PR-P2.3:** Require that proponents of large projects subject to Specific Plans and/or Development Agreements work with City staff early in the planning process to ensure that the project includes an adequate amount of developed parkland to satisfy City standards.
- **Policy PR-P2.4:** Require all residential developers, including apartment builders, to provide sufficient parks and other recreational facilities to meet the standards established by the Comprehensive Parks, Recreation, and Open Space Facilities Master Plan by dedicating land and/or paying in-lieu fees for land acquisition, and by paying Park Development Impact Fees for the construction of new facilities.

- **Policy PR-P2.5:** Encourage development of turn-key neighborhood parks, which are completed in conjunction with development of a new subdivision, rather than payment of impact fees.
- **Policy PR-P3.1:** Locate new neighborhood parks adjacent to new elementary schools where possible. Whenever possible, work with the school district to design both the park and school to maximize the benefits to the public.
- **Policy PR-P3.4:** Locate parks and recreation facilities to take advantage of natural features, adjoining open spaces, trail access, lands that may be jointly-used for recreation purposes, land use buffers (i.e., areas of open space or low-intensity uses between potentially conflicting land uses), urban separators and easements.

Discussion

a, b) As discussed in the Setting above, the City is currently deficient in meeting the provision standards for neighborhood and community parkland, but exceeds the standard for regional and total parkland. The City is also deficient in meeting service standards for eight of the eleven recreational facility types. The General Plan is projected to add a total population of 112,000 residents by 2035, which would exacerbate the deficiencies in neighborhood and community parks and recreational facilities. It is estimated that in order to meet these standards by 2035, an additional 91 acres of neighborhood parkland and 50 acres of community parkland would be needed (City of Vacaville 2013, p. 4.13-49). General Plan policies would ensure that parkland and recreational facility goals are met by requiring construction of new park facilities or payment of in-lieu park fees for land acquisition and park development impact fees for the construction of new facilities. Additional policies would ensure that parks and recreational facilities are not overburdened by use and that the public's investment in parks and recreational facilities is protected. The General Plan EIR concluded that with implementation of General Plan policies, impacts to parks and recreational facilities would be less than significant.

The proposed project includes over 23 acres of open space along the eastern boundary of the project site. This open space is envisioned to include a mix of uses such as hiking, biking, horseback riding and other open space activities; group picnic facilities; a dog park, community gardens, environmental education facilities and observation points that interface with the adjacent detention basin. These uses are consistent with the General Plan, Parks and Recreation Element designation of accessible open space for areas along the eastern edge of the project site. The project also includes five small "stroller" parks, approximately one half acre in size, which would include special paving, themed plant collections, motion sensing lights, shaded group seating and public art. In addition, the project has dedicated 16 acres for a school site that could include a shared park facility once constructed. The project would

provide park and open space that is adequate to serve the projected population and would not contribute to the degradation of neighborhood parks elsewhere. Additionally, the project will implement all General Plan policies and pay any park fees related to the adequate provision of parkland and recreational facilities. Therefore, the project's impacts to recreation facilities would not result in significant effect not already identified in the General Plan EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XVI. TRANSPORTATION/TRAFFIC – Would the project?			
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☒	☐	☐
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☒	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒
e) Result in inadequate emergency access?	☒	☐	☐
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☒	☐	☐

Environmental Setting

The City is served by two major freeways, Interstate 80 (I-80) with four lanes in each direction extending southwest toward Highway 101 in San Francisco and northeast toward Sacramento and beyond, and Interstate 505 (I-505) with two lanes in each direction connecting I-80 with Interstate 5 (I-5). Six lane arterials in the City include a portion of Elmira Road, a portion of Alamo Drive and, where Vaca Valley Parkway turns into Leisure Town Road. Leisure Town Road and Fry Road are both identified as two lane arterial streets (City of Vacaville 2015a, Figure TR-1). Leisure Town Road is slated to be widened to a four lane arterial or collector

street and Fry Road would be widened to a four lane collector at Leisure Town Road and a 2 lane collector further east (City of Vacaville 2015a, Figure TR-4). Existing public transportation in the area includes local and regional bus service and taxi operations. Bus service in the City is provided by Vacaville City Coach, Fairfield and Suisun Transit (FAST), and YOLOBUS, while taxi service is provided by a number of privately-operated taxi companies (City of Vacaville 2015a, p. TR-8-9).

Planned improvements under the General Plan that would be implemented by the City include six roadway improvements in the East of Leisure Town Road Growth Area. These improvements include widening Elmira Road to a four-lane arterial from Leisure Town Road to the new north-south (N-S) 2-lane arterial; widening Fry Road to a four-lane arterial from Leisure Town Road to the new N-S 2-lane arterial; widening Hawkins Road to a four-lane arterial from Leisure Town Road to the New N-S 2-lane arterial; extending Marshall Road as a 2-lane collector from Leisure Town Road to the New N-S 2-lane collector; the construction of a new N-S 2-lane arterial between Fry Road and Hawkins Road; and the construction of a new N-S 2-lane collector between Marshall Road Extension and Elmira Road (City of Vacaville 2015a, Table TR-1). Planned transit improvements in the City include construction of a new commuter rail station at the southeast corner of Peabody Road and Vanden Road. Additionally, non-motorized transportation improvements include construction of a Class I bike path along Ulatis Creek between Allison Drive and I-80, and construction of a Class I bike path along the Union Pacific Railroad right-of-way on the north side of Elmira Road between Leisure Town Road and Edwin Drive approximately 0.5 mile north of the project site (City of Vacaville 2015a, p. TR-21).

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy TR-P3.1:** Strive to maintain LOS C as the LOS goal at all intersections and interchanges to facilitate the safe and efficient movement of people, goods and services. Design improvements to provide LOS C conditions based on the City's most recent 20+year traffic forecast. At unsignalized intersections, maintain an overall LOS C standard with the worst approach to the intersection not exceed LOS D.
- **Policy TR-P3.2:** At signalized and all-way stop control intersections, LOS mid-D shall be the LOS significance threshold. At two-way stop control intersections, LOS-midE shall be the LOS significance threshold on the worst approach.
- **Policy TR-P4.2:** As part of development approvals, require reasonable demonstration that traffic improvements necessary to mitigate development in accordance with policies TR-P3.1 through TR-P3.3 will be in place in time to accommodate trips generated by the project, or satisfy findings identified in policies TR-P3.4 and TR-P3.5.

- **Policy TR-P4.3:** In order to ensure that adequate roadway capacity is provided for the buildout of the General Plan and that new development does not preclude the construction of adequate circulation facilities, require all new development to provide right-of-way dedications consistent with this Transportation Element (Figure TR-6).
- **Policy TR-P6.3:** Consider traffic calming measures consistent with the City's traffic calming policies and approved by the City as part of development proposals in an effort to lower vehicle speeds and enhance mobility for bicyclists and pedestrians.
- **Policy TR-P7.3:** Require that new development applications include transit amenities, such as bus stops, bus bays, transit shelters, benches and on-site drop-off locations, as appropriate, or explain why these features are infeasible or unnecessary.

a, b) Under the General Plan 2035 conditions, 34 of the 100 study intersections would exceed level of service standards during one or both peak hours (City of Vacaville 2013, p. 4.14-41). Of these 34 intersections, seven intersections were identified along Leisure Town Road at Alamo Road, Elmira Road, I-80 Eastbound Ramps, Orange Drive, Midway Road, Gilley Way, and Marshall Road. Mitigation Measures TRAF-4, TRAF-5, TRAF-6, TRAF-7, TRAF-19, TRAF-23 and TRAF-24 require the City to make various improvements to the intersections such as addition of right-turn and through lanes, conversion of through-right shared lanes to through lanes and addition of traffic signals to improve LOS. The General Plan EIR concluded that these measures would raise LOS to acceptable levels at all intersections. Improvements required at the intersection of I-80 and Leisure Town Road are not within the City's jurisdiction and since the City cannot assure the timing, right-of-way and funding for improvements this impact is significant and unavoidable.

Project-specific impacts to LOS operations and compliance with General Plan LOS standards and CMP requirements are considered potentially significant and will be further evaluated in the EIR.

c) The Nut Tree Airport is within the City limits and under the General Plan land use designations this area would be consistent with existing development and with airport operation requirements (City of Vacaville 2013, p. 4.14-72). General Plan policies limit residential development in areas impacted by potential hazards from airport uses and requires working with the Solano County Airport Land Use Commission to prevent development that could affect air traffic patterns due to its nature or height. The General Plan EIR concluded that future development would have a less than significant impact on air traffic patterns. The project site is not located within the Nut Tree Airport Land Use Compatibility Zone. This impact has been adequately addressed and would not change from what was identified in the General Plan EIR.

d) Future development would increase both residential and commercial land uses requiring modification of existing roadways and construction of new roadways to support growth (City of Vacaville 2013, p. 4.14-72). Roadway improvements are required to comply with the City's Standard Specifications for Public Improvements, which would reduce potential hazards due to roadway design or incompatible uses. General Plan policies require arterial and collector roadways to meet LOS standards to avoid traffic diversion and to discourage traffic on local streets. The General Plan EIR concluded that designing roadway improvements in accordance with City standards and General Plan policies would ensure that future development does not significantly increase hazards due to design features. This impact would be less than significant. All roadway improvements and new roadway construction included as part of the proposed project will comply with General Plan policies and City standards related to design and LOS; and the impact would not change from what was identified in the General Plan EIR.

e) General Plan policies related to LOS standards, integrated roadway networks and arterial roadway design would ensure efficient circulation and adequate access are provided throughout the City, which would help facilitate emergency response (City of Vacaville 2013, p. 4.14-73). However, the General Plan EIR found that 34 intersections would fall below an acceptable LOS standard as a result of future development, and these intersections may not be able to be mitigated when the improvements are needed (City of Vacaville 2013, p. 4.14-74). This effect, combined with the project's planned build-out in phases could potentially affect emergency access and the General Plan EIR concluded that this impact would be significant and unavoidable. Project-specific impacts to emergency access will be further evaluated in the EIR.

f) The General Plan contains policies to provide for an integrated network of bicycle and pedestrian facilities as well as public transit (City of Vacaville 2013, p. 4.14-74). General Plan policies are designed to enhance and construct bike route networks throughout the City, develop continuous pedestrian walkways within the Downtown and residential neighborhoods, add pedestrian trials, and support expansion of transit network services. Under the General Plan, new development is required to include transit amenities unless justification for non-provision is provided, bike paths or bike lanes when appropriate and adequate public and private bicycle parking and storage facilities. New roadway networks must be designed to accommodate transit vehicles, on-street bicycle lanes and form grid patterns to improve access and circulation for all modes. The General Plan EIR concluded that implementation of General Plan policies would ensure that future development would support and not conflict with plans, programs and policies regarding bicycle or pedestrian facilities and the impact would be less than significant (City of Vacaville 2013, p. 4.14-75).

The proposed project includes a transportation network that would serve all modes of transportation including pedestrians, bicyclists, vehicles and provide access to transit. The on-site roadway network consists of a 2-lane divided arterial, major collector roads, an undivided minor collector road, and a series of undivided 2-lane neighborhood serving streets. All roads would include sidewalks or a multi-purpose trail to accommodate pedestrians and bicyclists. Multi-purpose trails are proposed along Leisure Town Road, Alamo Drive Extension and Fry Road. The project is not currently served by public transit, but the project includes space along the arterial and major collector roads to accommodate future transit stop facilities. The project would dedicate lands adjacent to Leisure Town Road to the City for future expansion of this roadway. The potential for the project to conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities will be further evaluated in the EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XVII. UTILITIES AND SERVICE SYSTEMS – Would the project?			
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☒	☐	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☒	☐	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☒	☐	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒
e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☒	☐	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☒	☐	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒

Environmental Setting

Water

The City has three primary water sources: the Solano Project, State Water Project (SWP) water and settlement water from the North Bay Aqueduct (NBA), and groundwater sources (City of Vacaville 2015a, p. PUB-18). From the Solano Project, the City is entitled to 5,750 acre-feet per year (AFY) of water (City of Vacaville 2011a). The NBR plant provides a capacity of 13.3 mgd for the City and supplies water directly to the City's distribution system. The NBR plant draws water from the Sacramento River Delta via the NBA, as well as Solano Project water from the Putah South Canal (NV5 2016). In addition, the 1995 Master Water Agreement with the Solano Irrigation District (SID) provides the City with an increasing supply of water from SID through the year 2040 and a consistent supply thereafter until 2050. In 2016, the City will receive 3,325 AFY from SID, which would increase to 10,050 AFY by 2040 (City of Vacaville 2011a, Table 5). From the SWP, the City receives an annual allocation of 8,978 AFY (NV5 2016). The City receives 9,320 AFY annually of Settlement Water (available by the State Department of Water Resources), of which it currently only uses 25 to 30% (NV5 2016).

The City has 11 operating groundwater wells, most of which are located in the Elmira well field, and currently provide approximately 5,500 afy of potable water (NV5 2016).The City's total water supply available in 2015 from groundwater, surface water, and recycled water was approximately 34,173 AFY. The actual water supplied to the City in 2015 was 13,205 AFY (NV5 2016). The total water supply (allocation or safe yield) available to the City in 2040 will be approximately 42,198 AFY (NV5 2016).

The City plans to expand its water distribution system infrastructure to serve future development by 2035 including the addition of an 18 to 24-inch pipeline along Leisure Town Road from Fry Road to Elmira Road (City of Vacaville 2015a, Figure PUB-4). Two water treatment facilities are operated by the City: the Diatomaceous Earth Water Treatment Plant (DE Plant) located on Elmira Road and owned by the City, and the North Bay Regional Water Treatment Plant (NBR Plant) located in Fairfield and jointly owned by the City and the City of Fairfield (City of Vacaville 2015a, p. PUB-19). The NBR Plant can provide approximately 13.3 million gallons per day (mgd) to the City via a 30-inch transmission water main routed along Peabody Road. The DE Plant has a 12-mgd capacity, but currently operates for 12 hours of full production resulting in an estimated daily capacity of 6 mgd (City of Vacaville2016).

The proposed project would tie into existing water lines in Leisure Town Road as well as connecting to water lines within the approved Brighton Landing Subdivision project to the north in order provide a looped system. The proposed project would install a water main within Fry Road that the project's on-site water system would tie into. This establishes Fry Road as a

looped redundant water supply system that connects to the water line in Leisure Town Road. Residences would be served by a series of 8-inch and 12-inch water lines to be located with project roadways. The non-potable or irrigation supply for public areas of the project is anticipated to be recycled. All supply lines, valves, and sprinkler heads are required to be marked as such, and public landscape signed to indicate the use of recycled water. This system is expected to interconnect with the system to the north at Leisure Town Road, as well as to Brighton Landing to the north via the two lane arterial.

A Water Supply Assessment (WSA) was prepared by NV5 for the proposed project as well as other current planned development in the City (see Appendix C).

Wastewater

The City provides wastewater collection and treatment infrastructure to the project area. The City owns and operates the Easterly Wastewater Treatment Plant (WWTP) located east of the City adjacent to the unincorporated town of Elmira. The Easterly WWTP has a sanitary base flow (SBF) capacity of 15 mgd and a 55 mgd peak hour wet weather flow (City of Vacaville 2014b). The existing SBF capacity is approximately 8 mgd and the measured peak hour wet weather flow has only exceeded 40 mgd on two occasions in the past ten years (City of Vacaville 2014b). Upgrades to the Easterly WWTP allow the plant to maintain compliance with its NPDES permit, but did not add capacity above the current 15 mgd. The City's wastewater collection system consists of sewer lines ranging in diameter from 6- to 54-inches, and seven lift stations and associated facilities (City of Vacaville 2013, p. 4.15-29).

Stormwater

The City is located within four watersheds, Gibson Canyon Creek, Ulatis Creek, Horse Creek and Alamo Creek, all of which are part of the larger 150 square mile Ulatis Creek watershed (City of Vacaville 2013, p. 4.15-40). The natural, unaltered portions of the creeks generally do not have adequate flow capacity to convey a 100-year storm event, while the modified natural channels were designed to provide a 10-year or 50-year level of protection (City of Vacaville 2013, p. 4.15-42). The City has several regional detention basins, both natural and constructed, that reduce the flow in the creeks before reaching the City in order to reduce flooding. Storm drains within the City are required to convey the 10-year design flows and in order to accommodate surface drainage, the City requires that streets and public rights-of-way be designed to provide overland release of runoff for the 100-year storm (City of Vacaville 2013, p. 4.15-43).

A detention basin constructed by the Brighton Landing Subdivision project, which is located adjacent to and east of the PG&E power lines, was constructed to serve build-out of both the Brighton Landing and the Roberts' Ranch projects. The project's on-site storm drain pipes

connecting to the detention basin would range in size starting at the detention basin and gradually decreasing in size as the storm drain system extends west to the upper ends of the system. Discharge from the basin is through use of a public pump station which discharges into the Frost Spill, a small drainage way paralleling the railroad tracks which conveys storm water north to Old Alamo Creek. The pump station may require an upgrade to install high flow pumps which would provide the capacity to accommodate post development flows from both the Brighton Landing and Roberts' Ranch projects.

Solid Waste and Recycling

Recology Vacaville Solano provides solid waste, yard waste and recyclable materials collection in the City. The City's 2010 per capita disposal rate was 4.9 pounds per resident per day, which is below the City's target disposal rate of 6.5 pounds per resident per day (City of Vacaville 2013, p. 4.15-47). Solid waste collected by Recology is deposited at the Hay Road Landfill (SWFP 48-AA-0002) located at 6426 Hay Road in Vacaville. The Hay Road Landfill has a permitted daily capacity of 2,400 tons and a total capacity of 37 million cubic yards (Cal Recycle 2016). The landfill receives approximately 136,066 tons of solid waste, of which 81,268 tons is from Vacaville (City of Vacaville 2013, p. 4.15-48). The landfill has a remaining capacity of 30.4 million cubic yards and is projected to reach capacity in 2069 (Cal Recycle 2016). The Household Hazardous Waste Facility, operated by Recology Vacaville Solano, accepts disposal of household hazardous waste (City of Vacaville 2013, p. 4.15-48).

Recyclable material generated by the proposed project would be taken to the Recology Vallejo facility located in Vallejo. Unrecyclable solid waste would be taken to the Hay Road Landfill l in Vacaville.

Listed below are relevant policies from the City of Vacaville General Plan adopted on August 11, 2015:

- **Policy COS-P13.4:** Require new development to incorporate Best Management Practices (BMPs) for water use and efficiency and demonstrate specific water conservation measures.
- **Policy COS-P13.7:** Explore installation of dual plumbing in large, new commercial and/or residential developments to enable future use of recycled non-potable water generated on- or off-site.
- **Policy COS-P14.3:** Encourage pest-tolerant landscapes using native plants to minimize the need for pesticides.
- **Policy COS-P14.5:** Require the implementation of Best Management Practices (BMPs) to minimize erosion, sedimentation, and water quality degradation resulting from construction or from new impervious surfaces.
- **Policy PUB-P9.9:** Require construction sites provide for the salvage, reuse, or recycling of construction and demolition materials and debris.

- **Policy PUB-P12.1:** Prohibit any development that will not meet standards of water service. All service standards shall be met prior to project occupancy.
- **Policy PUB-**P12.3: Require new development provides fair share funding for all required water utility infrastructure and facilities.
- **Policy PUB-P12.4:** Require that new development designate water service corridor easements or routes when tentative maps or specific plans are approved.
- **Policy PUB-14.3:** Ensure that new development provides adequate funding for all wastewater infrastructure and facilities.
- **Policy PUB-P14.4:** Prohibit any development that will not maintain adequate standards for wastewater service. All wastewater service standards shall be met prior to project occupancy.
- **Policy PUB-P14.5:** Require that new development designate sewer easements or routes when tentative maps or specific plans are approved.
- **Policy SAF-P3.1:** Evaluate the storm drainage needs for each project; this evaluation should account for projected runoff volumes and flow rates once the drainage area is fully developed. In the Alamo Creek watershed upstream of Peabody Road (including Alamo, Laguna, and Encinosa creeks), require post-development 10-year and 100-year peak flows to be reduced to 90% of predevelopment levels. In the remainder of Vacaville, for development involving new connections to creeks, peak flow shall not exceed predevelopment levels for 10- and 100-year storm events.
- **Policy SAF-P3.2:** Continue to require development impact fees to fund necessary storm drainage improvements, including drainage detention basins.
- **Policy SAF-P3.4:** Require that new development designate storm drainage easements or routes when tentative maps or specific plans are approved.

Discussion

a) Future development within the City is expected to increase flows to the Easterly WWTP to 16.2 mgd by 2035 (City of Vacaville 2013, p. 4.15-35). This would exceed the current treatment capacity of the plant by approximately 8%, and per the City's NPDES permit, the City is required to have a plan in place for expanding the Easterly WWTP by the time flows are expected to reach 15 mgd (City of Vacaville 2013, p. 4.15-35). Recent improvements to the Easterly WWTP allow for compliance with new NPDES permit discharge requirements, but did not add capacity over the current 15 mgd (City of Vacaville 2016). The City is required to plan, construct and maintain wastewater treatment facilities to meet State discharge requirements and to plan for expanding wastewater treatment capacity consistent with anticipated needs under General Plan policy PUB-P13.4. The General Plan EIR

concluded that with implementation of General Plan policy PUB-P13.4, future development would have a less-than-significant impact on meeting wastewater treatment requirements. The increase in wastewater generated by the proposed project would be quantified and the project specific impact on the capacity of the existing wastewater conveyance will be evaluated in the EIR.

b) The WSA prepared for the project (included as Appendix C), determined that the project would result in an estimated water demand of 419,410 gpd or 469.8 AFY at project buildout by 2025 (NV5 2016, p. 20). As stated in the WSA, the total average annual demand for the existing City, proposed growth and Roberts' Ranch will reach 20,358 AFY by the Year 2040. Tables 22 through 24 in the WSA identify the City's available water supply through year 2040 under normal, and single and multiple dry years. Under a multiple-dry year scenario, a total of 26,652 AFY would be available (NV5 2016, p. 28). The WSA has determined that the City has sufficient water to meet its customers' needs through 2040, including the proposed project. This is based on continued application of the water conservation ordinance and on-going conjunctive use of water supply sources (NV5 2016).

   In addition, the City has identified facilities improvements which include expansion of the NVR Plant, increased hours of production at the DE Plant, addition of three new main zone reservoirs and a new upper zone reservoir, construction of three new groundwater wells and replacement of five existing wells, and construction of new transmission and distribution system water mains (City of Vacaville 2013, p. 4.15-16-19). Expansion of the Easterly WWTP would be required to accommodate future development through 2040 to increase capacity beyond 15.0 mgd (City of Vacaville 2013, p. 4.15-36). It is likely that additional new or expanded facilities would also be needed to serve future development, the construction of which could significantly impact the environment. The construction or expansion of facilities would be subject to project-specific environmental review. The General Plan EIR concluded that General Plan policies to promote water conservation and reduce potential impacts of new or expanded production facilities for water and wastewater would reduce impacts to a less-than-significant level. The proposed project would not require the construction of new water or wastewater treatment facilities or expansion of existing facilities, therefore the impact would not change from what was identified in the General Plan EIR.

c) The increase in impervious surfaces from future development would generate additional stormwater runoff that, without new or expanded storm drainage facilities, would endanger public safety and the environment (City of Vacaville 2013, p. 4.15-44). Compliance with General Plan policies would ensure that adequate storm drainage facilities for existing and new development would be provided. The General Plan EIR determined that new stormwater drainage facilities would still be needed to accommodate anticipated new development and any new or expanded facilities would be subject to project-level

environmental review. The General Plan EIR concluded that future development impacts to stormwater drainage facilities would be less than significant**.**

The proposed project would develop approximately 248-acres of currently undeveloped land, which would increase impervious surface and generate additional runoff. The project would require the construction of facilities to ensure adequate connection to the existing stormwater detention basin and discharge facilities. The project's impact on stormwater facilities will be further evaluated in the EIR.

d) The General Plan EIR determined that the projected increase in water demand for future development is 26.2 mgd or 29,350 afy (City of Vacaville 2013, p. 4.15-21). As discussed in the Setting above, in 2035 the City will be allocated 41,653 afy of water, which would be adequate to meet the average daily potable water demand without requiring additional water supply entitlements (City of Vacaville 2013, p. 4.15-21). The General Plan EIR concluded that this impact would be less than significant. The WSA prepared for the project notes that the City has sufficient water to meet its needs through 2040, including the proposed project's water demand. Therefore, the impact would not change from what was identified in the General Plan EIR.

e) As discussed in item (b) above, the predicted wastewater generated by future development in 2035 would exceed the capacity of the Easterly WWTP and flows collected throughout the City would exceed the capacity of certain sewer lines and lift stations. Impacted facilities would require replacement with larger facilities or the construction of new collection system routes (City of Vacaville 2013, p. 4.15-37). Compliance with General Plan policies would ensure sufficient wastewater treatment capacity is available to serve the projected demand in addition to existing demand. The General Plan EIR concluded that this impact would be less than significant.

Although the proposed project was included in the General Plan EIR development assumptions, the project specific demand for wastewater collection and treatment facilities will be quantified and further evaluated in the EIR.

f, g) As discussed in the Setting above, the Hay Road Landfill has a permitted daily capacity of 2,400 tons, a total capacity of 37 million cubic yards and remaining capacity of approximately 30.4 million cubic yards. The General Plan EIR determined that, based on the generation rate of 4.9 pounds per resident per day, future development would generate approximately 129,850 pounds (65 tons) of solid waste per day, or 47,395,250 pounds (26,698 tons) per year (City of Vacaville 2013, p. 4.15-50). Future development would increase the solid waste generation in Vacaville by approximately 0.03% of the permitted daily capacity of the Recology Hay Road landfill (City of Vacaville 2013, p. 4.15-50). The

General Plan EIR concluded that the Hay Road Landfill would have sufficient capacity to serve future development and the impact would be less than significant.

The City is meeting the state-mandated diversion goal of 6.5 pounds per person per day and has an actual per capita disposal rate of 4.9 pounds per person per day (City of Vacaville 2013, p. 4.15-47). It is expected that recycling options would continue and potentially increase, which would hold steady or potentially decrease the per capita solid waste disposal rate (City of Vacaville 2013, p. 4.15-51). Compliance with General Plan policies would help reduce per capita solid waste disposal and increase recycling in the City. The General Plan EIR concluded that future development would comply with federal, State and local solid waste statutes and impacts would be less than significant.

The proposed project was included in the General Plan EIR's development assumptions for the increase in solid waste generation. However, the project-specific demand will be quantified and further evaluated in the EIR.

	Significant Impact Peculiar to Project or Project Site	Significant Impact due to New Information	Impact Adequately Addressed in General Plan EIR
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE			
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☒	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☒	☐	☐

Discussion

a) The proposed project has the potential to affect biological resources including special-status species, riparian areas, wetlands and other sensitive natural communities. The project's potential to impact biological resources is considered potentially significant and will be further evaluated in the EIR. The project site is currently used for agriculture and no

buildings are present on the site. Development of the project site would not result in the loss of important examples of major periods in California history or prehistory; however, there is the potential for cultural resources to be discovered on this site, therefore this impact is considered potentially significant.

b) The proposed project was included in the future development assumptions evaluated in the General Plan EIR. The General Plan EIR concluded that cumulative impacts to agricultural resources, air quality, greenhouse gas emissions, population and housing and traffic would be significant and unavoidable. The proposed project would develop approximately 248-acres of currently undeveloped agricultural land. Future development in Solano County is estimated to convert over 21,000 acres of agricultural land to urban uses by 2030 (City of Vacaville 2013, p. 4.2-24). Future growth in Vacaville, including the project, would contribute to the cumulatively significant loss of agriculture in the region. The amount of regional growth projected and the decisions of surrounding counties regarding the conversion of agricultural land is outside the City's control and the General Plan EIR concluded that this impact is significant and unavoidable.

   Project-level air quality emissions resulting from construction and operation could contribute to a cumulative increase in air quality emissions and would be further evaluated in the EIR. Future development under the General Plan could conflict with Executive Order S-03-05's goal to reduce GHG emissions by 80% below 1990 levels by 2050 (City of Vacaville 2013 p. 4.7-27). GHG emissions are cumulative in nature and the project's potential GHG emissions were included in the City's GHG projections for buildout of the General Plan analyzed in the General Plan EIR. Additional reductions needed to meet the 2050 target would likely come from State measures over which the City has no control or authority. All GHG emission reduction measures feasible have been included in the ECAS and no further mitigation is available (City of Vacaville 2013 p.4.7-28). Since GHG emissions are cumulative in nature, the General Plan EIR determined this impact to be significant and unavoidable. Population growth from future development under the General Plan would be cumulatively considerable in combination with anticipated population growth in other parts of Solano County and the surrounding region. It is not feasible to mitigate population growth under the General Plan to a less-than-significant level and the General Plan EIR concluded that this impact is significant and unavoidable (City of Vacaville 2013 p. 4.12-10). The General Plan EIR concluded that future development would contribute to significant cumulative traffic impacts. The project-specific contribution to cumulative traffic impacts would be further evaluated in the EIR. Project construction could contribute to increased runoff and contribute to a decline in water quality and would be further evaluated in the EIR. The project would generate additional demand for utilities and could contribute to the need for expanded infrastructure. Project related cumulative impacts to wastewater, solid waste and energy are considered potentially significant will be evaluated in the EIR.

c) The proposed project would generate an increase in air emissions associated with construction and operation that may directly or indirectly have an adverse effect on residents living in the area. This impact is considered potentially significant and will be further evaluated in the EIR.

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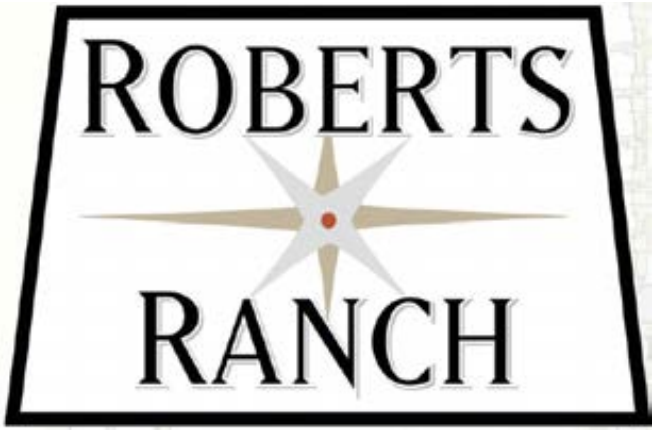
APPENDIX A

Water Supply Assessment Report

CITY OF VACAVILLE

SB 610 WATER SUPPLY ASSESSMENT REPORT FOR ROBERTS' RANCH



FINAL DRAFT

AUGUST 2016

NV5

CITY OF VACAVILLE

SB 610 WATER SUPPLY ASSESSMENT REPORT FOR ROBERTS' RANCH

FINAL DRAFT

AUGUST 2016

Submitted to:

City of Vacaville – Utilities Department
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CITY OF VACAVILLE
SB 610 WATER SUPPLY ASSESSMENT REPORT
FOR ROBERTS' RANCH

FINAL DRAFT
August 2016

Cities and counties with large development projects are required by Senate Bill 610 (Part 2.10, Division 6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment Report (WSAR). The purpose of this legislation is to ensure that adequate water is, or will be, available to accommodate a proposed large development. While an Urban Water Management Plan (UWMP) evaluates water demand at a programmatic level for the entire service area of an urban water supplier, a WSAR evaluates the specific water needs of a proposed project in relation to existing, present, and future water demand and supply within a service area. This WSAR will evaluate the projected water needs for existing and currently planned developments including the proposed Roberts' Ranch Subdivision project. Figure 1 is a schematic of the City of Vacaville (City) depicting the location of the currently planned developments as well as the proposed Roberts' Ranch Subdivision project. The WSAR includes a review of entitlements, water rights, and delivery contracts as well as incorporates information presented in the 2015 City UWMP [1]. This WSAR is intended to be included in the California Environmental Quality Act (CEQA) documents for the Roberts' Ranch development project. A copy of the Resolution approving this WSAR is included in Appendix A.

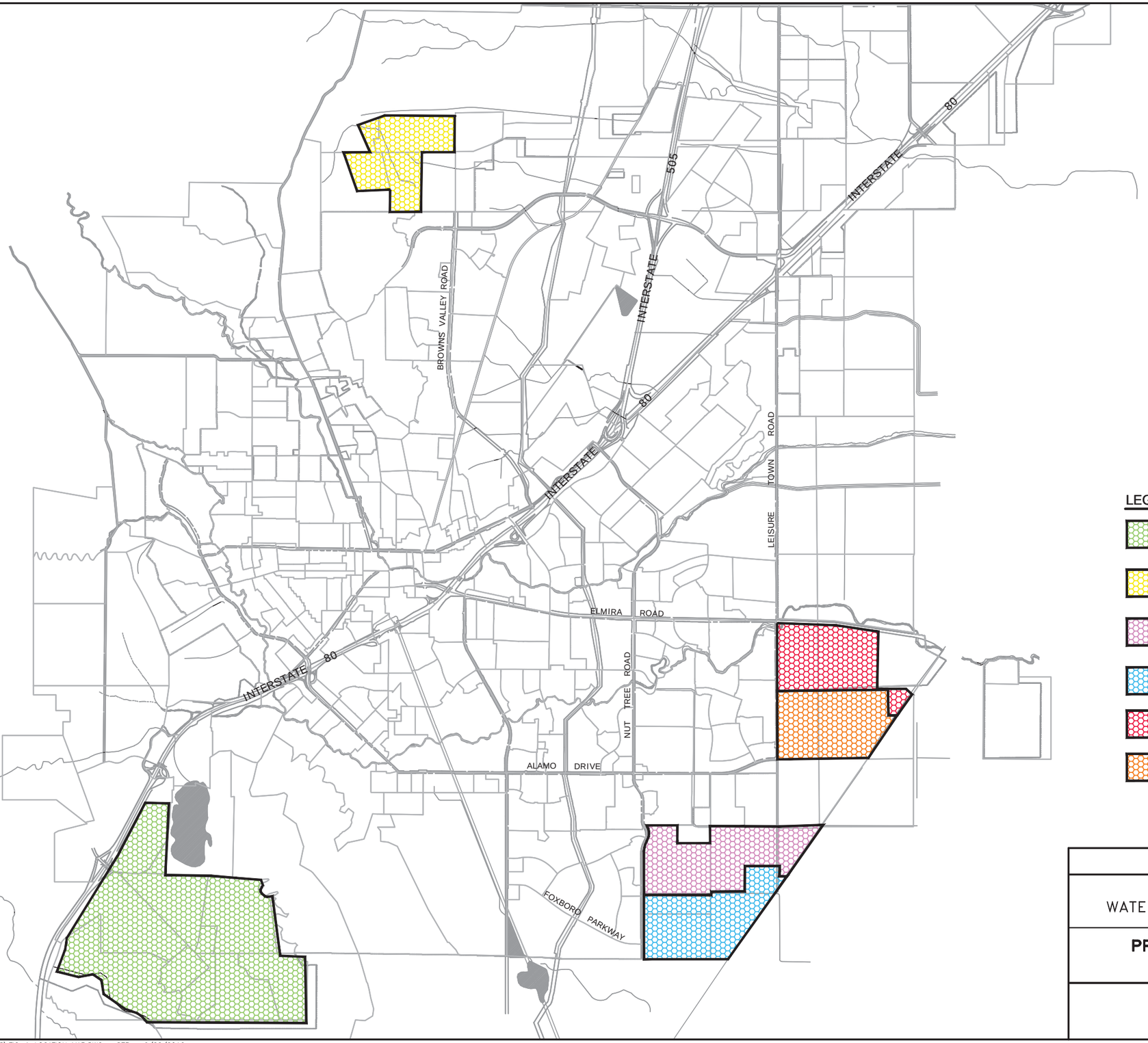
For purposes of this assessment, it is assumed the Roberts' Ranch development will be completely developed by 2025.

1.0 INTRODUCTION

The City, founded in 1850, is nestled at the base of the Vaca Mountains and centrally located between Sacramento and San Francisco on Interstate 80 (I-80). The City limits encompass over 29 square miles with a 2016 population of approximately 89,627, which makes Vacaville the third largest city in Solano County behind Vallejo and Fairfield. Additional information concerning the City population, climate/precipitation, and mechanism for financing water system infrastructure are provided below.

1.1 Current/Projected City Population

The population of Vacaville increased by 63 percent from 1980 to 1990 and increased an additional 24 percent from 1990 to 2000. The growth rate from 2000 to 2010 was approximately 10 percent. It is anticipated that the population will grow by an additional 20 percent from 2015 to 2040. This population projection is based on slower growth than previous population projections, due to decreasing population growth trends caused by the economic downturn observed recently. Table 1 is a summary of the population projections for the City.



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SCALE: 1"=4000'

LEGEND

- LOWER LAGOON VALLEY PROJECT
- CHEYENNE PROJECT
- SOUTHTOWN PROJECT (INCLUDES SOUTHTOWN COMMONS)
- VANDEN MEADOWS PROJECT
- BRIGHTON LANDING PROJECT
- ROBERTS RANCH PROJECT

FIGURE 1

ROBERTS' RANCH SB610
WATER SUPPLY ASSESSMENT REPORT

PROPOSED DEVELOPMENTS LOCATION MAP

NV5
BEYOND ENGINEERING

Z:\226215-00008.06 ROBERTS RANCH WSAR\CADD\EXHIBITS\FIG-1_LOCATION MAP.DWG SEB 6/22/2016

TABLE 1
CITY OF VACAVILLE POPULATION AND PROJECTIONS 2015 – 2040

	Year					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
Adjusted Population [a]	89,627	92,464	95,964	99,764	103,964	108,264

[a] Adjusted population values are per Table 3-1 from the *City of Vacaville 2015 Urban Water Management Plan Update* [1]. These values have been adjusted to exclude the prison population that is served by Solano County Water Agency (SCWA).

1.2 Climate/Precipitation

The climate in Vacaville is characterized by mild winters and hot summers. The average annual precipitation is 25 inches, 85 percent of which occurs from December through March. Temperatures during the winter usually drop into the forties at night and occasionally fall below the freezing point. Snow is rare. In the summer, temperatures occasionally rise above 100 degrees. The days are typically hottest between 4 and 5 p.m., and temperatures cool off noticeably in the evenings.

The climate has significant influence on water demands in the City. Winters are characterized by relatively low water demands, while the summers have substantially higher demands. Landscape irrigation in the summer is a major contributor to the higher summer demands.

1.3 Development Impact Fee for Water System Infrastructure

The goal of the Development Impact Fee (DIF) for water is to provide adequate financing for water facilities required to implement the City's General Plan. The fees are used to finance the planning, design, construction, and inspection of water supply and distribution system projects.

The fee programs are based on a market rate of growth constrained by the limits of the General Plan. Fee programs are adjusted annually to reflect inflation and other changes in the cost estimates, and are subject to a major revision every five years or whenever a major change occurs that would impact the fees.

Water system impact fees are assessed on water meter size and average citywide consumption for each meter size. The charges are based on equivalent dwelling unit (EDU) factors and assessed relative to a single-family home which is one EDU. Table 2 is a summary of the City water connection impact fees as of January 1, 2016. It is anticipated that water system infrastructure improvements required to support the proposed Roberts' Ranch project will be funded through the proposed development project and existing DIF funds.

TABLE 2
CITY OF VACAVILLE WATER CONNECTION FEES

Land Use Type	EDU	Meter Size, inch	Fee, $[a]
Single-Family	1.0	¾	8,218
Single Family - Senior	1.0	1	8,218
Second Unit - Granny Flat	2.5	1	20,545
	5.0	1-½	41,090
	8.0	2	65,744
Multiple - Family Multiple Family - Senior	2.0	¾	16,436
	2.6	1	21,366
	7.0	1-½	57,526
	13.4	2	110,121
	23.2	3	190,658
	37.4	4	307,353
Commercial/Industrial Public/Private Schools	2.0	¾	16,436
	2.6	1	21,366
	7.0	1-½	57,526
	13.4	2	110,121
	23.2	3	190,658
	37.4	4	307,353

[a] City of Vacaville, Connection and Development Fees [2], as of January 1, 2016.

An additional annexation water supply and delivery cost is assessed to projects as a condition for annexation. Because a project's boundaries require annexation into the City limits, water supplies and infrastructure costs for these projects were not part of the City's General Plan and are not fully covered in the DIF. Therefore, an additional fee is assessed per EDU to cover acquisition and delivery costs of water purchased to meet the increased annexation demands. According to a City memorandum titled *Annexation Water Supply Costs – Revised 2008* dated September 26, 2008, the 2008 annexation water supply costs are $2,139 per EDU or $3,753 per acre-foot (ac-ft). For current costs, the fees should be updated with Engineering News Record (ENR) construction cost index adjustments. Roberts' Ranch lies entirely within the City limits and the Solano Irrigation District (SID) currently serves the Roberts' Ranch Project area. Roberts' Ranch must de-annex from SID and be subject to the City's Annexation Water Supply Fee at the time of development.

2.0 EXISTING AND PLANNED WATER SOURCES

This section contains a description of the existing and planned groundwater, surface water, and water conveyance facilities. The water utility system is a self-supporting City enterprise. The water utility is responsible for operation, maintenance, and repair of the City's water treatment and distribution system, as well as water quality and potential recycled water distribution. The City's water utility system was purchased from Pacific Gas and Electric (PG&E) Company in 1959 by issuing voter-approved water revenue bonds. Since purchasing the system, the City has systematically improved and upgraded this infrastructure.

2.1 Description of Existing Facilities

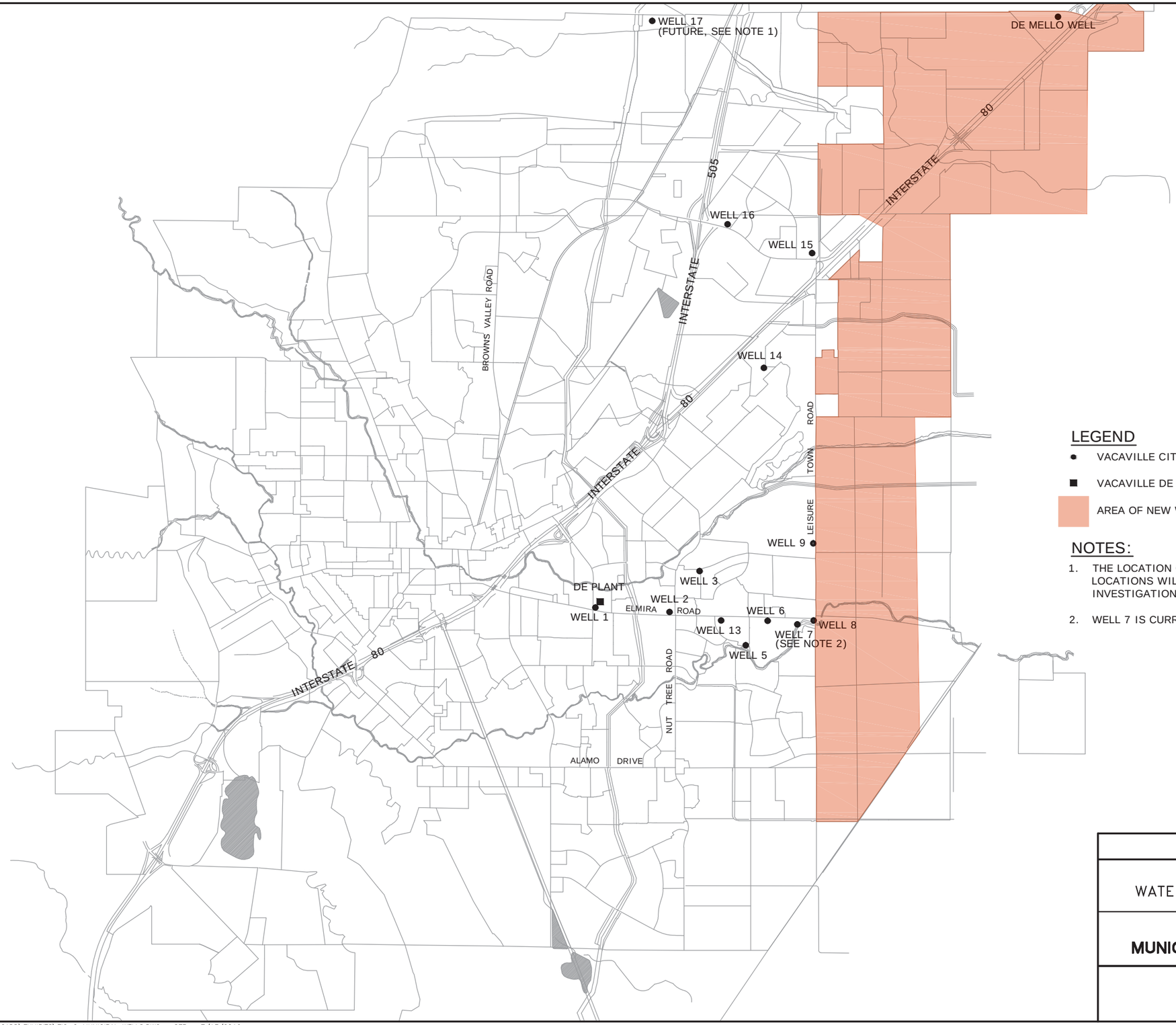
The City water system consists of surface water treatment facilities, wells, pumping facilities, distribution and transmission pipelines, and storage reservoirs. The system receives water from several sources, including Solano Project water from the Lake Berryessa reservoir, State Water Project water and Settlement Water from the North Bay Aqueduct (NBA), and groundwater from local City wells. Within the City's water entitlements, the percentage of water used from each supply source varies due to conjunctive use. If any one source has limited water availability or poor water quality, use from other sources can increase. Likewise, if unscheduled water becomes available it can be utilized to the City's advantage.

Surface water from Lake Berryessa is provided by contract between the U.S. Bureau of Reclamation (BuRec) and the Solano County Water Agency (SCWA) and delivered by SID. This water is treated at either the North Bay Regional plant (NBR plant) or at the City's 10 million gallons per day (mgd) diatomaceous earth filter treatment plant (DE Plant), in which the treated water discharges into a ground-level chlorine contact basin. Wells 1, 6, and 13 also supply water directly to the DE Plant clearwell. From the clearwell, a booster pump station pumps the water into the distribution system. Water from the remaining wells (2, 3, 5, 8, 9, 14, 15, 16, and De Mello) is treated at the wellhead and pumped directly to the distribution system. Well 7 was identified to have a damaged casing and is permanently out of service. The City will likely abandon this well in the future. The De Mello Well is currently being used as a standby well. The City is currently planning for the construction of a new supply well, Well 17. Figure 2 is a schematic of the City depicting the locations of the existing City wells and DE Plant.

The NBR plant provides a capacity of 13.3 mgd for the City and supplies water directly to the City's distribution system. The NBR plant draws water from the Sacramento River Delta via the NBA, as well as Solano Project water from the Putah South Canal. Figure 3 is a schematic of regional water supply facilities and includes the location of the NBA and Putah South Canal.

2.2 Groundwater

As noted earlier, one source of supply for the City is groundwater. Currently, groundwater is provided through 11 operational wells, 10 of which withdraw water from the deep aquifer in the basal zone of the Tehama Formation. Most City wells are located in the Elmira well field. However, new wells will be more widely distributed, near I-80. Currently, approximately 5,500 ac-ft per year (ac-ft/yr) of groundwater is withdrawn. Vacaville continues to explore well field expansion as a means of maintaining adequate water supply. A regional program is being implemented to monitor groundwater data as a means of ensuring against overdraft or contamination. This program is described in Appendix B and Appendix C along with an investigation of groundwater pumping impacts [3]. A discussion of the groundwater basin and historic groundwater pumping follows. Figure 4 includes the area identified by the City for potential new wells in the future. Specific future well locations will be determined based on additional field investigations.



LEGEND

- ● VACAVILLE CITY WELL
- ■ VACAVILLE DE PLANT
- AREA OF NEW WELL LOCATION

NOTES:

1. THE LOCATION OF FUTURE WELLS IS PRELIMINARY. LOCATIONS WILL BE DETERMINED BASED ON FIELD INVESTIGATIONS.
2. WELL 7 IS CURRENTLY OUT OF SERVICE.

FIGURE 2

ROBERTS' RANCH SB610
WATER SUPPLY ASSESSMENT REPORT

CITY OF VACAVILLE
MUNICIPAL WELLS AND DE PLANT

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BEYOND ENGINEERING

N:\226215-00008.06 ROBERTS RANCH WSAR\CADD\EXHIBITS\FIG-2_MUNICIPAL WELLS.DWG SEB 7/13/2016

Lake Berryessa

Winters

PUTAH CREEK

Davis

SOLANO DIVERSION DAM

I-80

Dixon

I-505

Vacaville

NORTH BAY REGIONAL WATER TREATMENT PLANT

DEEP WATER SHIP CHANNEL

Napa

Fairfield

PUTAH SOUTH CANAL

NORTH BAY AQUEDUCT

BARKER SLOUGH PUMPING STATION

Suisun City

I-80

Fairfield

SOLANO COUNTY

American Canyon

I-680

N

10,000 5,000 0 10,000

Feet

FIGURE 3

ROBERTS' RANCH SB610
WATER SUPPLY ASSESSMENT REPORT

REGIONAL WATER SUPPLY FACILITIES

NV5

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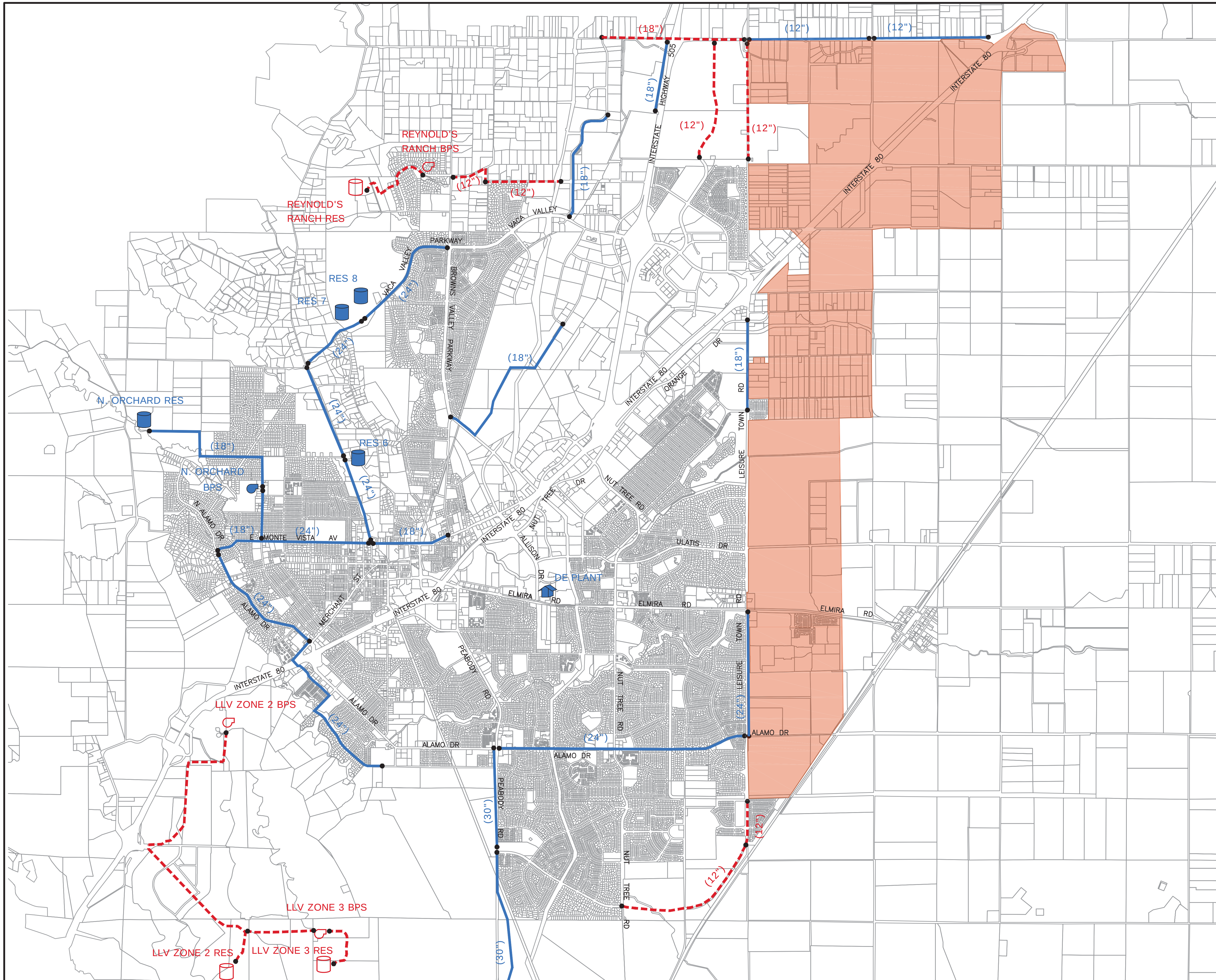

N

4000 0 4000

SCALE: 1"=4000'

LEGEND:

- WATER LINES
- WELLS/PLANTS
- RESERVOIRS
- BOOSTER PUMP STATIONS
- WATER LINES (LOCAL)
- RESERVOIRS (LOCAL)
- BOOSTER PUMP STATIONS (LOCAL)
- AREA OF NEW WELL LOCATION

FIGURE 4

ROBERTS' RANCH SB610
WATER SUPPLY ASSESSMENT REPORT

PROPOSED WATER PROJECT LOCATION MAP

NV5
BEYOND ENGINEERING

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Boundaries, Soils, Storage Capacity

The City pumps groundwater primarily from the basal zone of the Tehama Formation in the Solano Sub-basin, located east of the English Hills Fault. Well 1 is the only well currently in operation that extracts water from a different formation, the Markley Formation, located west of the English Hills Fault. Tehama Formation consists of moderately to highly consolidated fluvial, alluvial, and lacustrine deposits. Lithology present within the Tehama Formation includes inter-layered sand, silt, clay, and gravel, a stiff blue lacustrine clay located near the upper portions of the formation, and other continuous clay layers that divide the formation into upper, middle, and basal zones. The basal zone of the formation also includes gravel and cobble deposits, layers of detrital tuff, and calcium carbonate cemented conglomerate [4].

The primary source of groundwater supply for municipal use is the basal zone of the Tehama Formation, which is a highly confined aquifer. The overlying Quaternary alluvial deposits and upper and middle zones of the Tehama Formation are not suitable for high production municipal water supply. However, they are used for some domestic and agricultural purposes in unincorporated areas of Vacaville. East of the Vacaville area, these aquifers are utilized by SID to supplement surface water supplies and for shallow groundwater pumping for drainage purposes.

The Solano Sub-basin includes the southernmost portion of the Sacramento Valley Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. Sub-basin boundaries are as follows: (1) Putah Creek on the north; (2) Sacramento River on the east (from Sacramento to Walnut Grove); (3) North Mokelumne River on the southeast (from Walnut Grove to San Joaquin River); (4) San Joaquin River on the south (from the North Mokelumne River to Sacramento River); and, (5) boundary between the San Francisco Bay and Sacramento River hydrologic study areas as described in California Department of Water Resource (DWR) Bulletin 118 on the west.

Historic Groundwater Pumping

The City is the primary groundwater user within the Vacaville area. Unmeasured agricultural and domestic groundwater extractions in unincorporated areas of the Vacaville area, Rural North Vacaville Water District (RNVWD) production wells, and SID are the other groundwater users. Since 1968, the City's annual groundwater pumping has varied from a low of 2,862 ac-ft in year 1968 to a high of 8,165 ac-ft in year 1983. Annual groundwater production, including all wells, is summarized in Table 3 from year 1968 to year 2015. The majority of groundwater production in the past was obtained from wells located at the Elmira Road well field. The newer northeast sector well field located near I-80 also contributes to the groundwater production. In the future, groundwater pumping will be more widely distributed in the study area rather than concentrated in the Elmira Road well field.

TABLE 3
CITY OF VACAVILLE
HISTORICAL GROUNDWATER PUMPING [1]

Year	ac-ft/yr	Year	ac-ft/yr	Year	ac-ft/yr
1968	2,862	1985	5,853	2002	6,638
1969	3,046	1986	5,824	2003	6,628
1970	2,871	1987	6,236	2004	6,562
1971	3,198	1988	5,421	2005	6,680
1972	3,255	1989	6,072	2006	6,635
1973	3,125	1990	5,625	2007	6,612
1974	3,316	1991	5,447	2008	5,784
1975	3,970	1992	5,531	2009	4,647
1976	4,965	1993	4,395	2010	5,054
1977	5,093	1994	3,893	2011	5,049
1978	5,707	1995	3,885	2012	5,142
1979	6,185	1996	3,230	2013	5,236
1980	6,990	1997	3,386	2014	5,345
1981	7,740	1998	3,905	2015	5,222
1982	7,683	1999	4,096		
1983	8,165	2000	5,070		
1984	6,089	2001	6,214		

2.3 Surface Water

The City has three separate sources for surface water. Each source has a different level of reliability. This section describes the City's surface water sources. Appendix D contains information regarding specific contracts between the City and various water supply agencies.

Solano Project (Vacaville Supply, SID Agreement)

The Solano Project was constructed by the BuRec in 1958. The water rights permits for the Solano Project are held by the BuRec in trust for the Solano water users. The water rights permits further state that when the permits are converted to a license, the license will be issued in the name of Solano water users. Unlike most federal water projects, the water rights to the Solano Project "belong" to the Solano water users. The main feature of the Solano Project is Monticello Dam, which provides for storage of 1.6 million ac-ft of water in Lake Berryessa. Water from the Lake Berryessa is diverted through the Putah Diversion Dam to the 33-mile Putah South Canal, which transports water to the eight SCWA-member unit contractors for Solano Project water.

SCWA has entered into agreements with cities, districts, and state agencies to provide water from the Solano Project. The Solano Project contracting agencies are: Fairfield, Suisun City, Vacaville, Vallejo, SID, Maine Prairie Water District, University of California at Davis, and California State Prison - Solano. Table 4 summarizes the annual entitlement to each agency.

TABLE 4
SUMMARY OF SOLANO PROJECT
WATER CONTRACTS (AC-FT/YR) [1]

Agency	Annual Entitlement
Fairfield	9,200
Suisun City	1,600
Vacaville	5,750
Vallejo	14,600
SID	141,000
Maine Prairie Water District	15,000
UC Davis	4,000
California State Prison – Solano	1,200
Project Operating Loss (average estimated)	15,000
Total	**207,350**[a]

[a] Value approximates a firm yield during the driest hydrologic period on record (1916-1934).

The contracts with the public entities that use Solano Project water provide for the sale and distribution of water made available by the BuRec each year. The BuRec is contractually committed to delivering the full contract amount of water supply from the Solano Project unless the water supply does not physically exist (e.g., an empty reservoir). All Solano Project water contractors, whether they are municipal or agricultural, are impacted by water supply reductions on an equal basis.

In addition to its entitlement from SCWA, Vacaville entered into a 1995 Master Water Agreement (1995 Agreement) with SID. A second amendment to the 1995 Agreement, adopted in June 2010, updated the water purchase schedule. Pursuant to the second amendment, Vacaville receives an increasing supply from SID through the year 2040 and a consistent supply thereafter until the year 2050. The second amendment allows Vacaville to request additional water if needed to support growth. The agreement provides for changes in the delivery schedule, making the maximum entitlement of 10,050 ac-ft/yr available earlier than the year 2040 if desired by the City. The annual water schedule for SID water available to the City is contained in Table 5.

TABLE 5
ANNUAL WATER SCHEDULE FOR THE
SID 1995 AGREEMENT (AC-FT/YR) [5]

Year	Annual Entitlement	Year	Annual Entitlement
2010	2,500	2026	5,925
2011	2,625	2027	6,225
2012	2,750	2028	6,525
2013	2,875	2029	6,825
2014	3,000	2030	7,125
2015	3,125	2031	7,425
2016	3,325	2032	7,725
2017	3,525	2033	8,025
2018	3,725	2034	8,325
2019	3,925	2035	8,625
2020	4,125	2036	8,925
2021	4,425	2037	9,225
2022	4,725	2038	9,525
2023	5,025	2039	9,825
2024	5,325	2040 through 2050	10,050
2025	5,625		

State Water Project (North Bay Aqueduct)

Vacaville receives water allocations from the State Water Project through the SCWA (termed Table A water) that currently expires in 2035, but is renewable, and water from a Year 2001 purchase agreement from Kern County Water Agency (KCWA). Surface water received pursuant to these agreements is delivered through the NBA, a State Water Project facility. The City supply from the State Water Project is 6,100 ac-ft/yr, while KCWA Agreement water totals 2,878 ac-ft/yr. The Solano County branch of the NBA was completed in 1988. The NBA is 28 miles long starting from Barker Slough in the Delta and ending in Napa County. The location of the NBA can be seen in Figure 3. The DWR is the owner and operator of the NBA.

The water supply for the NBA is less reliable than the Solano Project. Supply from the NBA comes from the State Water Project which provides water to a total of 29 contractors. A list of these contractors and their respective allocations is shown in Table 6. Because the NBA is part of the entire State Water Project, any shortages occurring in the State Water Project impact the NBA.

Within Solano County there are currently seven agencies with NBA water allocations. These include Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo. Table 7 summarizes the annual increase in SCWA's contract. Member units using the NBA and their allocations are described in Table 8. Shortages during dry years are proportional to their share of the overall contract with DWR.

TABLE 6
STATE WATER PROJECT
2016 WATER ALLOCATIONS (AC-FT/YR) [1]

Agency	Maximum Allocations
Upper Feather River Area	
City of Yuba City	9,600
County of Butte	27,500
Plumas County Flood Control and Water Conservation District	2,700
Subtotal	39,800
North Bay Area	
Napa County Flood Control and Water Conservation District	29,025
Solano County Water Agency	47,756
Subtotal	76,781
South Bay Area	
Alameda County Flood Control and Water Conservation District	80,619
Alameda County Water District	42,000
Santa Clara Valley Water District	100,000
Subtotal	222,619
San Joaquin Valley Area	
County of Kings	9,305
Dudley Ridge Water District	45,350
Empire West Side Irrigation District	3,000
Kern County Water Agency	982,730
Oak Flat Water District	5,700
Tulare Lake Basin Water Storage District	87,471
Subtotal	1,133,556

Continued on Next Page

TABLE 6 (continued)
STATE WATER PROJECT 2016 WATER ALLOCATIONS (AC-FT/YR) [1]

Agency	Maximum Allocations
Central Coastal Area	
San Luis Obispo County Flood Control and Water Conservation District	25,000
Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	70,486
Southern California Area	
Antelope Valley-East Kern Water Agency	144,844
Castaic Lake Water Agency	95,200
Coachella Valley Water District	138,350
Crestline-Lake Arrowhead Water Agency	5,800
Desert Water Agency	55,750
Littlerock Creek Irrigation District	2,300
Metropolitan Water District of Southern California	1,911,500
Mojave Water Agency	85,800
Palmdale Water District	21,300
San Bernardino Valley Municipal Water District	102,600
San Gabriel Valley Municipal Water District	28,800
San Gorgonio Pass Water Agency	17,300
Ventura County Flood Control District	20,000
Subtotal	2,629,544
Total	**4,172,786**

TABLE 7
SUMMARY OF STATE WATER PROJECT ALLOCATIONS
TO THE SOLANO COUNTY WATER AGENCY
THROUGH THE NORTH BAY AQUEDUCT (AC-FT/YR) [1]

Year	Annual Allocations	Year	Annual Allocations
2001	45,836	2009	47,456
2002	46,296	2010	47,506
2003	46,756	2011	47,556
2004	47,206	2012	47,606
2005	47,256	2013	47,656
2006	47,306	2014	47,706
2007	47,356	2015	47,756
2008	47,406	2016[a]	47,756

[a] Each year thereafter will have an annual allocation of 47,756 ac-ft/yr.

TABLE 8
STATE WATER PROJECT
ALLOCATION TO SOLANO COUNTY CITIES SERVED
BY THE NORTH BAY AQUEDUCT (AC-FT/YR) IN YEAR 2040 [1]

City	Annual Allocations
Benicia	17,200
Dixon	0[a]
Fairfield	14,678
Rio Vista	0[a]
Suisun City	1,300
Vacaville	8,978[b]
Vallejo	5,600
Total	**47,756**

[a] Dixon and Rio Vista currently do not use their individual allocation of 1,500 ac-ft/yr. If Dixon and/or Rio Vista decide to use the NBA water supply, supplies to Benicia, Fairfield and Vallejo are reduced commensurately.

[b] Vacaville allocations from State Water Project (including KCWA Agreement).

Settlement Water (DWR Agreement)

Settlement Water consists of surface water from the Sacramento River and Sacramento-San Joaquin Delta Estuary. Settlement Water is diverted under water rights held by DWR, but is not considered State Water Project water. The water is made available by DWR in settlement of area-of-origin water right applications by the cities of Fairfield, Benicia, and Vacaville. The City currently uses only 25 to 30 percent of the Settlement Water, and experiences water quality and delivery challenges. The City is working with SCWA to construct a new intake on the Sacramento River to resolve these challenges. The Agreement provides an allocation to each of the three cities as shown in Table 9.

TABLE 9
SUMMARY OF SETTLEMENT WATER FOR THE CITIES OF
FAIRFIELD, BENICIA, AND VACAVILLE (AC-FT/YR) [1]

Agency	Annual Allocations
Fairfield	11,800
Benicia	10,500
Vacaville	9,320
Total	**31,620**

2.4 Wastewater and Recycled Water

The Easterly Wastewater Treatment Plant (EWWTP) is located southeast of the town of Elmira and serves the City of Vacaville. The City owns and operates this tertiary treatment and blending elimination facility with rated dry weather flow capacity of approximately 15 mgd.

The effluent from the EWWTP is discharged into Alamo Creek, which flows into Cache Slough. A portion of the effluent is used for irrigation by the Solano and Maine Prairie Irrigation Districts and is offered to construction firms free of charge for dust control and other construction activities outside of the City limits. Reclaimed water is an important and viable resource for urban irrigation and other potential uses. Use of reclaimed water where appropriate may help further reduce demand for domestic water supply.

A preliminary planning study performed in 2003 evaluated the potential for recycled water delivery and use citywide. This alternative requires a significant amount of recycled water infrastructure including, but not limited to: a recycled water distribution system network, pumping structures, and storage facilities. This distribution system could be used to deliver recycled water primarily for irrigation purposes, but additional customers could be added as they become viable. The City is currently looking at additional alternatives for use of recycled water.

2.5 Exchanges or Transfers

The City works closely through SCWA to purchase water for short-term and long-term use. The purchase of additional entitlements of State Water Project water from KCWA as outlined in Section 2.3 above, is a good example of how the City works with SCWA. As a wholesaler, SCWA ensures the City is appraised of any unscheduled water that may become available for short-term use. The City also has a good working relationship with SID and is notified of supply changes through its 1995 Master Water Agreement.

2.6 Future Water Projects

Early in 2016 (January 12, 2016) the City adopted a series of water service rate increases designed to generate an annual increase in revenues over the next five years. The City intends to combine the increased water rates, capital replacement funds, water connection fees, direct develop construction, and various long-term financing options, to raise the necessary revenue to fund and implement the construction of water production, treatment, and transmission facilities current defined in the Capital Improvements Plan (CIP) and Water Master Plan.

Implementing the CIP and Water Master Plan will provide the City with the necessary improvements to the existing water system facilities and continue to provide adequate water supply for the currently planned developments within the City's sphere of influence.

2.7 Summary of Existing and Planned Water Supply Sources

The total water supply (allocation or safe yield) available to the City in 2015 from groundwater, surface water, and recycled water was approximately 34,173 ac-ft/yr. The actual water supplied to the City in 2015 was 13,205 ac-ft/yr. Table 10 is a summary of the respective supply sources

as discussed in previous sections for the actual water supplied and the allocation or safe yield in 2015. The sources of water will remain the same for the City, however the allocations will increase over the years to meet the projected growth in the City. The total water supply (allocation or safe yield) available to the City in 2040 will be approximately 42,198 ac-ft/yr. Table 11 is a summary of the respective supply sources discussed in previous sections outlining the total water supply in year 2040.

TABLE 10
CITY OF VACAVILLE
TOTAL WATER SUPPLY IN YEAR 2015 [1]

Source of Supply	Total Right or Safe Yield (ac-ft/yr)	Total Actual Supply (ac-ft/yr)
Solano Project		
Vacaville Entitlement [a]	5,750	3,089
SID 1995 Agreement [b]	3,125	3,125
State Water Project		
Vacaville Entitlement [c]	8,978	1,769
Settlement Water [d]	9,320	0
Groundwater Pumping [e]	7,000	5,222
Total	**34,173**	**13,205**

[a] See Table 4
[b] See Table 5
[c] See Table 8
[d] See Table 9
[e] See Appendix B and Appendix C

TABLE 11
CITY OF VACAVILLE
TOTAL WATER SUPPLY IN YEAR 2040 [1]

Source of Supply	Total Right or Safe Yield (ac-ft/yr)
Solano Project	
Vacaville Entitlement [a]	5,750
SID 1995 Agreement [b]	10,050
State Water Project	
Vacaville Entitlement [c]	8,978
Settlement Water [d]	9,320
Groundwater Pumping [e]	8,100
Recycled Water [f]	0
Total	**42,198**

[a] See Table 4
[b] See Table 5
[c] See Table 8
[d] See Table 9
[e] See Appendix B and Appendix C
[f] Recycled water not considered a viable water supply source.

3.0 PROJECTED WATER DEMANDS

Presented in this section are land use summaries and projected water demands for the proposed Roberts' Ranch project. The water demand factors that serve as the basis for the demand projections are also described below.

3.1 Water Demand Factors

The City currently uses two sets of water demand factors (existing and growth) for planning and analysis of water supply and distribution systems. Table 12 is a summary of the current water demand factors. Most of these factors were approved as part of the *Water Demand Factors Summary Technical Memorandum* [6] and revised as part of the *General Plan Update* 2015 [11] The difference between the two sets of demand factors (existing versus growth) includes a contingency to reflect uncertainties in projecting future land use. It also includes increases in the water demand for new development versus existing within a given land use category.

The City is currently evaluating potential revisions to these demand factors. The revisions may include a constant reduction percentage in the demand factors to account for the observed water conservation efforts, reduced demands, and anticipated future water use requirements. For purposes of this assessment, the water demand factors included in Table 12 and used as part of the General Plan Update will be used in this analysis.

3.2 Projected Water Demands for Roberts' Ranch

Table 13 includes the land use summary and resulting water demands for the proposed Roberts' Ranch project. The *Roberts' Ranch Specific Plan* [7] presents the proposed land use and corresponding dwelling units or acreage by village. In addition to residential units of various densities, a public school, stroller parks, and open space/buffer are planned for the Roberts' Ranch project. This WSAR assumes that the Roberts' Ranch project will be constructed by 2030.

3.3 Summary of Projected Water Demands

Table 14 includes projected water demands for the City and future development in five-year increments through the year 2040. The 2015 baseline City water demand is estimated using the 164 gallons per capita per day (gpcd) target for Year 2020 and the 2015 adjusted population of 89,267 (see Table 1) for a total demand of 16,465 ac-ft/yr or 14.7 million gallons per day (mgd). Water demands for the Year 2020 through 2040 were based on the demand projections presented in the 2015 UWMP Update. These projections take into consideration the Year 2020 target per capita per day usage and applying that to the future population projections by the Association of Bay Area Governments.

As summarized in Table 14, total average annual demand for the existing City, proposed growth and Roberts' Ranch will reach 20,358 ac-ft/yr in the Year 2040. This value will be compared to available water supply in the subsequent report section. The Roberts' Ranch demand includes both potable and irrigation demands.

TABLE 12
SUMMARY OF CURRENT WATER DEMAND FACTORS USED BY CITY OF VACAVILLE FOR MASTER PLANNING PURPOSES

Land Use Description	Land Use Designation	Unit	Water Demand Factors, gpd/unit			
			Existing Land Use		Growth Land Use	
			Potable	Irrigation	Potable	Irrigation
Residential						
Residential Low Medium Density[a]	RLMD	du	340	0	420	0
Residential Low Density[a]	RLD	du	380	0	520	0
Residential Estates[a]	RE	du	680	0	600	0
Residential Rural	RR	du	850	0	1,000	0
Residential Medium Density	RMD	du	300	0	350	0
Residential High Density	RHD	du	260	0	300	0
Residential Urban High Density	RUHD	du	210	0	250	0
Manufactured Homes	MH	du	260	0	300	0
Retirement SF Residential	Ret SF	du	300	0	350	0
Retirement MF Residential	Ret MF	Du	300	0	350	0
Commercial						
Commercial Office	CO	ac	1,000	500	1,600	450
Medical Office	MO	ac	1,000	400	1,600	450
Retail Sales	RS	ac	1,000	400	1,600	450
Downtown	D	ac	3,900	100	3,900	100
Mixed Use	MX	Du	0	0	300	0
Commercial Highway[a]	CH	ac	4,750	450	5,350	450
Commercial Service[a]	CS	ac	1,400	400	1,650	450
Industrial						
Industrial	IND	ac	1,200	400	2,000	450
Public						
Public Low	PL	ac	0	0	0	0
Public Medium	PM	ac	1,000	400	1,600	450
Public High	PH	ac	1,000	400	1,600	450
Elementary School	ESC	stu or ac	25/stu	900/ac	30/stu	1,500/ac
High School	HSC	stu or ac	30/stu	900/ac	40/stu	1,500/ac
College	COL	stu or ac	0/stu	0/ac	40/stu	1,500/ac
Hospital[a]	HOS	ac	3,900	400	3,900	400
Church[a]	CRH	ac	1,500	400	2,300	450
Open Space						
Park	PK	ac	0	1,300	0	2,100
Park Recreational	PR	ac	100	1,500	170	2,500
Landscape Buffer	BUFF	ac	0	1,300	0	1,300
Hillside Agricultural	HIAG	ac	0	0	0	0
Agricultural[b]	AG	ac	0	2,100	0	3,440

[a] Demand factor determined from actual metering information obtained from the City of Vacaville, August 2003 and 2012.

[b] AG demand factor included but that demand not provided by City. Demand assumed to be non-potable water demand from others.

TABLE 13
ROBERTS' RANCH PROJECT
LAND USE AND DEMAND SUMMARY AT YEAR 2025

Village [a]	Land Use [b]	Designation	Quantity[b]	Unit	Demand Factors		Estimated Water Demand			
					Potable gpd/unit	Irrigation[c] gpd/unit	Potable gpd	Irrigation gpd	Total gpd	Annual ac-ft/yr
1	Residential Low Medium Density	RLMD	80	du	420	0	33,600	0	33,600	37.6
1	Public Park	PK	0.5	ac	0	2,100	--	1,050	1,050	1.2
1	Residential Moderate Density[d]	RLMD	60	du	420	0	25,200	0	25,200	28.2
2	Residential Low Density	RLD	212	du	520	0	110,240	0	110,240	123.5
2	Residential Moderate Density[d]	RLMD	75	du	420	0	31,500	0	31,500	35.3
2	Public Park	PK	1.0	ac	0	2,100	--	2,100	2,100	2.4
3	Residential Low Density	RLD	233	du	520	0	121,160	0	121,160	135.7
3	Residential Moderate Density[d]	RLD	36	du	420	0	15,120	0	15,120	16.9
3	Public Park	PK	1.0	ac	0	2,100	--	2,100	2,100	2.4
4	Residential Low Density	RLD	102	du	520	0	53,040	0	53,040	59.4
4	Public School	HSC	16.2	ac	0	1,500	--	24,300	24,300	27.2
		HSC	0	stu	35	0	0	--		
	ROW Areas & Parkways[e]	ROW	25.9	ac	0	0	0	0	0	0
	Agricultural Buffer/Open Space	OS	25.3	ac	0	0	0	0	0	0
Total Demand – Roberts' Ranch Project			**798**	**du**			389,860	29,550	419,410	469.8

[a] Assumes Roberts' Ranch Project built out by year 2025.

[b] Village numbers, land use, and quantities from *Roberts' Ranch Specific Plan* [7].

[c] Domestic irrigation demand (for residential land uses) will be met with potable water, and therefore is included in potable demand factor.

[d] Residential Moderate Density is comprised of RLMD and RMD land use zoning designations according to the GPU as noted in *Roberts' Ranch Specific Plan* [7]. RLMD assumed for this analysis.

[e] No demand for these land uses.

TABLE 14
CITY OF VACAVILLE
SUMMARY OF NORMAL YEAR ANNUAL WATER DEMAND (AC-FT/YR)
IN FIVE YEAR INCREMENTS

Demand	2015	2020	2025	2030	2035	2040
Existing 2015 City [a]	16,465	16,465	16,465	16,465	16,465	16,465
Future Growth in City [b]	0	520	1,162	1,772	2,634	3,423
Roberts' Ranch Project [c]	0	0	470	470	470	470
Total Demand	**16,465**	**16,985**	**18,097**	**18,707**	**19,569**	**20,358**

[a] Existing 2015 City demand based on Year 2020 gpcd target (164 gpcd) and Year 2015 adjusted population of 89,267 [1].

[b] Based on Year 2020 gpcd target (164 gpcd) and future population projections provided by ABAG [1].

[c] Roberts's Ranch Project assumed complete development by Year 2025. See Table 13.

3.4 Water Shortage Contingency Planning

Under drought conditions, the City has an ability to reduce water demand. The primary mechanism for demand management is through public awareness and enforcement of water conservation ordinances. Specifically, the City's Urban Water Shortage Contingency Plan (UWSCP), see Appendix E . The UWSCP was revised in August 2014 and concluded with the adoption of the Drought Ordinance No. 1877 [8]. This ordinance establishes water conservations requirements and a water rate structure that addresses Normal, Drought, and Emergency Conditions. As drought or emergency conditions are declared by the City Council, additional rate tiers are added to the existing rate structure to promote conservation. A target water use amount is determined for all residential customers based on past usage patterns for commercial, industrial, and landscape customers. Customers using water above their target amount pay increasingly higher rates for that water.

The City is also committed to implementing water conservation programs. To achieve short term and long term conservation, the City has implemented, is planning to implement, or is studying Demand Management Measures (DMMs), as described in the *2015 Urban Water Management Plan Update* [1]. The DMMs are administered in conjunction with the five (5) Foundational Best Management Practices (BMPs) as outlined by the California Urban Water Conservation Council (CUWCC).

Since 2010, the City has maintained and implemented the DMMs. The implementation included proactive and responsive enforcement via the City's Code Compliance of the City's Municipal Code 13.20, Ordinance No. 1877, and Section 4 of the UWSCP.

In past drought years, demand management practices have been effective in reducing water demand. As shown in Table 15, during the 1991-1993 drought, the per capita demand was reduced from 195 gpd/person to 150 gpd/person, a reduction of at least 23 percent. Historically, the City has had the ability to lower demand by 10 percent during a single dry year and by 20 percent during multiple dry years.

TABLE 15
CITY OF VACAVILLE
CHANGE IN WATER PRODUCTION (DEMAND)
DURING DROUGHT YEARS (1990-1995)

Year	Adjusted Population [a]	Water Production		Per Capita Demand, gpd/person	Demand Change [b], %
		ac-ft/yr	mgd		
1990	64,148	13,991	12.5	195	0
1991	68,755	11,672	10.4	151	-23
1992	71,156	12,036	10.7	150	-23
1993	73,608	12,764	11.4	155	-21
1994	75,244	14,189	12.7	169	-13
1995	75,013	14,695	13.1	175	-10

[a] Adjusted population values are per the City of Vacaville 2015 Urban Water Management Plan Update [1] and have been updated to exclude the prison population that is served by SCWA.

[b] Reduction in per capita demand as compared to 1990 demand.

Table 16 includes the change in per capita demand during the current drought from 2008 through 2015. In summary, the City has observed the per capita demand reduce from 201 gpd/person to 132 gpd/person, a reduction of approximately 34 percent. This confirms that historically, the City is capable of lowering the average day demand by 10 percent during a single dry year and by as much as 20 percent during multiple dry years.

TABLE 16
CITY OF VACAVILLE
CHANGE IN WATER PRODUCTION (DEMAND)
DURING DROUGHT YEARS (2008-2015)

Year	Adjusted Population [a]	Water Production		Per Capita Demand, gpd/person	Demand Change [b], %
		ac-ft/yr	mgd		
2008	85,911	19,344	17.3	201	0
2009	85,959	17,673	15.8	184	-8
2010	86,317	16,335	14.6	169	-16
2011	87,715	16,055	14.3	163	-19
2012	88,692	16,933	15.1	170	-15
2013	91,281	18,602	16.6	182	-9
2014	89,988	15,799	14.1	157	-22
2015	89,627	13,200	11.8	132	-34

[a] Adjusted population values are per the City of Vacaville 2015 Urban Water Management Plan Update [1] and have been updated to exclude the prison population that is served by SCWA.

[b] Reduction in per capita demand as compared to 2008 demand.

4.0 ANALYSIS OF WATER SUPPLY RELIABILITY

In this section, the City's groundwater and surface water supplies previously identified are analyzed. The sources are identified for their availability during normal, single, and multiple dry years as determined by the Department of Water Resources' Sacramento Valley Water

Hydrologic Classifications. The three separate hydrologic conditions considered are described as follows:

Normal year:	This is a year when average rainfall has been received. During a normal year, the water availability from some sources may be less than the allocated amount.
Single dry year:	This is a solitary dry or critical dry year and may be the first year of a multiple year drought.
Multiple dry years:	This is a series of three consecutive dry and/or critical dry years.

4.1 Groundwater

A groundwater source sufficiency report was prepared in 2011 and updated in May 2016 by Ludhorff and Scalmanini Consulting Engineers to describe the use and sufficiency of groundwater supplies beneath the City (see Appendix B and Appendix C). As part of the groundwater source sufficiency report, an analytical groundwater flow model was used to provide a preliminary assessment of water level impacts from future increases in groundwater pumping by the City to meet future water demands. The modeling effort included simulations of ten future pumping scenarios in which pumping would be increased and/or redistributed within the study area. The recommended maximum pumping is summarized in Table 16. The values presented in Table 16 include the following reliability percentages for groundwater: 100 percent reliability in normal years, 119 percent reliability in single dry years, and 120 percent reliability in multiple dry years. Details regarding the model simulations and suggested pumping practices are found in Appendix B and Appendix C.

TABLE 16
CITY OF VACAVILLE
PROJECTED GROUNDWATER PUMPING (AC-FT/YR)
DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS [3]

Year	Normal Year	Single Dry Year	Multiple Dry Years
2020	7,000	8,320	8,320
2025	7,300	8,740	8,740
2030	7,700	9,160	9,160
2035	8,100	9,700	9,700
2040	8,100	9,700	9,700

4.2 Surface Water

The following contains a description of the availability of the City's surface water sources during normal, single, and multiple dry years.

Solano Project (Vacaville Supply, SID Agreement)

The Solano Project has an annual water supply of 207,350 ac-ft/yr. As shown in Table 11, Vacaville is entitled to 15,800 ac-ft/yr (sum of Vacaville entitlement and SID agreement) of this

annual yield in the year 2040. The Solano Project differs from other reservoir projects in California because of the reservoir storage size relative to the watershed yield. This means it may take a relatively long time to deplete the reservoir, but, in turn, it takes a relatively long time to fill the reservoir. Because the size of the reservoir is a function of its yield, the long-term reliability for the Solano project is excellent.

Because of the high degree of reliability and historical records, the City anticipates the following reliabilities for normal, single dry, and multiple dry years from the Vacaville Entitlement and SID Agreement:

Vacaville Entitlement and SID Agreement
- Normal – 99 percent
- Single Dry Year – 98 percent
- Multiple Dry Years – 89 percent

Solano Project availability percentages for the City are derived using Sacramento Valley Water Year Hydrologic Classifications and historical records and are included in Appendix F, *SCWA Water Supply Reliability Technical Memorandum,* dated April 2016.

State Water Project (North Bay Aqueduct)

Supply from the NBA originates from the State Water Project and has a similar level of priority as all the other 28 contractors to the project. As a result, this source is subject to significant cutbacks during dry years. Specifically, the City anticipates the following reliabilities for normal, single dry, and multiple dry years from the Solano County Water Agency/Kern County Water Agency (KCWA Agreement) and Settlement Water:

Solano County Water Agency/KCWA Agreement
- Normal – 83 percent
- Single Dry Year – 22 percent
- Multiple Dry Years – 27 percent

Settlement Water
- Normal – 20 percent
- Single Dry Year – 0 percent
- Multiple Dry Years – 5 percent

4.3 Summary of Water Supply Availability

This section contains a determination of the water supply availability. As previously described, the amount of water entitled to the City is increasing until the maximum entitlement is reached by the year 2040. Furthermore, each source has a different availability under normal, single dry, and multiple dry years. Information on supply entitlement and availability is shown in Tables 17 through 21 for normal, single dry, and multiple dry years in five-year increments between 2020 and 2040. The water supply availability is summarized in Tables 22, 23, and 24.

TABLE 17
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2020

Sources of Supply	Entitlement	Normal Year		Single Dry Year		Multiple Dry Years	
		% Available	ac-ft/yr	% Available	ac-ft/yr	% Available	ac-ft/yr
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	4,125	99	4,084	98	4,043	89	3,671
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	5	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	7,000		7,000		8,320		8,320
Total	**35,173**		**26,092**		**19,973**		**19,999**

[a] Recommended maximum groundwater pumping.

TABLE 18
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2025

Sources of Supply	Entitlement	Normal Year		Single Dry Year		Multiple Dry Years	
		% Available	ac-ft/yr	% Available	ac-ft/yr	% Available	ac-ft/yr
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	5,625	99	5,569	98	5,513	89	5,006
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	7,300		7,300		8,740		8,740
Total	**36,973**		**27,877**		**21,863**		**21,754**

[a] Recommended maximum groundwater pumping.

TABLE 19
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2030

Sources of Supply	Entitlement	Normal Year		Single Dry Year		Multiple Dry Year	
		% Available	ac-ft/yr	% Available	ac-ft/yr	% Available	ac-ft/yr
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	7,125	99	7,054	98	6,983	89	6,341
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	7,700		7,700		9,160		9,160
Total	**38,873**		**29,762**		**23,753**		**23,509**

[a] Recommended maximum groundwater pumping.

TABLE 20
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2035

Sources of Supply	Entitlement	Normal Year		Single Dry Year		Multiple Dry Year	
		% Available	ac-ft/yr	% Available	ac-ft/yr	% Available	ac-ft/yr
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	8,625	99	8,539	98	8,453	89	7,676
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	8,100		8,100		9,700		9,700
Total	**40,773**		**31,647**		**25,763**		**25,384**

[a] Recommended maximum groundwater pumping.

TABLE 21
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2040

Sources of Supply	Entitlement	Normal Year		Single Dry Year		Multiple Dry Year	
		% Available	ac-ft/yr	% Available	ac-ft/yr	% Available	ac-ft/yr
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	10,050	99	9,950	98	9,849	89	8,945
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	8,100		8,100		9,700		9,700
Total	**42,198**		**33,058**		**27,159**		**26,652**

[a] Recommended maximum groundwater pumping.

TABLE 22
CITY OF VACAVILLE
WATER SUPPLY DURING NORMAL YEAR (AC-FT/YR)

Sources of Supply	Year				
	2020	**2025**	**2030**	**2035**	**2040**
Solano Project					
Vacaville Entitlement	5,693	5,693	5,693	5,693	5,693
SID Agreement	4,084	5,569	7,054	8,539	9,950
State Water Project					
Solano County Water Agency	7,452	7,452	7,452	7,452	7,452
Settlement Water	1,864	1,864	1,864	1,864	1,864
Groundwater	7,000	7,300	7,700	8,100	8,100
Total	**26,092**	**27,877**	**29,762**	**31,647**	**33,058**

TABLE 23
CITY OF VACAVILLE
WATER SUPPLY DURING SINGLE DRY YEAR (AC-FT/YR)

Sources of Supply	Year				
	2020	**2025**	**2030**	**2035**	**2040**
Solano Project					
Vacaville Entitlement	5,635	5,635	5,635	5,635	5,635
SID Agreement	4,043	5,513	6,983	8,453	9,849
State Water Project					
Solano County Water Agency	1,975	1,975	1,975	1,975	1,975
Settlement Water	0	0	0	0	0
Groundwater	8,320	8,740	9,160	9,700	9,700
Total	**19,973**	**21,863**	**23,753**	**25,763**	**27,159**

TABLE 24
CITY OF VACAVILLE
WATER SUPPLY DURING MULTIPLE DRY YEAR (AC-FT/YR)

Sources of Supply	Year				
	2020	**2025**	**2030**	**2035**	**2040**
Solano Project					
Vacaville Entitlement	5,118	5,118	5,118	5,118	5,118
SID Agreement	3,671	5,006	6,341	7,676	8,945
State Water Project					
Solano County Water Agency	2,424	2,424	2,424	2,424	2,424
Settlement Water	466	466	466	466	466
Groundwater	8,320	8,740	9,160	9,700	9,700
Total	**19,999**	**21,754**	**23,509**	**25,384**	**26,652**

5.0 COMPARISON AND DETERMINATION OF SUFFICIENT SUPPLY

This section compares projected water demand to available water supply during normal, single, and multiple dry years. As shown in Table 25, Vacaville has sufficient water to meet its customers' needs through 2040, including the proposed Roberts' Ranch project. This is based on continued application of the water conservation ordinance and on-going conjunctive use of water supply sources.

Groundwater and surface water supplies are projected to meet or exceed projected water demands even during extended drought conditions. This was demonstrated during a previous drought that lasted for seven years. In view of this demonstrated reliability of the City's conjunctive water supply strategy, future water supply will be adequate to offset future water demands during normal, single, and multiple dry years.

TABLE 25
CITY OF VACAVILLE
SUMMARY OF PROJECTED WATER DEMAND VERSUS AVAILABLE SUPPLY DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS (AC-FT/YR)

Year	Normal Year		Single Dry Year		Multiple Dry Year	
	Projected Demand [a]	Available Supply	Projected Demand [b]	Available Supply	Projected Demand [b]	Available Supply
2020	16,985	26,092	16,985	19,973	16,985	19,999
2025 [c]	18,097	27,877	18,097	21,863	18,097	21.754
2030	18,707	29,762	18,707	23,753	18,707	23,509
2035	19,569	31,647	19,569	25,763	19,569	25,384
2040	20,358	33,058	20,358	27,159	20,358	26,652

[a] From Table 14.

[b] Water supply for single dry or multiple dry year is more than 35% reduction from the normal year which constitutes a Stage 1 Drought, 20% voluntary reduction, therefore the demand values for Single Dry and Multiple Dry Year are the same as a Normal Year.

[c] Roberts's Ranch Project assumed complete development by Year 2025.

6.0 REFERENCES

[1] City of Vacaville, *2015 Urban Water Management Plan Update*, July 2016.

[2] City of Vacaville, *Connection and Development Fees*, January 2016.

[3] Luhdorff and Scalmanini, Consulting Engineers, *Groundwater Source Sufficiency Technical Memorandum, May 2016*.

[4] Luhdorff and Scalmanini, Consulting Engineers, *Conceptualization of the Aquifer System for the City of Vacaville*, March 2003.

[5] *Second Amendment to Master Water Agreement Between Solano Irrigation District and City of Vacaville*, Approved June 8, 2010.

[6] Nolte Associates, *City of Vacaville Water Demand Factors Summary Technical Memorandum*, June 2005.

[7] Phillippi Engineering, *Roberts' Ranch Specific Plan*, June 2015.

[8] City of Vacaville Ordinance 1877, *Ordinance of the City Council of the City of Vacaville, Rescinding Ordinance No. 1431 and Amending Chapter 13.20 of the Vacaville Municipal Code Relating to Water Conservation in Normal, Drought, and Emergency Conditions*, adopted December 1, 2014.

APPENDIX A

CITY COUNCIL RESOLUTION NO. _____ ADOPTING ROBERTS' RANCH WSAR

(to be added once available.)

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APPENDIX B

2011 GROUNDWATER MANAGEMENT PLAN UPDATE

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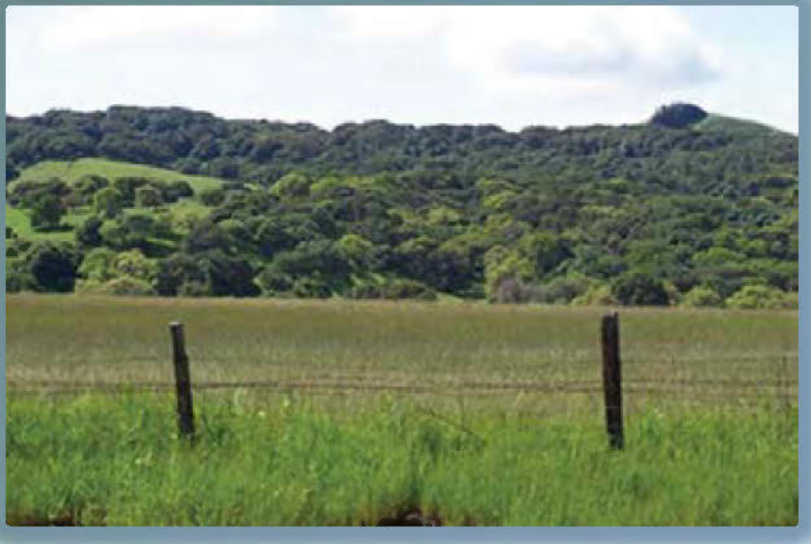
City of Vacaville Groundwater Management Plan Update

Prepared by:
Luhdorff & Scalmanini, Consulting Engineers
Woodland, California

February, 2011



LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

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1.0 INTRODUCTION

1.1 CITY DESCRIPTION AND OVERVIEW

1.1.1 City of Vacaville

The City of Vacaville, founded in 1850, is located at the base of the Vaca Mountains, approximately halfway between Sacramento and San Francisco on Interstate 80 (**Figure 1-1**). The City limits encompass over 21 square miles with a population in excess of 92,000, which makes Vacaville the third largest city in Solano County.

Water demand has increased as the City's population grew from about 43,400 in 1980 to 71,500 in 1990 and 92,000 in 2009. The rate of growth has been slower in recent years, and recently imposed growth measures are expected to ensure adequate water supply for the community (Nolte, 2005).

1.1.2 Authority for Groundwater Management

The City of Vacaville is a local public agency that provides water service to customers within the City limits. As a result of Assembly Bill (AB) 3030, the California Water Code (CWC), Section 10750 *et seq.*, provides local agencies with the authority to adopt and implement groundwater management plans. On March 9, 1993, the City Council of Vacaville voted to adopt a resolution of intent to draft a groundwater management plan, and following the requirements of the CWC at that time, the City passed a resolution on February 14, 1995 approving the *City of Vacaville AB 3030 Groundwater Management Plan* (West Yost, 1995). As described further below, the CWC was subsequently amended as a result of Senate Bill (SB) 1938 (Machado), effective January 2003. As a result, the City has prepared this updated Groundwater Management Plan to comply with the revised requirements.

1.1.3 Plan Purpose

The purpose of the Plan is to maintain a high quality, reliable, and sustainable water supply for the citizens of Vacaville. To accomplish this, the City will continue to manage groundwater conjunctively with its surface water resources and support groundwater basin management objectives directed toward the sustainability of groundwater supplies. Groundwater management involves the ongoing performance of coordinated actions related to groundwater withdrawal, replenishment, and protection to achieve long-term sustainability of the resource without detrimental effects on other resources. To accomplish the City's purposes and the regional basin management objectives, the Plan sets forth a framework and related actions necessary to meet those objectives.

1.2 OVERVIEW OF REGIONAL PLANNING EFFORTS

1.2.1 Agency Coordination

The City is one of the member agencies of the Solano County Water Agency (SCWA), which encompasses all of Solano County plus the University of California at Davis (UCD) and the Yolo County portion of Reclamation District No. 2068 (RD 2068). SCWA was established in 1951 as the Solano County Flood Control and Water Conservation District (SCFC&WCD) under the governance of the Solano County Board of Supervisors. The governing board was expanded in 1988 to include the Solano County Board of Supervisors; mayors of the cities of Vallejo, Benicia, Suisun City, Dixon, Rio Vista, Fairfield, and Vacaville; Solano Irrigation District (SID); Maine Prairie Water District (MPWD); and RD 2068. The SCFC&WCD changed its name to SCWA in 1989. SCWA is responsible for water supply and flood control within its service area. Its water supply role consists of providing untreated surface water to cities, water districts, and state agencies within its boundaries. Other stakeholders that are not SCWA members include Rural North Vacaville Water District (RNVWD), the Dixon-Solano Municipal Water Service (DSMWS), and California Water Service Company (CWSC).

SCWA's primary source of water is the Solano Project, which stores water in the Lake Berryessa Reservoir created by the construction of Monticello Dam on Putah Creek in 1957. Other Solano Project facilities include the Putah Diversion Dam and the Putah South Canal, which delivers Solano Project water to the City and other recipients.

The City is also a member of the Solano Water Authority (SWA), which is a joint powers authority formed in 1987 with the same membership as SCWA. The SWA conducts its work through project agreements; one of these projects, the Coordinated Groundwater Data Analysis Project or SWA-4, is responsible for groundwater data management in northern Solano County. SWA prepares periodic reports to summarize the compiled data and describe historical and current groundwater conditions. Participants in this project include the cities of Vacaville and Dixon, SID, MPWD, RD 2068, SCWA, and Solano County.

Four local agencies, including the City of Vacaville, SID, MPWD, and RD 2068, each adopted groundwater management plans prior to the 2003 CWC amendments. In 2004 and 2005, SCWA facilitated a coordinated effort among these agencies directed toward updates of these plans such that the plans would comply with the amended CWC and also to accomplish consistency among the plans to achieve basin management objectives (West Yost, 2006).

1.2.2 Integrated Regional Water Management Plan

An Integrated Regional Water Management Plan (IRWMP) was prepared in 2005 (Solano Agencies, 2005) for the Solano agencies, including SCWA and its member entities, that identifies and prioritizes all water related actions for these Solano County agencies. Among the highest priorities noted in the IRWMP are conjunctive water resources management and groundwater management. The City and other SWA-4 entities have actively participated in steps to implement the IRWMP.

1.3 CITY WATER SUPPLY

The City's water utility system was purchased from the Pacific Gas and Electric Company in 1959 by issuing voter-approved water revenue bonds (Nolte, 2005). Since that time, the City has systematically improved and upgraded the water utility system. Today, the City's system consists of transmission and distribution pipelines, storage reservoirs, wells, pumping facilities, and water treatment facilities. The system receives water from several sources, including Solano Project water from the Lake Berryessa Reservoir, State Water Project (SWP) water and Settlement Water from the North Bay Aqueduct (NBA), and groundwater from local City wells. The percentage of water used from each supply source varies due to the City's conjunctive management of its water resources. Prior to completion of the Solano Project, all water supplies provided for municipal purposes were developed from local groundwater. The City has received Solano Project water through an agreement with SCWA since 1959. In 1995, the City entered into a Water Master Agreement with SID that increases the City's allocation from this source until the year 2045. The City has also received surface water allocations from the SWP and from a purchase agreement with Kern County Water Agency. Settlement Water is not considered SWP water but consists of surface water from the Sacramento River and Sacramento-San Joaquin Delta estuary diverted under water rights held by the California Department of Water Resources (DWR). This water is made available by DWR in settlement of area-of-origin water right applications by the cities of Vacaville, Fairfield, and Benicia. The City would receive an increasing supply from SID through the year 2040 followed by a consistent supply of 10,050 AF until the year 2050 (City, in process). In aggregate, the estimated water resources available to the City in the year 2030 total 42,000 acre-feet (AF), including about 8,000 AF of groundwater (19% of the total supply).

1.4 LEGISLATION RELATED TO GROUNDWATER MANAGEMENT PLANS

The Legislature enacted legislation in 1992 (AB 3030) and 2002 (SB 1938), now incorporated in the CWC Section 10753, *et seq*. to encourage local public agencies to adopt plans to manage groundwater resources within their jurisdictions. The City is updating its Groundwater Management Plan to be compliant with revisions to the CWC that resulted from SB 1938.

SB 1938 provided that adoption of a groundwater management plan will be a prerequisite to obtaining funding assistance for groundwater projects from funds administered by DWR. To comply with SB 1938, a groundwater management plan must include components that address monitoring and management of water levels, groundwater quality degradation, inelastic land subsidence, and changes in surface flows and quality that either affect groundwater or are affected by groundwater pumping. SB 1938 specifies that groundwater management plans contain provisions to cooperatively work with other public (and presumably private) entities whose service areas or boundaries overlie the groundwater basin. Provisions must also be made to allow participation by interested parties in development of the plan. The plan must include mapping of the groundwater basin, as defined in DWR's Bulletin 118, along with the boundaries of the local agencies that overlie the basin. In this case, the Plan focuses on that portion of the Solano Subbasin that underlies the City. Finally, to comply with SB 1938, monitoring protocols must be designed to detect changes in groundwater levels, groundwater quality, inelastic land

subsidence (for basins where subsidence has been identified as a potential problem), and flow and quality of surface water that either directly affect groundwater, or are directly affected by groundwater pumping.

The potential components of groundwater management plans are listed in CWC Section 10753:

- the control of saline water intrusion;
- identification and management of wellhead protection areas and recharge areas;
- regulation of the migration of contaminated groundwater;
- the administration of a well abandonment and well destruction program;
- mitigation of conditions of overdraft;
- replacement of groundwater extracted by water producers;
- monitoring of groundwater levels and storage;
- facilitating conjunctive use operations;
- identification of well construction policies;
- the construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects;
- the development of relationships with state and federal regulatory agencies; and
- the review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination.

In 2002, SB 1938 amended and added to CWC Section 10750 *et seq.* regarding the implementation of local groundwater management plans. While the provisions of SB 1938 did not alter the potential components of a local groundwater management plan, as listed above, it added the following provisions:

- The local agency, in preparing a groundwater management plan, shall make available to the public a written statement describing how interested parties may participate in developing the plan. For that purpose, the local agency may appoint, and consult with, a technical advisory committee consisting of interested parties.

- In order to qualify for funding assistance for groundwater projects, for funds administered by DWR, a local agency must accomplish all the following relative to groundwater management (CWC 10753.7(a)):

    - Prepare and implement a groundwater management plan that includes basin management objectives for the groundwater basin that is subject to the plan.

    - Include groundwater management components that address monitoring and management of water levels, groundwater quality degradation, inelastic land subsidence, and changes in surface flows and quality that either affect groundwater or are affected by groundwater pumping.

    - Include provisions to cooperatively work with other public (and presumably private) entities whose service area or boundary overlies the groundwater basin.

    - Include mapping of the groundwater basin, as defined in DWR's Bulletin 118,

and the boundaries of the local agency subject to the plan, plus the boundaries of other local agencies that overlie the basin.

- Adopt monitoring protocols designed to detect changes in groundwater levels, groundwater quality, inelastic land subsidence (for basins where subsidence has been identified as a potential problem), and flow and quality of surface water that either directly affect groundwater, or are directly affected by groundwater pumping.

Of the potential groundwater management activities listed in CWC Section 10753.8, those already being investigated and actively implemented as part of less formal groundwater management by the City include avoidance of overdraft, implementation of conjunctive use, monitoring of groundwater levels and quality, initiation of groundwater contamination control, analysis of basin yield for ongoing avoidance of overdraft, and regular analysis and reporting on groundwater conditions. The historic focus of informal groundwater management by the City has been on the quantity and quality of water supply, including avoidance of overdraft conditions, primarily by augmenting local groundwater supplies with supplemental, imported surface water resources. More recently, efforts have been added to include ongoing monitoring and the compilation of data into a database system. Recent efforts have also included use of an analytical groundwater model of the greater Vacaville area for analysis of aquifer system response to various groundwater extraction scenarios for a 20-year horizon. This work also provides an initial foundation for the future development of a numerical groundwater flow model that would be used to evaluate water supply, recharge, and conjunctive use alternatives that might be applicable to the basin. The City withdraws groundwater for municipal purposes from a deep aquifer, and most other extraction in the area occurs from overlying aquifers. Because there is much less risk of contamination of the deep aquifer as compared to shallow aquifers, the City's groundwater management provisions have focused more on supply and less on groundwater contamination. However, this component of local groundwater management is important in terms of overall basin management objectives as described in more detail herein.

In summary, the City has had a formal AB 3030 Groundwater Management Plan since 1995. The City is updating its current plan to be compliant with the SB 1938 requirements as part of its interest in developing and sustaining reliable water supplies to meet its own and also basin needs. To ensure the reliability of groundwater supplies to meet existing and projected demands, the components of local groundwater management planning already implemented include a monitoring program, formulation and maintenance of a database to manage the monitoring data, analysis of and annual reporting on groundwater conditions in the basin, initiation of groundwater modeling, ongoing conjunctive use of local groundwater and imported surface water supplies, and coordination with other agencies on the control of localized groundwater contamination.

1.5 ORGANIZATION OF GROUNDWATER MANAGEMENT PLAN

The balance of this plan is organized to describe management objectives, or goals, for the basin; describe existing groundwater basin conditions, including areas of concern and identified problems; present historical and projected water demands by the City from the basin; and finally to present a set of groundwater management actions which, collectively, form the components of this Groundwater Management Plan.

2.0 SUMMARY OF CITY WATER SUPPLIES AND GROUNDWATER CONDITIONS

2.1 GROUNDWATER BASIN DESCRIPTIONS

As shown on **Figure 2-1**, the City of Vacaville overlies portions of two DWR-designated groundwater basins. The City primarily overlies the northwestern portion of the Solano Subbasin, which is one of 18 subbasins in the Sacramento Valley Basin of the Sacramento River Hydrologic Region. A small area in the southern portion of the City overlies the Suisun-Fairfield Valley Basin in the San Francisco Bay Hydrologic Region. The western portion of the City, west of the Solano Subbasin boundary, is located in the Sacramento River Hydrologic Study Area but does not overlie any area currently designated by DWR as a groundwater basin or subbasin (**Figure 2-1**).

All of the City's existing and proposed municipal wells are located in the Solano Subbasin. **Figure 2-2** also shows the other major purveyors in the northern portion of the subbasin. These include the City of Dixon, SID, RNVWD, MPWD, and RD 2068. Descriptions of the Solano Subbasin and the Suisun-Fairfield Valley Basin are provided below. These descriptions are partly based on the information contained in *California's Groundwater, Bulletin 118 Update 2003* (DWR, 2003). For the Solano Subbasin, a more detailed groundwater basin description is posted on the DWR web site (DWR, 2010).

2.1.1 Sacramento Valley Basin, Solano Subbasin (Basin Number: 5-21.66)

The Solano Subbasin includes the southernmost portion of the Sacramento Valley Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. Overall, population density within the subbasin is sparse, with the major cities being Vacaville, Dixon, and Rio Vista. Subbasin boundaries are defined by Putah Creek on the north, the Sacramento River on the east (from Sacramento to Walnut Grove), the North Mokelumne River on the southeast (from Walnut Grove to the San Joaquin River), and the San Joaquin River on the south (from the North Mokelumne River to the Sacramento River). The western subbasin boundary, which extends through a portion of the City, is partly defined by the groundwater divide between the San Francisco Bay and Sacramento River Hydrologic Regions as described by DWR (2010). DWR reports that the location of the divide is roughly delineated by the English Hills (a section of the Coast Range south of Putah Creek and north of Vacaville) and the Montezuma Hills. There is an area west of the Solano Subbasin between the subbasin boundary and the Lagoon Valley/Vaca Valley fault in which some groundwater development has occurred, but which does not lie within a designated basin or subbasin area.

2.1.2 Suisun-Fairfield Valley Basin (Basin Number: 2-3)

The Suisun-Fairfield Valley Basin is composed of low alluvial plains, with surrounding foothills and mountains, located immediately north of Suisun Bay. The foothills of the Coast Ranges, lying west of Green Valley, bound the basin on the west. The southern extent of the Vaca Mountains forms the northern boundary of the basin. The eastern extent of the basin is marked by low ridges of consolidated rock that appear near the City and extend southeast to the Montezuma Hills (Thomasson et al, 1960).

2.2 SOURCES OF SUPPLY

As summarized in the City's General Plan Update (City, in process), the City's water supply includes both surface water and groundwater sources. The City's surface water sources are Lake Berryessa (Solano Project water) and the State Water Project (SWP) water delivered via the NBA. The balance of the City's water supply is groundwater. Current City water supplies are summarized in **Table 2-1** for normal, single-dry, and multiple-dry years. As indicated on the table, some of the Solano Project and SWP water supply is based on the City's entitlement and some is based on other agreements and settlements. The City's surface water entitlements for 2010 total 26,548 AF, but SWP deliveries are less than the entitlement in all but the wettest years. The availability of SWP water is approximately 64% of the entitlement in a normal year and is projected to decrease to 31% in a single-dry year and to 46% in a multiple-dry year. Therefore, approximately 16,991 AF of surface water would typically be available in a normal year. Total groundwater pumping by the City has decreased from 6,600 AF in 2007 to 5,068 AF in 2010. This represents a 5% reduction in the percentage of the City's total available water supplied by groundwater pumping in a normal year. Surface water use by the City of Vacaville from 2008 to October 2010 is outlined in **Table 2-2**.

Raw surface water deliveries to the City of Vacaville are regularly tested (at least quarterly) for microbiological constituents, regulated organic chemicals, inorganic chemicals, radioactivity, secondary aesthetic standards, and a series of unregulated constituents (pH, alkalinity, hardness, sodium, calcium, potassium, manganese, asbestos, bromide and total organic carbon). The surface water deliveries received by the City are typically high quality with the majority of constituents consistently falling below detection limits.

Projected water supply sources in future years are summarized in **Table 2-3**. Surface water supplies are expected to increase from 16,991 AF in 2010 to 21,754 AF in 2050. Total City groundwater pumpage in normal years is projected to increase to 8,000 AF in 2020 and 2025 as new City wells come on line.

2.2.1 City of Vacaville Pumpage

Prior to 1997, all City pumpage was from the Elmira Road well field, primarily from wells completed in the basal zone of the Tehama Formation but also including a small amount of pumpage from Well 1 completed in the Markley Formation. Concentrated pumpage in the Elmira Road area caused a localized cone of depression and declining groundwater levels in the basal zone. In order to alleviate this condition, the City began constructing new wells outside of the

Elmira Road area in the mid-1990s. Beginning with the construction of Well 14, which came on line in 1997, some pumpage has been redistributed from Elmira Road to the northeastern portion of the City. Two other northeast sector wells have since been constructed in the basal zone. Well 15 came on line in 2004, and Well 16 came on line in 2007. Construction of a new production well in the northeast sector, Well 17, is expected to begin in 2011. The northeast sector wells produced about 1,900 AF (41% of the total) in 2009 and 2010. The locations of existing City wells are shown on **Figure 2-3**.

The majority of the City's historical and current pumpage is from the basal zone of the Tehama Formation; Well 1 is the only non-basal zone well currently in operation. Total annual pumpage for the City from 1968 to October 2010 is shown on **Table 2-4** and **Figure 2-4**. Annual pumpage from the City's wells is divided into four categories on **Figure 2-4**:

1) Basal zone pumpage from the Elmira Road well field (Wells 2 through 13);
2) Non-basal zone pumpage from Well 1 at Elmira Road (currently less than 100 AF per year);
3) Basal zone pumpage from northeast sector wells (currently Wells 14, 15, and 16);
4) Non-basal zone pumpage from the DeMello well in the northeast sector (maximum of 160 AF per year in 2003, offline as of 2005).

The City's annual groundwater pumpage was relatively constant from 1968 to 1974, ranging from 2,862 to 3,316 AF per year. All pumpage during this period was from Elmira Road wells but was not differentiated by zone. Pumpage began to increase in 1975 and reached a peak of 8,024 AF in 1983. Pumpage decreased to 6,089 AF in 1984 and ranged from 5,421 to 6,236 AF, with an average of about 5,800 AF, during 1984 to 1992. Pumpage decreased to 4,395 AF in 1993 and continued to decrease to a low of 3,230 AF in 1996. Pumpage increased from1996 to 2002, reaching 6,638 AF in 2002. From 2002 to 2007 pumping remained relatively constant, averaging 6,635 AF per year. Since 2007, the City of Vacaville has gradually reduced the amount of groundwater it produces to 5,068 AF in 2010, which represents 31% of total use for that year. In 2007, 34% of water demand was supplied by groundwater.

Changes in the City's historical pumpage are correspondingly reflected in the water level data from the Elmira Road well field; specifically, water levels increased as pumpage decreased and vice versa. Notably, the relationship between pumpage and water level response and the development of the localized cone of depression was recognized in the 1980s (Mann, 1985). The City has since developed new groundwater supplies for municipal purposes north of Elmira Road and decreased its total pumping to reduce the local pumping depression in the Elmira Road area. Beginning with the construction of City Well 14, which came on line in 1997, roughly 40% of pumpage has been redistributed from Elmira Road to the northeast sector of the City.

Well 15, located northeast of Well 14, came on line in September 2004. Well 16, located northwest of Wells 14 and 15, was drilled in January 2005 and came on line in July 2007. The DeMello well (completed in the upper Tehama Formation) came on line in 2003, but the capacity of this well is much smaller than the basal zone wells and it has been used only for backup supply since 2004. It has been offline as of 2005. With the addition of the northeast sector wells, Elmira Road pumpage decreased from 5,549 AF in 2003 to 2,698 AF in 2009. Increased

pumpage from the northeast sector wells in future years will further decrease reliance on the Elmira Road wells.

2.2.2 Other Pumpage in Northern Solano County

A brief summary of groundwater development in Solano County is contained in the IRWMP prepared in 2005. Prior to construction of the Solano Project, both municipal and agricultural users relied primarily on groundwater. Wells were perforated primarily in the Quaternary alluvium and the upper and middle zones of the Tehama Formation, and groundwater levels declined significantly in those zones. After completion of the Solano Project in 1958, most agricultural users switched to surface water, and groundwater levels recovered. Most growers in SID rely primarily on surface water, and growers in MPWD and RD 2068 use surface water exclusively (Solano Agencies, 2005).

After the City of Vacaville, SID, and the City of Dixon are the largest producers of groundwater in northern Solano County. SID operates wells to supplement surface water supplies and also to provide for drainage due to a high water table in certain areas. Although pumpage by privately owned wells in SID is unknown, annual metered pumpage is available for SID-owned wells since 1964. SID's pumpage ranged from a low of 2,311 AF during a wet year (1983) to a high of 13,965 AF during the 1976 drought year. SID's pumpage in 2005 (5,440 AF) was only slightly above the 40-year average of 5,363 AF.

The City of Dixon relies entirely on groundwater for its water supply. The City of Dixon is supplied with domestic water by California Water Service Company (Cal Water) and the Dixon-Solano Municipal Water Service (DSMWS). The City's water demand in 2005 was approximately 2,858 AF/year and is projected to be 3,899 AF/year in 2010 (Dixon, 2008).

The RNVWD also produces groundwater from the basal zone of the Tehama Formation. RNVWD pumpage was about 40 AF in 2003 (LSCE, 2003b). Pumpage by industrial and domestic wells in unincorporated portions of the Vacaville area is unmetered, but is assumed to be small. Groundwater development in the Vacaville area by others than the City has largely been from the upper part of the aquifer system rather than the basal zone of the Tehama Formation.

2.2.3 Conjunctive Water Use and Management

The City conjunctively manages its groundwater and surface water resources to most effectively use those resources during different water year types. This has been previously demonstrated to be an effective and flexible management approach. Continued conjunctive water management is expected to enable the City to meet its future water demands for a 20-year horizon and beyond. Groundwater-related objectives of the conjunctive water management plan are to:

1) Recognize and implement actions to prevent persistent water level declines, and
2) Continue to maintain water levels above historical lows when levels temporarily decline during dry years to minimize adverse consequences that would result from over pumping of the aquifer system.

As discussed below, groundwater monitoring data collected by the City indicate the response of the aquifer system to variations in the City's annual pumping amounts. Spring groundwater levels measured during 1992-1993 were initially used to establish "base year" groundwater levels, or the levels to which the aquifer had recovered in response to an estimated sustainable level of pumpage. The 1992-1993 base year groundwater levels have been augmented with more complete data collected during 2002-2010. This base year groundwater level concept serves to guide conjunctive management of the City's water resources. The base year concept is used to define the "normal condition" referenced in the Master Water Agreement between the City of Vacaville and SID signed on May 25, 1995. This plan was developed to ensure sustainable groundwater supplies in the City and SID service areas.

Base year water levels are not anticipated to be exceeded during "normal" water years (i.e., precipitation amount referred to as normal) in response to the pumpage associated with those years. The concept also recognizes that if pumpage is increased during single-dry or multiple-dry years, water levels would temporarily decline to below base year levels in response to increased pumpage. Following a short-term water level decline during a dry year with increased pumping, the base year groundwater levels provide a target to which to restore water levels.

2.3 GROUNDWATER CONDITIONS

2.3.1 Hydrogeology

Most City and non-City wells in the Vacaville area are completed in the Tehama Formation, which has been subdivided into upper, middle, and basal zones. The City's wells are largely completed in the basal zone of the Tehama Formation. City Well 1 is also partially completed in older pre-Tehama deposits. Shallow wells are typically completed in the upper zone of the Tehama Formation and the overlying Quaternary alluvium. A geologic map is provided as **Figure 2-5** to illustrate the regional geology. A detailed discussion of the regional geologic setting, including geologic cross sections, is provided in *Hydrostratigraphic Interpretation and Groundwater Conditions of the Northern Solano County Deep Aquifer System* (LSCE, 2010). A brief summary of geologic conditions is provided below.

The Pliocene and Pleistocene Tehama Formation is the primary aquifer for agricultural and municipal water supply in northern Solano County, including the Vacaville area. This formation consists of slightly to moderately consolidated fluvial, alluvial, and lacustrine deposits and includes interlayered clay, silt, sand, and gravel beds. A stiff blue lacustrine clay found near the upper boundary of the formation and other relatively continuous clay layers divide the formation into upper, middle, and basal zones.

In the Vacaville area, the continuous clay layers within the Tehama Formation appear to thin to the west-southwest, with some layers pinching out altogether. The Tehama Formation has a thickness of up to 2,200 feet in the vicinity of the City's eastern boundary and an outcrop area of over 35 square miles in the English Hills, north of the City, and continuing north toward the Solano County line (**Figure 2-5**). This outcrop serves as the primary recharge area for the Tehama Formation.

The upper and middle zones of the Tehama Formation are used for domestic and agricultural water supply. Southwest of the Highway 80/Midway Road junction, these zones are characterized by predominately thick, fine-grained silt and clay with a few thin sand and gravel beds. Northeast of this area, the number of coarser-grained beds appears to increase. In most western areas, the fine-grained nature, discontinuity of the sands, and generally low yields make these zones unsuitable for high capacity municipal water wells. Typically, these zones are only capable of producing 100 to 300 gallons per minute (gpm) with specific capacities of less than 2 gallons per minute per foot (gpm/ft), although some wells can produce up to 1,000 gpm. Aquifer test data in the upper zone are limited, but a transmissivity of only 1,500 gallons per day per foot (gpd/ft) was estimated based on a test of the City's DeMello well. Reliable transmissivity estimates are not available for the middle zone.

The basal zone of the Tehama Formation includes gravel and cobble deposits and layers of volcanic tuff and conglomerate cemented with calcium carbonate. The more permeable portions of the basal zone are comprised primarily of gravelly sand with calcium carbonate cementation in some areas. The basal zone occurs near the surface on the western edge of the City's Elmira Road well field and gradually deepens to the east (**Figure 2-6**, basal zone outlined in blue). The basal zone ranges in thickness from less than 400 feet in the Elmira Road area, to greater than 700 feet between Vacaville and Dixon (**Figure 2-7**). Up to 350 feet of this zone yields significant quantities of groundwater. The bottom of the basal zone occurs at a depth of about 2,400 feet in the vicinity of the City's Easterly Wastewater Treatment Plant and near the Midway Road/Highway 80 junction area. East of these areas, the basal zone appears to contain fine-grained sand beds. Detailed correlations using numerous oil and gas test holes with geophysical logs indicate that the basal zone extends beneath the Dixon area at a depth of 2,000-2,500 feet. The top of the basal zone was encountered at 1,980 feet bgs during construction of a multiple completion monitoring well in the Dixon area for SCWA (LSCE, 2010). Regional correlations suggest a finer-grained sandy zone extending eastward to beneath the Davis area at depths below existing municipal wells. However, the yield and water quality of this zone are presently unknown.

Specific capacities of wells completed in the basal zone in the Vacaville area generally range from 4 to 24 gpm/ft, depending on the thickness of aquifer materials encountered by the well and included in the perforated interval. The City's municipal basal zone wells range in capacity from 500 to 1,800 gpm. The mean transmissivity of the basal zone is roughly 48,000 gpd/ft (LSCE, 2003a; LSCE, 2008). The transmissivity is significantly lower to the north in the RNVWD wells (mean of about 17,000 gpd/ft).

The Lagoon Valley/Vaca Valley fault flanks the eastern side of the Vaca Mountains and was recognized by Thomasson (1960) and others. The Lagoon Valley/Vaca Valley fault is an extension of the Vaca-Kirby Hills fault and is interpreted as a high-angle, northwest striking, east dipping, normal fault associated with Miocene to Pliocene age uplift and volcanism. Data to determine the hydraulic properties of this fault are limited, and it is unknown whether the fault affects groundwater flow.

2.3.2 Groundwater Levels

Groundwater level data for the City's wells are available from the City's monitoring program, which is discussed in Section 3.3. The monitoring program includes semi-annual manual water level measurements in 13 production wells and 11 monitoring wells. In addition to the manual measurements, nine production wells are also monitored electronically with transducers connected to the City's Supervisory Control and Data Acquisition (SCADA) system. Groundwater levels in other wells in and near the City are also monitored at least semi-annually by (or on behalf of) other entities, including SCWA, DWR, the U.S. Bureau of Reclamation (USBR), SID, and RNVWD (**Figure A-1**).

Representative water level hydrographs for the Vacaville area are provided in **Appendix A** (**Figures A-3 and A-4)**. The hydrographs included in **Appendix A** are organized according to the four primary formations in which the wells are completed: Quaternary alluvium and the upper, middle, and basal zones of the Tehama Formation (**Figure A-2**). Groundwater elevation contour maps prepared for the basal zone of the Tehama Formation are also included in **Appendix A** (**Figures A-7 to A-10**) to indicate the hydraulic gradient and direction of groundwater flow beneath the City.

Water levels in wells completed in Quaternary alluvium and the upper zone of the Tehama Formation (**Figure A-3**) show similar trends. Water levels in those zones generally show declining levels from the 1940s to the early 1960s as a result of increasing groundwater pumpage. Beginning in the 1960s, water levels rose following the delivery of surface water from the Solano Project and corresponding reductions in groundwater pumpage. Water levels have remained relatively high since the late 1960s, largely unaffected by wet or dry climatic periods, with depths to water typically less than 10 feet. Groundwater levels in the Quaternary alluvium and upper zone of the Tehama Formation show small seasonal effects with slightly higher groundwater levels in the spring. Water levels in these relatively shallow aquifers appear to be unaffected by basal zone pumpage.

Water level data are more limited for wells completed in the middle zone of the Tehama Formation. **Figure A-3** illustrates groundwater levels for two wells (6N/1W-23C1 and 7N/1W-34F1) monitored by DWR in the Vacaville area that had sufficient historical data to indicate water level trends in this zone. Groundwater level trends in these wells are generally similar to those observed in the upper zone of the Tehama Formation. Also shown in **Figure A-3** are two monitoring wells (Rural North Vacaville Water District (RNVWD) MW-446 screened between 426 and 436 feet and RNVWD MW-594 screened between depths of 564 to 584 feet) located near RNVWD production Well No. 1. Groundwater levels in the RNVWD monitoring wells show declining groundwater levels until about 2008. The trends in these wells are likely due to local pumping effects from the RNVWD water supply well and a higher level of hydraulic connectivity between the middle and deeper (basal) Tehama Formation deposits.

Water level data since 2000 for the basal zone of the Tehama Formation are shown in (**Figure A-4**). A response to reduced pumping since 2008 can be seen in all of the wells shown. A detailed hydrograph of City Well 8 at Elmira Road shows a typical water level response to pumpage for the City's basal zone wells since 1988 (**Figure 2-8**). In order to obtain generally static

measurements, manual water level measurements in the City's wells since 1992 have been preceded by a three-day shutdown period that eliminated the most pronounced effects of recent pumping by one or more nearby wells to ensure consistent and generally static monitoring conditions. Beginning in 2002, selected transducer measurements from the City's SCADA system have been available to indicate the highest water levels in the spring and the lowest water levels during the summer.

As noted above, the City has considered 1992 to 1993 to represent a "base year" groundwater level condition. The maximum spring water levels in 2003 were approximately the same as 1992 for a similar level of Elmira Road pumpage (about 5,400 AF per year), and the spring 1993 and 2003 water levels are highlighted on **Figure 2-8**. Water level data from Well 8 reflect changes in the City's basal zone pumpage from the Elmira Road well field; specifically, water levels increase as pumpage decreases and vice versa. Elmira Road basal zone pumpage decreased from 1992 to 1996, was relatively constant from 1996 to 1999, and increased from 1999 to 2002. The City kept its total production at a constant level (between 6,600 and 6,700 AF) from 2002 through 2007, then pumpage decreased to about 5,800 AF in 2008 and to 4,600 AF in 2009. The changes in pumpage resulted in increasing water levels in Well 8 from 1992 to 1998, relatively constant water levels from 1998 to 2000, and water level declines of about 35 to 40 feet from spring 2000 to spring 2002 as pumpage increased. Spring water levels declined slightly from 2003 to 2005, recovered in 2006, and declined slightly in 2007. Hydrographs of other Elmira Road wells show water level declines from 2000 to 2005 and relatively stable water levels beginning in 2005. In spring 2009, groundwater levels in the basal Tehama Formation recovered by about 14 feet to an elevation of about -66 feet. In spring 2010, groundwater levels rose to an elevation of about -61 feet in response to further decreases in pumpage in 2009.

The City has reduced its Elmira Road basal zone pumpage by shifting more pumpage to new wells constructed in the northeast sector (Wells 14, 15, and 16). As of 2010, 42% of groundwater production occurred in the northeast sector wells, up from 30% in 2007 and 16% in 2000. Overall, this has resulted in water level declines in the northeast sector wells and reduced drawdown in the Elmira Road well field. A hydrograph of Well 14, which has the longest period of record of the northeast sector production wells, is included in **Appendix A** (**Figure A-4**). Water levels in Well 14 declined at a faster rate between 1998 and 2005 than in the Elmira Road wells (about 50 feet in seven years), stabilized between 2005 and 2007, and as discussed above, have risen since 2007.

Groundwater elevations in the basal zone are much lower than in the middle and upper zones in the Vacaville area, ranging from about 20 feet above sea level in RNVWD to 60 feet below sea level in the vicinity of the City's main well field on Elmira Road. A pumping depression in the basal zone exists in the Elmira Road area, and the gradient for groundwater flow is southerly toward this depression. North of the City, the gradient has a magnitude of approximately 45 feet per mile (measured between RNVWD MW-1389 and Vacaville MW-16 1430 2009 to 2010), which is much steeper than the gradient in the upper zone of the Tehama Formation. The gradient becomes less steep in the Elmira Road area, e.g., the gradient between Well 14 and the Elmira Road wells is only about 3 feet per mile. This is due to the northerly expansion of the cone of depression in the Elmira Road area as more pumpage has been shifted to Wells 14 and 15 in the northeast sector.

2.3.3 Comparison of Groundwater Level Responses in Different Aquifer Zones

Groundwater elevations in the deeper, more confined zones of the Tehama Formation have shown considerable variation over time in direct response to changes in the amount of groundwater used as a source of supply by the City. Groundwater levels in shallower, unconfined to semi-confined aquifers (e.g., the Quaternary alluvium and the upper zone of the Tehama), in which private water supply wells are typically constructed, appear to be largely unaffected by basal zone pumpage. Groundwater levels in the shallower compared to deeper portions of the aquifer system are shown in **Figures A-5 and A-6. Figure A-5** shows three monitoring wells near City Well No. 15. The shallowest well (MW-188, screened from a depth of 158 to 178 feet) shows stable groundwater elevations. Monitoring well MW-508, screened from a depth of 438 to 498 feet, also shows stable groundwater elevations. As seen in **Figure A-5**, water level trends in MW-188 and MW-508 are unaffected by the City's pumping. MW-1815, screened at multiple depths between 1,207 to 1,785 feet in the basal Tehama Formation, shows water level trends in response to the City's pumping. Similarly, **Figure A-6** shows three monitoring wells located near City Well No. 16. As seen in **Figure A-6**, groundwater levels in the shallowest monitoring well (MW- 117 screened from 97 to 107 feet) are unaffected by the City's pumping, whereas groundwater levels measured in the two deeper monitoring wells (MW-1176 and MW-1430, which are completed in zones that are also among the zones screened by Well No. 16), show a direct response to the City's pumping.

During 1968 to 2009, the City's total groundwater production ranged from 2,862 to 8,165 AF with significant variability in pumpage during that period. Even so, groundwater levels representing the shallower part of the Tehama Formation have shown little to no effect in relation to the City's basal zone pumpage. The basal Tehama Formation is highly confined meaning there are large sections of lower permeability materials, silts and clays, which occur between the zones from which the City's wells produce groundwater and the overlying units. This confinement has caused rapid, notable responses to groundwater levels in the pumped basal zone and at the same time precludes noticeable groundwater level responses in the overlying shallower part of the aquifer system.

As the City expands groundwater development of the basal Tehama Formation in the northern to northeastern areas, similar groundwater level observations are anticipated. Specifically, it is anticipated that additional drawdown will occur in the basal zone in response to such pumping, while little or no groundwater drawdown is anticipated in the shallower part of the aquifer system. Ongoing monitoring is recommended to further evaluate groundwater level trends in relation to the City's utilization of groundwater produced from the basal Tehama Formation.

2.3.4 Groundwater Quality

Historical groundwater quality data for the City's water supply wells are available from 1986 to the present, and the results are summarized in **Table 2-5**. Every three years, the City performs water quality monitoring as required for all public water supply systems. The City also collects samples annually for nitrate analysis. Water quality is generally good at all City wells, and most of the historical data do not show signs of water quality degradation. Concentrations have remained steady.

Total dissolved solids (TDS) concentrations in the basal zone wells ranged from 270 to 546 milligrams per liter (mg/L) in 2008. The TDS concentration in Well 1 was 546 mg/L in 2008, which slightly exceeds the recommended secondary Maximum Contaminant Level (MCL) of 500 mg/L but not the upper secondary limit of 1,000 mg/L. Nitrate concentrations exhibit more variability from well to well than TDS, but concentrations have been stable at most wells. Nitrate (as NO_3) ranged from non-detect (<2 mg/L) in Well 16 to 19.9 mg/L in Well 5 during 2007 to 2008. Nitrate concentrations in Wells 1, 2, 5, and 13 have historically been over 10 mg/L nitrate (as NO_3), but not near the MCL of 45 mg/L.

Concentrations of trace elements in the City wells have generally been low. Copper and selenium have been non-detect at all City wells; and iron, manganese, and zinc have been non-detect at most City wells. Arsenic, boron, chromium-VI, and total chromium are typically detected at relatively low concentrations (less than half the MCL), except in Well 16 where arsenic approaches, and on one occasion has exceeded, the MCL of 10 µg/L[1].

There have been localized instances of impacts to shallow groundwater quality due to hazardous chemical contamination, but existing or potential municipal supplies have not been affected. Analyses for volatile organic compounds (VOCs) and other manmade constituents in the City's water supply wells have all been non-detect.

2.3.5 Land Subsidence

Limited monitoring of land subsidence has been conducted in Solano County using leveling surveys that relied on conventional spirit level surveying equipment prior to 1985. Since 1985, conventional survey methods have largely been replaced by Global Positioning System (GPS) techniques. The results of historical spirit level and more recent GPS surveys have been combined to estimate total subsidence and subsidence rates in the southern portion of the Sacramento Valley. The greatest subsidence in the Valley, more than 20 feet in some areas, has occurred in the Delta region as a result of draining of peat soils (Blodgett et al., 1990). Subsidence north of the Delta is caused primarily by groundwater pumping, but oil and gas extraction may be responsible for a significant fraction of the total subsidence in some areas.

The only available estimate of historical land subsidence near the City is based on Ikehara's 1994 report *Global positioning system surveying to monitor land subsidence in the Sacramento Valley, California, USA* that contains estimated subsidence rates for 18 benchmarks in the southern Sacramento Valley. One of these benchmarks (X128 R71) is located approximately halfway between the cities of Vacaville and Dixon. There was approximately 2.4 feet of total subsidence at this location between 1971 and 1989, which represents a subsidence rate of 0.131 feet/year. The location of this site, along with other subsidence monitoring stations in northern Solano County and adjoining portions of Yolo County, is shown on **Figure 2-9**.

Although greater subsidence rates have occurred to the north in Yolo County, the Vacaville area is considered to have a relatively high potential for future subsidence based on the historical data, geologic conditions, and lowered groundwater levels in the basal zone, particularly in areas

[1] An investigation of the elevated arsenic concentration on February 8, 2007 led to controlled operation of Well 16 to ensure the delivered water quality is within the drinking water standard for arsenic of 10 µg/L (LSCE, 2009).

where limited development of the basal zone has occurred historically. In January 2011 two permanent GPS subsidence stations will be added to the regional monitoring network. These stations, located at City Well 16 and SCWA's Dixon monitoring well (**Figure 2-3**) will help decision makers to identify and mitigate any subsidence that may be occurring.

2.4 AREAS OF CONCERN

Although groundwater conditions in the Vacaville area are generally good, there are several areas of concern that may require changes in future groundwater management. These include:

- Sustainable pumpage from the basal zone of the Tehama Formation,
- Preservation of groundwater quality, and
- Prevention of significant future land subsidence.

From 2002 to 2007 the City's total annual pumping rate was held relatively constant at 6,600 to 6,700 AF. Water level data and groundwater modeling results from that period, summarized above and in LSCE (2003a), indicate that future City pumpage from the basal zone ranging from 7,000 AF, based on existing City wells, to 8,000 AF, with additional northeast sector wells, could be sustained to meet normal-year demands. As discussed above, spring groundwater levels measured in City wells during 1992 to 1993 were used to establish "base year" groundwater levels, or the levels to which the aquifer has recovered in response to an estimated sustainable level of pumpage from the Elmira Road well field. The actual amount of sustainable basal zone City pumpage will depend on factors such as other pumping in the area, the locations and perforated intervals of future wells, and effects of climatic conditions and land use factors on groundwater recharge reaching the basal zone. More recently, it has been observed that reducing overall pumping to 4,600 to 4,700 AF has produced significant rebound in groundwater levels. It is assumed that the continued shifting of pumpage away from the Elmira Road area will enable the City to increase pumpage from the basal zone without causing future chronic water level declines. It is also expected that if the City continues to pump at the currently reduced rates, groundwater levels in and around the City of Vacaville will continue to rebound.

In general, the City's groundwater supply is of high quality and meets drinking water standards. Groundwater produced from the basal zone of the Tehama Formation contains slightly elevated arsenic concentrations at Well 16. Vertical flow within the well structure causes some water quality variability when the well is idle; as a result, the City operates this well in a manner to ensure that the produced water meets the MCL for arsenic of 10 ug/L. There have also been localized instances of impacts on shallow groundwater quality due to hazardous chemical contamination, but existing or potential municipal supplies have not been affected to date. This Plan includes recommendations for prevention, monitoring, and mitigation of future threats to groundwater quality.

Land subsidence monitoring data are very limited in the Vacaville area, but data from one USGS report discussed above show that about 2.4 feet of total subsidence occurred between Vacaville and Dixon between 1971 and 1989. There are no data to indicate how much subsidence occurred within the City limits, and especially in the vicinity of the Elmira Road well field, but historical water level declines and geologic conditions result in a potential for future subsidence. Ensuring

that groundwater levels in the basal zone do not decline below 1992 levels at Elmira Road will reduce the risk of significant future subsidence in this area. Declining water levels in the northeast sector, which have resulted from the City's more distributed pumping scheme, may increase the risk of subsidence in that area. Two subsidence monitoring stations to be added to the regional monitoring network in January 2011 will help the City to analyze any trends and mitigate impacts as needed.

3.0 GROUNDWATER MANAGEMENT PLAN OBJECTIVES AND COMPONENTS

3.1 GROUNDWATER MANAGEMENT PLAN OBJECTIVES

The overall purpose of the Plan is to maintain a high quality, reliable, and sustainable water supply for the citizens of Vacaville. To accomplish this, the City will continue to manage groundwater conjunctively with its surface water resources and support basin management objectives (BMOs) directed toward the sustainability of groundwater supplies within the basin and subbasin. Groundwater management involves the ongoing performance of coordinated actions related to groundwater withdrawal, replenishment, and protection to achieve long-term sustainability of the resource without detrimental effects on other resources. To accomplish the City's purposes and the regional BMOs, the Plan sets forth a framework and related actions necessary to meet those objectives.

The City's utilization of surface water supplies from various sources along with local groundwater development represents a long history of water resource and water supply management actions that are consistent with what can be considered to be overall objectives for the Solano Subbasin. The BMOs addressed by this Plan can be expressed as follows:

1. **Assessment of Groundwater Basin Conditions.** Programs to monitor and report on groundwater levels, groundwater quality, and pumpage have been implemented to assess groundwater conditions in the Solano Subbasin. Plans to expand the existing programs and add monitoring of land subsidence are in progress. These monitoring programs are necessary to ensure that undesirable effects such as long-term groundwater level declines, groundwater quality degradation, and significant inelastic land subsidence are avoided. Regional coordination of groundwater monitoring is important, and monitoring programs should be reevaluated periodically to determine whether the location, depth, and frequency of monitoring is adequate. Data collected by the monitoring programs need to be evaluated on a regular basis to ensure that other BMOs are met.

2. **Avoidance of Progressive Groundwater Level Declines.** It is important that groundwater pumpage in the Solano Subbasin not exceed the sustainable yield of the subbasin in order to avoid chronic water level declines that could lead to overdraft conditions or cause significant inelastic land subsidence. This objective can be met through periodic evaluation of groundwater level and pumpage data collected by the monitoring program, along with refining the estimated sustainable yield of the subbasin.

3. **Preservation of Groundwater Quality.** This objective involves actions needed to sustain a supply of good quality groundwater for beneficial uses in the basin. It includes coordinated efforts that will be required to conduct a regional monitoring program that

identifies short and longer-term water quality trends. It also includes wellhead and recharge area protection and actions to avoid salt accumulation and/or mobility of naturally occurring constituents. Also included in this BMO will be the active characterization and solution of any groundwater contamination problems through cooperation with responsible parties or through independent action if timely response by responsible parties is not forthcoming and the preceding management objectives are thereby impacted or constrained.

4. **Increased Conjunctive Use of Surface Water and Groundwater Resources.** Several entities in the Solano Subbasin, including the City and SID, have used surface water and groundwater conjunctively for decades. There are opportunities to expand these programs in the future and to increase the use of recycled water to meet existing and projected demands. Included in this management objective is the non-degradation of surface water flows or quality as a result of groundwater management practices. In addition to being classified as a separate BMO, conjunctive use is one of the primary means of accomplishing BMOs 2 and 3 above.

Quantitatively, the preceding objectives translate into general preservation of groundwater levels and quality in the basin. Groundwater levels are allowed to fluctuate through seasonal demands and local hydrologic variations (wet and dry periods), but a progressive lowering of groundwater levels that could lead to overdraft would be prevented. As discussed in more detail in Chapter 2.0, the hydrogeologic setting in the Vacaville area and the City's extraction of groundwater from the deeper part of the aquifer system has resulted in large groundwater level fluctuations in the basal unit of the Tehama Formation. Fluctuations have been much smaller in the upper part of the aquifer where changes are primarily due to seasonal variations. Due to the integrated or conjunctive use of local groundwater and imported surface water, the City has managed its extraction, including locations and quantity, to prevent progressive lowering of groundwater levels in the deeper aquifer in the area beneath the City. A continuation of such local conjunctive use operations will help to accomplish the second BMO (avoidance of progressive groundwater level declines) while continuing to utilize local groundwater to meet a portion of the City's projected water requirements.

The City plans to intermittently use more groundwater from the basal zone of the Tehama Formation for dry-period and/or emergency water supply. Interpretation of historical pumping fluctuations and corresponding aquifer response suggests that such intermittent utilization of a slightly larger fraction of the Tehama Formation's large storage capacity during dry years can successfully contribute to meeting the City's water requirements while still accomplishing the management objectives listed above, primarily via corresponding reductions in pumping during normal and wet years.

3.2 PLAN CATEGORIES AND COMPONENTS

To accomplish the BMOs discussed above, this Plan incorporates a number of components that are divided into five categories: 1) monitoring program, 2) water resource sustainability, 3) groundwater resource protection, 4) agency coordination and public outreach, and 5) plan

implementation and updates. Each of these categories and the Plan components within each category are described in this section.

The Plan components reflect the focus on local groundwater management in the Solano Subbasin by the City and continuing cooperation with the members of the SWA and other stakeholders in the Solano Subbasin. In summary, this Plan aids the City in the continued management of its own groundwater resources, and provides the foundation for the City and other entities in the basin to cooperatively manage and potentially expand use of groundwater on a regional basis for municipal and emergency water supply purposes.

Category 1: Monitoring Program
- 1A. Elements of Monitoring Program
- 1B. Evaluation and Reporting of Monitoring Data

Category 2: Water Resource Sustainability
- 2A. Maintaining Stable Groundwater Levels
- 2B. Determination of Sustainable Pumpage
- 2C. Continuation of Conjunctive Use Operations
- 2D. Integration of Recycled Water
- 2E. Water Conservation

Category 3: Groundwater Resource Protection
- 3A. Well Construction and Destruction Policies
- 3B. Identification and Management of Recharge Areas and Wellhead Protection Areas
- 3C. Management and Mitigation of Contaminated Groundwater
- 3D. Long-Term Salinity Management

Category 4: Agency Coordination and Public Outreach
- 4A. Continuation of Local, State, and Federal Agency Relationships
- 4B. Public Outreach
- 4C. Water Awareness Education

Category 5: Plan Implementation and Updates
- 5A. Plan Implementation and Reporting
- 5B. Provisions to Update the Groundwater Management Plan

3.3 COMPONENT CATEGORY 1: MONITORING PROGRAM

The City's groundwater monitoring program was initially described in its first *AB 3030 Groundwater Management Plan* (West Yost, 1995), and additions to the monitoring program were outlined in a report updating local groundwater conditions through 2003 (LSCE, 2004b). The City's current groundwater monitoring program includes monitoring of groundwater levels, quality, and production. As discussed below, the City is coordinating with SCWA on the addition of two land subsidence monitoring stations to the regional monitoring program in January 2011.

3.3.1 Component 1A: Elements of Monitoring Program

The City's groundwater monitoring program is summarized in **Table 3-1**, and the monitoring locations are shown on **Figure 3-1**. The monitoring program summarized on this table and figure does not include 14 shallow monitoring wells located at the City's two wastewater treatment plants (WWTPs). There are nine monitoring wells at the Gibson Creek WWTP and five monitoring wells at the Easterly WWTP. Although these wells are not included in the groundwater monitoring program summarized below, the monitoring results are evaluated as part of achieving the third BMO (preservation of groundwater quality).

Groundwater Levels

As shown in **Table 3-1**, manual water level measurements are currently made by the City on a semi-annual basis in 11 of its 13 production wells and all of its dedicated Tehama Formation monitoring wells. In addition to the manual measurements, nine production wells are equipped with transducers connected to the City's SCADA system. Additional transducers are scheduled to be deployed in wells MW-14, MW15-1815, MW16-1430, MW-98A, and MW-98C in January 2011.

In 1992, the City implemented a program to obtain spring and fall water level measurements from its production wells that best represent static conditions. Manual water level measurements are preceded by a three-day shutdown period for all wells in order to eliminate the most pronounced effects of recent pumping to ensure consistent and generally static monitoring conditions. However, the spring measurements often do not reflect the highest groundwater levels of the year, and the fall measurements provide little indication of the low groundwater levels that occur during the summer. Since 2002, transducer measurements from the City's SCADA system have also been available to indicate the highest water levels in the spring and the lowest water levels during the summer. The SCADA system allows the City to continuously monitor pumpage and water levels in most of its active production wells. The exceptions are Well 1, which has a SCADA connection that monitors pumpage but not water levels, and Wells 2, 3, and DeMello, which are not connected to the SCADA system. Water level readings are taken every 10 seconds in the other wells, and the data are automatically uploaded via radio or telephone line to a computer at the City's Water Treatment Plant on Allison Road.

In 2001, the City began manual water level measurements in monitoring wells completed in all three zones of the Tehama Formation. As summarized in **Table 3-1**, manual water level measurements are currently made semi-annually (spring and fall) in 11 monitoring wells.

Several other entities also monitor groundwater levels in the vicinity of the City, including SCWA, DWR, USBR, SID, and RNVWD. Data collected by DWR and USBR are available on DWR's website, and data collected by SID and RNVWD are available from those districts. SWA also acts as a repository for water level data collected by DWR, USBR, SID, and UCD under the SWA-4 agreement. The purpose of the SWA-4 agreement is to coordinate groundwater monitoring data among the SWA member agencies and also other agencies, including DWR and USBR. SCWA has responsibility for managing the data and preparing periodic reports on behalf

of SWA to summarize the compiled data and describe historical and current groundwater conditions.

SWA has completed an initial report on groundwater conditions in northern Solano County (Summers Engineering, 1995) and three data summary reports, the most recent of which is entitled *2003-2005 Ground Water Report, Groundwater Conditions in Solano County* (SWA, in progress). This report lists the wells with groundwater data, shows the sampling frequency, and refers to a database that includes the well construction and water level data. The report includes data for 139 to 202 wells, depending of the year water levels were measured. The majority of these wells are monitored monthly or semi-annually; some wells are monitored annually. The majority of these wells are agricultural or domestic wells perforated in the upper aquifers (above 400 feet).

The regional groundwater monitoring program has been expanded. In October 2007, SCWA began installing multiple-completion monitoring wells at four locations in northern Solano County. Since then, monitoring wells have been installed at all four locations and are currently equipped with transducers. Transducer data are downloaded and analyzed at least semi-annually. Manual water level measurements are taken on the same frequency. A summary of construction information and monitoring activities for each SCWA monitoring well is provided in **Table 3-2**.

Groundwater Quality

Groundwater quality sampling of the City's production wells for general minerals, inorganics, and organics is conducted every three years as required for all public water supply systems. The City also collects samples annually for nitrate analysis. Samples were collected quarterly for radionuclide analysis from May 2005 to January 2006, and the City has received a 9-year waiver from the California Department of Public Health (DPH) for future radionuclide sampling because the gross alpha results were below the threshold of 3 pCi/L. The City's current groundwater quality monitoring program is summarized in **Table 3-1**.

SWA does not include groundwater quality data in its periodic monitoring reports; therefore, there is no central repository for water quality data in Solano County. In the vicinity of the City, RNVWD and SID conduct routine groundwater quality sampling. Although RNVWD has two production wells, only one is operated for public water supply. Due to elevated arsenic concentrations, exceeding the MCL of 10 ug/L, in the second production well, it is currently offline. Routine water quality sampling is conducted in both wells as required by DPH.

SID's *SB 1938 Groundwater Management Plan Upgrade* (Summers Engineering, 2006) states that groundwater quality is monitored on a rotating basis in agricultural wells in the SID service area. Although the number of wells sampled each year and the sample analyses conducted are not specified, SID produces a brief annual report each year that includes groundwater quality results. The 2009 annual report shows that four wells were sampled, and the samples were analyzed for general minerals including nitrate, boron, and sodium adsorption ratio (SAR). The 2009 annual report also indicates that nine SID wells have been sampled since 2001, and most of these were sampled every other year (Summers Engineering, 2009).

Groundwater Production

The City monitors pumpage in its water supply wells on a daily basis. As shown in **Table 3-1**, all but three water supply wells are connected to the SCADA system that allows the City to monitor pumpage electronically. By February of 2011, Wells 2 and 3 will be added to the SCADA system, leaving only the inactive DeMello Well to be monitored manually. The electronic pumpage data are typically recorded daily (at noon), but more frequent data can be collected if necessary. Other well information such as flow rate, pressure, pump speed, chemical tank level, etc. are also recorded daily.

There is no regional compilation of pumpage data in Solano County because SWA does not include pumpage in its database or reports. In the vicinity of the City, municipal pumpage is monitored by RNVWD. SID monitors agricultural pumpage from District wells but does not monitor non-District pumpage within its boundaries. As noted above, the DeMello well has been offline since 2005.

Land Subsidence

The City does not currently monitor land subsidence within its boundaries, and regional monitoring of land subsidence in Solano County has been limited. Regional land subsidence monitoring has included non-instrumented GPS monuments and continuous GPS monitoring stations; there are no extensometers in Solano County. In January 2011, two permanent GPS subsidence stations (located at the Vacaville Well 16 and SCWA Dixon monitoring well sites) will be added to the regional monitoring network.

The Sacramento-San Joaquin Delta non-instrumented GPS network consists of about 120 monuments, including about 30 monuments in Solano County. This network was initially surveyed in 1997 and resurveyed in 2002, but funding has not been available to process the data from the 2002 resurvey. Yolo County also has a non-instrumented GPS monitoring network consisting of 58 stations. The Yolo County network was surveyed in 1999, 2002, and 2005. The 2005 survey of the Yolo County network included several stations in northern Solano County. GPS monitoring locations in northern Solano County and adjoining portions of Yolo County are shown on **Figure 2-9**.

Instrumented GPS monitoring stations are generally referred to as Continuously Operating Reference Stations (CORS). Each CORS site includes a high-resolution GPS receiver and antenna with a solar collector and battery for power supply. The GPS receivers are attached to steel or concrete structures that are anchored deep into the soil. GPS positions are recorded at intervals of five to 30 seconds, and a daily average is calculated from all of the data to achieve maximum accuracy. CORS sites use some form of telemetry (typically a radio transceiver) to upload the data. After processing, the data are accessible on Internet sites operated by entities such as the National Geodetic Survey (NGS) or the California Spatial Reference Center (CSRC).

At present, there is one CORS site in northern Solano County. This site, labeled P267, is located south of Dixon and approximately six miles east of the City (**Figure 2-9**) and is operated by the Plate Boundary Observatory. Historical data are limited for this station, which began operation in

April 2005. The two new subsidence stations scheduled for January of 2011 will also be operated by the Plate Boundary Observatory.

Surface Water Flows and Quality

Monitoring of surface water flows and quality is generally not applicable to the City of Vacaville for three reasons: 1) there are no major streams in the vicinity of the City, 2) the City's production wells are completed in relatively deep and confined zones of the Tehama Formation (primarily the basal zone), and 3) there is no direct interaction between groundwater in this zone and surface water.

As required by DPH, the City monitors the quality of surface water delivered by the Solano Project and the SWP on a quarterly basis. Both raw and treated surface water are sampled at the City's water treatment plant and analyzed for nitrate on a quarterly basis (except for the first quarter) and for general mineral, general physical, inorganic, and organic constituents annually.

Actions

- Continue the City's existing groundwater monitoring program and complement with information gathered by other local and state agencies (e.g., DWR, SID, and USBR).

- Expand regional groundwater monitoring programs to ensure effective groundwater resource management and accomplishment of the BMOs.
    - Coordinate with SCWA regarding the adequacy of regional groundwater monitoring networks and programs.
    - Coordinate with SCWA on planned construction of additional monitoring facilities in northern Solano County.
    - Coordinate with SCWA on implementation of a land subsidence monitoring program.

3.3.2 Component 1B: Evaluation and Reporting of Monitoring Data

Groundwater level, quality, and production data collected as part of the City's monitoring program are periodically entered into a database, which allows the data to be summarized on tables and plots in an efficient manner. The data are routinely reviewed to check for any significant changes in groundwater conditions. On a less frequent basis, the data are comprehensively evaluated and a report is prepared to summarize the data.

The most recent evaluation of groundwater conditions in the Vacaville area is presented in the report entitled *Hydrostratigraphic Interpretation and Groundwater Conditions of the Northern Solano County Deep Aquifer System*, (LSCE, 2010). Previous reports have been prepared at least every other year beginning in 2000. Most of these reports have been comprehensive, detailed reports that contain much more analysis than is generally required in a routine annual summary of the data. Such routine annual reporting is recommended in the future, as described below.

Actions

- Prepare a brief annual summary of groundwater and land subsidence data collected through spring (i.e., March or April) in a groundwater management report to be completed each year by August 1st.

- Coordinate with SWA-4 on the maintenance and utilization of the regional monitoring database, including regular transfer of City data and coordination with others on the use of the data to assess basin conditions relative to the BMOs. Additionally, coordinate with SWA-4 on monitoring protocols (such as groundwater level objectives) being used to assess the effect of pumpage on levels and achieving BMOs.

- Coordinate with SWA-4 regarding the adequacy of regional evaluation and reporting of groundwater data. Potential improvements to the SWA database and reports include:
    - the addition of the City's wells and water level data;
    - the addition of groundwater quality, pumpage, and land subsidence data;
    - preparing reports on an annual basis to summarize data collected during the previous year; and
    - preparing a coordinated update of groundwater conditions in the subbasin at least every five years.

3.4 COMPONENT CATEGORY 2: WATER RESOURCE SUSTAINABILITY

3.4.1 Component 2A: Maintaining Stable Groundwater Levels

Accomplishment of the second BMO (avoidance of progressive groundwater level declines) requires that generally stable groundwater levels be maintained in the Tehama Formation, especially in the basal zone. On a subbasin scale, there have been increases in groundwater levels and storage since the Solano Project began delivering water in the late 1950s. As described above, however, groundwater levels in the basal zone of the Tehama Formation continue to exhibit a localized cone of depression in the vicinity of the City's Elmira Road well field, and groundwater levels in this area have fluctuated directly in response to the amount of pumpage. Following several years of maintaining total annual pumpage at 6,600 to 6,700 AF, basal zone groundwater levels in the Elmira Road wells appear to have stabilized as of spring 2006. Since 2007, reduced groundwater pumping by the City has caused groundwater levels in the basal aquifer to rebound significantly (upwards of 25 feet in some areas).

Water level fluctuations in the basal zone are typical of conditions in an area where groundwater and surface water are conjunctively managed. Historically, more groundwater was pumped from storage during dry years, and that storage was replenished when pumpage was reduced during subsequent wet years. Annual pumpage was held constant from 2002 to 2007 to observe water level responses in the basal zone. As discussed above, the City's conjunctive water management program allows it to adjust its groundwater production so that groundwater levels recover to spring 1992-1993 "base year" levels during normal years. The base year water levels are used to define the "normal condition" referenced in the Master Water Agreement (SID and City, 1995). Groundwater levels may decline below base year levels during dry years with increased

pumpage, but levels should remain above historical lows. Conjunctive water management is again used to restore groundwater levels to base year conditions following a dry year when increased pumpage has occurred.

In recent years, the City has also managed the location of its groundwater extraction in an effort to shift pumpage away from the Elmira Road well field to the northeast sector of the City. Prior to the construction of City wells 14, 15, and 16 in the northeast sector, there was no significant groundwater development of the basal zone of the Tehama Formation for municipal water supply in this area, although a small amount of groundwater is known to be produced from this zone for commercial purposes. Somewhat further north, there is a small amount of groundwater development from this zone by RNVWD. The City plans to develop some additional groundwater to supplement its currently available groundwater and surface water resources and add that yield to the existing water supply. One area identified for potential future groundwater development is in the northeast sector.

Actions

- Continue to manage groundwater and surface water conjunctively to ensure that groundwater levels in the Elmira Road wells recover to spring 1992-1993 "base year" levels during normal years based on the following criteria:
    - During dry years with increased pumpage, recognize that groundwater levels may decline below base year levels but maintain groundwater levels above historical lows.
    - Use conjunctive water management to restore groundwater levels to base year conditions following a dry year when increased pumpage has occurred.
    - Use 1992-1993 base year groundwater levels, in conjunction with the more complete data from 2002-2003, to measure aquifer system response to pumping and assess the sustainable pumpage.

- Manage pumping away from Elmira Road to prevent progressive groundwater level declines in other areas.

- Continue groundwater development programs that help to achieve the BMOs by optimizing the pumping distribution in the City's urban planning area.

3.4.2 Component 2B: Determination of Sustainable Pumpage

In order to accomplish BMOs that pertain to groundwater in the Vacaville area, it will be important to determine what yield can be developed on both a regular and an intermittent (dry period or emergency) basis. A determination of sustainable pumpage, particularly for the basal zone of the Tehama Formation, will be required to accomplish the main objectives of operating within the yield of the groundwater basin and avoiding overdraft.

The intent of this Plan component is to develop further understanding and quantification of sustainable pumpage from the Tehama Formation (especially the basal zone), accounting for variations in hydrologic conditions and the location and amount of pumpage, so that groundwater

development and use can be managed in such a way to meet an appropriate fraction of total water demand while avoiding over pumping that could result in overdraft conditions.

In the future, in coordination with other SWA members and state and federal agencies, implementation of this Plan component will be important in accomplishing the first and second management objectives for the basin. The observation of historical groundwater conditions, in combination with knowledge of pumpage from the basal zone of the Tehama Formation, has led to the City's current operational practices as well as general expectations regarding the approximate yield of this aquifer in the vicinity of the City. Historical operating experience, complemented by observed groundwater conditions, is an appropriate basis to initially determine available groundwater supplies. However, it is possible and appropriate to more precisely analyze the basin to determine values or ranges of yield under varying hydrologic conditions, and to assess the impacts of various management actions that might be implemented in the basin. Previous reports, including LSCE (2010), include recommendations for the future development of a numerical groundwater flow model that could be utilized for determination of the yield of the subbasin under existing land use and groundwater and surface water development conditions. Such a model could also be used for implementation of this Plan component to assess the yield of the subbasin under future land use conditions as well as future ranges of surface water importation, groundwater development, and recycled water use through varying hydrologic conditions, i.e., wet and dry periods that affect the availability of imported surface water.

Actions

- Assess levels of pumpage relative to the sustainable yield of the principal aquifer system.
    - Update sustainable pumpage estimates with expanded monitoring data (e.g., monitoring conducted with the new SCWA monitoring wells installed at the periphery of the urban planning area).

- Refine assessment of hydrogeologic conditions and the conceptual model in preparation for the future development of a regional numerical groundwater flow model.
    - Improve groundwater extraction (non-City pumpage) and recharge estimates.
    - Refine conceptual model of subbasin (e.g., conceptual model for enlarged study area).
    - Investigate stream-aquifer interactions.

- Discuss joint development of a regional numerical groundwater flow model to simulate and evaluate future water resources management scenarios with SWA and other entities that overlie the subbasin.

3.4.3 Component 2C: Continuation of Conjunctive Use Operations

The City conjunctively manages its groundwater and surface water resources to most effectively use those resources during different water year types. This has been previously demonstrated to be an effective and flexible management approach. Conjunctive water management goals have been established particularly to accomplish the second BMO, i.e., avoidance of progressive groundwater level declines. Continuation of conjunctive water management is expected to enable

the City to meet its future water demands to a 20-year horizon and beyond. Groundwater-related objectives of the conjunctive water management program are to:

- Recognize and implement actions to prevent persistent groundwater level declines.
- Continue to maintain groundwater levels above historical lows when levels temporarily decline during dry years in order to minimize subsidence and other adverse consequences caused by over pumping of the aquifer system.

Planning for additional groundwater development has preliminarily involved the use of an analytical groundwater flow model (LSCE, 2003 and 2007). Monitoring data have been and will continue to be utilized to assess actual response to pumping (particularly within the basal zone) so that operations can be adjusted as necessary to achieve this BMO, i.e. avoidance of progressive groundwater level declines.

As part of the conjunctive management of surface water and groundwater to meet the City's requirements, it is recognized that there will be variations in the amount of available surface water supplies from year to year, particularly since a large fraction of the supply is imported from outside the subbasin. Similarly, there are expected to be variations in groundwater conditions as a function of the local hydrogeology that affect, among other things, the natural recharge to the groundwater basin from year to year. Local hydrology, which affects local groundwater conditions in the basal zone, may be considerably different from the hydrology in a distant (Central Sierra Nevada) location that directly affects the availability of imported surface water in any given year.

Recharge to the basal zone is expected to occur primarily east of the English Hills and north of the Vacaville area where the Tehama Formation outcrops. A significant portion of the recharge is probably the result of leakage from the overlying Quaternary alluvium and the upper zone of the Tehama Formation in the outcrop areas (**Figure 2-5**). Thus, conjunctive water management by the City necessitates particular attention to groundwater level recovery from year to year to ensure that water levels in the basal zone are maintained to meet a regular component of the City's water supply in normal and wet years and a larger component of the water supply during "dry periods" that affect supplemental surface water availability. In light of all the preceding, continuation of this Plan component is essential to accomplishing all the BMOs.

Actions

- Continue the City's conjunctive management of its available water resources;
- Coordinate with other SWA members to explore other conjunctive use opportunities directed toward the BMOs.

3.4.4 Component 2D: Water Conservation

The City of Vacaville is committed to implementing water conservation programs. The 2005 UWMP contains descriptions of the conservation measures that the City has implemented, plans to implement, or intends to study (Nolte, 2005). This section highlights those measures that are the same as the best management practices (BMPs) outlined by the California Urban Water

Conservation Council. For more than 18 years, the City has participated in a Water Conservation Council that includes other cities in Solano County and SCWA, the City's wholesale supplier of imported surface water. Through regional partnering efforts, the cities have shared resources and benefited from each other's programs and studies.

Water conservation and related public education measures have generally been developed in California to achieve the following goals:

- meet legal mandates,
- reduce average annual potable water demands,
- reduce sewer flows,
- reduce water demands during peak seasons, and
- meet drought restrictions.

The City has implemented the following BMPs to increase water conservation:

- distribution system water audits and leak detection and repair;
- public information;
- school education;
- conservation pricing;
- conservation coordinator;
- residential plumbing retrofits;
- metering with commodity rates for all new connections and retrofit of existing connections;
- large landscape conservation programs and incentives;
- conservation programs for commercial, industrial, and institutional accounts; and
- water waste prohibition.

The City's water conservation and public education program will expand to include the following BMPs found to be locally cost-effective, as detailed in the 2005 UWMP. These BMPs are intended to reduce California's long-term urban water demands and have been incorporated into the water demand management measures section of the Urban Water Management Planning Act.

- Water survey programs for single-family residential and multi-family residential programs (surveys of customers having the greatest potential to reduce water use started in 2006);
- High-efficiency washing machine rebate programs (the City supports the rebate program offered by Pacific Gas & Electric Company); and
- Residential ultra-low-flow toilet replacement program (the City exempted itself from this water demand management measure in its 1999 Water Management Plan; however, it is continuing to research an effective and efficient method to implement in the future).

The City uses a variety of communication tools to encourage water conservation. These tools include: press announcements and newspaper advertisements; public workshops; City web site posting with a dedicated water conservation section to promote water conservation practices and water rate information; billing software that shows each customer's water use over the last 12 months; cooperative exhibits, demonstration sites, library displays, and a water model used for

public meetings and school education; public information through regional projects; speakers for community groups and the media; and coordination with other government agencies, industry groups, public interest groups, and the media.

This Plan component will be incorporated with educational and outreach material to complement other Plan components. This update of the City's Plan includes continuation of public water awareness programs directed toward achievement of the BMOs.

Actions

- Continue to implement and promote water conservation programs within the City's service area.

3.5 COMPONENT CATEGORY 3: GROUNDWATER RESOURCE PROTECTION

3.5.1 Component 3A: Well Construction and Destruction Policies

Most of the City's groundwater supply is developed from the basal zone of the Tehama Formation. The City's wells are commonly completed to depths of over 600 feet, including many wells over 1,000 feet deep and one well over 1,800 feet deep. Proper well design and construction is required to prevent the movement of poorer quality water between aquifers through the well structure. In coordination with SWA, the City has implemented well construction guidelines to minimize the potential for groundwater quality degradation in deeper aquifers. These guidelines, which especially include the installation of deep seals, are followed for construction of all new City wells. The City also continues to follow the Solano County Code (see below) and guidance provided in DWR Bulletins 74-81 and 74-90 on well construction (DWR, 1981 and 1990).

The Solano County Environmental Health Services Division of the Department of Resource Management is responsible for well construction permitting in Solano County. The County Code, Chapter 13.10, effectively implements the State Well Standards for water supply wells, monitoring wells, and cathodic protection wells. Permitting of municipal supply wells is also within the purview of DPH. The third BMO, preservation of groundwater quality, requires that all wells be properly constructed and maintained during their operational lives and properly destroyed after their useful lives, so that they do not adversely affect groundwater quality by, for example, serving as conduits for movement of contaminants from the ground surface and/or from an aquifer with poor groundwater quality to one with good quality. Toward that end, this component is included in the overall plan to support well construction and destruction policies, and to participate in their implementation in the subbasin, particularly with regard to surface and inter-aquifer well sealing and proper well destruction, which are critical in the management of a multiple aquifer system.

Actions

- Continue current well construction and destruction policies.

- Coordinate with other SWA members as appropriate on well construction and future resource utilization.

3.5.2 Component 3B: Identification and Management of Recharge Areas and Wellhead Protection Areas

The 1986 Amendments to the federal Safe Drinking Water Act (SDWA) established requirements for new Wellhead Protection Programs (WPPs) to protect groundwater that supplies drinking water wells for public water systems. Each state was required to prepare a WPP and submit it to the USEPA by June 19, 1989. However, California did not develop an active statewide WPP at that time. Subsequently, in 1996, reauthorization of the SDWA established a related program called the Source Water Assessment Program. In 1999, the DPH Division of Drinking Water and Environmental Management developed its Drinking Water Source Assessment Program (DWSAP), which was approved by USEPA. The overall objective of the DWSAP is to ensure that the quality of drinking water sources is protected. The wellhead protection aspect of this groundwater management plan component is now essentially required as a result of the 1996 SDWA reauthorization.

In California, the DWSAP satisfies the mandates of both the 1986 and 1996 SDWA amendments. The California DWSAP includes delineation of Groundwater Protection Zones surrounding an existing or proposed drinking water source where contaminants have the potential to migrate and reach that source. The program includes preparation of an inventory of activities that may lead to the release of contaminants within these zones. The activities, referred to in the DWSAP as Potentially Contaminating Activities, include such land uses as gas stations and dry cleaners, as well as many other land uses. Known contaminant plumes regulated by local, state, and federal agencies are also included. The Groundwater Protection Zones, which are determined based on local hydrogeological conditions and also well operation and construction parameters, represent the approximate area from which groundwater would be withdrawn during 2, 5, and 10-year time periods. These zones also represent the area in which contaminants released to groundwater could migrate and potentially affect the groundwater extracted by wells located within the designated zones. The DWSAP evaluation also includes a risk or vulnerability ranking based on a combined numerical score that results from points assigned to various evaluations conducted as part of the DWSAP process. This ranking provides a relative indication of the potential susceptibility of drinking water sources to contamination.

DPH is responsible for conducting DWSAP assessments for systems existing prior to the adoption of the California program but has encouraged purveyors to perform their own assessments. Assessments for existing systems were due to be completed by May 2003.

Permitting of a new water supply well requires that the applicant complete a DWSAP analysis as part of the permit process. Fifteen DWSAP assessments have been completed on behalf of the City. The results of the DWSAP assessments can be used as a planning tool to guide land use development in the vicinity of water sources. The DWSAP analyses prepared for water sources in the basin should, in some fashion, be reviewed at least every five years and updated as appropriate. The collective DWSAP information can also be integrated with other management

activities, including siting of new wells, land use policies, and the County's Code concerning well construction.

This Plan component is included to incorporate the DWSAP efforts into the City's Groundwater Management Plan. Compliance with these DPH requirements is a key part of accomplishing the BMOs.

Actions

- Employ wellhead protection measures to ensure long-term sustainability of good quality water.
    - Use DWSAP information, including delineation of source area and protection zones.
    - Require deep sanitary seal construction standards for municipal supply wells.
    - Employ well destruction policy to prevent groundwater contamination.

- Coordinate with other SWA members (as applicable) regarding DWSAP analyses (and also other environmental assessments) conducted to help guide management decisions in the subbasin.

- Promote recharge area protection to mitigate impacts of urban infrastructure and sources of groundwater contamination that could reduce recharge potential.

3.5.3 Component 3C: Management and Mitigation of Contaminated Groundwater

In general, groundwater is of high quality and meets drinking water standards in the Vacaville area.

In the more publicized arena of hazardous chemical contamination that falls under the purview of the Regional Water Quality Control Board and sometimes other state or federal agencies, there have been localized instances of impacts on groundwater quality; however, these do not constrain existing or potential municipal supplies. This Plan includes active monitoring of groundwater quality and active participation with local health and other agencies as appropriate to identify spills, leaks or other threats to groundwater quality, and to participate in their control and cleanup such that groundwater quality is not impacted and does not limit water supply. Mitigation measures will be employed (well construction, placement, treatment, etc.) as an element of developing groundwater supplies in order to reduce nitrate concentrations and other constituent concentrations if they exceed drinking water standards, as necessary.

When groundwater remediation activities involve groundwater extraction, remediated groundwater may be discharged to Publicly Owned Treatment Works (POTW) with permitting authority through the POTW program and the appropriate regulatory agency approvals, including the Regional Water Quality Control Board and the State Water Resources Control Board. Remediated groundwater may also be discharged to surface water, applied to land, recycled, or otherwise beneficially used or discharged, with all required agency approvals and permits.

The Solano County Environmental Health Services Division has local oversight for groundwater protection through the Underground Storage Tank (UST) and Hazardous Materials programs. The UST regulations provide groundwater protection through annual integrity testing and stringent tank requirements.

Prevention is the most important factor in minimizing groundwater contamination. The City promotes public awareness of the importance of preventing water pollution through its web site and other outreach tools.

Actions

- Identify short and longer-term water quality trends and actions needed to sustain a supply of good quality groundwater.

- Employ BMPs to limit potential sources of contamination in the environment.

- Coordinate with the County Environmental Health Services Division and other land use/regulatory agencies to develop a method for identifying contamination concerns and mitigating public water supply contamination.
    - Identify locations of point sources of contamination.
    - Identify major nonpoint sources of contamination.
    - Mitigate potential impacts on groundwater quality resulting from point or nonpoint sources of contamination.
    - Identify short and longer-term water quality trends and actions needed to sustain a supply of good quality groundwater.

- Coordinate with other SWA members and the County Environmental Health Services Division to assess the quality of groundwater used by private well owners in the subbasin.

3.5.4 Component 3D: Long-Term Salinity Management Programs

In general, groundwater quality in the Solano Subbasin is such that groundwater supplies meet standards for beneficial uses in the basin, which include primarily Municipal and Domestic Supply and Agricultural Supply. There also have been no notable historical trends of groundwater quality degradation in the Solano Subbasin over time. However, several factors suggest that observations and interpretation of groundwater quality warrant attention to ensure long-term preservation of groundwater quality. Notable among these factors are: 1) historical and current agricultural irrigation practices, 2) other historical and current land uses that have contributed or can contribute higher salt concentrations than other sources of water supply in the basin (including, but not limited to, water softeners), 3) the presence of high water tables which cause increased soil salinity due to evaporation in some areas, and 4) tidal influences in the Sacramento-San Joaquin Delta. The combination of these factors suggests that, on a long-term basis, there could be an accumulation of dissolved minerals in the aquifer system if salinity is not managed in a way to avoid undesirable groundwater quality degradation. Consequently, this component is included in the overall Groundwater Management Plan to include the interpretation

of groundwater quality data and to incorporate groundwater quality as an important consideration in the implementation of the other Plan components, most notably continuation of conjunctive use operations, integration of recycled water, and management and mitigation of contaminated groundwater. The long-term salinity management component is essential to accomplishing the third management objective of preserving groundwater quality in the basin.

Actions

- Implement measures to avoid salt accumulation and other adverse changes in groundwater chemistry in the subbasin.

3.6 COMPONENT CATEGORY 4: AGENCY COORDINATION AND PUBLIC OUTREACH

3.6.1 Component 4A: Continuation of Local, State, and Federal Agency Relationships

The City has long-established working relationships with local and state agencies that will continue on an ongoing basis. The City will continue to interact with state agencies, particularly DWR, on the operation of the SWP and the agreement with DWR for Settlement water. The availability of surface water resources is key to continued conjunctive use operations in the future. The City has a historical and ongoing working relationship with local agencies, as well as with other local groundwater pumpers, to manage supplies to effectively meet water demands within the available yields of imported surface water and local groundwater.

The joint powers authority process that led to the formation of the SWA is a classic illustration of local agency partnering that has produced the beginnings of integrated regional water resources management. As a result of the willingness of the SWA members to seek opportunities to work together and develop programs that mutually benefit the region as well as their individual communities, these agencies prepared and executed the SWA-4 Project that initiated a collaborative and integrated approach to several of the aspects of groundwater resource management that are now included in this Plan. As a result of the SWA-4 Project, the member agencies have the capability to integrate their database management efforts, develop a regional monitoring network, and prepare reports on groundwater conditions in the subbasin.

In 2004 and 2005, SCWA coordinated meetings and other exchanges between local agencies (including the City, SID, MPWD, and RD 2068) with adopted groundwater management plans. The purpose was to identify common elements that could be used by each agency to update its individual plan to be consistent with the amended Water Code. Periodic review and update of the plans is planned to be coordinated with the SCWA member agencies.

The SWA-4 members are especially engaged in collaborative activities that are directed toward an integrated regional approach to groundwater resources management. The SWA-4 members also have the opportunity to inform citizens in their service areas of groundwater management activities, including plan updates and opportunities for the public to attend meetings and/or

provide comments on any issues of concern regarding groundwater in the northern Solano County area.

In 2005, SCWA adopted an IRWMP, which identifies and prioritizes water related actions for the Solano County agencies, including the City. One of the highest priorities of the IRWMP is continuation of conjunctive use and associated groundwater management. This Plan component is included to formalize the historical local and state agency working relationships as part of comprehensively managing local groundwater, in concert with imported surface water and local recycled water, to accomplish all the management objectives for the basin.

Actions

- Continue to develop working relationships with local, state, and federal agencies (regulatory and other) to achieve broader local and regional benefits.

- Continue to pursue grant opportunities in cooperation with SCWA to fund basin management activities and regional water projects including the planned IRWMP for the Westside Subregion that encompasses Solano County and other counties.

3.6.2 Component 4B: Public Outreach

The purpose of the Plan is to maintain a high quality, reliable, and sustainable water supply for the citizens of Vacaville. To accomplish this, the Plan components describe how the City intends to manage its water resources in support of four principle BMOs directed toward the sustainability of groundwater supplies. As the City is managing its water resources as a service to the local citizenry, the City is committed to engaging the public in awareness of the Plan's purpose and objectives.

The City plans to promote public awareness of the Plan through printed media, including bill inserts and periodic news releases.

Actions

- Continue public involvement process through the use of City Council meetings that periodically include updates on water resources management activities by the City.

- Continue public outreach through the use of the City's web site, bill inserts, radio spots, and printed media. These notices will include contact information so that interested parties can request additional information, ask questions, or provide comments on water resources management activities.

3.6.3 Component 4C: Water Awareness Education

The City of Vacaville is committed to implementing water awareness and conservation programs. The UWMP contains descriptions of the measures that the City has implemented, plans to implement, or intends to study (Nolte, 2005).

The City uses a variety of communication tools to provide for public information and involvement. These tools include: press announcements and newspaper advertisements; radio spots; public workshops; City web site posting with a dedicated water conservation section to promote water conservation practices and water rate information; billing software that shows each customer's water use over the last 12 months; cooperative exhibits, demonstration sites, library displays, and a water model used for public meetings and school education; public information through regional projects; speakers for community groups and the media; and coordination with other government agencies, industry groups, public interest groups, and the media.

This Plan component will be incorporated with educational and outreach materials to complement other Plan components, including the Water Conservation component. This update of the City's Plan will continue to include public education and water awareness programs directed toward achievement of the four BMOs.

Actions

- Continue water awareness education programs.

3.7 COMPONENT CATEGORY 5: PLAN IMPLEMENTATION AND UPDATES

3.7.1 Component 5A: Plan Implementation and Reporting

Action Plan

Table 3-3 summarizes the action items discussed under each Plan component and the implementation schedule for each item. Action items planned to be completed within two years are labeled "short-term" actions, and items expected to require more than two years to complete are labeled "long-term" actions. Action items that represent on-going groundwater management activities conducted by the City are labeled "continuing" actions.

Provisions to Cooperate with Other Agencies

The IRWMP adopted by SCWA in 2005 identifies and prioritizes regional water-related actions for the Solano County agencies, including the City. Highest priority actions identified in the IRWMP include quantifying countywide water demand and supply, increasing opportunities for conjunctive use, increasing the use of groundwater as part of conjunctive use operations, and implementation of water use efficiency programs (CDM, 2005). The City supports implementation of the current IRWMP and also efforts to develop a new IRWMP for the Westside Subregion.

As a member of the SWA-4 Project, the City will update other members on its groundwater monitoring and management activities. Updates to SWA-4 members include information and data transfer via reports and data exchanges as further described below.

Groundwater Management Reports

As described in the Introduction to this Plan, local groundwater management planning already includes, among several other activities, analysis of groundwater conditions and preparation of periodic reports on groundwater and all other aspects of water resources and water supplies within the Solano Subbasin in the vicinity of the City of Vacaville. In addition, the City updated its UWMP (Nolte, 2005) in 2005 and finalized a comprehensive report on groundwater conditions, including recommendations for additional groundwater and subsidence monitoring (LSCE, 2010).

Beginning in the 1980s, the City has prepared several reports to describe its groundwater utilization and summarize groundwater level and quality trends. The City plans to produce future reports on an annual basis to describe the status of management actions performed and/or recommended, including monitoring–related and other cooperative activities with other Solano County entities or state or federal agencies. These annual reports will include summaries of monitoring data collected during the previous year, including groundwater conditions (groundwater levels, quality, and production) and land subsidence data. The reports will include data collected through spring (March 31st) so that water level recovery during the winter months can be evaluated. The reports will also summarize current water requirements, use of local groundwater and imported surface water from the Solano Project and the SWP to meet those requirements, and other appropriate details about water requirements and supplies such as, for example, the status of introducing recycled water as a component of non-potable water supply. As appropriate, other more detailed technical reports on various aspects of Plan implementation and reports prepared in coordination with others, such as SCWA and/or SWA, would complement the City's annual management reports.

Actions

- Cooperate with other agencies.
  - Provide copies of adopted Plan, and related reports, to SCWA/SWA members.
  - Support the IRWMP, including implementation of priority objectives of the IRWMP.

- Prepare groundwater management reports.
  - Prepare annual groundwater management reports to be completed by August 1st. Reports will summarize activities conducted by the City to implement the components of the Plan and will include a summary of monitoring data collected through spring (March 31st).
  - Coordinate with SWA to prepare an update of groundwater conditions in the subbasin every five years.

3.7.2 Component 5B: Provisions to Update the Groundwater Management Plan

The components of this Plan reflect the current understanding of the occurrence of groundwater in the Solano Subbasin in the vicinity of Vacaville and specific problems or areas of concern about that resource. The Plan components are designed to achieve specified objectives to utilize local groundwater for regular water supply while both protecting and preserving groundwater quantity and quality. While the Plan provides a framework for present and future actions, new data will be developed as a result of Plan implementation. That new data could identify conditions which will require modifications to currently definable management actions. As a result, this Plan is intended to be a flexible document that can be updated to modify existing components and/or incorporate new components as appropriate in order to recognize and respond to future groundwater conditions. Review and update of this Plan would initially occur in about five years, or sooner if necessary. Subsequent future updates would be similarly scheduled. SWA members would be apprised of future updates to the City's Plan to ensure that the City's Plan is consistent with BMOs and management actions being implemented by others utilizing water resources within the same basin/subbasin. The City will also conduct outreach to encourage public participation in future Plan updates.

Actions

- Review and update Plan every five years or more often as needed.

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TABLES

Table 2-1

City of Vacaville Water Supply[1]

Source	Surface-Water Entitlement (ac-ft)	Normal Year		Single-Dry Year		Multiple-Dry Year	
		Percent Available	(ac-ft)	Percent Available	(ac-ft)	Percent Available	(ac-ft)
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement[2]	2,500	99	2,475	98	2,450	89	2,225
State Water Project							
Vacaville Entitlement	6,100	64	3,904	63	3,843	33	2,013
KCWA Agreement	2,878	64	1,842	63	1,813	33	950
Settlement Water	9,320	100	9,320	100	9,320	100	9,320
Groundwater[3]		100	7,000	120	8,400	110	7,700
Total	26,548		30,233		31,461		27,325

1. Source: Memorandum from David B. Okita (General Manager) to City/District Urban Agencies Subject - UWMP Reliability Data. August 10, 2010.
2. From: City of Vacaville General Plan Update - Water Supply and Service in Vacaville (In Process), http://www.vacavillegeneralplan.org.
3. Based on: Luhdroff & Scalmanini Consulting Engineers. Sept. 2003, *City of Vacaville, SB 610 Water Supply Assessment Groundwater Source Sufficiency.*

Table 2-2
City of Vacaville Water Supply Summary (Acre-Feet/Year)

		2008		2009		2010	
Source Agency	**Description**	**Allocated**	**Used**	**Allocated**	**Used**	**Allocated**	**Used**
Solano Project	Vacaville Entitlement	5750	0	5750	0	5750	0
Solano Project	Carryover	5230	4553	7428	2433	9793	2
Solano Project	SID Exchange	0	0	3000	3000	2500	2500
Solano Project	SID Exchange (M&I carryover)	0	0	678	678	527	527
State Water Project	Table A	3142	3142	3591	2276	4489	3513
State Water Project	Carryover	1960	1960	0	0	1520	1520
State Water Project	Benecia Exchange	1343	1343	0	0	0	0
State Water Project	Article 21	0	0	771	771	1040	1040
State Water Project	Settlement Water (E)	682	682	0	0	0	0
State Water Project	Settlement Water (B)	8638	1097	9320	3362	9320	1481
City of Vacaville	Groundwater Pumping		5784		4647		5068
	Total	26745	18561	30538	17167	34652	15651

Table 2-3
City of Vacaville Water Supply Sources in Normal Year
(acre-feet) [3]

Source	2010	2015	2020	2025	2050
Solano Project					
Vacaville Entitlement	5,693	5,693	5,693	5,693	5,693
SID Agreement[1]	2,475	3,094	4,084	5,569	9,850
State Water Project					
Vacaville Entitlement (Table A)	3,904	3,904	3,904	3,904	3,904
KCWA Agreement	1,842	1,842	1,842	1,842	1,842
Settlement Water	9,320	9,320	9,320	9,320	9,320
Groundwater[2]	8,000	8,000	8,000	8,000	8,000
Total	31,234	31,853	32,843	34,328	38,609

1. From: City of Vacaville General Plan Update - Water Supply and Service in Vacaville (In Process), http://www.vacavillegeneralplan.org.
2. Based on: Luhdroff & Scalmanini Consulting Engineers. Sept. 2003, *City of Vacaville, SB 610 Water Supply Assessment Groundwater Source Sufficiency.*
3. Source: *2010 Draft Urban Water Management Plan* . Vander Meadows Draft, W.S.A.R.

Table 2-4
City of Vacaville Annual Well Production (acre-feet)

Year	Elmira Road			Northeast Sector			All Wells		
	Basal Zone (Wells 2-13)	Non-Basal Zone (Well 1)	Total	Basal Zone (Wells 14-16)	Non-Basal Zone (DeMello)	Total	Basal Zone (Wells 2-16)	Non-Basal Zone (Well 1 & DeMello)	Total
1968									2862
1969									3046
1970									2871
1971									3198
1972									3255
1973									3125
1974	2,870	446	3,316				2,870	446	3,316
1975	3,492	478	3,970				3,492	478	3,970
1976	4,525	440	4,965				4,525	440	4,965
1977	4,725	368	5,093				4,725	368	5,093
1978	4,667	353	5,020				4,667	353	5,020
1979	5,858	327	6,185				5,858	327	6,185
1980	6,595	395	6,990				6,595	395	6,990
1981	7,540	200	7,740				7,540	200	7,740
1982	7,429	254	7,683				7,429	254	7,683
1983	7,751	273	8,024				7,751	273	8,024
1984	6,067	22	6,089				6,067	22	6,089
1985	5,709	144	5,853				5,709	144	5,853
1986	5,595	229	5,824				5,595	229	5,824
1987	6,085	151	6,236				6,085	151	6,236
1988	5,292	129	5,421				5,292	129	5,421
1989	5,897	148	6,045				5,897	148	6,045
1990	5,519	106	5,625				5,519	106	5,625
1991	5,298	149	5,447				5,298	149	5,447
1992	5,405	126	5,531				5,405	126	5,531
1993	4,395	0	4,395				4,395	0	4,395
1994	3,889	4	3,893				3,889	4	3,893
1995	3,856	30	3,886				3,856	30	3,886
1996	3,128	102	3,230				3,128	102	3,230
1997	3,240	14	3,254	132		132	3,372	14	3,386
1998	3,369	34	3,403	502		502	3,871	34	3,905
1999	3,288	33	3,321	775		775	4,063	33	4,096
2000	4,278	52	4,330	811		811	5,089	52	5,141
2001	5,162	113	5,275	939		939	6,101	113	6,214
2002	5,564	101	5,665	973		973	6,537	101	6,638
2003	5,456	93	5,549	919	160	1,079	6,375	253	6,628
2004	5,130	107	5,237	1,325	60	1,385	6,455	167	6,622
2005	4,862	96	4,959	1,722	0	1,722	6,584	96	6,680
2006	4,840	95	4,934	1,701	0	1,701	6,541	1,701	6,635
2007	4,590	101	4,691	1,920	0	1,920	6,511	101	6,612
2008	3,575	92	3,667	2,116	0	2,116	5,692	92	5,784
2009	2,644	54	2,698	1,946	0	1,946	4,593	54	4,647
2010	2,902	69	2,971	2,097	0	2,097	4,999	69	5,068

Table 2-5
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements											
Well Name	Date	EC (µmho/cm)	TDS (mg/L)	pH	Total Alkalinity [1] (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SO_4 (mg/L)	Cl (mg/L)	HCO_3 [1] (mg/L)	NO_3 [1] (mg/L)	F (mg/L)	Al (µg/L)	As (µg/L)	B (mg/L)	Ba (mg/L)	Cr (µg/L)	Cr (VI) (µg/L)	Cu (mg/L)	Fe (mg/L)	Fe (f) (mg/L)	Mn (µg/L)	Mn (f) (µg/L)	Se (µg/L)	Zn (mg/L)
		900 [b]	500 [b]	6.5/8.5 [b]						250 [b]	250 [b]		45 [a]	2 [a]	1000 [a]	10 [a]	1 [c]	1 [a]	50 [a]		1.3 [a]	0.30 [b]	0.30 [b]	50 [b]	50 [b]	50 [a]	5 [a]
Well 01	2/18/1987	780	**530**	7.3	320	67	28	56	2.9	82	3	320	12	-	-	<4	-	0.11	<20	-	<0.02	<0.03	-	<10	-	<2	<0.01
Well 01	6/19/1990	790	**540**	7.6	310	72	25	55	2.5	69	35	310	13	-	<100	<10	-	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 01	1/1/1994	-	**520**	-	-	-	-	-	-	-	20	-	11	-	-	3	-	-	ND	-	-	-	-	-	-	ND	-
Well 01	1/1/1997	-	-	-	-	-	-	-	-	-	21	-	14.2	-	-	4	-	-	ND	-	-	-	-	-	-	15	-
Well 01	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	12.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 01	4/29/1999	815	**500**	7.3	326	85.1	26.6	54.1	2.6	62	23	398	12.8	-	ND	2.6	-	ND	23	-	ND	ND	-	2.2	-	ND	ND
Well 01	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
Well 01	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-
Well 01	1/1/2001	-	-	-	-	-	-	-	-	-	-	-	12.8	-	-	-	-	-	2.3	-	-	-	-	-	-	-	-
Well 01	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	1.5	-	-	-	-	-	-	-
Well 01	1/1/2002	-	-	-	-	-	-	-	-	-	-	-	12.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 01	3/7/2002	789	**530**	7.4	331	87	27	59	2.8	63	23	404	12.76	-	ND	2.1	0.2	ND	ND	1.7	ND	ND	-	ND	-	ND	ND
Well 01	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 01	3/16/2005	656	**530**	7.4	322	87	28	57	2.9	65	24	-	12	-	-	<2	-	-	<10	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 01	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	13.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 01	3/14/2007	-	-	-	-	-	-	-	-	-	-	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 01	1/31/2008	846	**546**	7.7	305	51	23	47	2.7	63	23	-	12.4	-	ND	1.4	0.16	0.094	3.8	-	ND	ND	-	ND	-	ND	ND
Well 02	2/18/1987	520	390	7.3	220	39	21	44	3.6	47	16	220	11	-	-	<4	-	<0.1	<20	-	<0.02	<0.03	-	<10	-	<2	<0.01
Well 02	6/17/1991	540	310	7.8	204	39	20	48	2.3	36	15	204	7.8	-	<100	<10	-	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 02	1/1/1993	-	-	-	-	-	-	-	-	-	-	-	9.3	-	-	ND	-	-	ND	-	-	-	-	-	-	5	-
Well 02	3/29/1993	-	-	-	-	-	-	-	-	-	-	-	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	6/21/1993	-	-	-	-	-	-	-	-	42	-	-	9.3	-	-	-	-	-	-	-	-	-	-	-	-	5	-
Well 02	1/1/1994	-	-	-	-	-	-	-	-	-	-	-	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	5/2/1994	570	380	7.3	220	53	22	51	3.5	46	16	130	9.5	-	<50	<5	-	0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 02	1/1/1996	-	370	-	-	-	-	-	-	-	19	-	27	-	-	ND	-	-	ND	-	-	-	-	-	-	ND	-
Well 02	1/1/1997	-	380	-	-	-	-	-	-	-	16	-	9.7	-	-	ND	-	-	ND	-	-	-	-	-	-	9	-
Well 02	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	15.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	6/3/1999	550	320	7.8	243	49.7	21.2	51.5	2	35.3	20.4	296	15.1	-	ND	1.9	-	ND	11	-	ND	ND	-	ND	-	ND	ND
Well 02	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-
Well 02	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	-	-
Well 02	1/1/2001	-	370	-	-	-	-	-	-	-	-	-	11.1	-	-	ND	-	-	ND	5	-	-	-	-	-	-	-
Well 02	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	4.3	-	-	-	-	-	-	-
Well 02	1/1/2002	-	-	-	-	-	-	-	-	-	-	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	3/7/2002	558	370	7.4	216	51	21	44	3.3	42	16	263	11	-	ND	3	0.13	ND	6.2	4.7	ND	ND	-	ND	-	ND	ND
Well 02	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	3/16/2005	486	380	7.6	223	53	22	46	3.3	43	17	-	11	-	-	2	-	-	<10	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 02	3/15/2006	-	-	-	-	-	-	-	-	-	-	-	13.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	5/10/2007	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 02	1/31/2008	616	380	8	161	85	28	59	2.9	40	19	-	13.3	-	ND	1.6	0.24	0.067	1.7	-	0.0035	0.035	-	ND	-	ND	ND
Well 03	3/30/1987	410	340	7.9	210	36	20	39	3.3	34	8	208	4	-	-	<4	-	0.12	20	-	<0.02	0.03	-	<10	-	<3	<0.01
Well 03	1/1/1992	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	3/3/1992	520	320	7.9	200	33	24	47	3	45	12	200	<0.4	-	<100	<10	-	0.14	12	-	<0.05	<0.1	-	<30	-	<5	<0.05

Table 2-5 (continued)
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements											
Well Name	Date	EC (µmho/cm) 900 [b]	TDS (mg/L) 500 [b]	pH 6.5/8.5 [b]	Total Alkalinity [1] (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SO_4 (mg/L) 250 [b]	Cl (mg/L) 250 [b]	HCO_3 [1] (mg/L)	NO_3 [1] (mg/L) 45 [a]	F (mg/L) 2 [a]	Al (µg/L) 1000 [a]	As (µg/L) 10 [a]	B (mg/L) 1 [c]	Ba (mg/L) 1 [a]	Cr (µg/L) 50 [a]	Cr (VI) (µg/L)	Cu (mg/L) 1.3 [a]	Fe (mg/L) 0.30 [b]	Fe (f) (mg/L) 0.30 [b]	Mn (µg/L) 50 [b]	Mn (f) (µg/L) 50 [b]	Se (µg/L) 50 [a]	Zn (mg/L) 5 [a]
Well 03	3/29/1993	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	6/21/1993	-	-	-	-	-	-	-	-	37	-	-	6.2	-	-	ND	-	-	16	-	-	-	-	-	-	6	-
Well 03	1/1/1994	-	-	-	-	-	-	-	-	-	-	-	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	1/26/1995	480	320	7.6	200	42	21	41	4	38	11	120	6.6	-	<50	2	-	0.12	14	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 03	1/1/1996	-	340	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	3/20/1996	-	-	-	-	-	-	-	-	-	-	-	4.9	-	-	ND	-	-	ND	-	-	ND	-	ND	-	-	-
Well 03	1/1/1997	-	-	-	-	-	-	-	-	-	-	-	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	4/29/1999	510	300	7.7	218	43.1	19.7	40.7	4.1	38	10	266	ND	-	ND	3.1	-	ND	26	-	ND	ND	-	ND	-	ND	ND
Well 03	8/24/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	17	-	-	-	-	-	-	-
Well 03	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
Well 03	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-
Well 03	1/1/2001	-	330	-	-	-	-	-	-	-	9.9	-	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	2/15/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-
Well 03	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	14.4	-	-	-	-	-	-	-
Well 03	3/7/2002	506	330	7.7	218	46	20	40	4.3	37	9.9	266	6.6	-	ND	3	ND	ND	15	15.9	ND	ND	-	ND	-	ND	ND
Well 03	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	3/16/2005	461	340	7.8	210	45	20	41	4.2	37	9.9	-	6.8	-	-	2.6	-	-	17	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 03	3/15/2006	-	-	-	-	-	-	-	-	-	-	-	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 03	3/14/2007	-	-	-	-	-	-	-	-	-	-	-	13.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	2/25/1986	570	380	7.3	240	54	22.6	56.8	-	56	24	240	2.7	-	-	<4	-	<0.05	<20	-	<0.02	<0.03	-	<10	-	<5	<0.01
Well 05	2/22/1989	654	400	7.5	230	54	22	58	2.1	62	26	230	12	-	-	<4	-	<0.06	20	-	<0.02	<0.03	-	<10	-	<2	<0.02
Well 05	3/3/1992	700	430	7.6	238	64	26	47	3	57	37	238	<0.4	-	<100	<10	-	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 05	1/1/1993	-	-	-	-	-	-	-	-	-	-	-	15.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	3/29/1993	-	-	-	-	-	-	-	-	-	-	-	14.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	6/21/1993	-	-	-	-	-	-	-	-	56	-	-	15.1	-	-	-	-	-	-	-	-	-	-	-	-	6	-
Well 05	1/1/1994	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	1/26/1995	610	410	7.5	240	61	25	54	3	52	28	140	13	-	<50	2	-	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 05	1/1/1996	-	460	-	-	-	-	-	-	-	30	-	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	1/1/1997	-	-	-	-	-	-	-	-	-	-	-	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	16.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	19.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	6/3/1999	685	410	7.9	248	63.8	26.3	57.8	3.2	63	36.9	302	19.7	-	ND	1.6	-	ND	8.8	-	ND	ND	-	ND	-	ND	0.021
Well 05	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	3.3	-	-	-	-	-	-	-
Well 05	1/1/2001	-	430	-	-	-	-	-	-	-	32	-	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	3.2	-	-	-	-	-	-	-
Well 05	3/7/2002	672	430	7.5	244	62	25	54	2.9	60	32	297	15.84	-	ND	2	0.27	ND	6.8	4.1	ND	ND	-	ND	-	ND	ND
Well 05	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	16.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	3/16/2005	615	440	7.6	243	65	26	58	3.2	64	32	-	17	-	-	<2	-	-	<10	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 05	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	16.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	3/14/2007	-	-	-	-	-	-	-	-	-	-	-	19.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 05	1/31/2008	774	476	7.7	265	67	27	58	3.2	66	33	-	18.2	-	ND	1.2	0.31	0.072	2.9	-	ND	ND	-	ND	-	ND	ND
Well 06	3/16/1988	542	340	7.7	220	44	19	48	4.3	36	11	220	7	-	-	<4	-	<0.07	<10	-	<0.02	<0.03	-	<10	-	<2	<0.01

Table 2-5 (continued)
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements												
Well Name	Date	EC (µmho/cm) 900 [b]	TDS (mg/L) 500 [b]	pH 6.5/8.5 [b]	Total Alkalinity [1] (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SO_4 (mg/L) 250 [b]	Cl (mg/L) 250 [b]	HCO_3 [1] (mg/L)	NO_3 [1] (mg/L) 45 [a]	F (mg/L) 2 [a]	Al (µg/L) 1000 [a]	As (µg/L) 10 [a]	B (mg/L) 1 [c]	Ba (mg/L) 1 [a]	Cr (µg/L) 50 [a]	Cr (VI) (µg/L)	Cu (mg/L) 1.3 [a]	Fe (mg/L) 0.30 [b]	Fe (f) (mg/L) 0.30 [b]	Mn (µg/L) 50 [b]	Mn (f) (µg/L) 50 [b]	Se (µg/L) 50 [a]	Zn (mg/L) 5 [a]
Well 06	2/6/1991	550	360	7.7	226	37	21	45	2.5	39	13	226	6.1	-	<100	<10	-	<0.1	11	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 06	1/1/1994	-	350	-	-	-	-	-	-	-	11	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 06	1/1/1997	-	380	-	-	-	-	-	-	-	14	-	7.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 06	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 06	4/29/1999	610	340	7.7	240	49.9	18.9	55.8	3.3	49	16	292	10.6	-	ND	1.9	-	ND	16	-	ND	ND	-	2.6	-	ND	ND
Well 06	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.3	-	-	-	-	-	-	-	-
Well 06	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-
Well 06	1/1/2001	-	360	-	-	-	-	-	-	-	12	-	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 06	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	9.8	-	-	-	-	-	-	-
Well 06	3/7/2002	533	360	7.8	222	48	19	48	4.6	40	12	270	6.6	-	ND	3	0.15	ND	12	11.2	ND	ND	-	ND	-	ND	ND
Well 06	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 06	3/16/2005	465	360	7.9	218	46	17	55	4.3	41	13	-	6.7	-	-	2.4	-	-	10	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 06	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 06	1/31/2008	586	382	8	231	48	19	50	4.6	43	15	-	7.1	-	ND	2.1	0.16	0.067	8.9	-	ND	ND	-	ND	-	ND	ND
Well 07	3/16/1988	541	350	7.8	230	40	19	53	5.4	32	11	230	4	-	-	<4	-	<0.08	<10	-	<0.02	<0.03	-	<10	-	<2	<0.01
Well 07	6/17/1991	640	380	7.8	240	43	18	66	6.3	44	18	240	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	8/2/1994	-	-	-	-	-	-	-	-	40	-	-	4.4	-	-	4	-	-	-	-	-	-	-	-	-	-	-
Well 07	1/1/1996	-	380	-	-	-	-	-	-	-	14	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	1/1/1997	-	350	-	-	-	-	-	-	-	14	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	1/1/1999	-	360	-	-	-	-	-	-	-	-	-	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	4/29/1999	540	360	7.8	226	41.3	16.9	52.4	5.2	42	13	275	ND	-	ND	3.9	-	ND	19	-	ND	ND	-	ND	-	ND	ND
Well 07	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-
Well 07	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.9	-	-	-	-	-	-	-
Well 07	1/1/2001	-	360	-	-	-	-	-	-	-	12	-	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	8.5	-	-	-	-	-	-	-
Well 07	3/14/2002	521	360	8	228	41	17	57	5.8	41	12	277	4.224	-	ND	4.1	0.17	ND	8.3	9.5	ND	ND	-	ND	-	ND	ND
Well 07	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	3/16/2005	458	360	7.8	218	42	18	56	5.6	41	13	-	4.3	-	-	3.5	-	-	11	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 07	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	3/14/2007	-	-	-	-	-	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 07	1/31/2008	580	384	7.9	228	43	18	59	6.1	43	14	-	4.4	-	ND	3.1	0.19	0.082	8	-	ND	ND	-	ND	-	ND	ND
Well 08	3/16/1988	588	360	7.7	220	47	23	47	3	43	16	220	13	-	-	<4	-	<0.08	<10	-	<0.03	<0.03	-	<10	-	<2	<0.04
Well 08	2/6/1991	530	360	7.5	223	42	18	48	5	37	10	223	5.6	-	<100	<10	-	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 08	1/1/1993	-	-	-	-	-	-	-	-	-	-	-	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	3/29/1993	-	-	-	-	-	-	-	-	-	-	-	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	6/21/1993	-	-	-	-	-	-	-	-	37	-	-	4	-	-	-	-	-	15	-	-	-	-	-	-	-	-
Well 08	1/1/1994	-	430	-	-	-	-	-	-	-	-	-	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	5/2/1994	630	430	7.5	240	59	-	63	4.7	45	17	150	10	-	<50	<5	-	0.12	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 08	1/1/1996	-	400	-	-	-	-	-	-	-	17	-	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	1/1/1997	-	-	-	-	-	-	-	-	-	11	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2-5 (continued)
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements											
Well Name	Date	EC (µmho/cm)	TDS (mg/L)	pH	Total Alkalinity [1] (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SO_4 (mg/L)	Cl (mg/L)	HCO_3 [1] (mg/L)	NO_3 [1] (mg/L)	F (mg/L)	Al (µg/L)	As (µg/L)	B (mg/L)	Ba (mg/L)	Cr (µg/L)	Cr (VI) (µg/L)	Cu (mg/L)	Fe (mg/L)	Fe (f) (mg/L)	Mn (µg/L)	Mn (f) (µg/L)	Se (µg/L)	Zn (mg/L)
		900 [b]	500 [b]	6.5/8.5 [b]						250 [b]	250 [b]		45 [a]	2 [a]	1000 [a]	10 [a]	1 [c]	1 [a]	50 [a]		1.3 [a]	0.30 [b]	0.30 [b]	50 [b]	50 [b]	50 [a]	5 [a]
Well 08	10/28/1999	550	340	7.5	222	41.3	17.7	49.5	4.9	37.9	12.1	271	ND	-	ND	4.2	-	ND	30	-	0.005	ND	-	ND	-	ND	ND
Well 08	8/24/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	9	-	-	-	-	-	-	-
Well 08	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
Well 08	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
Well 08	1/1/2001	-	350	-	-	-	-	-	-	-	11	-	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	2/8/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-
Well 08	2/15/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
Well 08	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	6.4	-	-	-	-	-	-	-
Well 08	3/14/2002	504	350	7.7	222	43	18	52	5.7	37	11	270	4.4	-	170	5.4	0.16	0.1	17	12.8	ND	-	-	ND	-	ND	ND
Well 08	5/27/2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-
Well 08	3/16/2005	451	360	7.7	215	41	18	49	5.5	37	10	-	4	-	-	3.8	-	-	13	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 08	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	3/14/2007	-	-	-	-	-	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 08	1/31/2008	552	270	8	222	42	19	50	5.8	38	11	-	4.1	-	ND	3	0.17	0.088	11	-	ND	ND	-	ND	-	ND	ND
Well 09	1/30/1989	524	300	7.8	210	39	21	45	4.2	37	17	210	4	-	-	<4	-	0.11	20	-	<0.02	0.12	-	<30	-	<1	0.07
Well 09	3/2/1992	690	480	7.2	240	60	28	57	<3	96	17	240	<0.4	-	<100	<10	-	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 09	3/3/1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	ND	-	-	-	-	-	-	-	-
Well 09	3/29/1993	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	6/21/1993	-	-	-	-	-	-	-	-	33	-	-	4	-	-	ND	-	0.1	ND	-	-	-	-	-	-	3	-
Well 09	1/1/1994	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	1/26/1995	490	330	7.6	200	39	23	45	3	43	11	120	4.9	-	<50	2	-	0.11	15	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 09	1/1/1996	-	340	-	-	-	-	-	-	-	10	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	3/20/1996	-	-	-	-	-	-	-	-	-	-	-	4	-	-	ND	-	-	ND	-	-	ND	-	ND	-	-	-
Well 09	1/1/1997	-	-	-	-	-	-	-	-	-	-	-	7.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	4/29/1999	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	3	-	-	30	-	-	ND	-	ND	-	-	-
Well 09	10/28/1999	515	320	7.6	206	37.4	20.6	45.1	3.2	44.1	11.3	251	ND	-	ND	3.1	-	ND	30	-	ND	ND	-	ND	-	ND	ND
Well 09	8/24/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	23	-	-	-	-	-	-	-
Well 09	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
Well 09	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-
Well 09	1/1/2001	-	300	-	-	-	-	-	-	-	8.6	-	4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	2/15/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
Well 09	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	17.9	-	-	-	-	-	-	-
Well 09	3/14/2002	454	300	7.8	209	36	20	41	4.1	31	8.6	255	4.048	-	ND	4.4	0.13	0.11	22	20.4	ND	ND	-	ND	-	ND	ND
Well 09	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	3/16/2005	429	300	7.8	200	36	20	42	4.2	32	8.5	-	3.9	-	-	3.3	-	-	19	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 09	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 09	5/10/2007	-	-	-	-	-	-	-	-	-	-	-	16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	6/7/1990	530	340	7.9	230	44	21	43	2.6	40	16	230	7.7	-	50	<5	0.1	<0.1	<10	-	<0.05	<0.1	-	<30	-	<5	<0.05
Well 13	9/30/1991	540	370	7.74	210	2.5	2.06	2	<3	41	18	210	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	1/1/1992	-	480	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	1/1/1994	-	330	-	-	-	-	-	-	-	13	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2-5 (continued)
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements												
Well Name	Date	EC (µmho/cm)	TDS (mg/L)	pH	Total Alkalinity [1] (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SO_4 (mg/L)	Cl (mg/L)	HCO_3 [1] (mg/L)	NO_3 [1] (mg/L)	F (mg/L)	Al (µg/L)	As (µg/L)	B (mg/L)	Ba (mg/L)	Cr (µg/L)	Cr (VI) (µg/L)	Cu (mg/L)	Fe (mg/L)	Fe (f) (mg/L)	Mn (µg/L)	Mn (f) (µg/L)	Se (µg/L)	Zn (mg/L)
		900 [b]	500 [b]	6.5/8.5 [b]						250 [b]	250 [b]		45 [a]	2 [a]	1000 [a]	10 [a]	1 [c]	1 [a]	50 [a]		1.3 [a]	0.30 [b]	0.30 [b]	50 [b]	50 [b]	50 [a]	5 [a]
Well 13	1/1/1997	-	330	-	-	-	-	-	-	-	20	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	1/1/1999	-	310	-	-	-	-	-	-	-	-	-	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	4/29/1999	490	310	8.1	172	45.6	8.42	46.1	3.1	43	18	209	ND	-	ND	1.9	-	ND	16	-	0.028	ND	-	ND	-	ND	ND
Well 13	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.4	-	-	-	-	-	-	-	-
Well 13	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	-
Well 13	1/1/2001	-	360	-	-	-	-	-	-	-	19	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	7.8	-	-	-	-	-	-	-
Well 13	3/7/2002	553	360	7.7	219	47	23	46	2.8	43	19	267	11	-	ND	2	0.15	ND	ND	7.8	ND	ND	-	ND	-	ND	ND
Well 13	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	3/16/2005	511	350	7.8	208	45	24	48	2.8	47	21	-	12	-	-	2	-	-	<10	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 13	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	11.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	3/14/2007	-	-	-	-	-	-	-	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 13	1/31/2008	615	372	7.9	229	49	25	47	3.1	45	21	-	12	-	ND	1.6	0.18	0.083	8.2	-	ND	ND	-	ND	-	ND	ND
Well 14	10/20/1993	452	290	8	-	16	10	58	3.1	23	<0.5	230	3.1	-	<50	4.1	-	0.14	13	-	<0.02	0.075	-	<5	-	<1	<0.005
Well 14	1/1/1997	-	-	-	-	-	-	-	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	8/4/1997	460	280	8.2	190	17	12	74	4	30	10	190	2	-	ND	7	-	0.11	10	-	ND	0.11	-	ND	-	ND	ND
Well 14	1/1/1998	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	6/4/1998	450	290	7.9	190	18	12	70	4	25	9	230	2	-	ND	6	-	0.1	20	-	ND	ND	-	ND	-	ND	ND
Well 14	8/28/1998	440	330	7.9	190	18	13	59	3	29	10	230	-	-	ND	5	-	0.1	20	-	ND	ND	-	ND	-	ND	ND
Well 14	8/31/1998	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	1/1/1999	-	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	4/29/1999	440	280	8.1	197	20.6	13.7	60.2	3.1	26	8.3	240	ND	-	ND	5.4	-	0.13	28	-	0.0029	ND	-	ND	-	ND	ND
Well 14	1/1/2000	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	8/24/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	23	-	-	-	-	-	-	-
Well 14	10/31/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-
Well 14	11/1/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-
Well 14	1/1/2001	-	290	-	-	-	-	-	-	-	8.8	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	2/15/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-	-	-	-	-
Well 14	5/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	20.3	-	-	-	-	-	-	-
Well 14	3/14/2002	441	290	8.1	199	21	14	62	3.4	25	8.8	242	3	-	ND	6.2	0.15	0.12	18	22.2	ND	ND	-	ND	-	ND	ND
Well 14	5/27/2003	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	3/16/2005	393	280	8.1	193	21	14	61	3.3	26	7.8	-	2.9	-	-	4.8	-	-	20	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 14	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	5/10/2007	-	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 14	1/31/2008	471	288	8.2	199	22	14	62	3.5	27	8.1	-	3	-	ND	3.9	0.17	0.12	17	-	ND	ND	-	ND	-	ND	0.065
MW-14	3/25/1993	453	290	8.1	190	17	12	66	3.5	29	10	240	2.2	-	740	<10	-	0.11	<10	-	<0.05	**1.3**	<0.03	**64**	<10	1.4	<0.05
Well 15	2/22/2001	440	300	8.1	210	20	12	73	3.8	23	8.9	-	2.5	-	-	3.9	0.22	-	20	12	<0.05	<0.1	-	<10	-	<5	<0.05
Well 15	3/16/2005	395	300	8	198	26	14	55	5.1	21	7.9	-	3.5	-	-	3.8	-	-	13	-	<0.05	<0.1	-	<20	-	<5	<0.05
Well 15	1/25/2006	-	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 15	5/10/2007	-	-	-	-	-	-	-	-	-	-	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Well 15	1/31/2008	483	298	8.1	197	21	12	70	4.2	24	8.2	-	3.1	-	ND	3.5	0.22	0.11	11	-	ND	ND	-	ND	-	ND	ND
MW-15-1815ft	1/6/1999	458	277	7.91	-	23.1	9.91	53.6	4.17	16.7	10.8	210	3.73	-	<50	<2	0.109	0.0691	<5	-	<0.005	**2.2**	0.261	27.4	28.9	<4	-

Table 2-5 (continued)
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements												
Well Name	Date	EC (µmho/cm)	TDS (mg/L)	pH	Total Alkalinity [1] (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SO_4 (mg/L)	Cl (mg/L)	HCO_3 [1] (mg/L)	NO_3 [1] (mg/L)	F (mg/L)	Al (µg/L)	As (µg/L)	B (mg/L)	Ba (mg/L)	Cr (µg/L)	Cr (VI) (µg/L)	Cu (mg/L)	Fe (mg/L)	Fe (f) (mg/L)	Mn (µg/L)	Mn (f) (µg/L)	Se (µg/L)	Zn (mg/L)
		900 [b]	500 [b]	6.5/8.5 [b]						250 [b]	250 [b]		45 [a]	2 [a]	1000 [a]	10 [a]	1 [c]	1 [a]	50 [a]		1.3 [a]	0.30 [b]	0.30 [b]	50 [b]	50 [b]	50 [a]	5 [a]
Well 16	12/28/2004	475	290	8.3	206	13	12	81	2.4	26	6.9	-	1.9	-	-	7.1	0.29	-	22	18.3	<0.05	0.043	-	<10	-	<25	0.055
Well 16	2/8/2007	506	350	8.3	208	7.5	4.4	98	1.9	38	9.3	-	ND	-	ND	**13**	0.41	0.073	5	-	ND	ND	-	ND	-	ND	ND
Well 16	4/13/2007	470	-	-	218	14	12	84	2.2	29.7	9	218	0.5	-	-	8.5	-	-	-	-	-	-	-	-	-	-	-
Well 16	6/18/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-	-	-
Well 16	9/28/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-	-	-
Well 16	10/30/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	-	-	-	-	-	-	-	-	-	-	-
Well 16	11/28/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.7	-	-	-	-	-	-	-	-	-	-	-
Well 16	11/30/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.6	-	-	-	-	-	-	-	-	-	-	-
Well 16	12/4/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.2	-	-	-	-	-	-	-	-	-	-	-
Well 16	1/24/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-
Well 16	1/30/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-	-	-
Well 16	1/31/2008	495	308	8.2	198	14	12	82	2.3	30	7.9	-	1.9	-	ND	7.8	0.31	0.12	21	-	0.0037	ND	-	ND	-	ND	ND
Well 16	2/12/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-
Well 16	3/12/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.9	-	-	-	-	-	-	-	-	-	-	-
Well 16	4/14/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-	-	-	-
Well 16	5/27/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.9	-	-	-	-	-	-	-	-	-	-	-
Well 16	6/29/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-	-	-
Well 16	7/19/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-
Well 16	9/19/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.3	-	-	-	-	-	-	-	-	-	-	-
Well 16	11/13/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.7	-	-	-	-	-	-	-	-	-	-	-
MW-16-1430ft	11/19/2002	460	280	7.8	230	18	19	63	2.7	19	6.5	230	2.1	-	<50	7.4	0.18	0.21	**50**	-	<0.05	<0.1	-	<10	-	<25	<0.05
MW-16-1430ft	7/5/2007	470	302	-	234	19	21	53.4	2.5	15.94	6.73	337	0.63	-	<20	2.3	-	0.2	**50**	-	<0.002	-	-	-	-	<5	<0.02
MW-16-1464-1604	9/20/2002	490	330	8.3	200	8.7	6.6	110	2.1	42	11	200	<1	-	-	**11**	-	-	-	-	-	-	-	-	-	-	-
MW-98A	11/16/1998	500	271	7.67	-	21	27.3	40.3	3.15	16.8	8.24	242	2.24	-	<50	<3	0.111	0.214	24.2	-	<0.005	**1**	**0.461**	35.1	37.6	<4	<0.005
MW-98A	11/23/1999	477	296	7.93	-	21.6	27.3	38.8	3.18	16.4	7.72	253	-	-	-	-	-	-	-	-	<0.005	**1.29**	0.197	34	33.8	-	<0.005
MW-98B	1/13/1999	494	362	8.02	-	13.6	6.01	84	5.22	25.6	7.88	259	<0.1	-	<50	4.7	0.28	0.0672	<5	-	<0.005	**1.01**	**0.813**	45.6	47	<4	0.0345
MW-98C	1/29/1999	506	302	8.32	-	11.1	8.4	93.9	1.86	43	7.41	238	0.32	-	<50	<2	0.42	0.107	<5	-	<0.005	**0.788**	**0.774**	34	34.5	<4	<0.005
SCWA-Meridian MW-1680	6/4/2008	540	320	7.55	220	24	18	74	3.9	41	13	220	3.6	-	<50	3.3	0.22	<0.1	17	12	<0.05	<0.1	-	38	-	<5	<0.05
SCWA-MainePrairie MW-2170	4/29/2008	600	380	7.9	260	10	5.3	130	1.6	35	16	260	<2	-	<50	5.2	0.31	0.12	<10	<1	<0.05	<0.1	<0.1	38	37	<5	<0.05
SCWA-Allendale MW-1925	3/26/2008	620	360	7.58	230	23	37	62	3.9	61	17	230	<2	-	<50	3	0.39	0.12	13	11	<0.05	<0.1	<0.1	**63**	**63**	<5	<0.05
SCWA-Dixon MW-2212	10/1/2009	530	310	8.25	200	7.8	4.3	110	1.3	47	20	200	<2	-	<50	3.5	0.74	<0.1	<10	<1	<0.05	<0.1	<0.1	21	24	<5	<0.05
RNVWD MW-1389ft	9/9/1998	533	344	7.67	-	29.2	18.7	54	4.51	34.2	8.99	248	6.07	-	<50	6.3	0.125	0.0865	<5	-	<0.005	**1.06**	**0.43**	41.2	39	<4	<0.005

Table 2-5 (continued)
Groundwater Quality Northern Solano County

						Cations				Anions					Trace Elements											
Well Name	Date	EC	TDS	pH	Total Alkalinity [1]	Ca	Mg	Na	K	SO_4	Cl	HCO_3 [1]	NO_3 [1]	F	Al	As	B	Ba	Cr	Cr (VI)	Cu	Fe	Fe (f)	Mn	Mn (f)	Se	Zn
		(µmho/cm)	(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)
		900 [b]	500 [b]	6.5/8.5 [b]						250 [b]	250 [b]		45 [a]	2 [a]	1000 [a]	10 [a]	1 [c]	1 [a]	50 [a]		1.3 [a]	0.30 [b]	0.30 [b]	50 [b]	50 [b]	50 [a]	5 [a]

1. HCO_3 , Total Alkalinity and NO_3 reported as HCO_3 , $CaCO_3$ and NO_3 respectively.

a) Primary Drinking Water Standards for California and Federal Maximum Contaminant Levels

b) Secondary Drinking Water Standards for California and Federal Maximum Contaminant Levels

c) California State Notification Level

"-" Not Analyzed; ND = Non-Detect (Reporting Limit unknown)
For repeated sampling within a day, the maximum result for each constituent for the day is shown
Bold indicates value exceeds Water Quality Limit

Table 3-1
City of Vacaville Groundwater Monitoring Program[1]

Well Type	Well ID	Formation	Perforated Interval[2] (ft)	Water Levels		Water Quality[3]				Production	
				Manual	Electronic	General Mineral/ Physical	Inorganics	Organics	Nitrate	Manual	Electronic
Production	Well 1	Markley	Depth = 605	Semi-annual	-	Triennial	Triennial	Triennial	Annual	-	SCADA
	Well 2	Basal & Middle Tehama	335-710	-	-					Daily	-
	Well 3	Basal & Middle Tehama	420-900	-	-					Daily	-
	Well 5	Basal Tehama	588-793	Semi-annual	SCADA					-	SCADA
	Well 6	Basal Tehama	752-932							-	
	Well 7	Basal Tehama	964-1004							-	
	Well 8	Basal Tehama	952-1192							-	
	Well 9	Basal Tehama	1100-1430							-	
	Well 13	Basal & Middle	560-840							-	
	Well 14	Basal Tehama	1108-1663							-	
	Well 15	Basal Tehama	1206-1816							-	
	Well 16	Basal Tehama	1165-1610							-	
	DeMello	Upper Tehama	372-572		-					Daily	-
Monitoring[4]	MW-14	Basal Tehama	1100-1650	Semi-annual	Transducer	NA	NA	NA	NA	NA	NA
	MW-15-188'	Qal & Upper Tehama	158-178		-						
	MW-15-508'	Upper Tehama	438-498		-						
	MW-15-1815'	Basal Tehama	1207-1785		Transducer						
	MW-16-117'	Upper Tehama	97-107		-						
	MW-16-1176'	Basal Tehama	1136-1166		-						
	MW-16-1430'	Basal Tehama	1264-1374		Transducer						
	MW-98A	Basal Tehama	1727-1830		Transducer						
	MW-98B	Basal Tehama	1559-1798		-						
	MW-98C	Basal Tehama	2152-2305		Transducer						
	DeMello-MW-95'	Qal	65-85		-						

1. Does not include shallow monitoring wells at wastewater treatment plants.
2. Depth to top and bottom of perforated interval, if available. Otherwise, total well depth shown.
3. Does not include weekly monitoring of the distribution system for coliform bacteria, chloride residual, etc..
4. Transducers to be installed in monitoring wells before January 1, 2011.

NA - Not applicable

Table 3-2
Summary of SCWA Monitoring Well Construction

Well ID [1]	*Depth (ft)*	*Perforated Interval (ft)*	*Diameter (in)*	*Began Monitoring Water Levels*
Allendale 1235	1235	1205-1225	2.5	8/7/2008
Allendale 1345	1345	1315-1335	2.5	8/7/2008
Allendale 1925	1925	1877-1917	4/2[2]	8/7/2008
Dixon 1200	1200	1180-1190	2.5	11/13/2009
Dixon 2212	2212	2182-2202	4/2	11/13/2009
Dixon 2370	2370	2340-2360	4/2	11/13/2009
Maine Prairie 840	841	811-831	2.5	8/7/2008
Maine Prairie 1960	1960	1930-1950	4/2	8/7/2008
Maine Prairie 2170	2170	2140-2160	4/2	8/7/2008
Meridian 400	400	360-370	2.5	8/7/2008
Meridian 825	824	794-814	2.5	8/7/2008
Meridian 1680	1680	1650-1670	4/2	8/7/2008

1. See Appendix X for as-built construction drawings and additional construction details.
2. Four-inch diameter with reduction to two-inch diameter.

Table 3-3
Summary of Action Items

Plan Components and Action Items	Short-term[1]	Long-term[2]	Continuing[3]
CATEGORY 1: MONITORING PROGRAM			
1A. Elements of Monitoring Program			
• Continue City's existing monitoring program and complement with information gathered by other agencies			X
• Expand regional monitoring programs			
o Coordinate with SCWA regarding adequacy of regional groundwater monitoring networks and programs	X		
o Coordinate with SCWA on planned construction of additional monitoring facilities in northern Solano County	X		
o Coordinate with SCWA on implementation of land subsidence monitoring program	X		
1B. Evaluation and Reporting of Monitoring			
• Prepare brief annual summary of groundwater and land subsidence data collected through March 31st in groundwater management report to be completed each year by June 30th	X		
• Coordinate with SWA-4 on maintenance and utilization of regional monitoring database, including regular transfer of City data. Also coordinate with SWA on monitoring protocols used to evaluate data	X		
• Coordinate with SWA-4 regarding adequacy of regional evaluation and reporting of groundwater data (see Sect. 3.3.2)	X		
CATEGORY 2: WATER RESOURCE SUSTAINABILITY			
2A. Maintaining Stable Groundwater Levels			
• Continue to manage groundwater and surface water conjunctively to ensure that groundwater levels in Elmira Road wells recover to spring 1992-1993 "base year" levels during normal years			X
• Manage pumping away from Elmira Road to prevent progressive groundwater level declines		X	
• Continue groundwater development programs that optimize pumping distribution in City's urban planning area			X
2B. Determination of Sustainable Pumpage			
• Assess pumpage relative to sustainable yield of principal aquifer system			
o Update sustainable pumpage estimates with expanded monitoring data		X	
• Refine assessment of hydrogeologic conditions and conceptual model in preparation for future development of regional numerical groundwater flow model (see Section 3.4.2)		X	
• Discuss joint development of regional numerical groundwater flow model with SCWA and other entitles that overlie subbasin		X	

Table 3-3 (continued)
Summary of Action Items

Plan Components and Action Items	Short-term	Long-term	Continuing
2C. Continuation of Conjunctive Use Operations			
• Continue City's conjunctive management of available water resources			X
• Coordinate with SCWA to explore other conjunctive use opportunities			
2D. Water Conservation			
• Continue to implement and promote water conservation programs			X
CATEGORY 3: GROUNDWATER RESOURCE PROTECTION			
3A. Well Construction and Destruction Policies			
• Continue current well construction and destruction policies			X
• Coordinate with other SCWA members on well construction and future resource utilization		X	
3B. Identification and Management of Recharge Areas and Wellhead Protection Areas			
• Employ wellhead protection measures to ensure long-term sustainability of good quality water			
o Use DWSAP information, including delineation of source area and protection zones	X		
o Require deep sanitary seal construction standards for municipal supply wells			X
o Employ well destruction policy to prevent groundwater contamination			X
• Coordinate with other SCWA members regarding DWSAP analyses and other environmental assessments		X	
• Promote recharge area protection to mitigate impacts of urban infrastructure and sources of groundwater contamination		X	
3C. Management and Mitigation of Contaminated Groundwater			
• Identify short and longer-term water quality trends and actions needed to sustain supply of good quality groundwater		X	
• Employ BMPs to limit potential sources of contamination	X		
• Coordinate with County Environmental Health Services Division and other land use/regulatory agencies to identify and mitigate any public water supply contamination	X		
• Coordinate with SCWA members and County Environmental Health Services Division to assess quality of groundwater used by private well owners in subbasin		X	
3D. Long-Term Salinity Management Programs			
• Implement measures to avoid salt accumulation and other adverse changes in groundwater chemistry		X	

Table 3-3 (continued)
Summary of Action Items

Plan Components and Action Items	Short-term	Long-term	Continuing
CATEGORY 4: AGENCY COORDINATION AND PUBLIC OUTREACH			
4A. Continuation of Local, State, and Federal Agency Relationships			
• Continue relationships with local, state, and federal agencies to achieve broader local and regional benefits			X
• Continue to pursue grant opportunities with SCWA to fund basin management activities and regional water projects			X
4B. Public Outreach			
• Continue public involvement through City Council meetings that include updates on water resource management			X
• Continue public outreach on Plan activities through web site, bill inserts, radio spots, and printed media			X
4C. Water Awareness Education			
• Continue water awareness education programs			X
CATEGORY 5: PLAN IMPLEMENTATION AND UPDATES			
5A. Plan Implementation and Reports			
• Cooperate with other agencies			
o Provide copies of adopted Plan, and related reports, to SCWA/SWA members	X		
o Continue to support IRWMP, including implementation of priority objectives			X
• Prepare groundwater management reports			
o Prepare annual groundwater management reports to be completed by August 1st. Reports will summarize activities conducted to implement Plan and include summary of monitoring data collected through March 31st	X		
o Coordinate with SWA to prepare update of groundwater conditions in subbasin every five years		X	
5B. Provisions to Update the Groundwater Management Plan			
• Review and update plan every five years or more often as needed		X	

1. Short-term actions are items to be completed within two years.
2. Long-term actions are items expected to require more than two years.
3. Continuing are items that are ongoing groundwater management activities.

FIGURES

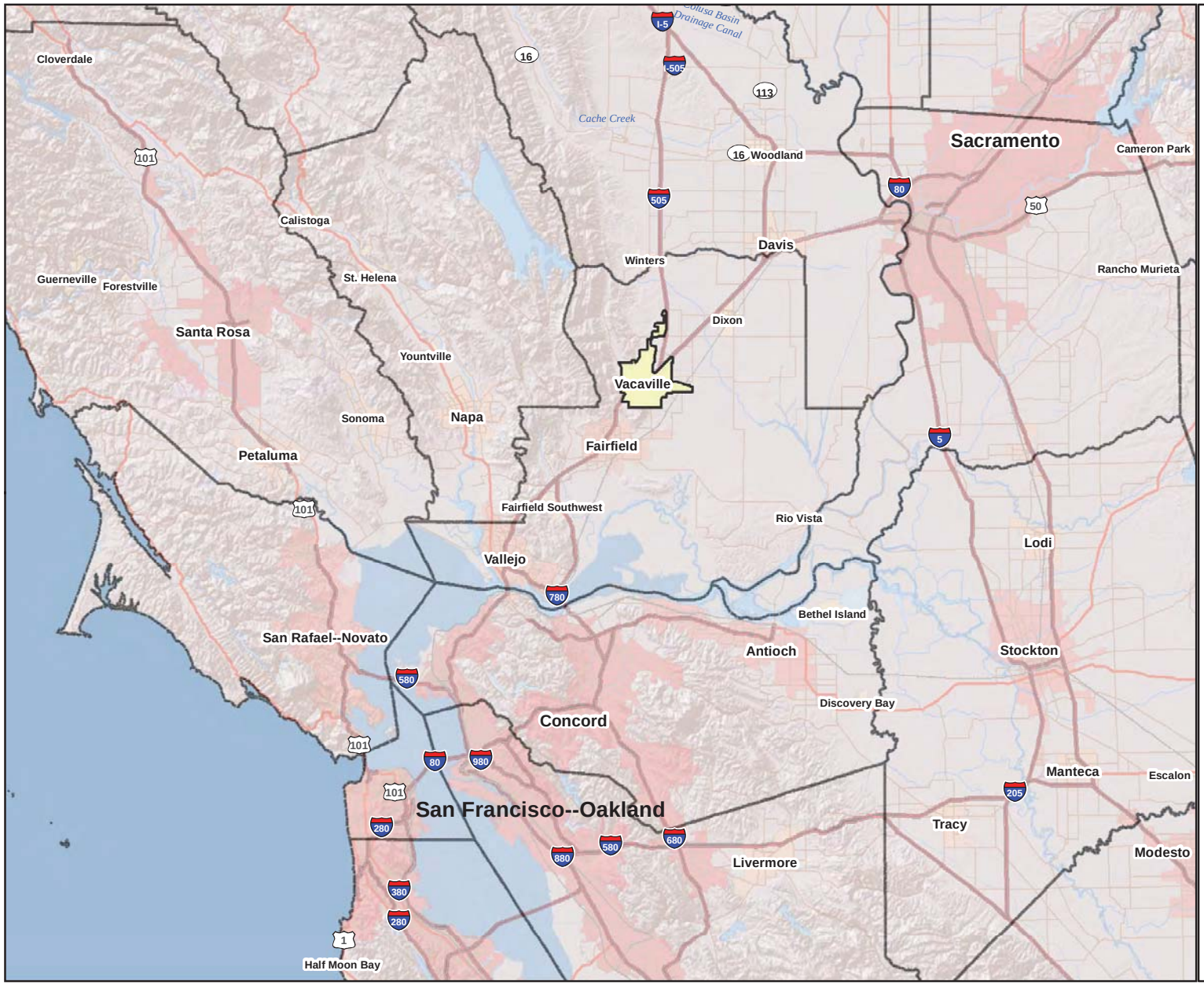

Figure 1-1
City of Vacaville
Location Map

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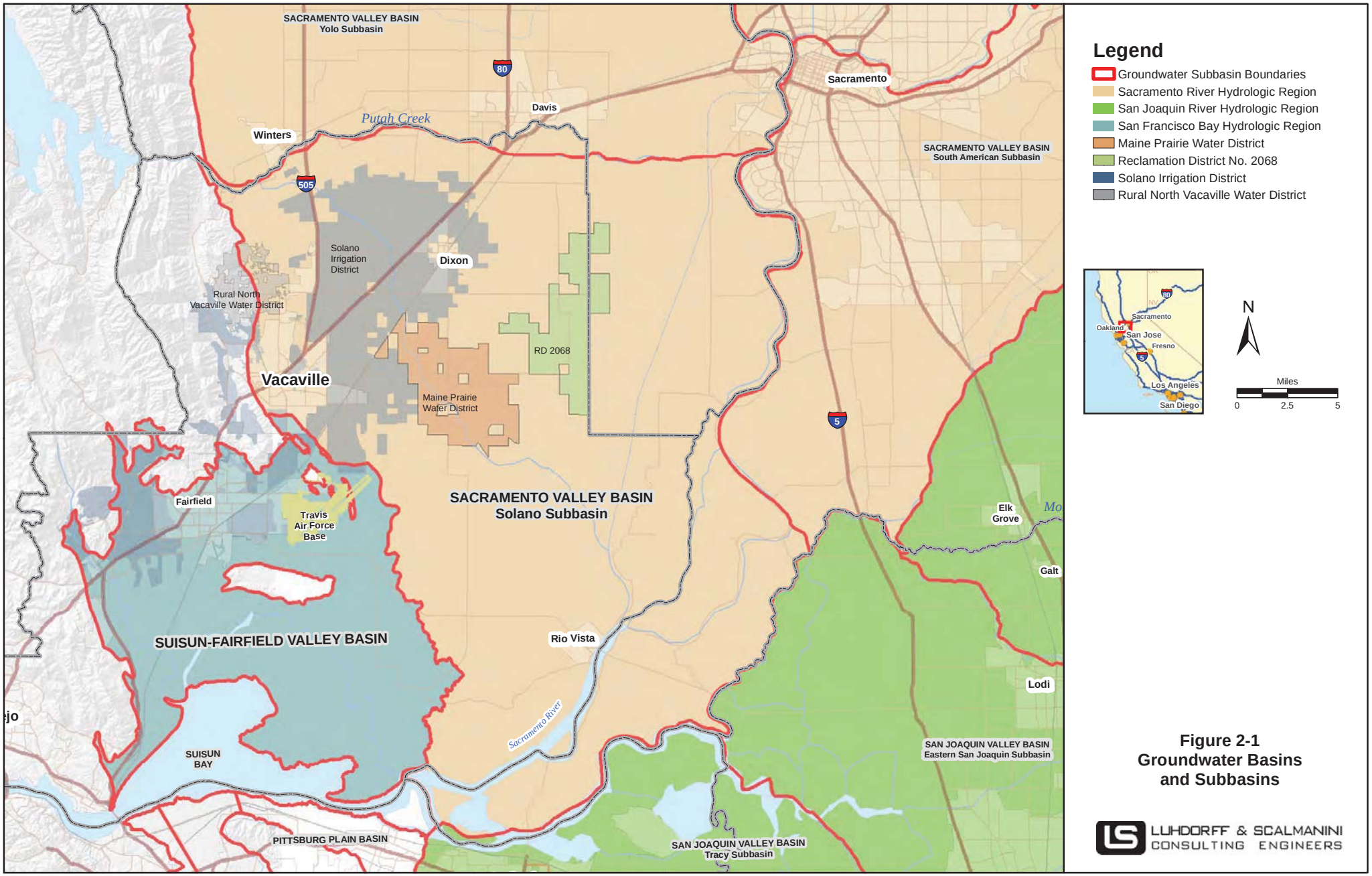

Figure 2-1
Groundwater Basins and Subbasins

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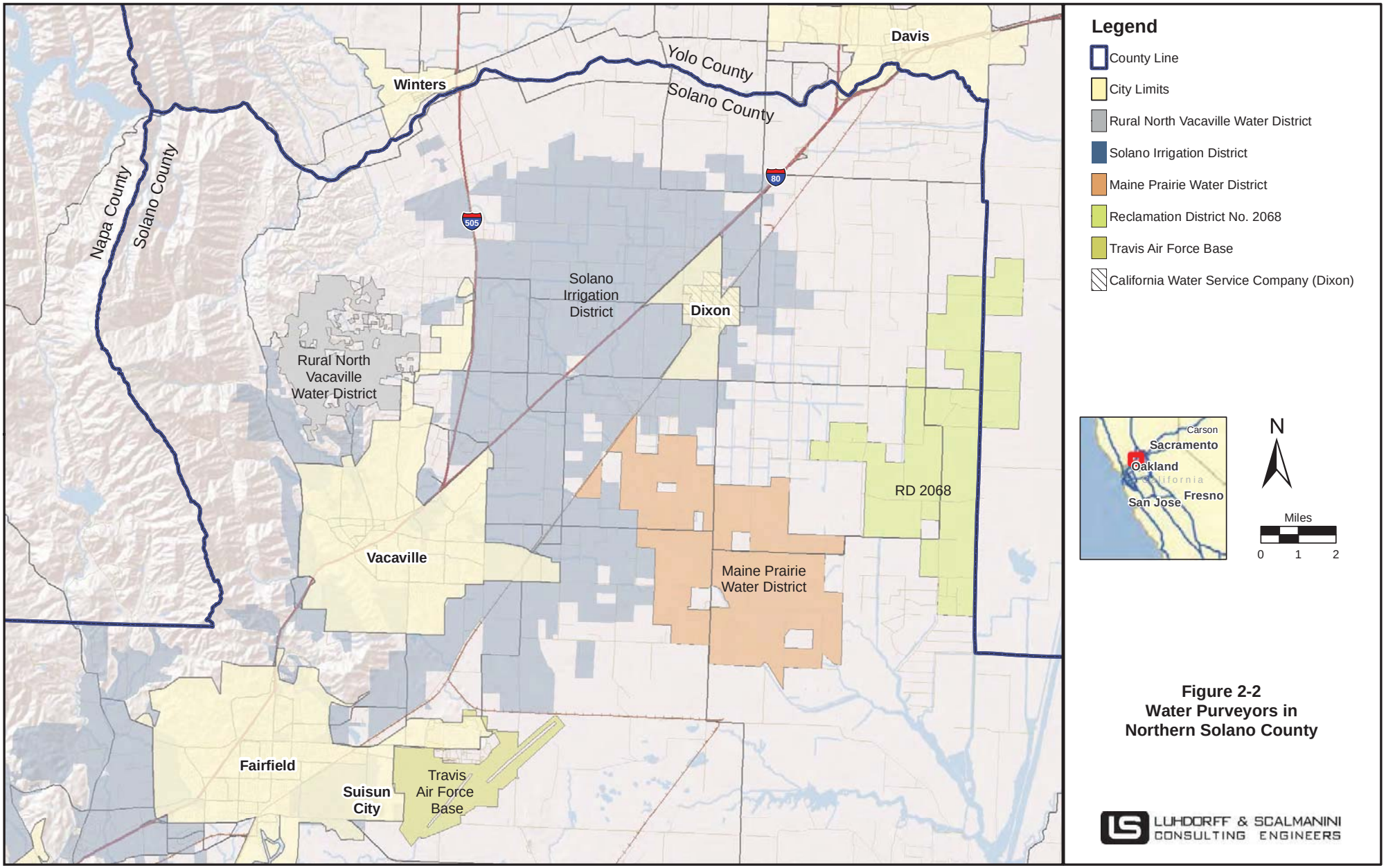

Figure 2-2
Water Purveyors in Northern Solano County

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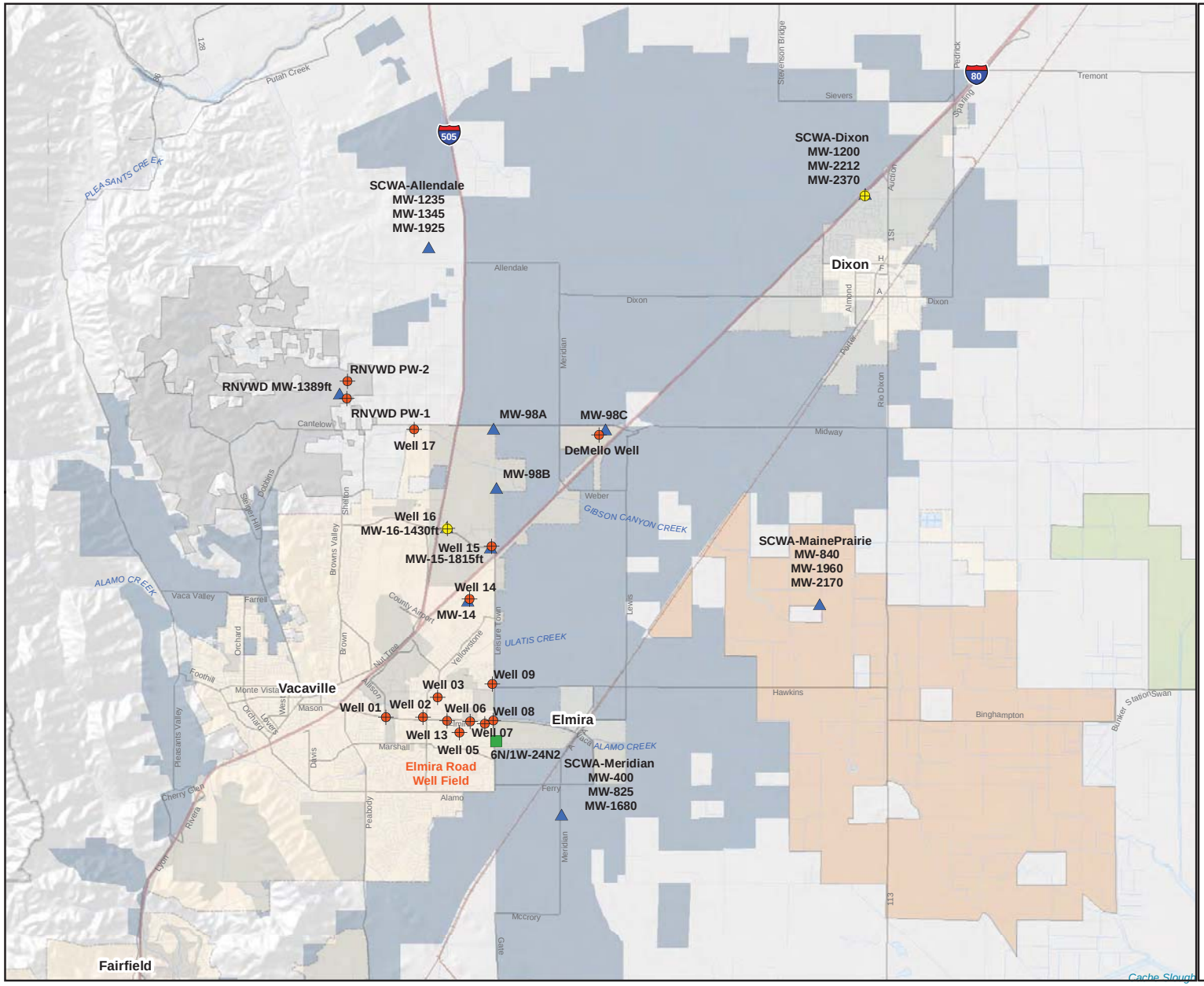

Legend

- Permanent GPS Stations (Jan. 2011)
- Production Well
- Monitoring Well
- Well Monitored by DWR
- County Boundary
- City Boundary
- Maine Prairie Water District
- Reclamation District No. 2068
- Solano Irrigation District
- Rural North Vacaville Water District

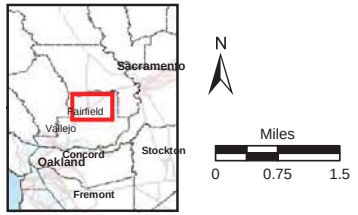

Figure 2-3
Location Map with
Groundwater Monitoring Facilities

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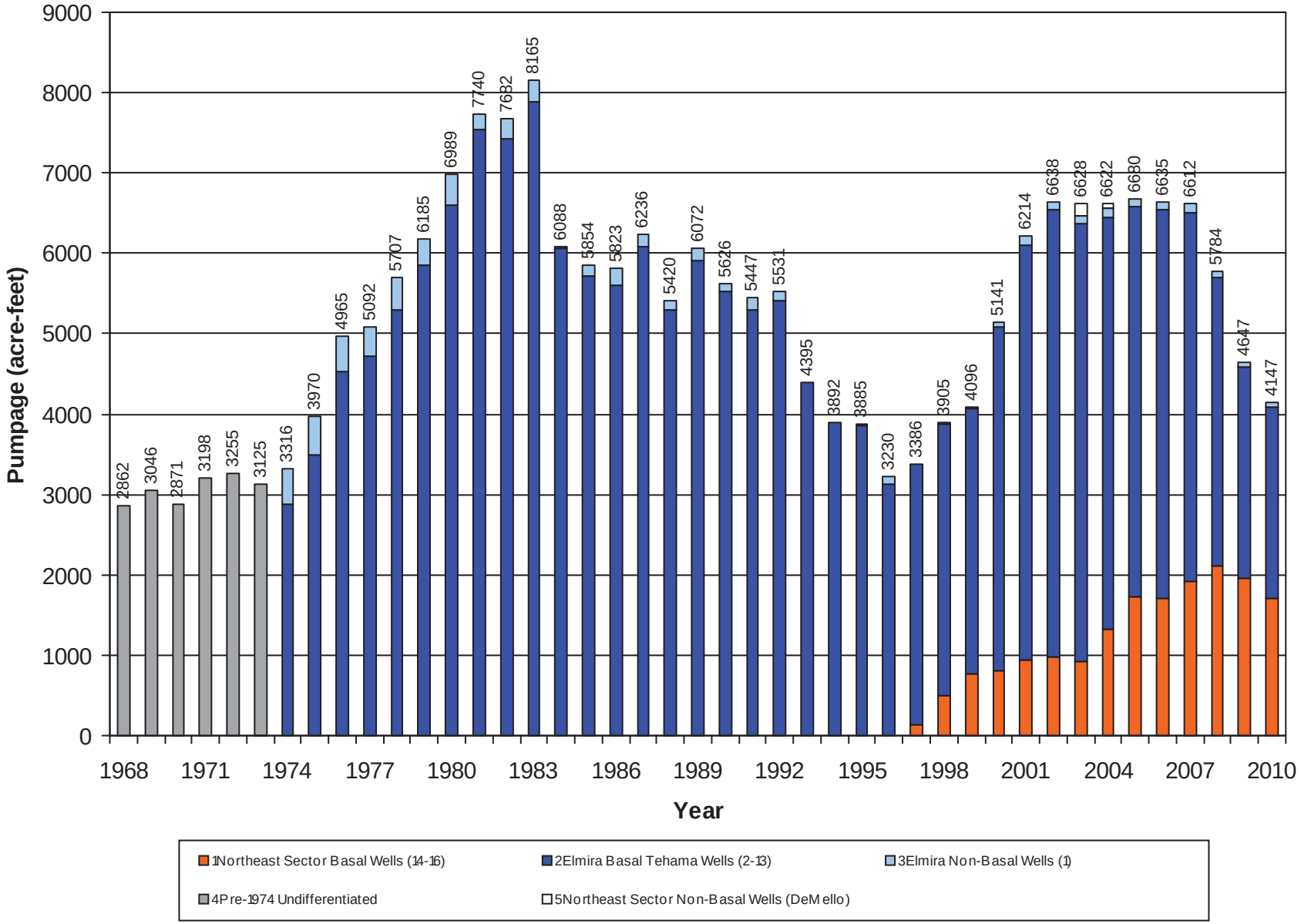

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Figure 2-4
City of Vacaville Annual Groundwater Pumpage

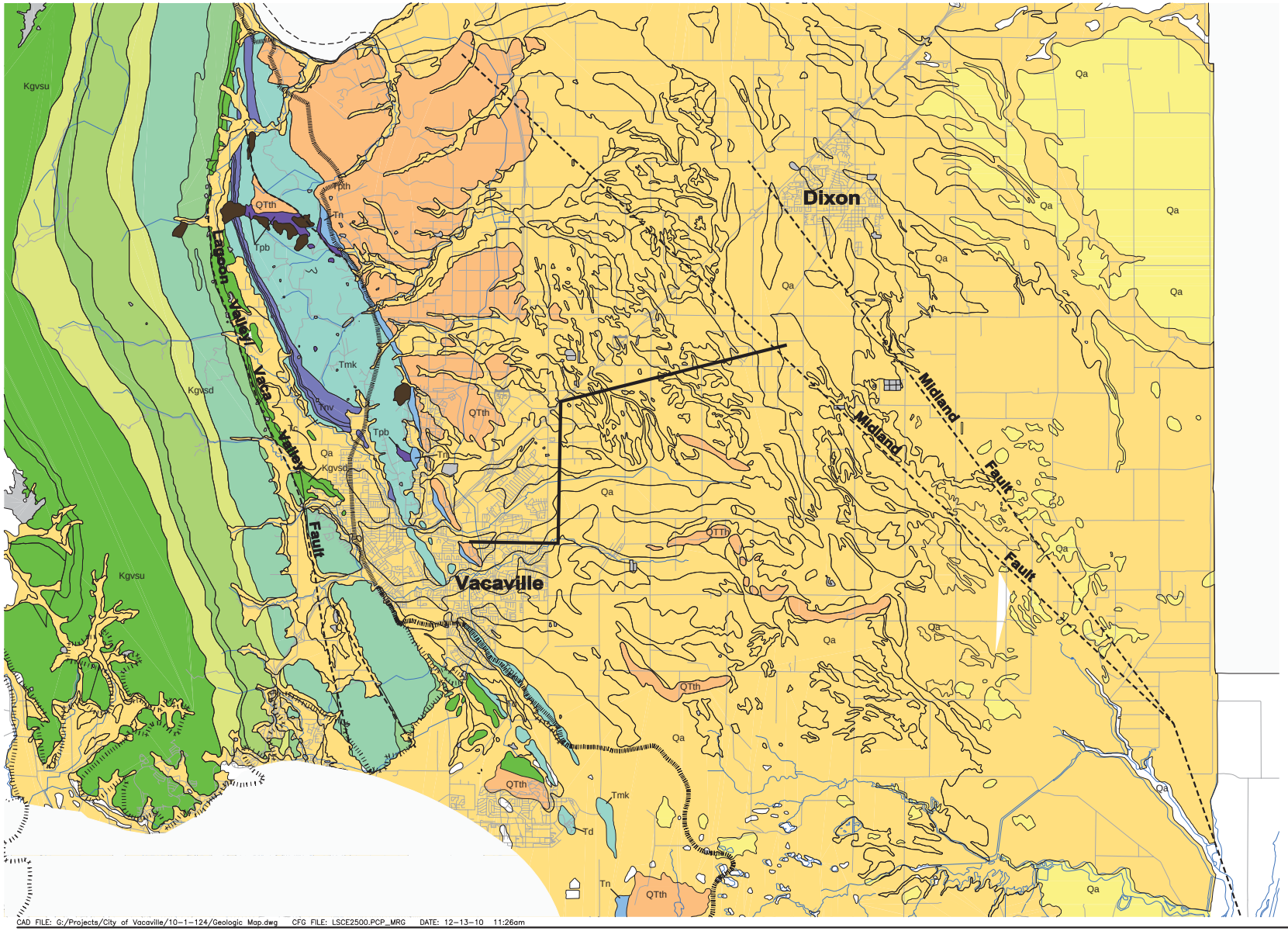

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Figure 2-5
Surficial Geologic Map of Solano County

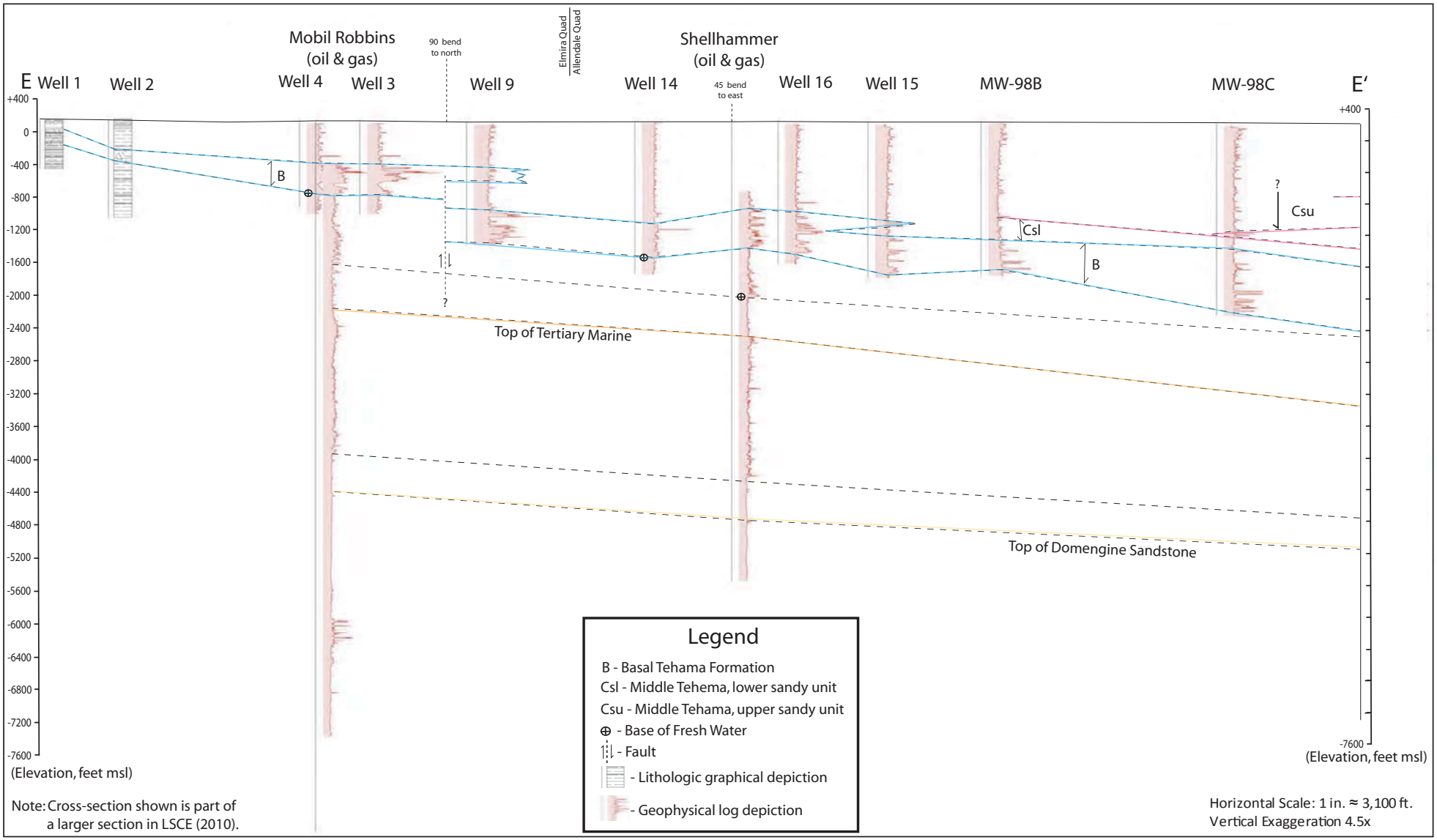

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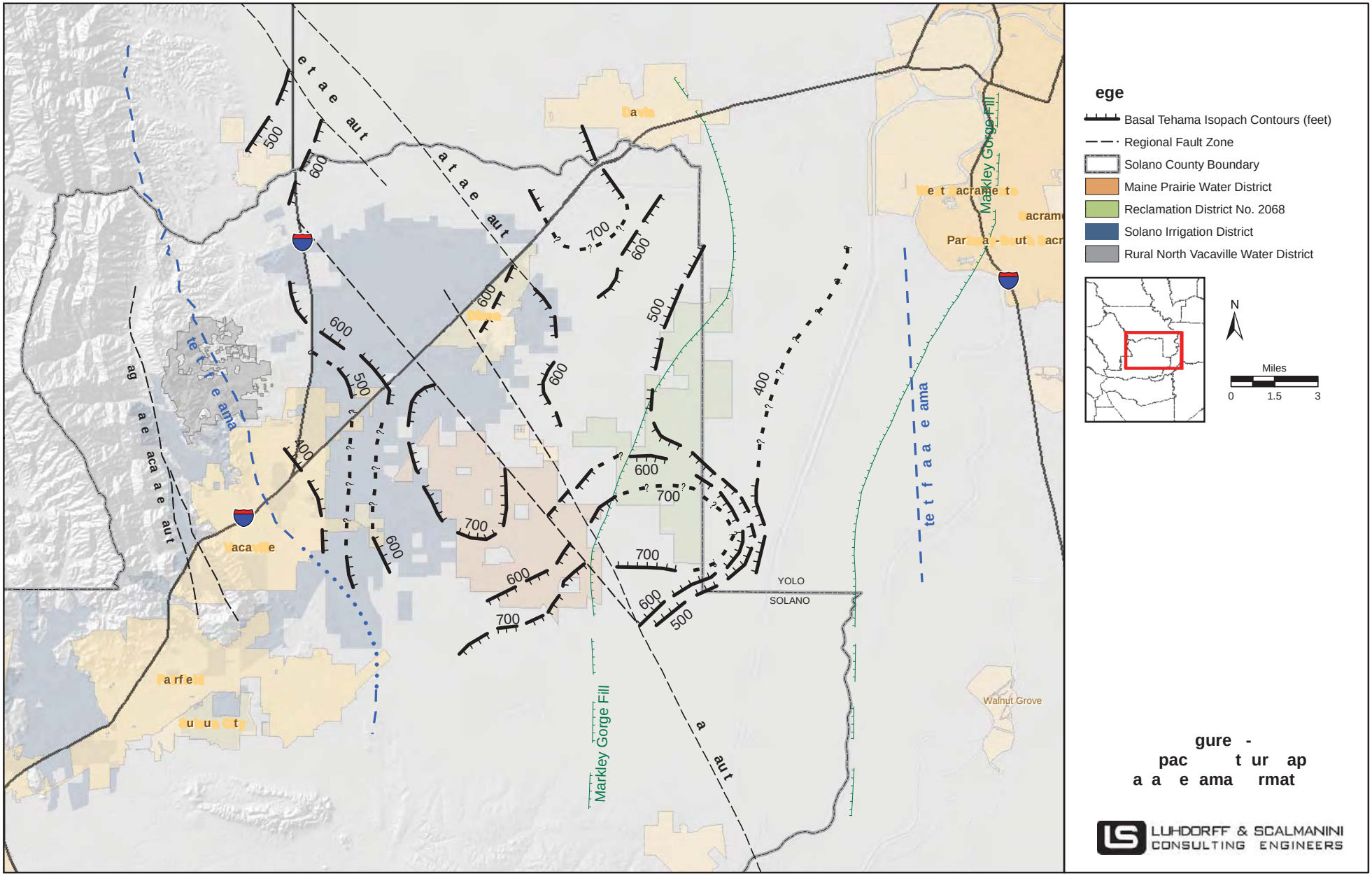
Figure 2-6
Cross-Section E-E'



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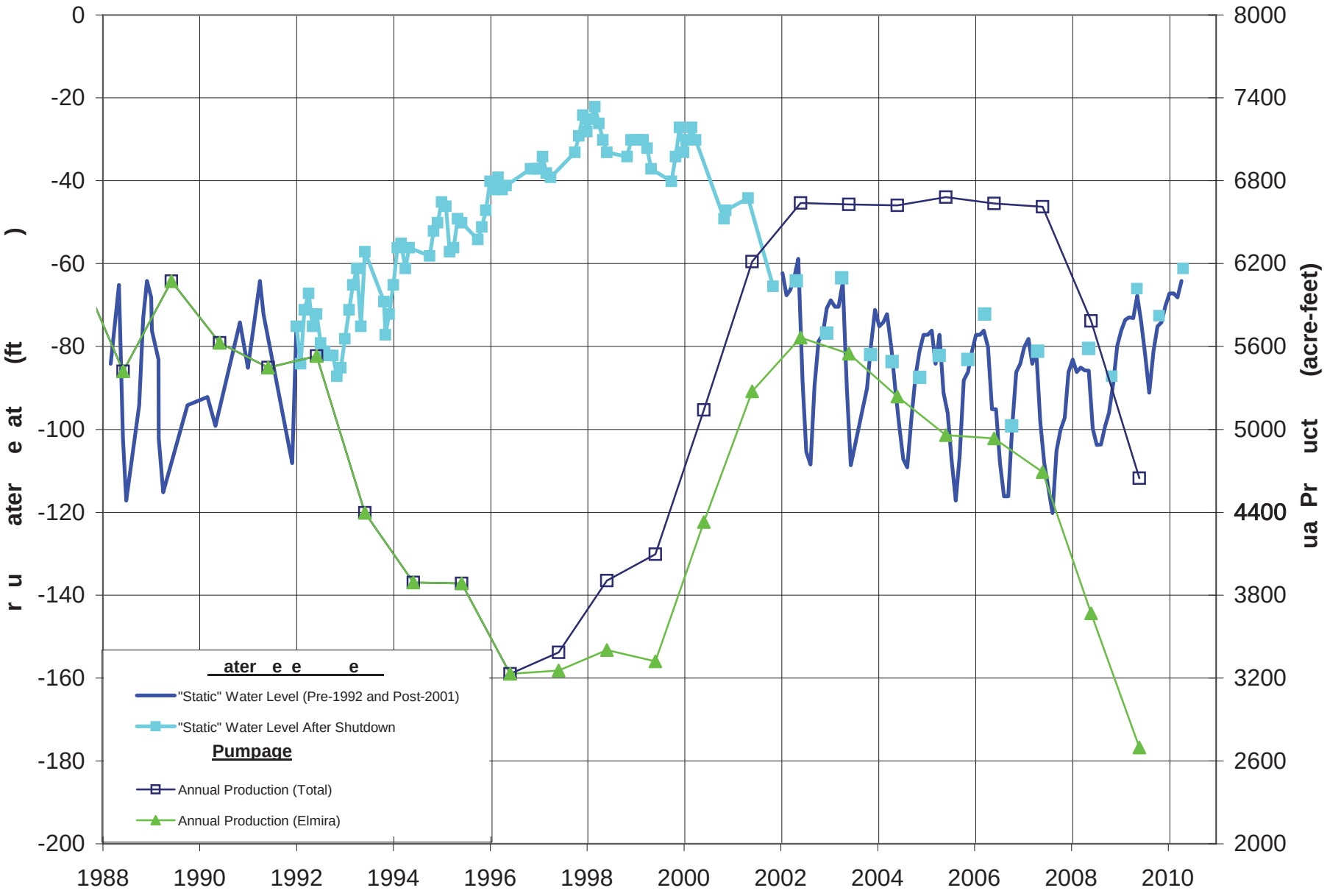

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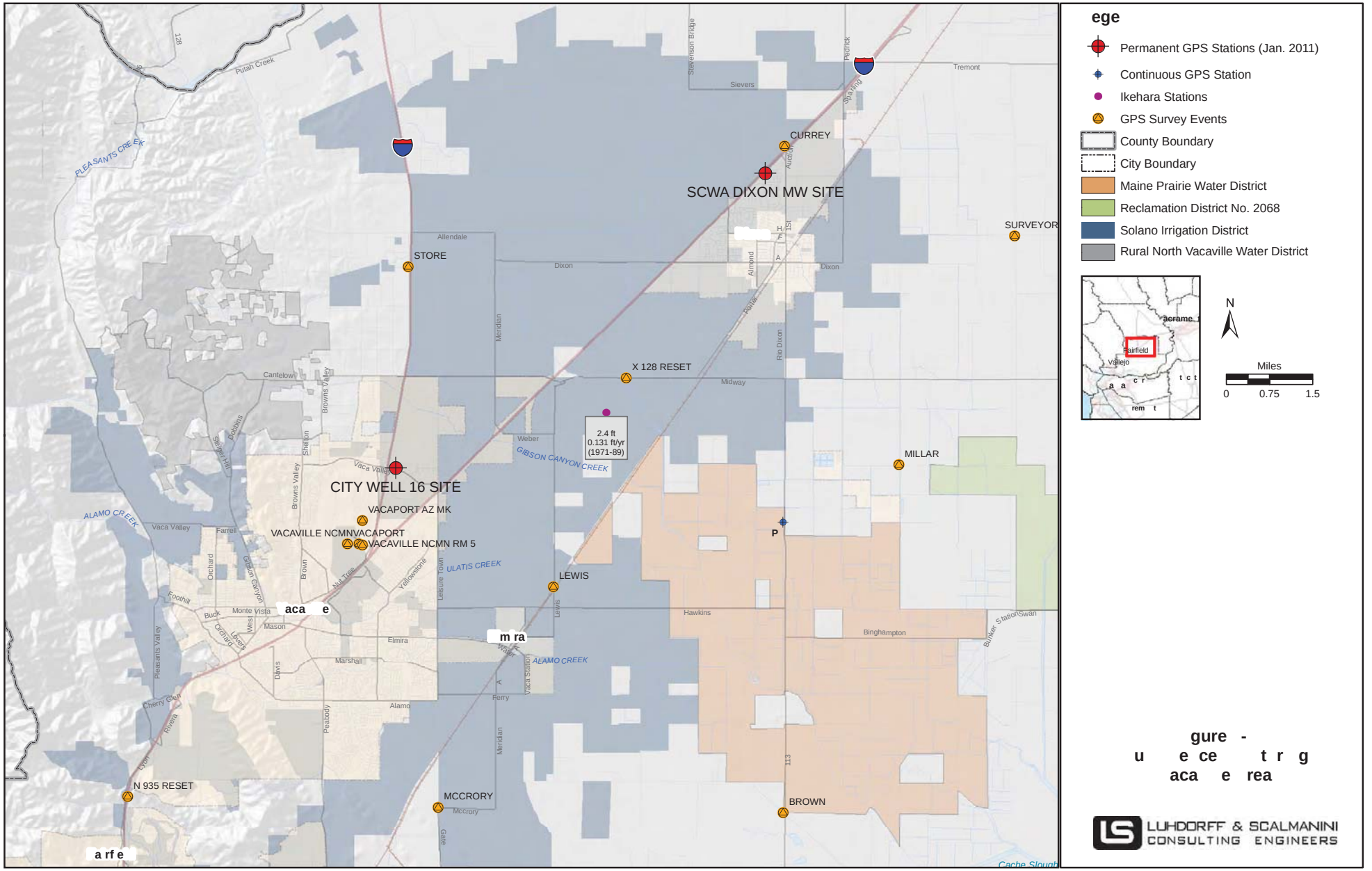
Figure 2-8
Groundwater Level Hydrograph
City of Vacaville, Well No. 8



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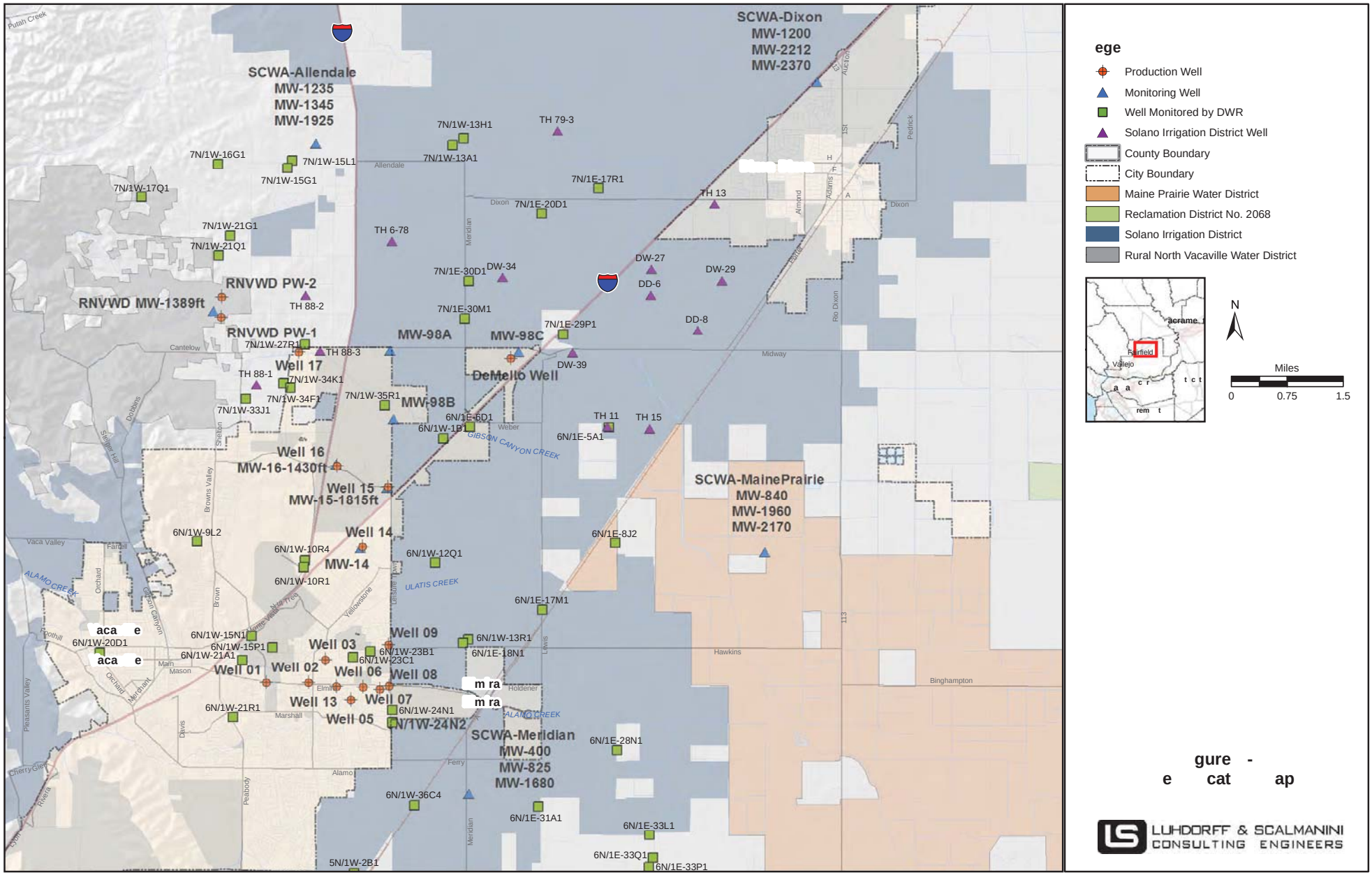

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- Production Well
- Monitoring Well
- Well Monitored by DWR
- Solano Irrigation District Well
- County Boundary
- City Boundary
- Maine Prairie Water District
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- Solano Irrigation District
- Rural North Vacaville Water District

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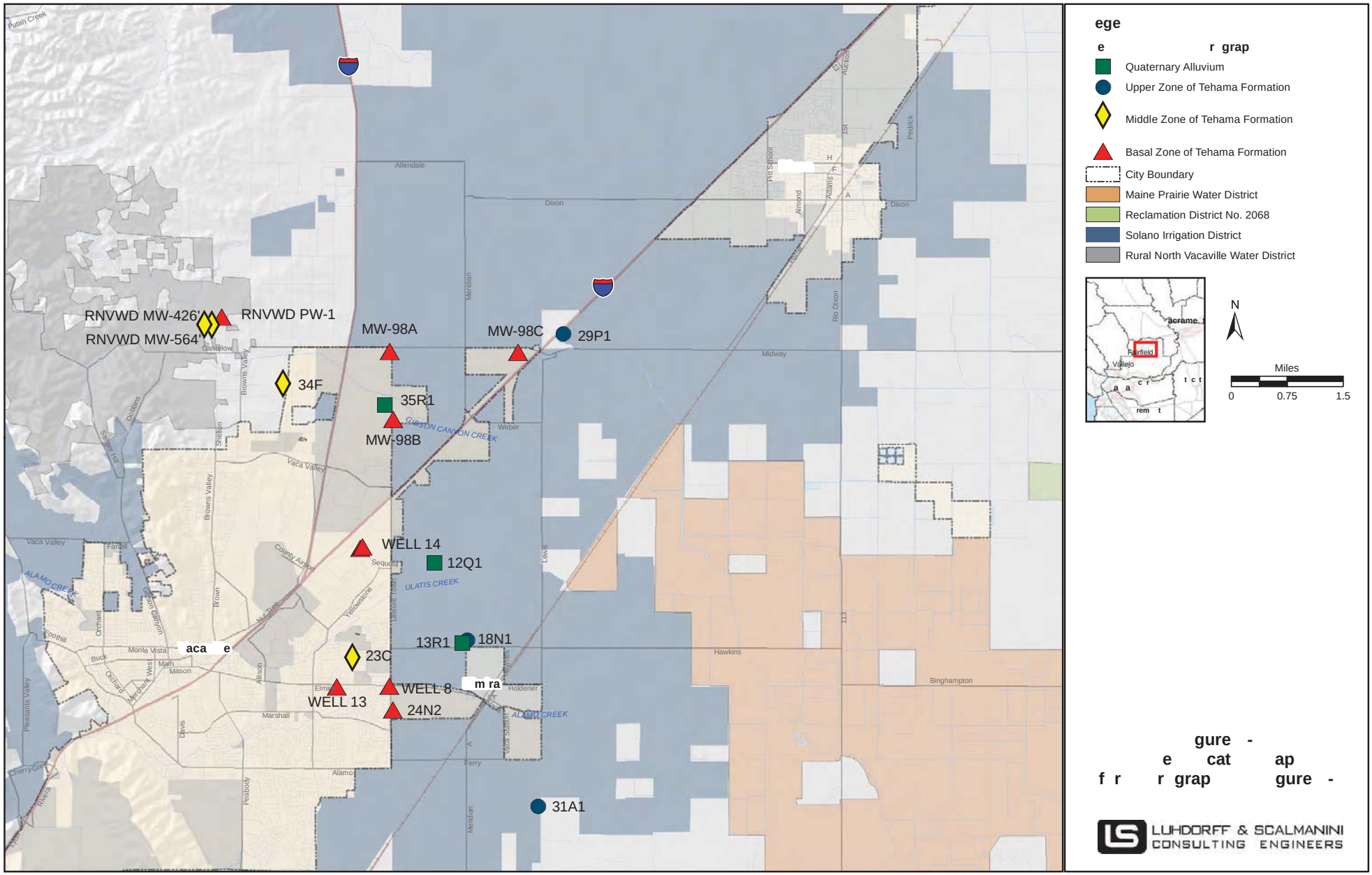
File: Y:\Casey_Meirovitz\10-1-124 Vacaville GWMP Update\Report\GIS\Figure A-1 Well Location Map.mxd Date: 12/15/2010



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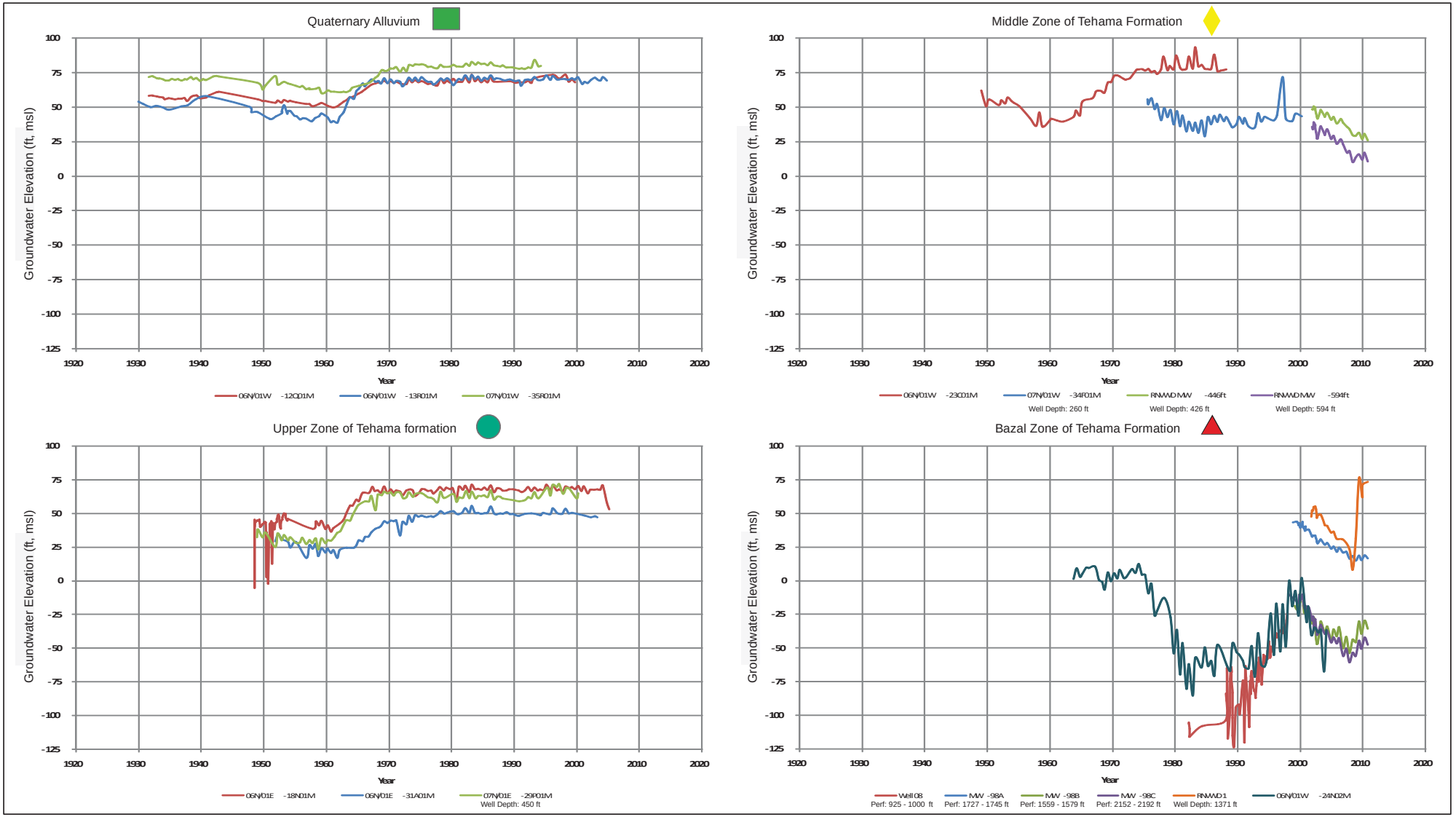

File: Y:\Casey_Meirovitz\10-1-124 Vacaville GWMP Update\Report\GIS\Figure A-3 WL Hydrograph for all zones.mxd Date: 12/15/2010

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Figure A-3
Hydrographs of Groundwater Elevations by Zone

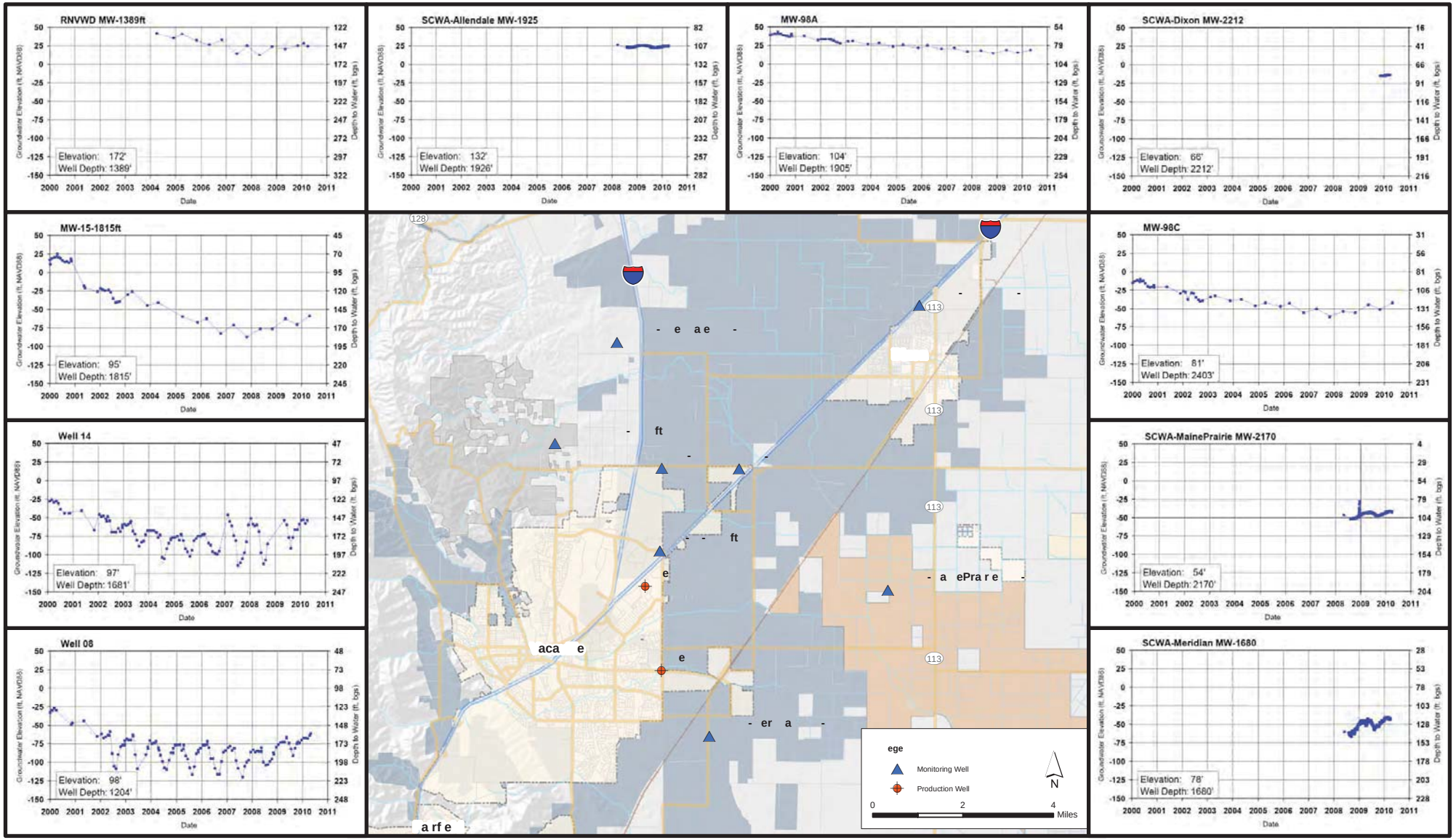

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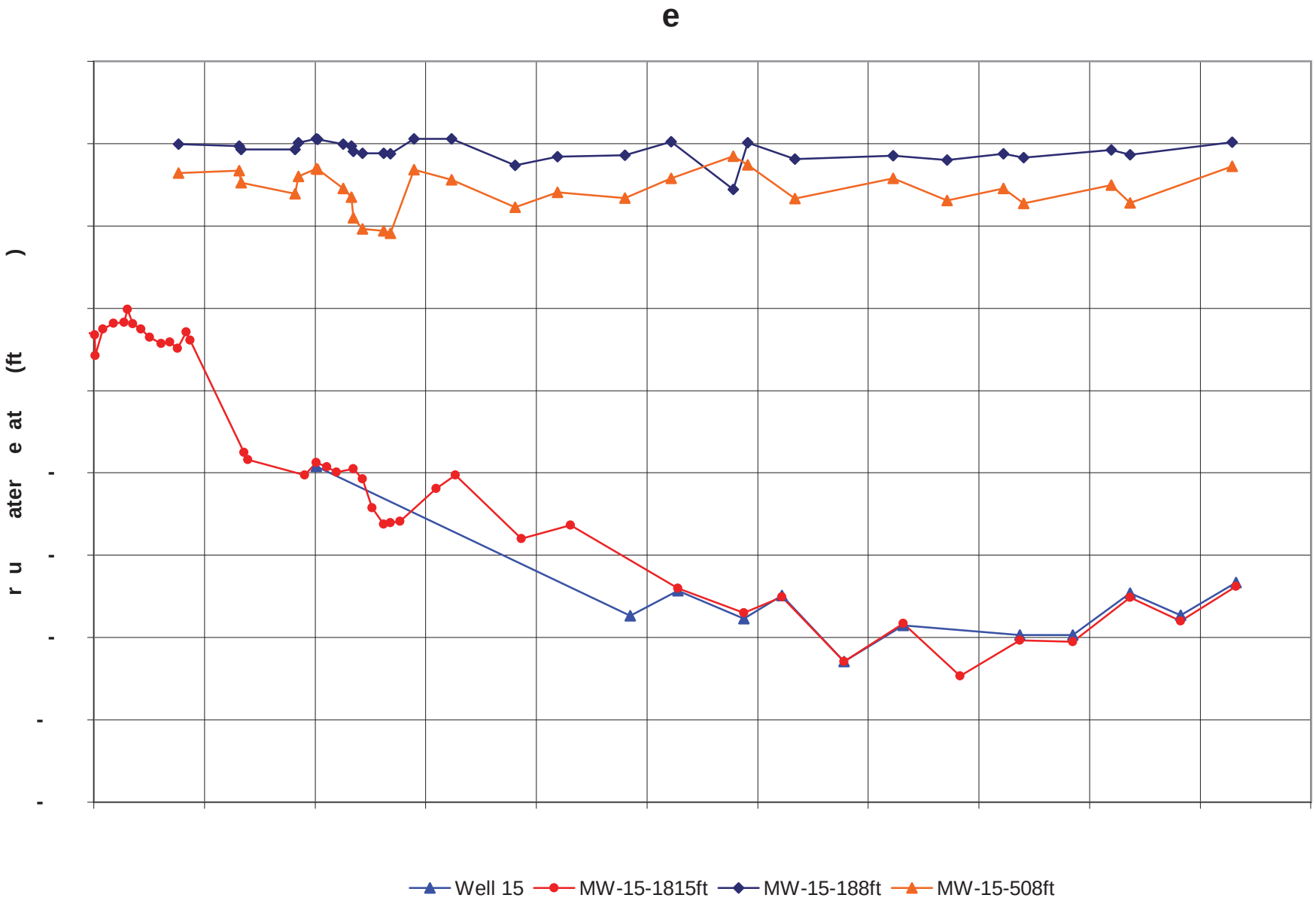
Figure A-4
Representative Hydrographs of Basal Zone Wells



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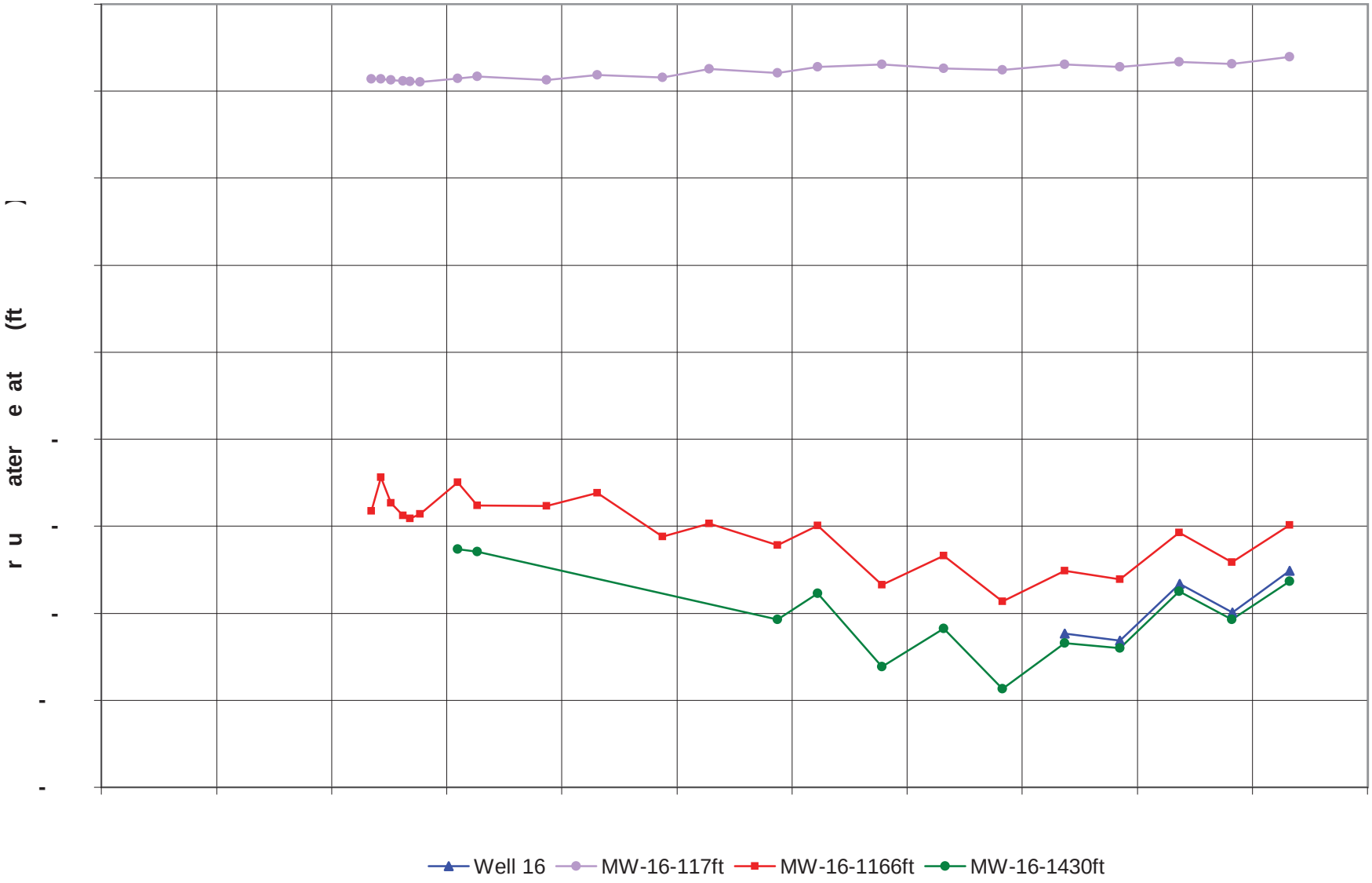

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