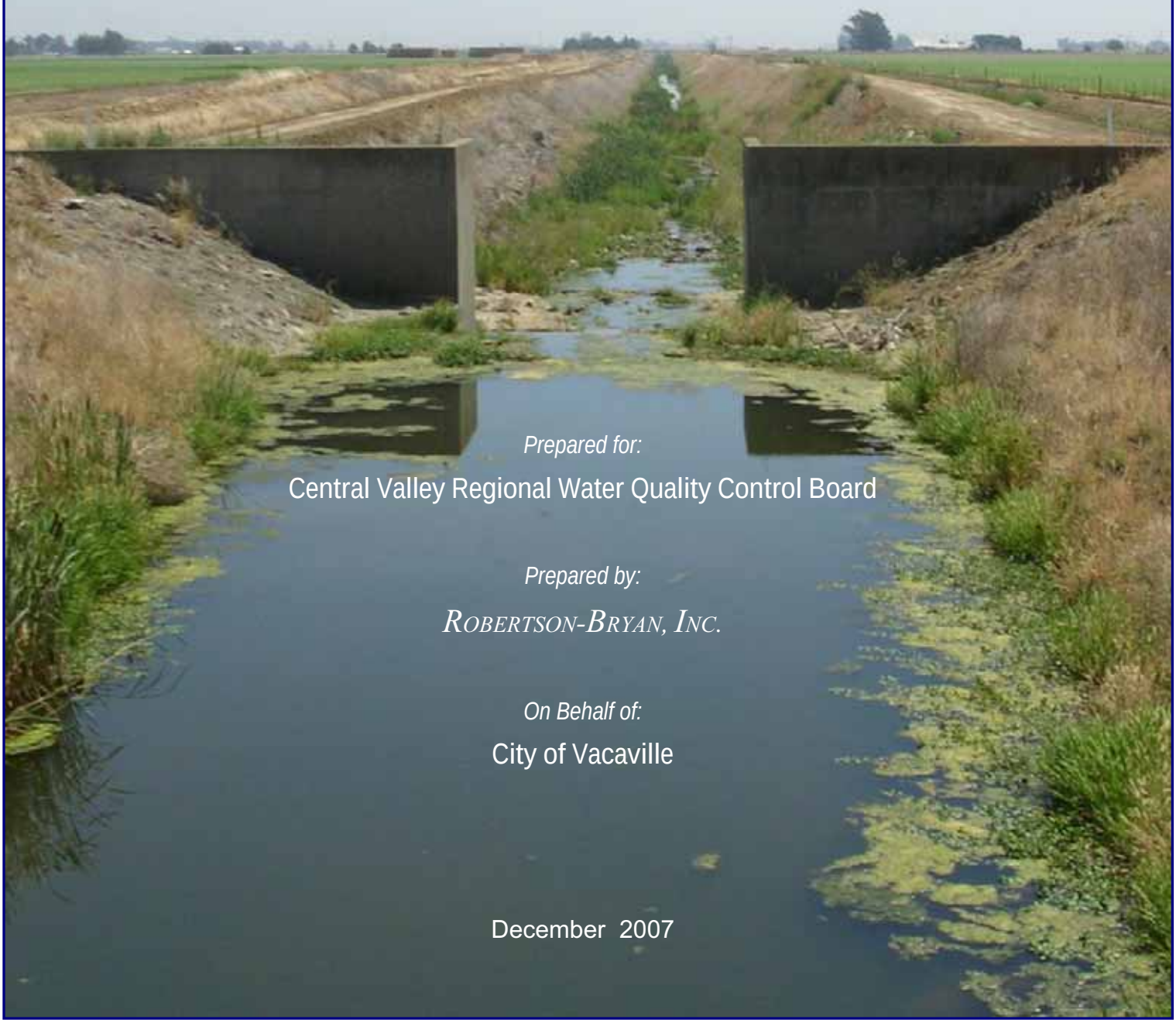
FINAL REPORT

USE ATTAINABILITY ANALYSIS FOR MUNICIPAL AND DOMESTIC SUPPLY (MUN) USE IN SEGMENTS OF NEW ALAMO CREEK AND ULATIS CREEK, SOLANO COUNTY, CALIFORNIA



Prepared for:

Central Valley Regional Water Quality Control Board

Prepared by:

ROBERTSON-BRYAN, INC.

On Behalf of:

City of Vacaville

December 2007

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ACRONYMS AND ABBREVIATIONS

ADWF	average dry weather flow
Basin Plan	Water Quality Control Plan
BMPs	best management practices
CFR	Code of Federal Regulations
cfs	cubic feet per second
CTR	California Toxics Rule
CWA	Clean Water Act
Delta	Sacramento-San Joaquin Delta
DHS	Department of Health Services
EC	electrical conductivity
MCLs	maximum contaminant levels
mgd	million gallons per day
mg/L	milligrams per liter
MUN	municipal and domestic supply
NPDES	National Pollutant Discharge Elimination System
POTWs	publicly owned treatment works
Regional Water Board	Central Valley Regional Water Quality Control Board
State Water Board	State Water Resources Control Board
TDS	total dissolved solids
THM	trihalomethane
UAA	Use Attainability Analysis
U.S. EPA	U.S. Environmental Protection Agency
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

1.1 Role of Use Attainability Analyses in the Water Quality Standards Program

The Federal Water Pollution Control Act Amendments of 1972 called for the establishment of state water quality standards. As amended in 1977, this law became commonly known as the Clean Water Act (CWA). Water quality standards under the CWA consist of three elements: 1) use classification; 2) water quality criteria; and 3) an antidegradation policy (CWA § 303(c)(2); 40 CFR §§ 130.3, 131.6, 131.10, and 131.11). Due to time, logistical, and data limitations when standards were initially developed in the 1970s, certain uses may initially have been designated to water bodies where the use has not occurred and water quality and physical conditions have not been suitable to support the use. In its Order WQO 2002-0015, the State Water Resources Control Board (State Water Board) stated: "…where a Regional Board has evidence that a use neither exists nor likely can be feasibly attained, the Regional Board must expeditiously initiate appropriate basin plan amendments to consider dedesignating the use."

In recognition that accurate use designation is critical to states' water quality standards programs, U.S. EPA provided for states to conduct "Use Attainability Analyses" (UAA) for reviewing and potentially modifying a water body's designated uses, when necessary, based on site-specific information. A UAA may be undertaken for a variety of reasons; however, most occur to assure that other regulatory programs (e.g., National Pollutant Discharge Elimination System (NPDES) and Total Maximum Daily Load), and the regulatory requirements associated with these programs, are implemented appropriately. A credible and defensible UAA can result in refinements or changes in beneficial use designations that lead to either more or less protective criteria. If a credible and defensible UAA indicates a need for a water quality standards change, then a change to the standard is appropriate to effectively implement the water quality standards program (King 2006).

1.2 Regulatory Background

Use classifications, termed "beneficial uses" under California law, are *"uses specified in water quality standards for each water body or segment whether or not they are being attained."* (40 CFR § 131.3(f)) Beneficial uses must be consistent with the goal of CWA § 101(a)(2), which is to provide for *"the protection and propagation of fish, shellfish, and wildlife and…recreation in and on the water,"* unless the State demonstrates that those uses are not attainable. Beneficial uses must also consider among others, the use and value of water for public water supplies, agriculture and industry, and the water quality standards of downstream waters (40 CFR § 131.10).

Beneficial uses for surface waters in the Central Valley Region of California are defined in *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region, Fourth Edition, Revised February 2007 (with Approved Amendments), Sacramento River Basin and the San Joaquin River Basin*. The Basin Plan explicitly identifies the beneficial uses for approximately 100 water bodies within the Central

Valley. For water bodies without explicitly identified uses, the "tributary statement" is applied, which states:

> *"The beneficial uses of any specifically identified water body generally apply to its tributary streams…In some cases a beneficial use may not be applicable to the entire body of water. In these cases the Regional Water Board's judgment will be applied. It should be noted that it is impractical to list every surface water body in the Region. For unidentified water bodies, the beneficial uses will be evaluated on a case-by-case basis."* (Regional Water Board 2007, p. II-2.00)

New Alamo Creek and Ulatis Creek, located near the city of Vacaville, in Solano County, are within the Central Valley Region of California. These water bodies are eventually tributary to the Sacramento-San Joaquin Delta (Delta). The beneficial uses of these water bodies are not explicitly defined in the Basin Plan. The Central Valley Regional Water Quality Control Board (Regional Water Board) has applied the tributary statement to assign the beneficial uses of the Delta to these water bodies. These beneficial uses include municipal and domestic water supply (MUN). MUN is defined in the Basin Plan as, *"Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply."*

Furthermore, the Basin Plan is considered to have designated all water bodies that do not have explicit beneficial use designations as having the MUN use. The Basin Plan states:

> *"Water Bodies within the basins that do not have beneficial uses designated in Table II-1 are assigned MUN designations in accordance with the provisions of State Water Board Resolution No. 88-63 which is, by reference, a part of this Basin Plan, except as provided below:*
>
> *• Old Alamo Creek (Solano County) from its headwaters to the confluence with New Alamo Creek*
>
> *These MUN designations in no way affect the presence or absence of other beneficial use designations in these water bodies. In making any exemptions to the beneficial use designation of MUN, the Regional Board will apply the exceptions listed in Resolution 88-63 (Appendix Item 8)."*

In this case, the MUN designation is not a CWA section 101(a) use. Rather, by application of the state's Basin Plan's tributary statement and State Water Board Resolution No. 88-63, the Regional Water Board has determined the MUN use to be designated for New Alamo Creek and Ulatis Creek. However, no evaluation has ever been conducted to determine if MUN is an existing or attainable use for these water bodies.

Beneficial uses attained on or after November 28, 1975 are considered "existing uses," which means there is evidence that the use has occurred on or after November 28, 1975, or that water quality has been, at any time since this date, sufficient to allow the use to occur. (40 CFR § 131.3(e) "Attainable uses" are, at a minimum, the uses that can be achieved: 1) when effluent limits under sections 301(b)(1)(A) and (B) and section 306 of the CWA are imposed on point source dischargers, and 2) when cost-effective and reasonable best management practices

(BMPs) are imposed on nonpoint source dischargers (U.S. EPA 1994, p. 2-6). A beneficial use that is determined to be an "existing" use may not be dedesignated. To dedesignate a use that is not intended to satisfy the minimum of CWA section 101(a)(2) (i.e., "fishable/swimmable" uses), it must be demonstrated that the use is not attainable through one of the factors listed in 40 CFR § 131.10(g). To remove CWA section 101(a)(2) uses, a UAA, supported by at least one of the factors listed in 40 CFR § 131.10(g), must be conducted (**Figure 1**) (U.S. EPA 1994, p. 2-6 through 2-8).

1.3 Purpose and Need for Analysis

The need to evaluate the appropriateness of the MUN use designation for New Alamo Creek and Ulatis Creek has become apparent primarily in the context of renewing NPDES permits for the City of Vacaville's Easterly Wastewater Treatment Plant (WWTP), which discharges treated effluent to Old Alamo Creek, a tributary to New Alamo Creek. NPDES permit effluent limitations are derived, in part, from the water quality criteria/objectives of the receiving waters. The Basin Plan incorporates by reference Department of Health Services (DHS) maximum contaminant levels (MCLs) as water quality objectives for MUN-designated waters. Also, the California Toxics Rule (CTR) states that the CTR human health criteria for the consumption of water and organisms apply to MUN-designated waters. Questions exist as to whether the MUN use exists, or has the potential to exist, in the lower segments of New Alamo Creek and Ulatis Creek.

This UAA has been undertaken to definitively determine whether MUN is an existing or attainable use for the UAA study segments defined in Section 1.4. Although MUN is not a "fishable/swimmable" use under the CWA, it was, nevertheless, determined that a UAA would best facilitate this beneficial use assessment process.

1.4 Scope of UAA

This UAA is a focused assessment of MUN use attainability in specified segments of New Alamo Creek and Ulatis Creek. The specific water body segments evaluated in this UAA are:

- New Alamo Creek, from the confluence with Old Alamo Creek to the confluence with Ulatis Creek, and
- Lower reach of Ulatis Creek, from the confluence with New Alamo Creek to the confluence with Cache Slough.

This segment-specific assessment is justified not only by the purpose and need for the UAA, but also because the sources of water to the UAA study segments are markedly different than the sources of water to segments and water bodies upstream.

This UAA only evaluates the MUN use for these water body segments. No other uses are being evaluated. Because this UAA does not evaluate the MUN use in the segments of New Alamo Creek and Ulatis Creek upstream of the UAA study segments, nor does it evaluate the MUN use in Alamo Creek or its tributaries (Encinosa Creek and Laguna Creek) in the upper Alamo Creek

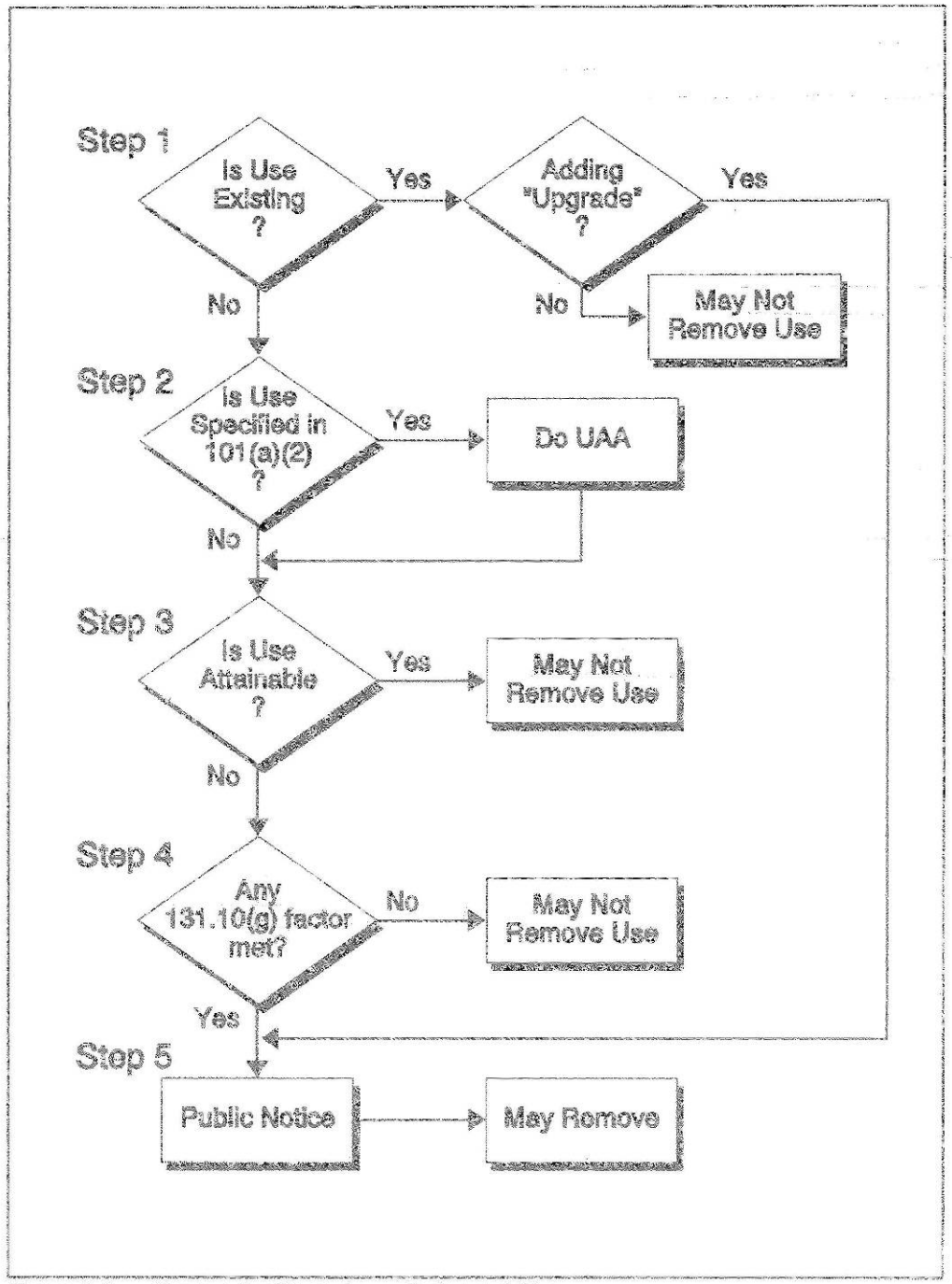

Figure 2-1. Process for Removing a Designated Use

Source: U.S. EPA 1994.

Figure 1. Process for removing a designated use.

watershed, the uses currently designated for these other water bodies/water body segments will remain unaffected by the findings of this UAA.

Because State Water Board Resolution No. 88-63 is considered to have designated MUN as a beneficial use for all unnamed water bodies, the information presented in this UAA, and its referenced documents, will be used to address both 40 CFR 131.3(g) factors and Resolution No. 88-63. If, based on the findings of this UAA, the Regional Water Board amends the Basin Plan to dedesignate MUN as a use for the segments of New Alamo Creek and Ulatis Creek defined herein, the State Water Board will, as necessary, consider amending Resolution No. 88-63 concurrently with the action of the Regional Board to specifically exempt these water body segments from Resolution No. 88-63.

1.5 Regulatory Authority

Beneficial use designations may be addressed by states for entire water bodies or defined segments of water bodies (40 CFR § 131.10; U.S. EPA 1994). Regulations at 40 CFR § 131.10(g) implement the CWA in regard to removing designated uses. The State may remove a designated use, which is not an existing use, as defined in 40 CFR § 131.3[1], if the State can demonstrate that attaining the use is not feasible, because:

> *"(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or*
>
> *(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violation of State water conservation requirements to enable uses to be met; or*
>
> *(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct that to leave in place; or*
>
> *(4) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or*
>
> *(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to the water quality, preclude attainment of aquatic life protection uses; or*
>
> *(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact."*

As defined in 40 CFR § 131.3(g), a UAA is a *"structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in Sec. 131.10(g)."*

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[1] 40 CFR §131.3(e) defines existing uses as those uses actually attained in the water body on or after November 28, 1975.

If a designated use is an existing use (as defined in 40 CFR § 131.3), the use cannot be dedesignated. An existing use is defined in 40 CFR § 131.3(e) as those uses actually attained in the water body on or after November 28, 1975. A use may be determined to be attained if (U.S. EPA 1994):

- the use has actually occurred since November 28, 1975; or
- water quality and/or habitat conditions suitable to attaining the use have occurred at any time since November 28, 1975.

2 CHARACTERISTICS OF WATERSHED AND WATER BODY SEGMENTS UNDER EVALUATION

The Ulatis Creek watershed, which includes the Alamo Creek sub-watershed, covers approximately 150 square miles within the northwestern portion of Solano County (). From west to east, the watershed is divided by two topographic highs—the Vaca Mountains and the English Hills. The southern portion of the intervening valley is locally named Lagoon Valley, and the northern portion is named Vaca Valley. Most of the watershed is east of the English Hills within the Sacramento Valley floor. Cache Slough, a northern tributary to the Delta, is the eastern outlet for the watershed. The following sections describe: 1) watershed and water body characteristics for New Alamo Creek, Ulatis Creek, and Cache Slough; which is the first water body downstream of the UAA study area; 2) watershed climate; 3) watershed land uses; and 4) point and nonpoint sources within the watersheds.

2.1 Watershed and Water Body Characteristics

Alamo Creek originates in the Vaca Mountains and flows east-southeast through the city of Vacaville ultimately joining Ulatis Creek on the Sacramento Valley floor. In 1961, the Ulatis Soil Conservation District, Solano Irrigation District, and Solano County Flood Control and Water Conservation District jointly developed the *Watershed Work Plan: Ulatis Creek Watershed* (Ulatis Creek Watershed Work Plan) to reduce flooding of the agricultural properties within the Ulatis Creek watershed (Ulatis Soil Conservation District et al. 1961). This work is generally referred to as the Ulatis Creek Watershed Protection and Flood Prevention Project.

The improvement works identified in the Ulatis Creek Watershed Work Plan consisted of: 1) land treatment measures (e.g., conservation cropping system, proper range use, pasture plantings) and 2) structural measures. The structural measures included, *"…improvement or realignment of 51.9 miles of floodwater channels together with the construction of drop and grade stabilization structures and inlet structures to convey local runoff into the channels."* Prior to this project, Alamo Creek's natural channel flowed in a southeasterly direction for over 7 miles and tied into Ulatis Creek approximately 1.5 miles from Cache Slough. As part of this project, which was completed in the mid-1960s, portions of Alamo Creek within the City were channelized and realigned, cutting off flows from the upper watershed to the lower portion of the original channel. The original, remnant channel is referred to as "Old Alamo Creek." The new, engineered channel is referred to as "New Alamo Creek." Today, Alamo Creek drains the upper

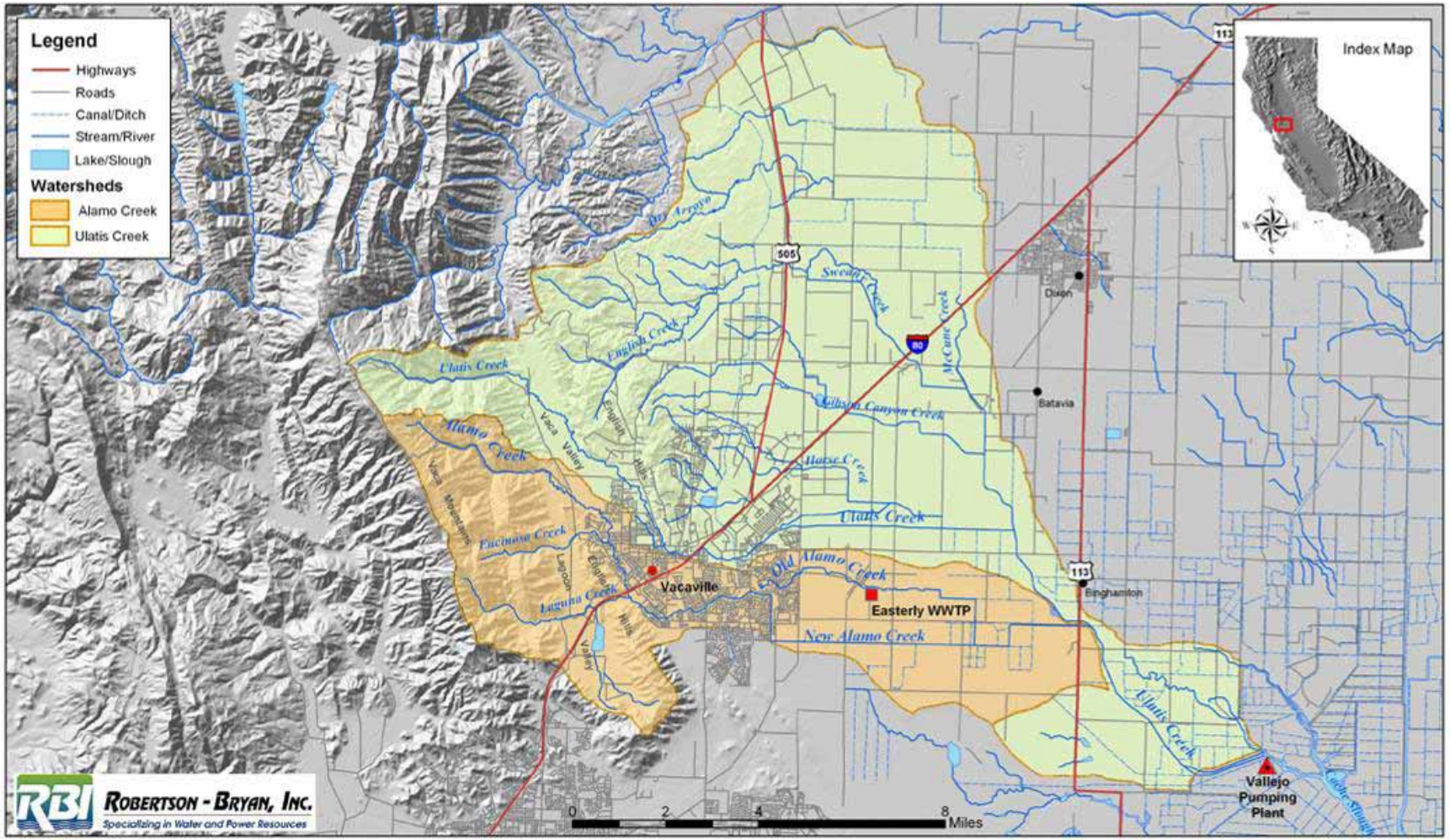


Figure 2. Alamo and Ulatis Creek watersheds.

watershed and flows into New Alamo Creek adjacent to the city of Vacaville. New Alamo Creek then flows into Ulatis Creek, near Highway 113. Overall, Alamo/New Alamo Creek travels roughly 20 miles before joining Ulatis Creek.

The physical characteristics of the UAA study segments are described in *Use Attainability Analysis for New Alamo Creek and Ulatis Creek, Technical Memorandum No. 1, Hydrological and Physical Characteristics of Alamo Creek, Ulatis Creek, and Cache Slough* (RBI 2007a). The following sections provide a summary characterization.

2.1.1 New Alamo Creek

New Alamo Creek is an engineered channel designed and constructed as part of the Ulatis Creek Watershed Protection and Flood Prevention Project (Ulatis Soil Conservation District et al. 1961) to collect and convey stormwater runoff from surrounding agricultural and urban lands, and runoff from the upper watershed, which flows into it from Alamo Creek. Upon its construction, it also conveyed Easterly WWTP effluent, which began discharging effluent in 1959. It also is used to convey agricultural conveyance and drainage water throughout the irrigation season. During the non-irrigation season, but prior to the start of the winter precipitation season, New Alamo Creek primarily conveys Easterly WWTP effluent and urban runoff.

The channel is characterized by earthen sides in a trapezoidal configuration with 2:1 slopes (horizontal to vertical), riprap protection, and little riparian vegetation (**Figure 3**). There are two diversion dams within the reach between Old Alamo Creek and Ulatis Creek, which are operated by Solano Irrigation District (Brown-Alamo Diversion Dam) and Maine Prairie Water District (Dam #4). Adjacent land uses are primarily agricultural.

Figure 3. Typical channel configuration of New Alamo Creek.

2.1.2 Ulatis Creek

Ulatis Creek is similar to Alamo/New Alamo Creek in that it originates in the Vaca Mountains and flows through the city of Vacaville and onto the Sacramento Valley floor. New Alamo Creek is a major tributary to the lower segment of Ulatis Creek. The segment of Ulatis Creek between New Alamo Creek and Cache Slough was channelized and its capacity expanded as part of the Ulatis Creek Watershed Protection and Flood Prevention Project. The channel in this segment consists of trapezoidal earthen sides with slopes of 3:1 (horizontal to vertical) and riprap protection placed in areas designated by hydraulic design, and at grade stabilization structures, drainage inlets, flow transitions, and bridges, as well as at inlet areas, to allow local runoff to enter the channels without damaging effects (e.g., erosion), with some riparian vegetation adjacent to the water (**Figure 4**). Maine Prairie Water District operates Dam #3 located shortly downstream of the confluence with New Alamo Creek. During the irrigation season, Maine Prairie Water District tries to minimize flows passing the dam, limiting water passing downstream to leakage, which is approximately 5 cubic feet per second (cfs). Land uses adjacent to the creek also are primarily agricultural.

Figure 4. Typical channel configuration of lower Ulatis Creek.

2.1.3 Cache Slough

Cache Slough begins at the terminus of Ulatis Creek, approximately 5.5 miles downstream of the confluence of New Alamo Creek and Ulatis Creek. Cache Slough extends approximately 6 miles downstream from Ulatis Creek to the Sacramento River. The Cache Slough channel changes sharply in character downstream of the confluence with Ulatis Creek, becoming wider, increasing from approximately 300 feet to 1,500 feet because of numerous tributaries entering from the north and east. The change in channel configuration is shown in **Figure 5**; the straightened channel of Ulatis Creek can be clearly distinguished from the more natural channel configuration of Cache Slough.

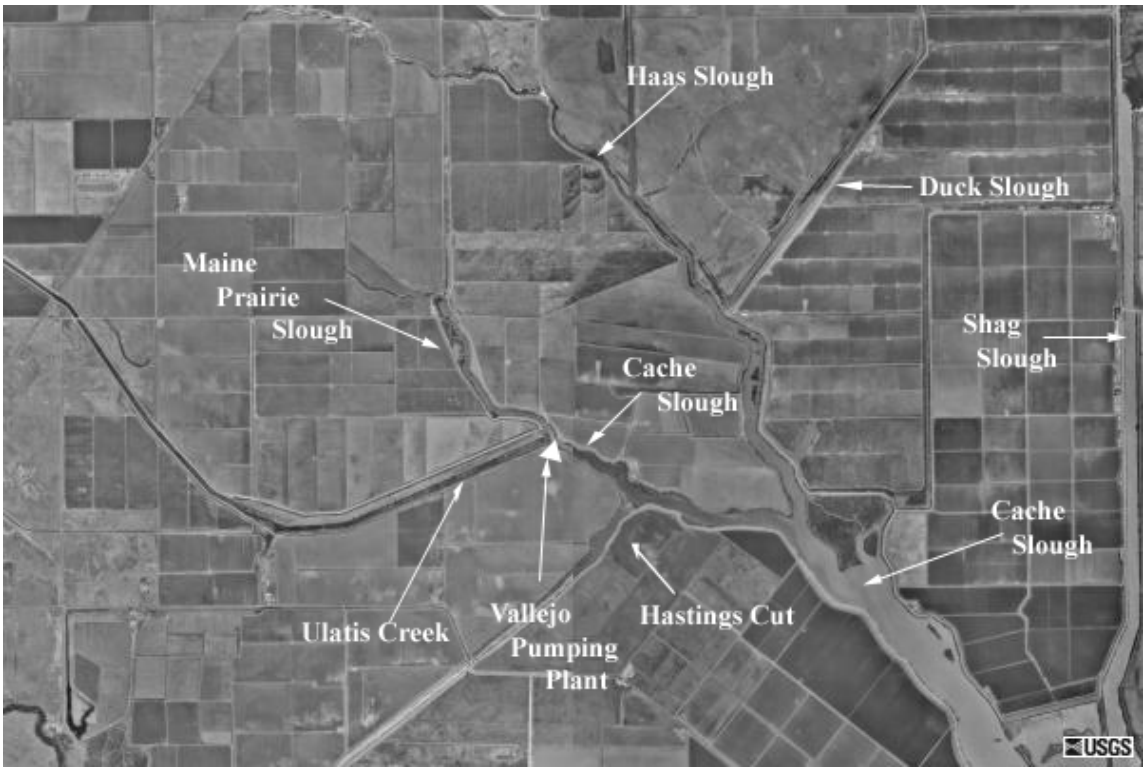


Figure 5. Cache Slough and Ulatis Creek within the Sacramento Valley floor.

Cache Slough, being a tributary to the Sacramento-San Joaquin Delta, is tidally influenced. Flows from Ulatis Creek and other creeks entering Cache Slough are affected by the tidal gradient from the Delta. The Cache Slough channel downstream of the confluence with Ulatis Creek, while confined by levees, has not been straightened and retains some natural structures, such as mid-channel islands and point bar features. While Cache Slough is lined with levees, there is considerably more riparian vegetation along its banks than along Ulatis or Alamo Creek channels. Riparian vegetation is present on numerous in-channel features in Cache Slough.

The City of Vallejo operated an emergency municipal diversion pump station in Cache Slough until 1990 (J. McCall, City of Vacaville, Water Quality Manager, pers. comm., 2007). The City of Vallejo's pump station (Vallejo Pump Station) is no longer in operating condition (**Figure 6**) nor is it permitted for use by the DHS. The Vallejo Pump Station is located in Cache Slough, about 400 feet downstream of where Ulatis Creek is tributary to Cache Slough (**Figure 7 and Figure 8**).

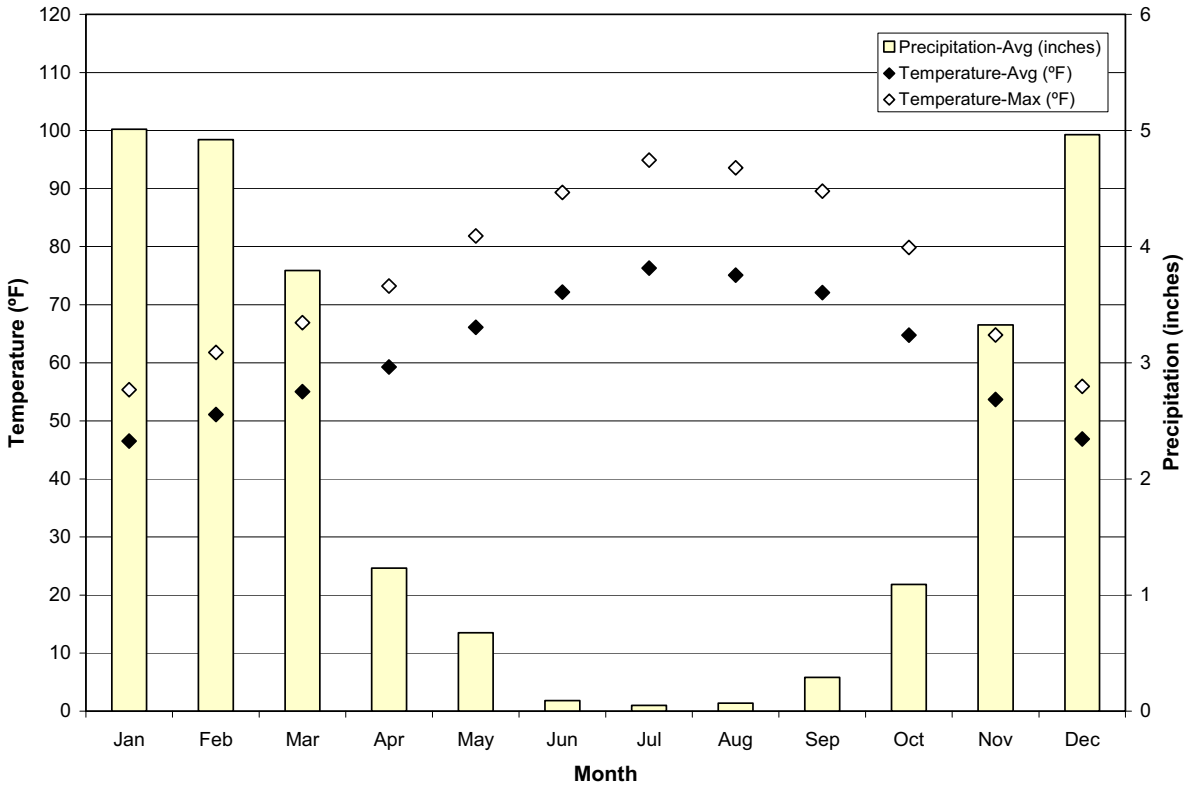
2.2 Watershed Climate

The Vacaville area of Solano County averages 25 inches of rainfall per year with most of the precipitation occurring October through April (NCDC 2007). Monthly average air temperatures range from 47ºF in the winter to 77ºF in the summer, with highs averaging above 90ºF in the summer (NCDC 2007). **Figure 9** summarizes the monthly average precipitation and air temperatures for the city of Vacaville.

Figure 6. Defunct Vallejo Pump Station in Cache Slough.

Figure 7. Confluence of Ulatis Creek with Cache Slough.

Figure 8. Location of the City of Vallejo's defunct raw water supply pump station.



Source: NCDC 2007.

Figure 9. Maximum and average air temperature and average monthly precipitation for the City of Vacaville from 1971–2007.

2.3 Watershed Land Uses

New Alamo Creek watershed land uses are primarily urban and agricultural, with forested areas located in the less intensively developed upper parts of the watershed. **Table 1** presents the land use types and relative percentages within the watershed from the headwaters to Ulatis Creek. **Figure 10** illustrates the locations of the various land uses.

Table 1. Land uses within the New Alamo Creek watershed from the headwaters to Ulatis Creek.

Land Use Type	Area (square miles)	Percent Coverage (%)
Urban	8	18
Agriculture	25	57
Natural / Forest	11	25
Source: Multi-Source Land Cover Data; 100-meter resolution (California Department of Forestry & Fire Protection 2002)		

Land uses in the Ulatis Creek watershed are predominantly agricultural with some urban uses, and some forested and natural areas located in the upper parts of the watershed. **Table 2** presents the land use types and relative percentages within the watershed from the headwaters to Cache Slough.

Table 2. Land uses within the Ulatis Creek watershed from the headwaters to Cache Slough.

Land Use Type	Area (square miles)	Percent Coverage (%)
Urban	10	9
Agriculture	86	80
Natural / Headwater	14	11
Source: Multi-Source Land Cover Data; 100-meter resolution (California Department of Forestry & Fire Protection 2002)		

The flow from the New Alamo Creek watershed produces approximately 36% of the volume of runoff in the Ulatis Creek watershed, while Ulatis Creek and its tributaries generate the remaining 64% of the volume of runoff (Camp Dresser & McKee 1990).

A 2007 Solano County press release, as posted to the County's web site, stated that the total gross agricultural production of the 80-plus crops and commodities in 2006 was $233.5 million. Nursery stock retained its No. 1 ranking with a value of $47.9 million, followed by cattle and calves at $25.1 million and alfalfa at $23.3 million. In this release, Supervisor John Vasquez was quoted as stating: "… our farmers and ranchers consistently make such an incredible impact on our economy." It should be noted that these dollar figures do not reflect the total contribution agriculture makes to the economy of Solano County. Transportation, processing, marketing and other farm-related services substantially multiply these values to the benefit of the local economy.

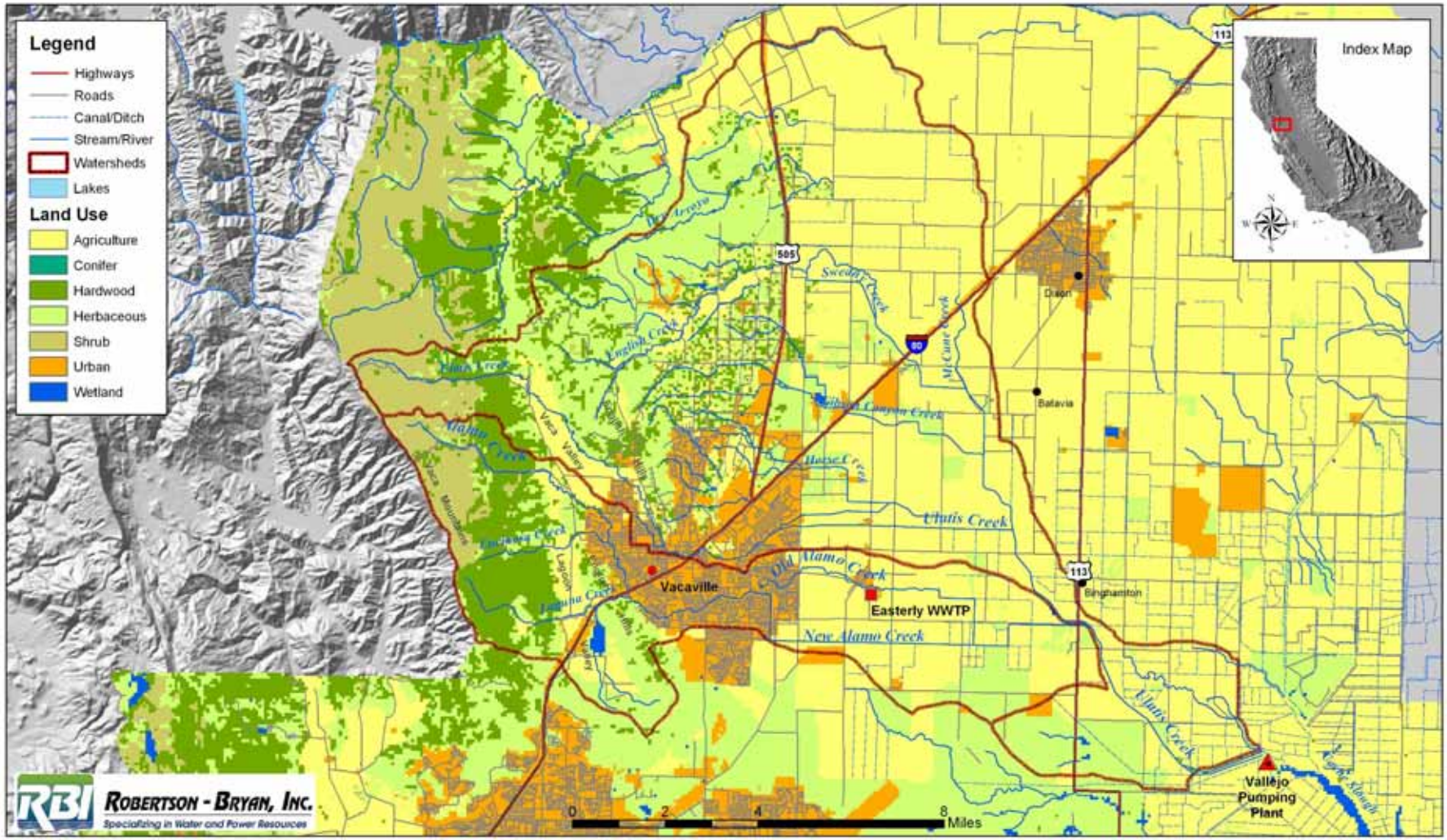


Figure 10. Land use categories in the New Alamo and Ulatis Creek watersheds.

2.4 Description of Point and Nonpoint Sources

The City of Vacaville operates the Easterly WWTP, which discharges treated municipal effluent to Old Alamo Creek, a tributary to New Alamo Creek. The Easterly WWTP has discharged wastewater effluent to the Alamo Creek system since 1959. Easterly WWTP is currently designed to discharge 15 million gallons per day (mgd), average dry weather flow (ADWF) and a peak wet weather flow of 55 mgd. Between 2020 and 2030, the City projects an expansion to 17.5 mgd, ADWF, and after 2030, a buildout expansion of 22 mgd, ADWF. Current flows are approximately 9 mgd, ADWF. Easterly WWTP disinfects the treated effluent with chlorine to inactivate pathogens that may be present in the wastewater. Trihalomethane (THM) compounds, a contaminant of concern in drinking water, are formed in the wastewater during the disinfection process. The WWTP also nitrifies the wastewater to reduce ammonia levels. The effluent discharged contains detectable levels of numerous constituents, including pathogens, THM compounds, and nitrate, which are regulated by the Regional Water Board through the facility's NPDES permit, and organic carbon (a THM precursor).

The Kinder-Morgan groundwater remediation project is another point source discharge within the New Alamo Creek watershed. The project discharges approximately 0.07 mgd of treated groundwater to Old Alamo Creek upstream of the Easterly WWTP. However, the discharge is such a low flow rate that very little water, if any, reaches New Alamo Creek. This is evidenced by the long periods of no flow in Old Alamo Creek upstream of the Easterly WWTP outfall (Tetra Tech 2004).

Nonpoint source contributions to New Alamo Creek and Ulatis Creek during the irrigation season include drainage water from agricultural lands within Solano Irrigation District and Maine Prairie Water District (**Figure 11 and Figure 12**), combined with a small amount of urban runoff (e.g., runoff from car washing and lawn watering). During the precipitation season, nonpoint source contributions consist of storm water runoff from the natural and forested areas in the upper watershed combined with runoff from the urban and agricultural lands within the lower watershed.

3 ANALYSIS METHODOLOGY

A UAA is a structured scientific assessment of the physical, chemical, biological, and economic factors affecting the attainment of a designated use (U.S. EPA 1994). This UAA evaluates whether MUN is an existing or attainable use for the segment of New Alamo Creek from its confluence with Old Alamo Creek downstream to Ulatis Creek, and the segment of Ulatis Creek, from its confluence with New Alamo Creek downstream to Cache Slough. A step-wise analysis was developed to provide the information upon which to base the decision as to whether MUN is and existing or attainable use within these water body segments. The evaluation is organized in a step-wise manner to answer the following key questions.

Figure 11. Agricultural return flow into Ulatis Creek between Maine Prairie Road and Brown Road.

Figure 12. Agricultural return flow into Ulatis Creek upstream of Cache Slough.

1. **Is the MUN use an existing use?**

    a. Is the use currently occurring or has it occurred within the UAA study segments at any time since November 28, 1975?

    b. Has the water quality within the UAA study segments at any time since November 28, 1975 been sufficient to allow the use to occur?

    If the answer is "yes" to question "a" or "b," then the use has been attained and is considered to be an existing use (as defined in 40 CFR § 131.3) and, therefore, cannot be dedesignated.

    If the analysis determines the answer is "no" to both questions "a" and "b," then the use is not an existing use and thus could be dedesignated.

2. **Is the MUN use attainable?**

    Determine whether any of the CFR § 131.10(g) factors preclude the attainment of the use.

3. **Is restoration to an attainable use condition feasible?**

    If restoration to an attainable condition is reasonably feasible, consider restoration rather than use dedesignation.

    If restoration to an attainable condition is not reasonably feasible, address question #4.

4. **If MUN is not an attainable use, is a lesser type and degree of this use occurring or reasonably expected to occur?**

    If yes, dedesignate MUN and then define and designate the appropriate use that is occurring or expected to occur, and define appropriate criteria/objectives to protect that use.

    If no lesser type and degree of the use is occurring and is not reasonably expected to occur in the future, then dedesignate MUN.

The following sections discuss the considerations within each of these steps.

3.1 Step 1: Is MUN an Existing Use?

The first step in this UAA is to determine whether the MUN use has been attained within the defined water body segments since November 28, 1975 and, therefore, whether it is an existing use. A use is considered to be an existing use if either: a) the use has occurred at some time since November 28, 1975, or 2) conditions within the water body have been sufficient to allow the use to occur since November 28, 1975. An existing use cannot be dedesignated.

Information obtained from water rights record reviews; site inspections for physical evidence of diversions, past or present; and interviews with agency staff and local residents was compiled to provide a factual basis upon which to determine whether the use is presently occurring or has occurred since November 28, 1975. In addition, characteristics of the UAA study segments of New Alamo Creek and Ulatis Creek and the surrounding watersheds, including system hydrology, water quality and source water inputs, and surrounding land uses, were compiled and evaluated to determine whether historic water quality conditions in the study segments have been sufficient to allow the use to occur. The determination of whether the MUN is an existing use must include an evaluation of both actual occurrences of the use activity and whether or not the level of water quality necessary to support the use has been achieved at any time since November 28, 1975. If the level of water quality necessary to support MUN has been achieved within the UAA study segments since November 28, 1975, the use is considered an existing use and cannot be dedesignated. If MUN is not an existing use, then its present and future attainability is evaluated in the second step of the assessment.

3.2 Step 2: Is MUN an Attainable Use?

The second step in the UAA process is to evaluate the MUN use within the context of each 40 CFR § 131.10(g) factor (which may be used as a basis for removing a designated use) to determine whether the MUN use is attainable. The 40 CFR § 131.10(g) factors relevant to the UAA study segments are identified in **Table 3** and summarized below.

Table 3. Information elements evaluated in the UAA by category of 40 CFR § 131.10(g) factor.

Factor	Information Elements
Natural Water Quality (131.10(g)(1))	This factor is not applicable, because most of the flow originates from human-influenced sources.
Water Flow Conditions (131.10(g)(2))	• Seasonal sources of water to the segment. • Types and number of MUN diversions and other intake structures in the segments.
Human-made Water Quality Conditions (131.10(g)(3))	• Human sources of contamination of water quality in the segments.
Human-made Physical Alterations (131.10(g)(4))	• Modifications to channels to convey runoff from adjacent developed lands.
Natural Physical Conditions (131.10(g)(5))	This factor is not applicable, because it is relates to evaluating aquatic life uses, not the MUN use.
Economic Considerations (131.10(g)(6))	• Costs to publicly owned treatment works (POTWs) to upgrade treatment processes to meet current water quality standards.

Water Flow Conditions. Quantity and consistency of water flow are essential components to municipal and domestic water supply systems that provide water for drinking, cooking, bathing, and other domestic activities. Thus, typical flow patterns of the water body segments were evaluated.

Human-made Water Quality Conditions. Water quality conditions as a result of human impact can be traced to surrounding urban and agricultural land uses and associated point-source and nonpoint source loadings of constituents. For MUN, pathogen and contaminant concentrations are particularly relevant.

***Human-made Physical Alterations*.** Engineered modifications to channels, including realignment and flow control structures to convey storm water runoff and agricultural drainage water, affect the source of the water in the channel available for MUN.

Economic Considerations. Implementation of water quality standards must consider the economic impact of their implementation. Thus, costs to publicly owned treatment works (POTWs) to meet discharge requirements based on water quality standards protective of the existing MUN beneficial use designation are presented.

This UAA compiled the characteristics of New Alamo Creek and Ulatis Creek and the surrounding watersheds, including system hydrology, water quality and source water inputs, and surrounding land uses to determine the factors that could preclude the attainment of the MUN use.

3.3 Step 3: Is Restoration to an Attainable Use Condition Feasible?

In Step 2 the factors that could preclude the MUN use from being attained are identified. In Step 3, these factors are then evaluated to assess whether reasonably feasible measures can be taken to allow the MUN use to occur. The ability to take actions to attain the MUN use considers the following:

- Water flow conditions,
- Human-made water quality conditions, and
- Human-made physical alterations.

Attainable uses are considered to be those that can be achieved through the implementation of reasonably feasible measures, not extreme measures. Thus, attainable uses are those that can be achieved: 1) when effluent limits under sections 301(b)(1)(A) and (B) and section 306 of the CWA are imposed on point source dischargers, and 2) when cost-effective and reasonable BMPs are imposed on nonpoint source dischargers. Extreme actions such as treatment of point and nonpoint source discharges well beyond that defined above, which may jeopardize the City of Vacaville's planned economic and social development or the viability of agriculture in the area, are not considered.

3.4 Step 4: If MUN is not Attainable, Is a Lesser Type and Degree of this Use Expected to Occur?

The final step of this UAA is to assess whether a lesser type and degree of thisuse is occurring or expected to occur in the future within the UAA study segments. A MUN use as defined in the

Basin Plan requires that the water body meet water quality criteria consisting of drinking water MCLs, and also meet CTR human health criteria for the consumption of water and organisms. These criteria are derived based on the assumption of consumption of 2 liters of water per day over the course of a 70-year lifetime. It is possible that a water body could be used for domestic supply at a lesser rate of water consumption, perhaps in a transient nature, or only for the purpose of non-consumptive household uses, such as bathing and indoor/outdoor household cleaning activities. The likelihood that area municipalities or residents living along the UAA study segments of New Alamo Creek and Ulatis Creek would construct systems to divert and treat this water for any form of municipal or domestic water supply use is evaluated. Determination of the availability of alternative, higher quality water supplies for municipal and domestic use in the area is a key aspect of this assessment.

Section 4 (Data Collection) identifies the information and data collected and compiled to support the necessary assessments needed to address the questions outlined in this UAA assessment methodology outlined above. These evaluations are presented in Section 5 (Evaluation of MUN Attainability), which provide the technical basis from which to make conclusions and recommendations, which are presented in Section 7 of this UAA.

4 DATA COLLECTION

Data were compiled and studies conducted to characterize the hydrologic conditions in the UAA study segments, document existing and historical municipal and domestic water uses, characterize the seasonal sources of flows, and characterize the water quality.

4.1 Hydrologic Conditions

The City of Vacaville operates a system of stream gauging stations with calibrated rating curves that are operated to measure storm runoff and the recording period is dependent on the precipitation forecast. Data from two locations were used to characterize stream flows in New Alamo Creek and Ulatis Creek. Vacaville-V4 is located on New Alamo Creek at Vanden Road, and Vacaville-V3 is located on Ulatis Creek at Leisure Town Road. The period of record is water years 1998-2006.

Additional stream flow data were collected by the City of Vacaville for New Alamo Creek at Fry Road (UAA2) and Ulatis Creek at Brown Road (UAA3) using acoustic Doppler meters. The period of record is October 2005 to May 2007 for the Fry Road (UAA2) gauge and July 2004 to May 2007 for the Brown Road (UAA3) gauge.

Figure 13 shows the location of the gauging stations on New Alamo Creek and Ulatis Creek.

The hydrological and physical characteristics of the UAA study segments are described in *Use Attainability Analysis for New Alamo Creek and Ulatis Creek, Technical Memorandum No. 1, Hydrological and Physical Characteristics of Alamo Creek, Ulatis Creek, and Cache Slough* (RBI 2007a).

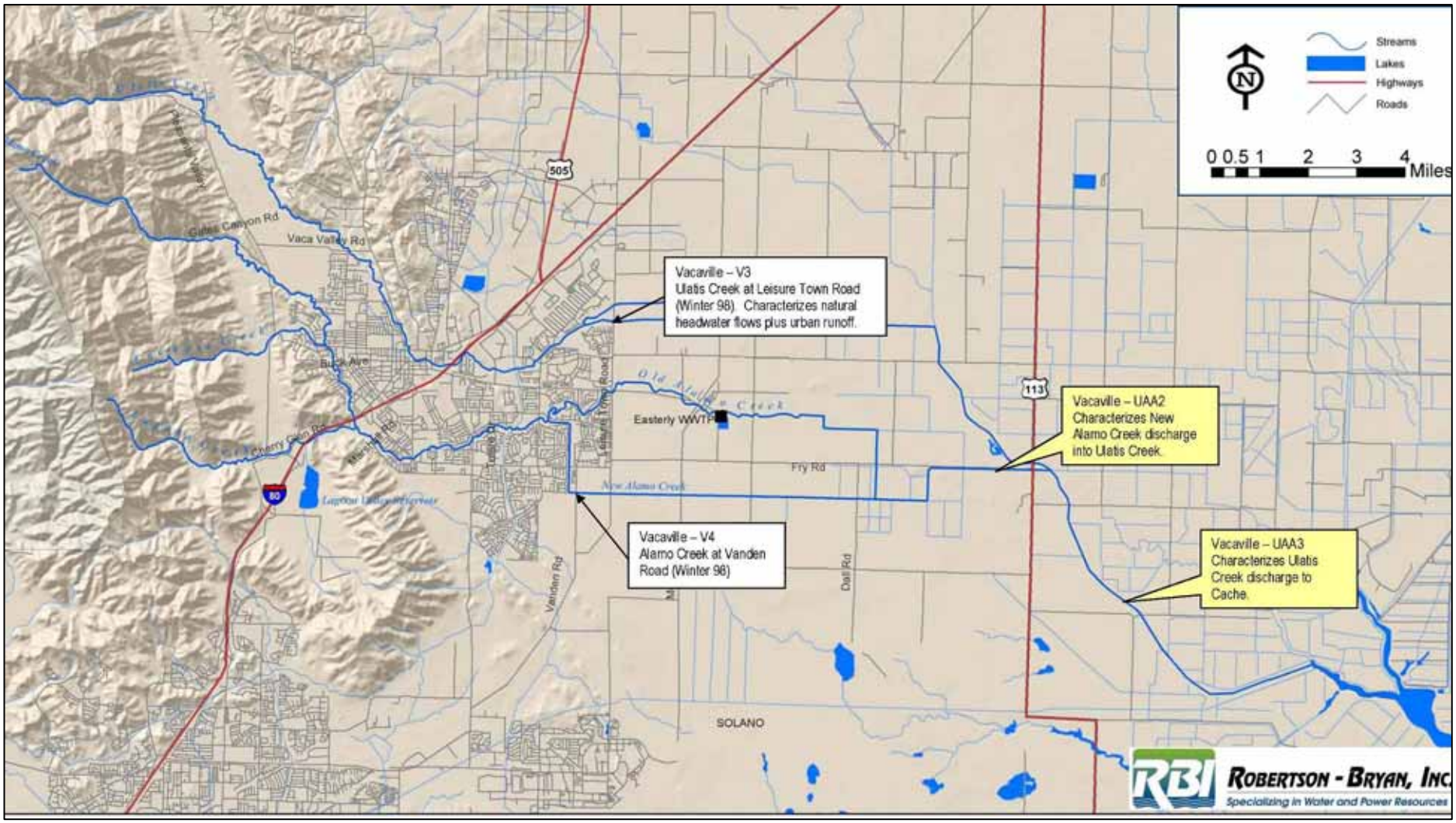


Figure 13. Stream gauge locations.

4.2 Existing and Historical Drinking Water Uses

Existing and historical drinking water uses were determined through a search of water rights records, a physical survey of the UAA study segments for diversion systems, and interviews with agency and City of Vacaville staff and local residents. The State Water Board's Water Rights Division performed a water rights search of the Ulatis Creek watershed to identify all permitted/licensed surface water rights in 2004 (State Water Board 2004). In July 2007, Robertson-Bryan, Inc. performed a follow-up search, by accessing the online database of water rights (WRIMS 2007), to identify any new water rights in the Ulatis Creek watershed during the period 2004-June 2007.

Physical surveys of the UAA study segments were conducted on June 23, and July 8, 27, and 28, 2004 with a follow up survey on July 5, 2007. The creeks were surveyed for pipes and pumps that would indicate an existing or historical diversion of water to an adjacent home for domestic use.

The findings from this research are presented in *Use Attainability Analysis for New Alamo Creek and Ulatis Creek, Technical Memorandum No. 2, Existing Municipal and Domestic Uses of Alamo Creek, Ulatis Creek, and Cache Slough* (RBI 2007b).

4.3 Easterly WWTP Effluent Dilution

Flow Science, Inc. performed field studies to evaluate the fate and dilution of Easterly WWTP effluent within the UAA study segments under a range of seasonal conditions. Dilution studies were conducted using two tracers (rhodamine WT and lithium) in November 2003 (dry conditions, no irrigation), in March 2004 (wet season, no irrigation), and in July 2004 (dry season, significant irrigation). Two tracers were used so that the rate of rhodamine dye loss (dye decay) over time could be estimated, and to improve the accuracy of the estimated effluent dilution ratios at various points throughout the system. Concentrations and mass fluxes of the two tracers were measured at various locations within the creek system and within Cache Slough, to which Ulatis Creek is tributary. Field study results include effluent concentrations throughout the system and estimates of dye decay rates.

Dye loss results from these studies also were used to adjust and interpret results from a 1990-1991 rhodamine dye study conducted by the City of Vacaville. The 1990-1991 studies measured rhodamine concentrations within Cache Slough (but not within the creek system), and these studies did not directly account for dye loss due to either dye decay or effluent pump out within the system over the period of time that dye concentrations were monitored. Results from the new tracer dilution studies, coupled with adjusted results from the 1990-1991 dye study, were used to estimate the seasonal proportion of flow in the system that consists of Easterly WWTP effluent.

This study is described in *Technical Memorandum No. 3, Easterly Wastewater Treatment Plant Effluent Dilution Analysis in Support of Potential Basin Plan Amendments for Defined Reaches of New Alamo Creek, Ulatis Creek and Cache Slough, Solano County, California* (Flow Science 2005).

4.4 Water Quality

Water quality data collected in the New Alamo Creek and Ulatis Creek watersheds were compiled to characterize the levels of contaminants of concern to drinking water supplies that are known to be contributed by the nonpoint and point sources identified in the watershed. Specifically, data were compiled for nitrate, total dissolved solids (TDS), pathogens, pesticides, THM compounds, and organic carbon. Sources of the data included monitoring conducted by the City of Vacaville and the Sacramento Valley Water Quality Coalition. These data are summarized in *Use Attainability Analysis for New Alamo Creek and Ulatis Creek, Technical Memorandum No. 4, Water Quality Characteristics of Alamo Creek, Ulatis Creek, and Cache Slough* (RBI 2007c).

5 EVALUATION OF MUN ATTAINABILITY

5.1 Is MUN an Existing Use?

5.1.1 Has the Use Occurred Since November 28, 1975?

A search of the State Water Board water rights records for Ulatis Creek and all of its tributaries revealed the following findings (RBI 2007b):

- There are a total of 65 water rights that have been filed with the State Water Board on Ulatis Creek or its tributaries, which include Alamo Creek, Laguna Creek, Encinosa Creek, McCune Creek, Sweeny Creek and a number of other named and unnamed smaller tributaries.

- Only two water rights exist for the purpose of domestic uses, D030686R and S009276, both of which are located in the upper reaches of Ulatis Creek, upstream of the UAA study segment for this water body.

- No water rights for domestic water uses exist within the UAA study segments. Only irrigation water rights exist within the UAA study segments, for both New Alamo Creek and Ulatis Creek.

Field surveys of the UAA study segments conducted in June and July 2004, and July 2007 to identify residents capable of diverting surface water for domestic use from New Alamo and lower Ulatis Creek (below the confluence of New Alamo Creek) revealed the following findings (RBI 2007b):

- There are nine residential dwellings adjacent to New Alamo Creek and none adjacent to the UAA study segment for Ulatis Creek.

- Only one parcel has a small privately operated pump capable of diverting surface water from New Alamo Creek; however, this diversion lead to a ditch in a field, indicating that

diverted water is used for irrigation purposes. This was confirmed by interviewing this landowner (RBI 2007b, Appendix B).

- All other diversions are operated by Solano Irrigation District or Maine Prairie Water District for irrigation uses.

Interviews were held with DHS, Solano County Department of Resources Management, Solano County Resource Conservation District, Solano Irrigation District, Solano County Water Agency, Dixon Resource Conservation District, and Maine Prairie Water District staff and with rural residents living adjacent to New Alamo Creek to determine whether municipal or domestic use of UAA study segment water has occurred at any time since November 28, 1975. All parties interviewed indicated that they are not aware of any current or past municipal or domestic use of water diverted from the UAA study segments (RBI 2007b).

The water rights records, field surveys, and interviews indicate that the MUN use has not occurred in the UAA study segments since November 28, 1975.

5.1.2 Has Water Quality Been Sufficient to Allow the Use to Occur Since November 28, 1975?

Current water quality conditions within the UAA study segments are characterized in Section 2. As stated in Section 2, the human-caused contamination of the water quality within New Alamo Creek and Ulatis Creek, which is dictated by the primary sources of the water being agricultural drainage water, agricultural and urban storm water runoff, and the Easterly WWTP, is currently precluding the MUN use from being attained in the UAA study segments. The Easterly WWTP began discharging treated effluent at its current location in 1959. Although its discharge rate was lower in 1959, relative to current conditions, so too was its effluent quality lower than that which exists presently. In the early 1960s, the Ulatis Soil Conservation District, Solano Irrigation District, and Solano County Flood Control and Water Conservation District jointly developed the "*Watershed Work Plan: Ulatis Creek Watershed*" to reduce flooding of the agricultural properties within the Ulatis Creek watershed (Ulatis Soil Conservation District et al. 1961). The improvement works identified in the 1961 Ulatis Creek Watershed Work Plan consisted of: 1) land treatment measures (e.g., conservation cropping system, proper range use, pasture plantings) and 2) structural measures. The structural measures included "*…improvement or realignment of 51.9 miles of floodwater channels together with the construction of drop and grade stabilization structures and inlet structures to convey local runoff into the channels."* Hence, the routing of storm water runoff from agricultural and urban lands into the UAA study segments has occurred since the early 1960s. Moreover, since the channel realignments were completed in the 1960s, the UAA study segments have been used to convey agricultural return flows during the irrigation season. Finally, the natural precipitation-driven hydrology of these segments (see Section 5.2.1) is believed to have remained similar throughout the 1975-present period.

Because the combined factors that currently make water quality within the UAA study segments unsuitable for the MUN use have occurred throughout the November 28, 1975 to present period, it can be concluded that water quality within the UAA study segments has never been sufficient to allow the MUN use to occur since November 28, 1975.

Based on the information presented in Sections 5.1.1 and 5.1.2, it is concluded that MUN is not an existing use.

5.2 Is MUN an Attainable Use?

The regulations at 40 CFR § 131.10(g) specify six factors that may provide the legal basis for changing or removing a designated use. As discussed below, the factors that apply to the attainability of the MUN use in the UAA study segments are:

- Natural, ephemeral, intermittent and low flow conditions or water levels prevent the attainment of the use, and cannot be compensated for by the discharge of sufficient volume of effluent discharges (40 CFR § 131.10(g)(2));
- Human caused conditions and sources of pollution prevent the attainment of the use and cannot be remedied (40 CFR § 131.10(g)(3)); and
- Hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water bodies to their original condition (40 CFR § 131.10(g)(4)).

The following sub-sections provide information and discussion that serve as the basis for determining whether these factors preclude the attainment of the MUN use within the water body segments. Among the key considerations discussed below are:

- seasonal sources of water to the segments,
- human sources of contamination of water quality within the segments,
- modifications to channels to convey runoff from adjacent urban and agricultural lands,
- costs to POTWs to upgrade treatment processes to meet current water quality standards and effect on attainability, and
- availability of alternative, higher quality water sources within the area for MUN use.

Treatment upgrades required at the Easterly WWTP are identified and compared to treatment trains needed to meet effluent limits under sections 301(b)(1)(A) and (B) and section 306 of the CWA.

5.2.1 Hydrologic Conditions

The hydrologic characteristics of New Alamo Creek and Ulatis Creek are described below according to precipitation season, non-precipitation season, and non-irrigation/non-precipitation season. These periods were chosen because they represent distinct hydrologic regimes of these creeks.

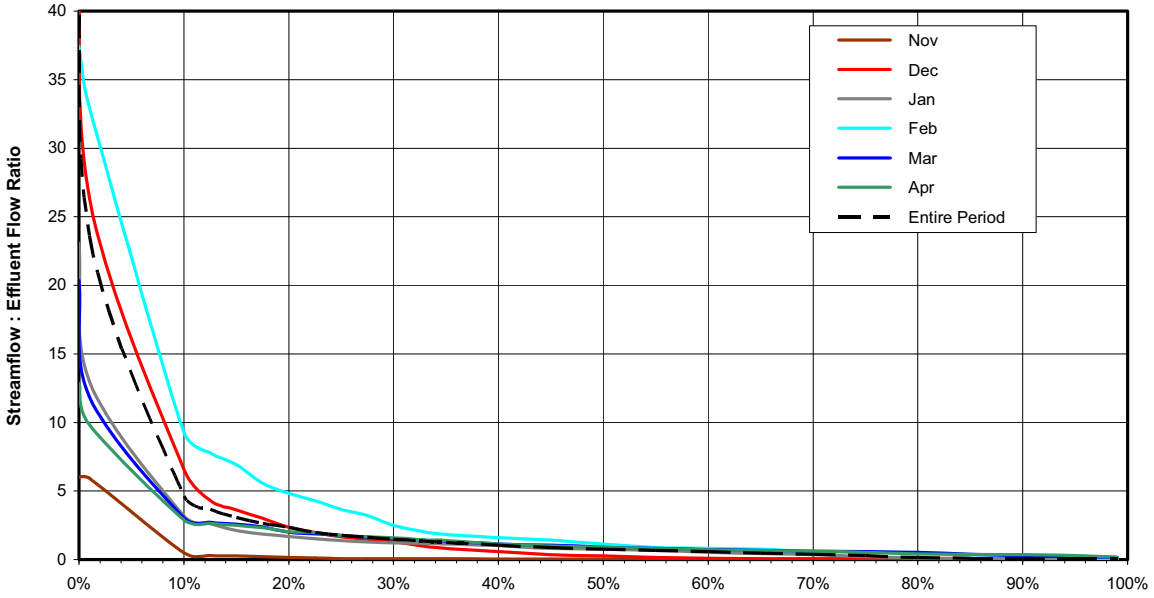
Precipitation Season

During the precipitation season (i.e., primarily November through April), the water in lower New Alamo Creek and Ulatis Creek is comprised of runoff from the upper watershed, urban runoff, runoff from agricultural lands, and Easterly WWTP effluent (RBI 2007a). The relative fraction of effluent throughout the precipitation season varies depending on the size of each storm event and the frequency and size of antecedent storms. The dilution study found the portion of Easterly WWTP present in March 2004 to be approximately 50% of the flow in New Alamo Creek and 25% of the flow in Ulatis Creek (Flow Science 2005). **Figure 14** demonstrates that there are periods when the flow in New Alamo Creek is largely runoff from the watershed lands, and that there are periods when very little flow is contributed by the watershed and most of the flow is Easterly WWTP effluent. For the period 1998-2006, the dilution ratio (New Alamo Creek flow:WWTP flow) was 5:1 or less approximately 90% of the time (Figure 14). As shown in **Figure 15**, the Easterly WWTP effluent is a smaller fraction of the Ulatis Creek flow as compared to New Alamo Creek (RBI 2007a). For the period 1998-2006, the dilution ratio (Ulatis Creek flow:WWTP flow) was 10:1 or less approximately 80% of the time and was 5:1 or less approximately 60% of the time (Figure 15).

Non-precipitation Season

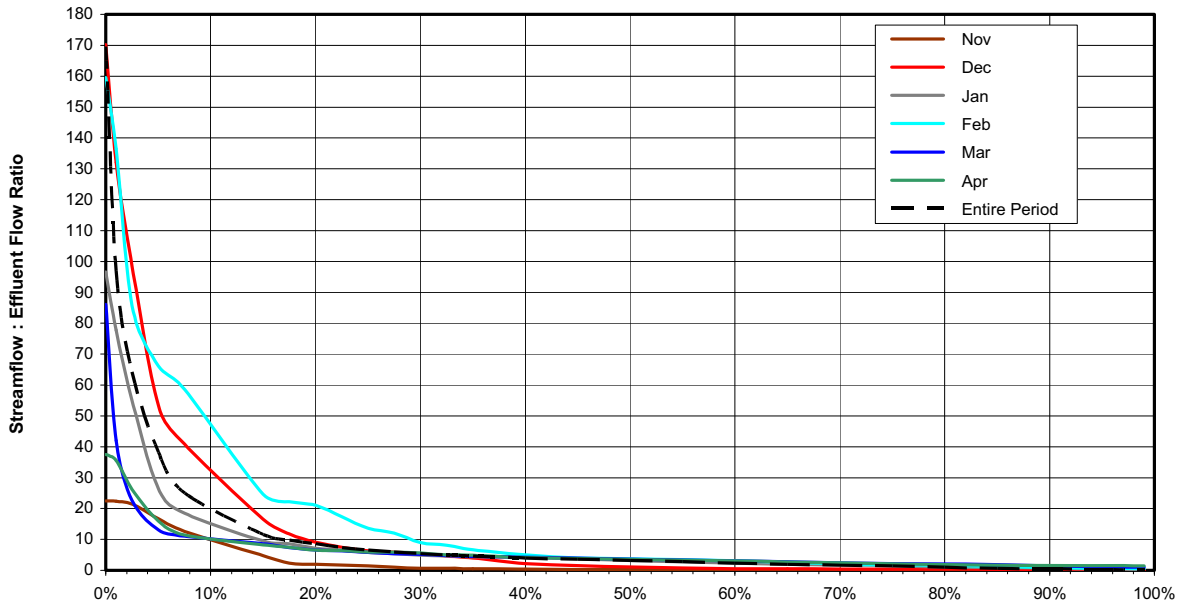
Natural base flow in the UAA study segments annually goes to zero, typically in June, and remains in a zero-flow condition until adequate rains have occurred, typically in November (RBI, 2007a). During the irrigation season (Mid-April through October), significant inflows of agricultural drainage and irrigation water enter lower New Alamo Creek and Ulatis Creek, and significant volumes are pumped out of the creeks. Additional inputs to the creeks include urban runoff and Easterly WWTP effluent. A schematic of flow measurements recorded July 27, 2004 on New Alamo Creek and Ulatis Creek, provided in **Figure 16**, illustrates the relative contribution of these sources. On this day, which is typical of operations throughout the irrigation season, there was no flow input to either New Alamo Creek or Ulatis Creek from the upper watershed. Of the 35 cfs of flow in New Alamo Creek downstream of the Old Alamo Creek confluence, 11 cfs (31%) came from the Easterly WWTP, 23.5 cfs (67%) came from agricultural drainage water, and 0.5 cfs (2%) came from urban runoff. Additional inputs to Ulatis Creek included approximately 5 cfs of water (agricultural drainage water or Solano Project inputs) plus 23 cfs of agricultural drainage water.

Within Ulatis Creek, Easterly WWTP effluent comprises a relatively smaller fraction of the total flow, as compared to New Alamo Creek. This is a result of the additional inputs of irrigation and drainage water to Ulatis Creek, and pump out of water on New Alamo Creek and Ulatis Creek for irrigation of adjacent agricultural lands. A dilution study conducted at the same time the flow measurements were conducted found that Easterly WWTP effluent was 5% of the flow in Ulatis Creek at Brown Road, with the remainder of flow constituted by imported irrigation water, agricultural drainage water, and urban runoff (Flow Science 2005).



Source: RBI 2007a.

Figure 14. Approximate dilution ratio of Easterly WWTP effluent in New Alamo Creek immediately below confluence of Old Alamo Creek for water years 1998–2006.



Source: RBI 2007a.

Figure 15. Approximate dilution ratio of Easterly WWTP effluent in Ulatis Creek immediately below confluence of New Alamo Creek for water years 1998–2006.

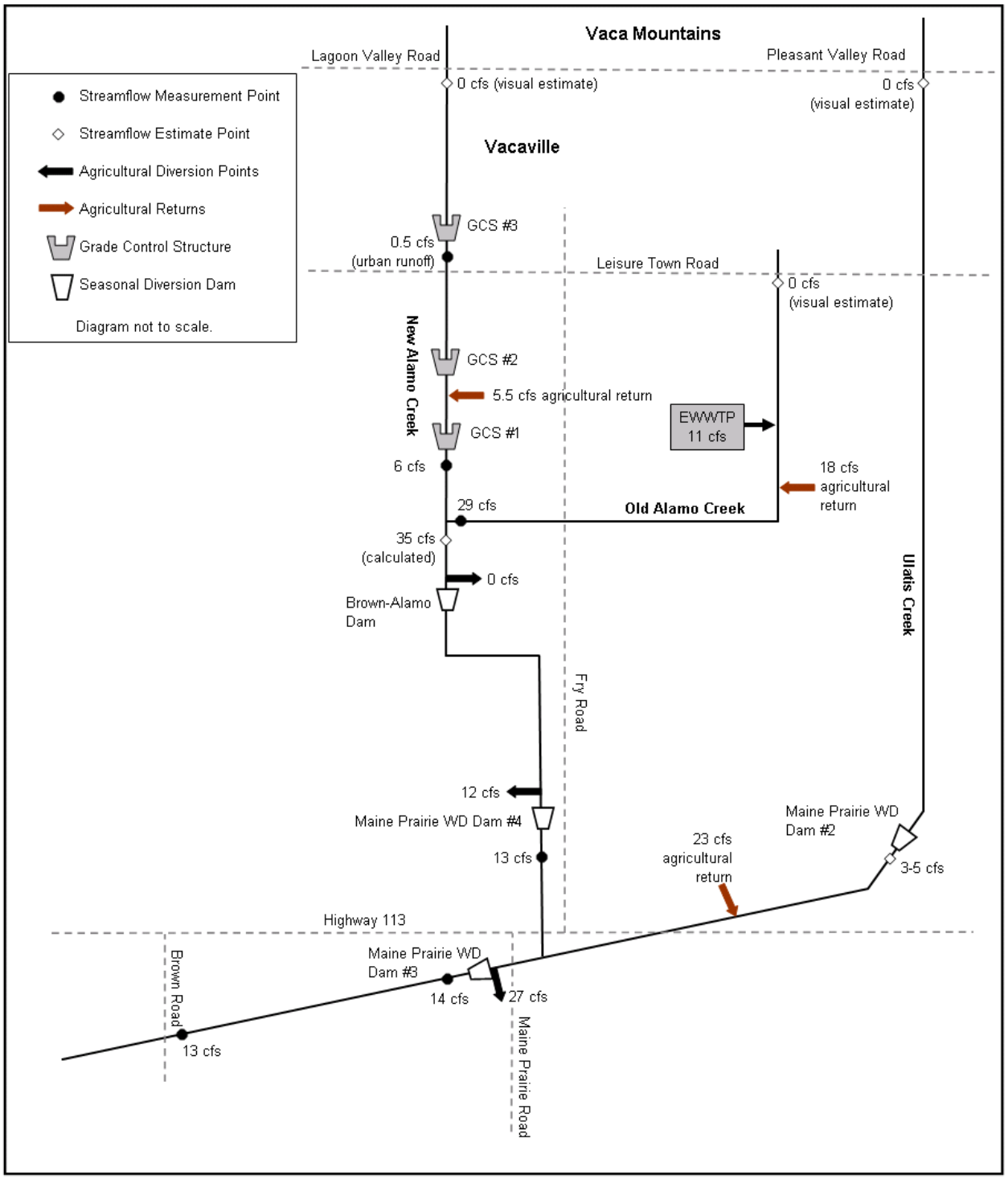


Figure 16. Schematic of New Alamo Creek and Ulatis Creek flow measurements and diversions for July 27, 2004.

The watershed hydrology precludes the MUN use during the non-precipitation season, because there is no natural flow within the UAA study segments that could be diverted for MUN use during this time of year (RBI 2007a). The water that does flow within the UAA study segments during the non-precipitation season is constituted by: 1) Easterly WWTP effluent; 2) fully-allocated irrigation and agricultural drainage water; and 3) urban runoff. These source waters are either already allocated for irrigation uses or are not of a source or of a quality to be suitable to serve as MUN source water, or both. The latter is particularly true when acknowledging that alternative, higher quality MUN water sources are available for municipal and domestic uses (i.e., North Bay Aqueduct, Lake Berryessa, groundwater). The cities of Vacaville and Vallejo rely upon North Bay Aqueduct and Lake Berryessa water sources and local residents rely upon higher quality groundwater.

Non-irrigation and Non-precipitation Season

In the fall, prior to the initiation of precipitation and runoff, but when irrigation activities have ceased, the flow in the UAA study segments is primarily Easterly WWTP effluent and urban runoff. A dilution study conducted in November 2003 found that the flow in New Alamo Creek at Brown-Alamo Dam was nearly 100% effluent, and that approximately 50% of the flow in Ulatis Creek at both Maine Prairie Road and Brown Road was Easterly WWTP effluent (Flow Science 2005).

5.2.2 Water Quality

Water Quality Effects on Locating the North Bay Aqueduct Diversion Intake

In 1982, the U.S. Army Corps of Engineers and the California Department of Water Resources (DWR) released their final ES/EIR for the planned Phase II facilities of the North Bay Aqueduct (NBA). In early 1984, concerns were raised regarding: 1) the quality of Cache Slough water (the selected location for the Phase II NBA intake) relative to higher water quality at alternative locations within the Delta evaluated in the ES/EIR, and 2) the declining quality of Cache Slough water. The DWR initiated a re-assessment of NBA Phase II alternatives in mid 1984 to further examine water quality in the vicinity of Cache Slough and to investigate possible alternatives for improving water quality for the NBA. The report produced from this assessment, titled: *North Bay Aqueduct Water Quality Improvement Alternatives,* was issued in October 1984 (DWR 1984).

At the time this re-assessment was performed by DWR, the current plan was to locate the Phase II NBA diversion intake in Cache Slough and to relocate the City of Vacaville's Easterly WWTP's discharge from Alamo Creek (a tributary to Cache Slough) to the Lindsey Slough basin. Based on DWR's assessment, it determined Cache Slough water quality, absent Easterly WWTP's effluent, would be of lower quality than water diverted from Barker Slough, a tributary of Lindsey Slough. DWR's recommendation from its 1984 reanalysis was: 1) locate the NBA diversion intake in Barker Slough rather than Cache Slough; 2) incorporate relocation of the City of Vallejo intake (then at Cache Slough) into the design of the new Barker Slough NBA intake; and 3) leave the City of Vacaville's Easterly WWTP discharge at its current location of Alamo

Creek, which is tributary to Cache Slough. DWR's three recommendations listed above were accepted and implemented.

Water Quality Conditions

Data indicate that the UAA study segments are not currently meeting drinking water quality standards for a number of constituents, and are expected to have other characteristics (e.g., pathogen levels) that make the water unsuitable for MUN use. Primary factors causing this condition are area agricultural and urban land uses and Easterly WWTP discharges. Such conditions are expected to have occurred since November 28, 1975. Potential watershed contaminant sources in the New Alamo Creek and Ulatis Creek watersheds include drainage from agricultural lands used for grazing and crop production, urban runoff, as well as effluent discharges from the City of Vacaville's Easterly WWTP. Agricultural land uses comprise approximately 57% of the New Alamo Creek watershed, and approximately 80% of the Ulatis Creek watershed (California Department of Forestry & Fire Protection 2002). Urban land uses comprise approximately 18% of the New Alamo Creek watershed, and approximately 9% of the Ulatis Creek watershed (California Department of Forestry & Fire Protection 2002).

Contaminants associated with agricultural activities with the potential to runoff into New Alamo Creek and Ulatis Creek include sediment (soil), nutrients, pathogens, pesticides, metals, salts, and organic carbon (U.S. EPA 2005, Tetra Tech 2006a). Contaminants commonly found in urban runoff include: trash; sediment; oil, grease, and toxic chemicals from motor vehicles; pesticides and nutrients from lawns and gardens; viruses, bacteria, and nutrients from pet waste and failing septic systems; and heavy metals from roof shingles, motor vehicles, and other sources (U.S. EPA 2003a; Tetra Tech 2006b). Urban land uses also contribute organic carbon to runoff (Tetra Tech 2006a).

A review of water quality data collected in New Alamo Creek, Ulatis Creek, and Cache Slough revealed the following (RBI 2007c).

Pathogens

E. coli, total coliform, and fecal coliform levels in New Alamo Creek, Ulatis Creek, and Cache Slough are orders of magnitude higher than levels in the Easterly WWTP effluent, indicating that the greater watershed land uses are the primary sources of these pathogens. Fecal coliform levels often exceed 1,000 MPN/100 ml within the UAA study segments, with total coliform bacteria levels recorded as high as >24,200 MPN/100 ml (RBI 2007c). Total coliform levels in the Easterly WWTP effluent are required to be maintained at levels that are orders of magnitude lower than those cited above. No data exist for other pathogens such as viruses and protozoans in the UAA study segments. Treated wastewater effluent and agricultural drainage water may contain other human pathogens including the protozoans *Cryptosporidium* and *Giardia*, both of which have maximum contaminant level goals of zero. The extensive agricultural land uses, including the Fry Ranch, which maintains an intensive cattle operation, likely load these protozoans to the UAA study segments (**Figure 17**). Other pathogens, such as viruses (e.g., poliovirus and hepatitis virus), and a variety of nematode and trematode parasites may also occur, for which no numeric criteria have been established to protect MUN-designated waters.

Figure 17. Discharge from Ferrara Ranch into New Alamo Creek, 0.8 miles upstream of confluence with Ulatis Creek.

Given the high percentage of agricultural land uses surrounding the study segments and the WWTP effluent, it is highly likely that these other pathogens occur in the UAA study segments, increasing the risk to human populations that might depend on this water as a domestic or public water supply (RBI 2007c, Tetra Tech 2004).

Nitrate

Nitrate often exceeds the drinking water MCL within lower New Alamo Creek and Ulatis Creek. Nitrate is contributed by agricultural drainage water, as well as the Easterly WWTP. Infants below the age of six months that drink water containing nitrate in excess of the MCL could develop methemoglobinemia or "blue-baby syndrome," which can be lethal (Greer et al. 2005). Data presented in RBI (2007c) and Tetra Tech (2004) demonstrate that significant concentrations of nitrate are contributed by the surrounding agricultural uses.

Organic Carbon

Organic carbon concentrations generally exceed the 2 milligrams per liter (mg/L) threshold of the Stage 1 Disinfectants and Disinfection Byproduct Rule, which requires drinking water utilities to reduce total organic carbon concentrations by specified percentages prior to adding disinfectants. The greater watershed land uses (agricultural, urban, natural) and the Easterly WWTP are sources of organic carbon to the water body segments. The organic carbon levels that exist in the UAA study segments raise concerns regarding the formation of disinfection by-products should this water be disinfected using chlorination for MUN use (RBI 2007c).

Total Dissolved Solids (TDS)

TDS concentrations and electrical conductivity (EC) levels often approach and sometimes exceed their secondary MCLs during the irrigation season in lower New Alamo Creek and Ulatis Creek. TDS and EC are elevated in these segments by agricultural drainage flows and by the Easterly WWTP discharge (RBI 2007c).

Pesticides

While pesticides are used extensively in the New Alamo Creek and Ulatis Creek watersheds, available data shows their concentrations to be less than primary drinking water MCLs for those pesticides with MCLs (RBI 2007c). Nevertheless, more monitoring would be required to fully characterize the pesticide levels in the study segments. Certain toxic pesticides are used in fairly high quantities within the watershed by Solano Irrigation District, including chlorpyrifos, diuron, 2-4 D, paraquat, and carbamate (Tetra Tech 2004). These pesticides are used on tomatoes, alfalfa, rights-of-way, and for structural pest control. Tetra Tech (2004) reported these applications used 378,785, 80,925, 100,595, and 28,459 pounds of pesticides, respectively, much of which was comprised of toxic chemicals such as those listed above. MCLs for these pesticides have not been established, except for 2-4 D (0.07 mg/L). Those pesticides that do have MCLs are generally near zero. Many of the pesticides listed above cause nervous system diseases leading to respiratory and circulatory problems. Chlorpyrifos, paraquat, and carbamate all are cholinesterase inhibitors that cause neurological dysfunction, labored breathing, and coma

at elevated, but sub-lethal levels of exposure. Under short-duration, lower-level exposure, all of the above pesticides can cause nausea, diarrhea, and skin irritations (Tetra Tech 2004).

Trihalomethanes (THMs)

THM compounds are present in the lower reaches of New Alamo Creek and Ulatis Creek at levels exceeding CTR human health criteria for the consumption of water and organisms. At the defunct Vallejo Pump Station, just into Cache Slough, CTR criteria for THMs are not exceeded. Chloroform concentrations in New Alamo Creek and downstream water bodies do not exceed the 2003 draft U.S. EPA human health criteria, but do exceed chloroform criteria derived from Office of Environmental Health Hazard Assessment (OEHHA) thresholds. Total THM concentrations are less than the drinking water MCL. The Easterly WWTP is the primary source of THMs in the UAA study segments (RBI 2007c).

The quality of source water dictates the level of treatment necessary for MUN uses to protect human health from contaminants of concern. The primary contaminants of concern in New Alamo Creek and Ulatis Creek that would need, at a minimum, to be addressed through drinking water treatment technologies are pathogens, nitrate, THMs, organic carbon, and possibly pesticides. Pathogens (e.g., *Cryptosporidium*, *Giardia lamblia*, *E. coli*) are of concern, because of their potential to cause gastrointestinal illness. Nitrate is of concern, because of its potential to cause methemoglobinemia, known as "blue-baby syndrome." THMs are of concern, because they are carcinogens. Organic carbon is of concern because it reacts during chlorination of MUN water supplies to form disinfection byproducts, including THMs and halogenated compounds, which are carcinogens. It should be noted that discharges from the Easterly WWTP do not cause exceedances of any adopted water quality criteria or objectives within Cache Slough, as measured at the defunct Vallejo Pump Station (RBI 2007c).

The actual source of the water also dictates the level of treatment necessary for drinking water. During much of the year, the primary sources of water to the UAA study segments are agricultural drainage water, urban runoff, and Easterly WWTP effluent. DHS developed Policy 97-005 to address the drinking water use of such waters, which it classifies as "extremely impaired" source waters (DHS 1997). DHS will not approve use of an extremely impaired source water if another source water of lesser risk to human health is available. DHS has already opposed future drinking water uses of Cache Slough by the City of Vallejo at its now defunct Vallejo Pump Station due to poor microbiological water quality (DHS 1995). DHS cites the surrounding land uses, primarily agricultural activities, as the basis of its concerns. In its letter to Mr. Tompkins of the City of Vacaville dated January 27, 1995, DHS stated, "*While we do not believe it is appropriate to withdraw drinking water downstream of a wastewater treatment plant discharge, no matter how highly treated, there is good reason to believe that water quality in Cache Slough would remain very poor even if Easterly Wastewater Treatment Plant effluent were removed from it. Water quality in Cache Slough remained poor during previous water quality monitoring conducted when the Easterly plant was not discharging treated effluent upstream*." (RBI 2007c). DHS concerns would be even greater for waters within the UAA study segments, which are primary source waters to the Vallejo Pump Station site, and which lack the dilution from other sources waters found within Cache Slough at the Vallejo Pump Station. This DHS position was confirmed by Ms. Leah Walker of the DHS, who, when attending the

Regional Water Board's California Environmental Quality Act scoping public meeting for this UAA/standards setting project on June 28, 2007 stated that the DHS supports the dedesignation of MUN from the UAA study segments.

The human-caused contamination of the water quality within New Alamo Creek and Ulatis Creek, which is dictated by the primary sources of the water being agricultural drainage water, agricultural and urban storm water runoff, and the Easterly WWTP, is currently precluding the MUN use in the UAA study segments. While DHS policy is not entirely determinative of whether MUN is attainable, it serves as an indication that other available sources (e.g., groundwater, North Bay Aqueduct, Lake Berryessa) would better and much more likely serve the municipal supply of cities in the region and domestic supply of homeowners adjacent to the creeks.

5.2.3 Potential for New Diversions

Attainment may be assessed either by pollutant concentrations present in a water body or by identifying an entity that has or will employ the water for the beneficial use. Even if known chemical and pollutant concentrations met all relevant criteria and objectives, it is unlikely that any person or population would directly employ the UAA study segments of New Alamo Creek or Ulatis Creek as a source of drinking water in light of the quality of the water within these segments, the primary sources of the water, and the fact that higher quality alternative sources are available within the area.

The only municipality in the vicinity that might consider use of either New Alamo Creek or Ulatis Creek as a water supply is the City of Vacaville. The City's water supplies consist of groundwater, Solano Project water, and the Delta via the North Bay Aqueduct (SCWA 2004). The City's supplies have been evaluated as part of its 2005 Urban Water Management Plan and it has been determined that these supplies are in excess of the General Plan buildout demand (Nolte Associates 2005). Neither New Alamo Creek nor Ulatis Creek are identified as sources of drinking water for the City of Vacaville currently, or in the future.

The likelihood of a riparian diversion for MUN is similarly remote. Riparian water rights attach only to the natural flow of a stream, not to "foreign" or imported water supplies, including agricultural drainage from imported water. Thus, any riparian right holder, existing or future, with a desire to use the water within the UAA study segments of New Alamo Creek and Ulatis Creek for MUN would have the right only to the natural flow of the creek and of the tributaries that enter into the creek above the riparian right holder's land.

As described in Section 5.2.1, natural flow is only available seasonally. Individuals are unlikely to pay for installation of diversion and treatment systems suitable to be permitted for MUN use of water diverted from the UAA study segments when such systems could not provide the individual's water supply during the non-precipitation season when no natural base flow is available. Moreover, riparian water rights holders along small water bodies such as these typically exercise their riparian rights for irrigation water supply, not MUN water supply, particularly when abundant, higher quality groundwater is available. In this situation, a well or municipal supply also would be required to obtain a year-round, safe, dependable MUN supply

to the home. With a well or municipal supply in place for use during much of the year, there becomes no need for a surface water diversion from the UAA study segments during the precipitation season of the year. Use of the well or City municipal supply year-round would be easier and more cost-effective for the individual than would installing the diversion, storage, and treatment system necessary to be permitted for MUN use of the diverted water under any riparian right that may exist. None of the residents interviewed along New Alamo Creek have in the past, are currently, or are planning in the future to utilize a riparian water right to produce a legal, permitted, MUN supply to their residence (RBI 2007b, Appendix B). As stated previously, there are no residents living immediately adjacent to the segment of Ulatis Creek under consideration in this UAA.

A further constraint on the use by adjacent landowners of flows within the UAA study segments is the fact that they must obtain a water rights permit for use of any foreign or imported water. (*Stevinson Water District v. Roduner* (1950) 36 Cal.2d 264, 223 P.2d 209) It is not likely that a water rights permit would be granted for municipal or domestic use of waters within the UAA study segments. New Alamo Creek and Ulatis Creek are eventually tributary to, or within, the Delta. The Delta and its tributaries, from the Delta upstream, have been designated as fully appropriated during the period June 15 to August 31. As such, a water right application for use of water during this period would not be accepted. (Wat. Code §§ 1205(b) and 1206.) Any application pending, as of the date of designation, for use during that period, may be cancelled. (Wat. Code § 1206(a).). As stated above, if use of a riparian water right cannot result in a year-round, cost-effective, safe, and dependable MUN supply to the home, in part because it could not be utilized during most of the irrigation season due to lack of natural base flow and the fully appropriated nature of Delta waters, there exists little to no reason for an individual, in this situation, to attempt to exercise a riparian right for MUN supply, assuming such rights exist.

5.2.4 Economic Considerations

CWA § 301(b)(1)(B) requires POTWs to meet secondary treatment standards. Secondary treatment standards are defined by numeric effluent limitations for 5-day biochemical oxygen demand, suspended solids, and pH (40 CFR § 133.102). More stringent limitations beyond those required to meet the definition of secondary treatment may be incorporated, if necessary, to achieve certain water quality standards (CWA § 301(b)(1)(C)).

The only POTW with a point source discharge that flows into the UAA study segments of New Alamo Creek and Ulatis Creek is the City of Vacaville's Easterly WWTP. The Easterly WWTP currently meets the CWA Section 301 requirements for the secondary treatment of wastewater. Because of the current designation of New Alamo Creek and Ulatis Creek with the MUN use, the following water quality criteria are among those that apply to these water bodies:

- Bromoform – 4.3 µg/L
- Dibromochloromethane – 0.41 µg/L
- Dichlorobromomethane – 0.56 µg/L

- Nitrate – 10 mg/L (as nitrogen)

The additional treatment processes that the City would be required to install and operate at the Easterly WWTP to not cause exceedance of these criteria in either New Alamo Creek or Ulatis Creek include:

- Expanded effluent storage, primary treatment, and secondary treatment facilities
- Membrane filtration
- Reverse osmosis
- Ultraviolet disinfection

Construction of treatment plant upgrades to comply with THM limits would cost the City approximately $171.7 million (in year 2007 dollars) (West Yost Associates 2007).

5.2.5 Factors Precluding Attainment of MUN

Because there is little or no natural flow input from the upper watershed during the irrigation season (i.e., generally from late-May/early-June through October), MUN is not an attainable use during this time of year simply because there is no natural base flow to use. Thus, natural flow conditions during approximately half the year prevent attainment of the use, because no base flow exists to support the use (40 CFR § 131.10(g)(2)).

During the non-precipitation season, not only is there no natural base flow to support the MUN use, the water that is present in the UAA study segments is comprised of Easterly WWTP effluent, agricultural drainage water, imported fully-allocated irrigation water, and urban runoff. Hence, the water that may be available (i.e., Easterly WWTP effluent and urban runoff) is of an unsuitable source and quality for MUN use (DHS 1995; DHS 1997; L. Walker, DHS, pers. comm., June 28, 2007). The surrounding agricultural and urban land uses that result in the available sources of poor quality water to the UAA study segments cannot be changed in a manner that would make the available water suitable for MUN use. Consequently, human caused conditions or sources of pollution during the non-precipitation period of the year also prevent the attainment of the MUN use and cannot be remedied (40 CFR § 131.10(g)(3)).

Hydrologic modifications resulting from the Ulatis Creek Watershed Protection and Flood Prevention Project in the early 1960s have resulted in the UAA study segments being used for collecting and conveying storm water runoff from adjacent urban and agricultural lands during the precipitation season (i.e., generally from late-October/November through May). Consequently, highly impaired source water conditions exist during the precipitation season. Although agricultural drainage water is not present during the precipitation season, storm water runoff from adjacent urban and agricultural lands and Easterly WWTP effluent is present. The Ulatis Creek watershed work of the early 1960s resulted in the UAA study segments being modified to collect and convey storm water runoff from adjacent urban and agricultural lands to minimize the flooding of these lands. Only during short periods (e.g., hours to days) surrounding large precipitation events does natural runoff from upper watershed areas adequately dilute these

other low quality source waters to produce water quality conditions within the UAA study segments that is potentially suitable for MUN use. As stated previously, for the period 1998-2006, the dilution ratio (New Alamo Creek flow:WWTP flow) of Easterly WWTP effluent in the New Alamo Creek segment was 5:1 or less approximately 90% of the time during the precipitation season (Figure 14). During this same period, the dilution ratio (Ulatis Creek flow:WWTP flow) of Easterly WWTP effluent in the Ulatis Creek segment was 10:1 or less approximately 80% of the time and was 5:1 or less approximately 60% of the time (Figure 15). Water having these characteristics is unsuitable for MUN supply, particularly when higher quality alternative sources are available within the area (DHS 1995; DHS 1997; L. Walker, DHS, pers. comm., June 28, 2007). The justifications provided by DHS for discouraging the use of Cache Slough water by the City of Vallejo (DHS 1995, 1997) are compounded for the UAA study segments, because UAA study segment water is a primary source water to the Vallejo Pump Station site, yet it does not receive any or as much dilution with higher quality Cache Slough water compared to waters at the Vallejo Pump Station site.

The infrequent occurrence of available water of suitable water quality within the UAA study segments during the precipitation period of the year (i.e., a matter of days to weeks in a given year) is inadequate to justify attainment of the MUN use seasonally. Thus, human-caused conditions and sources of pollution (including system hydrologic modifications resulting from the Ulatis Creek watershed work of the early 1960s which routed additional urban and agricultural storm water runoff into newly constructed channels to rapidly drain surrounding lands) prevent the attainment of the use throughout the precipitation season as well, and cannot be remedied or operated in a manner that would attain the use (40 CFR § 131.10(g)(3), as affected, in part, by 131.10(g)(4)). Human health concerns associated with UAA study segment waters are primarily pathogen related. This would be the case regardless of whether the Easterly WWTP effluent discharge met all drinking water MCLs and CTR human health criteria (DHS 1995).

5.3 Is Restoration to an Attainable Use Condition Feasible?

The following sections discuss the feasibility of restoring conditions to allow attainment of MUN in the New Alamo Creek and Ulatis Creek UAA study segments. Although it is not likely that conditions sufficient to allow the MUN use to occur have ever existed in the UAA study segments and, thus, technically could never be "restored," the feasibility of attainment is further evaluated.

5.3.1 Enhancement of Natural Flow Conditions

The regional climate is such that precipitation and natural flows from the upper New Alamo Creek and Ulatis Creek watershed occur seasonally, primarily from November through March (see Figure 9 on page 12). Thus, currently any natural flow for MUN use would be available only during part of the year, which cannot be changed. A future MUN user would have to secure a water right to divert, store, and treat segment water to produce a year-round MUN supply. An on-stream water storage facility (i.e., dam) would not be a feasible option. Such a facility would not be compatible with the current use of New Alamo Creek and Ulatis Creek for conveying storm water flows in the winter, and irrigation and agricultural drainage water in the summer.

To overcome seasonal flow constraints and provide for a MUN supply year-round, an off-stream facility (e.g., tank, pond, reservoir) would be required for storing water diverted when base flow supply was available. This would require an appropriative water right to be secured and would require permitting of the treatment and storage system for this highly impaired water source. Such a water right could not interfere with existing water rights. Off-stream storage of water diverted from the UAA study segments for MUN use is not within the current or future plans of the City of Vacaville, the only municipality close enough to realistically consider such an action. At an individual homeowner level, overcoming ephemeral flow limitations by constructing off-channel storage for year-round treatment and use is possible; however, it is highly unlikely to occur for three reasons. First, easier, safer, and more reliable alternative MUN supplies, such as groundwater, are available. Second, public perception of utilizing these highly impaired water supplies, which typically contain a relatively high percentage of Easterly WWTP effluent, would discourage area residents from selecting this option, regardless of its feasibility. This was affirmed in peer review of the Old Alamo Creek UAA of MUN (Hermanowicz 2004). Third, the cost of obtaining a water right; obtaining any needed easement from Solano Irrigation District or Solano County Water Agency; constructing diversion, storage, and treatment facilities; securing Solano County Health Department approval for use of these facilities; and maintaining these facilities is expected to be far more costly that installing a domestic well.

5.3.2 Restoration of Water Quality

As discussed in Section 2, water quality in lower New Alamo Creek and Ulatis Creek is influenced by the watershed land uses and the Easterly WWTP discharge. Thus, actions to restore or establish water quality such that the MUN use could be attained would have to involve extensive treatment controls at both the Easterly WWTP and on nonpoint runoff from urban and agricultural land, or substantially reducing or eliminating runoff from these lands. The following sections discuss the feasibility of implementing adequate treatment controls to improve water quality to a level that would attain the MUN use in the UAA study segments.

Treatment of Easterly WWTP Discharge

Treatment technologies exist that would allow the City of Vacaville to produce Easterly WWTP effluent of a quality that would meet most chemical pollutant objectives and criteria intended to protect MUN. However, nearly all approved domestic and public water supplies depend on a raw source water that is relatively free of human influences (e.g., contaminants, pathogens), or in which human influences are substantially diluted so that water treatment is likely to be effective in minimizing risks to those drinking the water. No matter how highly treated, municipal wastewater effluent that is minimally diluted or not diluted by other high quality waters would not be suitable as a MUN supply (DHS 1995). Even tertiary treatment and alternative forms of disinfection (e.g., ultraviolet radiation) cannot guarantee the lack of undesirable byproducts or pathogens. As discussed previously, viral and protozoan pathogens are likely to be present in wastewater effluent, even with tertiary treatment, due to the source of the wastewater. As most of these non-bacterial pathogens do not have criteria, and are not easily quantified in a continuous, rapid manner, these contaminants would pose a risk to populations that consistently rely on such water sources for MUN use. Given the importance of nonpoint sources of pollutants and pathogens loaded to the UAA study segments, and the concern regarding residual

pathogen levels in even highly treated municipal wastewaters, meeting MCL and CTR human health criteria in Easterly WWTP effluent in this situation may have little relevance in terms of attaining MUN. Further treatment of Easterly WWTP wastewater would need to be accompanied by either extensive treatment of storm water runoff and irrigation return waters, and/or major changes in surrounding land use practices in order to reduce risks from pesticides, pathogens, and nitrates below acceptable levels. The Easterly WWTP effluent, no matter how highly treated, would be mixed with storm water runoff from agricultural and urban lands and agricultural return flows, thereby resulting in water quality that remains unsuitable for MUN use (DHS 1995).

Treatment of Urban and Agricultural Runoff

Easterly WWTP effluent would be mixed with lower quality water downstream. Thus, extensive treatment of agricultural and urban runoff, or major changes in land uses, to reduce risks from nonpoint source loading of pathogens and nitrates, in particular, below acceptable levels also would be required to attain MUN. Storm water runoff is generally treated using BMPs (e.g., vegetation buffers, detention ponds) at inlets and outlets that are designed to reduce pollutants. BMPs generally contribute to the reduction of heavy metals in urban runoff, and some are designed to remove toxic organics and pathogens (U.S. EPA 2004). The efficiency of a BMP is dependent on a number of factors including the BMP's design, the volume of water being treated, and the contaminant load to the BMP (U.S. EPA 2004). The effectiveness of BMPs for removing pathogens from urban runoff is highly variable, with some BMPs actually showing an increase pathogen levels (U.S. EPA 2003b), due potentially to BMPs such as detention ponds attracting wildlife. The effectiveness of BMPs in treating agricultural runoff is expected to be affected by similar factors. Based on the high percentage of the watersheds draining to the UAA study segments that are in agricultural and urban land use (i.e., 75% for New Alamo Creek watershed and 89% for the Ulatis Creek watershed) and the hydrologic modifications made to these segments and elsewhere in the watersheds to drain storm water from adjacent agricultural and urban lands through the segments, it is not expected that even full implementation of storm water BMPs would produce water quality within the segments suitable for MUN use.

Restoration of Hydrologic Modifications

Structural modifications made to New Alamo Creek and Ulatis Creek in the 1960s as part of the Ulatis Creek Watershed Protection and Flood Prevention Project are extensive and include realignment and expansion of the channels, concrete gradient stabilization structures, and inlet structures to rapidly and effectively convey local runoff from urban and agricultural lands into the channels as a means of controlling local flooding. Without these drainage improvements in place, the adjacent agricultural and urban lands would be at risk for widespread flood damage because neither on- or off-channel detention/storage was seen as a viable option for addressing this issue. The improvements were designed to reduce the risk of flooding on adjacent lands to a once in ten-year event for agricultural lands and once in fifty-year event for urban areas. Historically, damaging floods occurred on an average of once in three years (Ulatis Soil Conservation District et al. 1961). Hence, although generally described as a flood-control project, the specific hydrologic modifications made in the 1960s were made to collect and convey storm water runoff from urban and agricultural lands.

Urban and agricultural land uses within the New Alamo Creek and Ulatis Creek watersheds depend on these creeks and the associated inlet and flow structures to convey storm water runoff rapidly to prevent flooding and damage to property. It is not reasonable to simply eliminate storm water discharges from urban or agricultural lands to New Alamo Creek or Ulatis Creek given that development and land use practices within that watershed have taken place with the understanding that flood protection would be maintained at a consistent level.

Furthermore, agricultural irrigation facilities within the watershed rely on the creek system to efficiently convey irrigation and agricultural drainage water. The distribution systems of Solano Irrigation District and Maine Prairie Water District are integrated with the current configuration of New Alamo Creek and Ulatis Creek. Solano Irrigation District operates the Brown-Alamo Dam on New Alamo Creek, and Maine Prairie Water District operates diversion dams on both New Alamo Creek and Ulatis Creek to divert, in part, Solano Irrigation District agricultural drainage water.

Restoration of hydrologic modifications is not feasible given that urban and agricultural land uses within the New Alamo Creek and Ulatis Creek watersheds rely on the protections provided by the channel improvements and storm water drainage structures, and use of these channels to convey irrigation water and Easterly WWTP effluent. Furthermore, even if the channel improvements were eliminated and reverted to more natural conditions, runoff from the urban and agricultural lands would still flow to these channels, but in a less efficient manner. Thus, the flows in the creeks would still be comprised largely of urban and agricultural storm water runoff and Easterly WWTP effluent throughout the precipitation period of the year.

In short, the urban and agricultural land uses cannot be eliminated and returned to natural, undeveloped lands nor can they be operated in a manner that would produce water quality within the segments suitable for MUN use.

5.4 If MUN is neither Existing nor Attainable, is a Lesser Type and Degree of this Use Occurring or Expected to Occur?

States may adopt use sub-categories and set the appropriate criteria to reflect varying needs of such sub-categories of use (40 CFR § 131.10(c)). However, subcategories of uses should only be developed and adopted in cases where they are needed to identify and appropriately protect uses that are actually occurring or uses reasonably expected to occur in the future.

As discussed in Section 5.1.1 and in RBI (2007b), no form of municipal or domestic use of water diverted from the UAA study segments is presently occurring. The sources of water to the UAA study segments are expected to be the same in the future as they are today. Predominant land uses in the watersheds are not expected to change and, thus, will continue to be agricultural and urban. Thus, the UAA study segment waters are expected to continue to be unsuitable for use as a municipal or domestic water supply. Other higher quality source waters within the region, which include groundwater, Delta waters via the North Bay Aqueduct, and Lake Berryessa water via the Solano Project are available currently, and will continue to be available in the future. Given the current and future expected quality of the UAA study segment waters and the availability of higher quality water supplies, UAA study segment waters are unlikely to be

utilized for municipal or domestic supply for the foreseeable future. The city of Vacaville's water supplies have been evaluated as part of its 2005 Urban Water Management Plan and it has been determined that these supplies are in excess of the General Plan buildout demand (Nolte Associates 2005). Based on current and projected future water quality within the UAA study segments and the fact that alternative higher quality water supplies exist within the area for both municipalities (i.e., groundwater, Delta waters, and Lake Berryessa) and individual homeowners along the UAA study segments (i.e., groundwater), no form of municipal or domestic supply use of UAA study segment waters is expected to occur in the future.

6 APPLICABILITY OF STATE WATER BOARD RESOLUTION NO. 88-63

The State Water Board Resolution No. 88-63, also referred to as the "Sources of Drinking Water Policy," states:

"*All surface and ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Boards with the exception of:*

1. Surface and ground waters where:

a. The total dissolved solids (TDS) exceeds 3,000 mg/L (5,000 uS/cm, electrical conductivity) and it is not reasonably expected by Regional Boards to supply a public water system, or

b. There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or

c. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day.

2. Surface waters where:

a. The water is in systems designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards; or,

b. The water is in systems designed or modified for the primary purpose of conveying or holding agricultural drainage waters, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards."

The State Water Board has determined that a UAA is required to dedesignate an MUN use, even if a water body is within one of the Resolution No. 88-63 exceptions. It also has, however,

concluded that a water body need not meet one of the 88-63 numbered exceptions in order to dedesignate the MUN use for that water body (e.g., Old Alamo Creek, Solano County – see State Water Board Resolutions 2006-0008 and 2006-0009). Thus, the specific relevance of Resolution No. 88-63 exceptions may be limited. However, the Regional Water Board in a previous UAA has considered the characteristics of Old Alamo Creek (Vacaville, CA) in light of Resolution No. 88-63 exceptions (Tetra Tech 2004). Thus, Resolution No. 88-63 exceptions are considered in this UAA, as well.

The following discussion assesses whether the UAA study segments meet one or more of the exceptions defined above. Specifically, the discussion below evaluates whether the water in the UAA study segments flows:

a) within channels where "*There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices.*" [exception 1b], and

b) within "…*systems designed or modified to collect…storm water runoff*." [exception 2a]

For the purpose of this assessment, the term "storm water runoff" is defined as the water that flows over developed urban and agricultural lands where it is then routed into constructed or modified drainage systems to be rapidly conveyed from the local area, thereby minimizing or avoiding flooding of these lands. It does not include water generated from precipitation events that is: a) directly absorbed into the ground, or b) naturally conveyed from undeveloped watershed lands via natural water courses.

The information presented in Sections 5.1, 5.2, and 5.3 of this UAA report, which collectively demonstrate that the 40 CFR § 131.10(g)(3) factor is satisfied by conditions within the UAA study segments, also demonstrates that Resolution No. 88-63 exception 1b is met.

The following discussion is presented in support of determining whether exception 2a to Resolution No. 88-63 also is satisfied by the UAA study segments. In March 1961, under the authority of the Watershed Protection and Flood Preservation Act (P.L. 566, as amended), the Ulatis Soil Conservation District, Solano Irrigation District, and Solano County Flood Control and Water Conservation District jointly developed the "*Watershed Work Plan: Ulatis Creek Watershed*" (Ulatis Creek Watershed Work Plan) to reduce flooding of the agricultural properties within the Ulatis Creek watershed (Ulatis Soil Conservation District et al. 1961). As stated in the Ulatis Creek Watershed Work Plan summary, p. 1-1, "*Frequent and damaging floods inundate vast areas of the lower 65,000 acres of the watershed…The works of improvement proposed in the work plan would reduce significant flooding to a once in ten-year event."* The improvement works identified in the 1961 Ulatis Creek Watershed Work Plan consisted of: 1) land treatment measures (e.g., conservation cropping system, proper range use, pasture plantings) and 2) structural measures. The structural measures included "…*improvement or realignment of 51.9 miles of floodwater channels together with the construction of drop and grade stabilization structures and inlet structures <u>to convey local runoff</u> into the channels."* (emphasis added). In addition, the Ulatis Creek Watershed Work Plan directed the raising of existing levees and

construction of new levees to protect the lands adjacent to Cache Slough. As stated in the Ulatis Creek Watershed Work Plan (p. 1-10), "*A system of flood gates and pumping facilities will also be installed to remove local runoff from behind the levees."* (emphasis added). (Ulatis Soil Conservation District et al. 1961). **Figure 18** identifies the locations of the channel improvements.

In December 1965, a report titled "*A Survey of Storm Drainage Southeast of Interstate Highway 80, Vacaville*" was prepared by M.C. Yoder Associates, Consulting Engineers for the City of Vacaville (Yoder Associates 1965). This report was prepared to address storm water runoff from existing and planned urban areas within the watershed. The summary of this report states:

> *"With the advent of urban development in the area between Interstate Highway 80 and Leisure Town Road, it was necessary to develop a long-range plan for drainage improvements to prevent future drainage problems; thereby, allowing the development of a well integrated system capable of serving the urban tributary areas. Some of the land in the study area has been subject to flooding. However, this will be alleviated as soon as the Alamo and Ulatis Creek improvements proposed in the Ulatis Creek Watershed Work Plan is completed."*

The Basis of Storm Drainage Design section of Yoder Associates (1965) states:

> *"Where storm drains discharge to Alamo, Ulatis, or Horse Creek, the terminal elevations of the proposed storm drains were established to permit gravity discharge to the streams after the channel improvements set forth in the Ulatis Creek Watershed Work Plan are completed."*

The Yoder Associates (1965) storm water drainage work was designed to collect and convey urban storm water runoff into the modified drainage system constructed under the Ulatis Creek Watershed Work Plan (Ulatis Soil Conservation District et al. 1961).

The Ulatis Creek Watershed Work Plan (p. 2-14, p. 1-1) states, *"Drastic relocations were required in the case of both Alamo and Ulatis Creeks inasmuch as the location of their present channels is on high ground, precluding their effectiveness as flood channels. ... All structural measures included in the plan will be operated and maintained by the Solano County Flood Control and Water Conservation District."*

With regard to Ulatis Creek, the Ulatis Creek Watershed Work Plan (p. 1-10, 2-15) states:

> "No improvements will be made on the natural channel between Vacaville and a point approximately one-fourth mile above the Cooper School. From this point to Cache Slough, the lower project limit, the channel improvement will be continuous, consisting of the construction of approximately 4.9 miles of new channel and the straightening and enlargement of 9.7 miles of existing channel. Grade stabilization or drop structures will be provided where necessary. …A reinforced concrete chute will convey the flows from the Rabbit Creek bypass into Ulatis Creek at the upper end of the improved reach." (emphasis added).

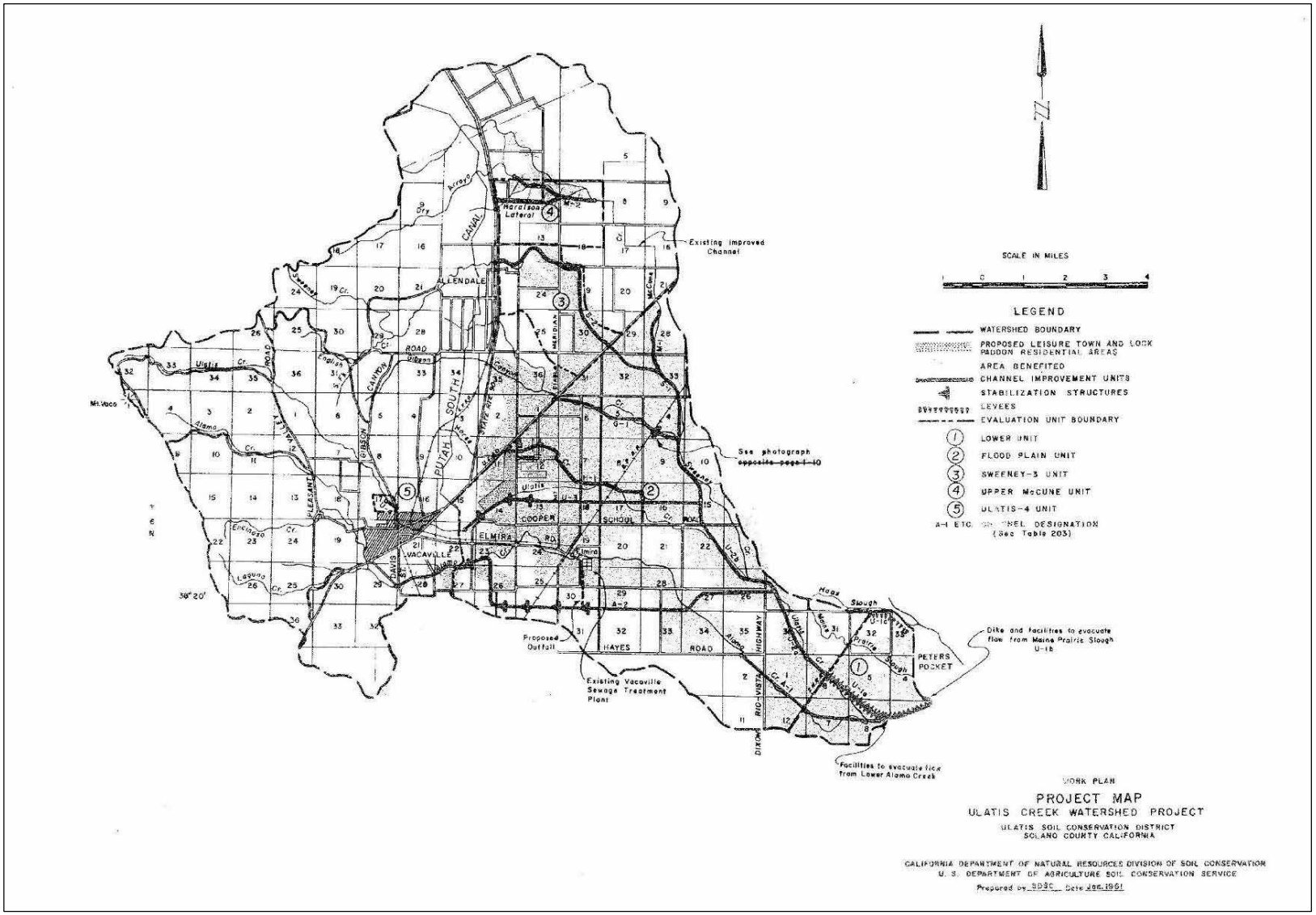


Figure 18. Ulatis Creek Watershed Project channel improvement locations.

The fact that storm drain inlets and bypasses structures were constructed to convey local runoff into the newly constructed channels presented the need to enlarge their conveyance capacity, as cited above. Additionally, the Ulatis Creek Watershed Work Plan states, "*The use of flood detention reservoirs in the foothill area is not effective because of the large local inflow on the valley floor*."

As shown in **Figure 19**, a storm drain was planned to convey the runoff from area "EH," east of Leisure Town Road, and from there the drain would extend northward to the new, constructed Ulatis Creek channel alignment (Yoder Associates 1965).

For Alamo Creek, the Ulatis Creek Watershed Work Plan (p. 1-11) states:

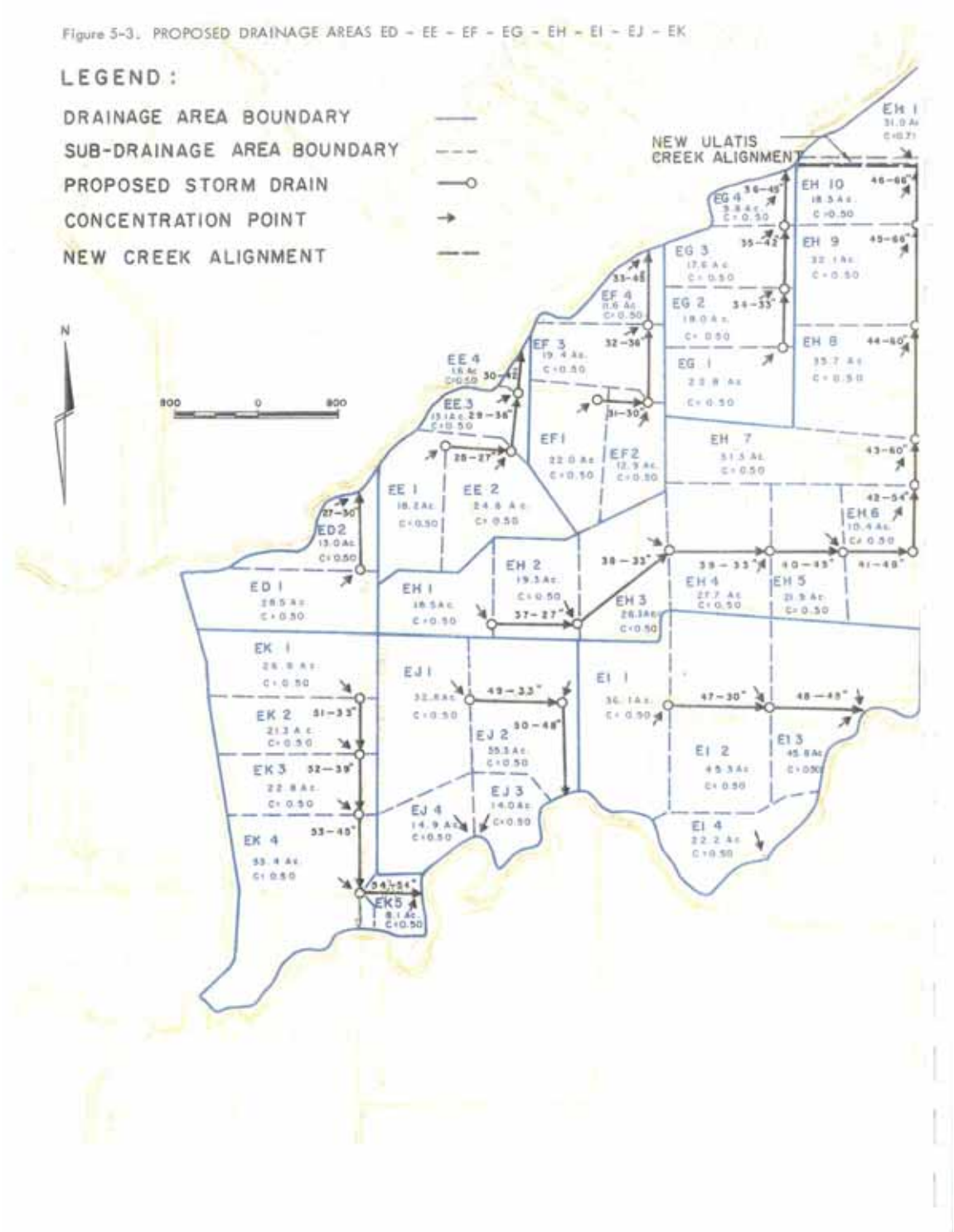
> "*The first unit will include an improved channel to convey the flood flows from the upper project area (Davis Street) to an intersection with Ulatis Creek at a point approximately one-half mile to the east of the intersection of the Elmira Road and the Dixon Highway. The improvements on the upper 2.1 miles of this unit consist of clearing of brush and trees and removal of snags from the existing channel. Below this reach a new trapezoidal earthen channel will be constructed*."

This new trapezoidal channel was constructed to more effectively collect and convey storm water runoff from agricultural and urban lands because the historic Alamo Creek channel (in the area of modification) meandered through higher ground, thereby precluding it from effectively collecting and conveying storm water. The newly constructed, trapezoidal channel contains three drop structures and flap gates at the confluence of "Old Alamo Creek," which is referred to in the As Built drawings as "Wycoff drain inlet" (see SCFCWCD (1966), p. 005411).

As shown in **Figure 20**, storm drains were planned to convey the runoff from area "ES" and "ET," to a storm drain on the west side of Leisure Town Road that would, in turn, convey the flow south to the newly constructed Alamo Creek channel (Yoder Associates 1965).

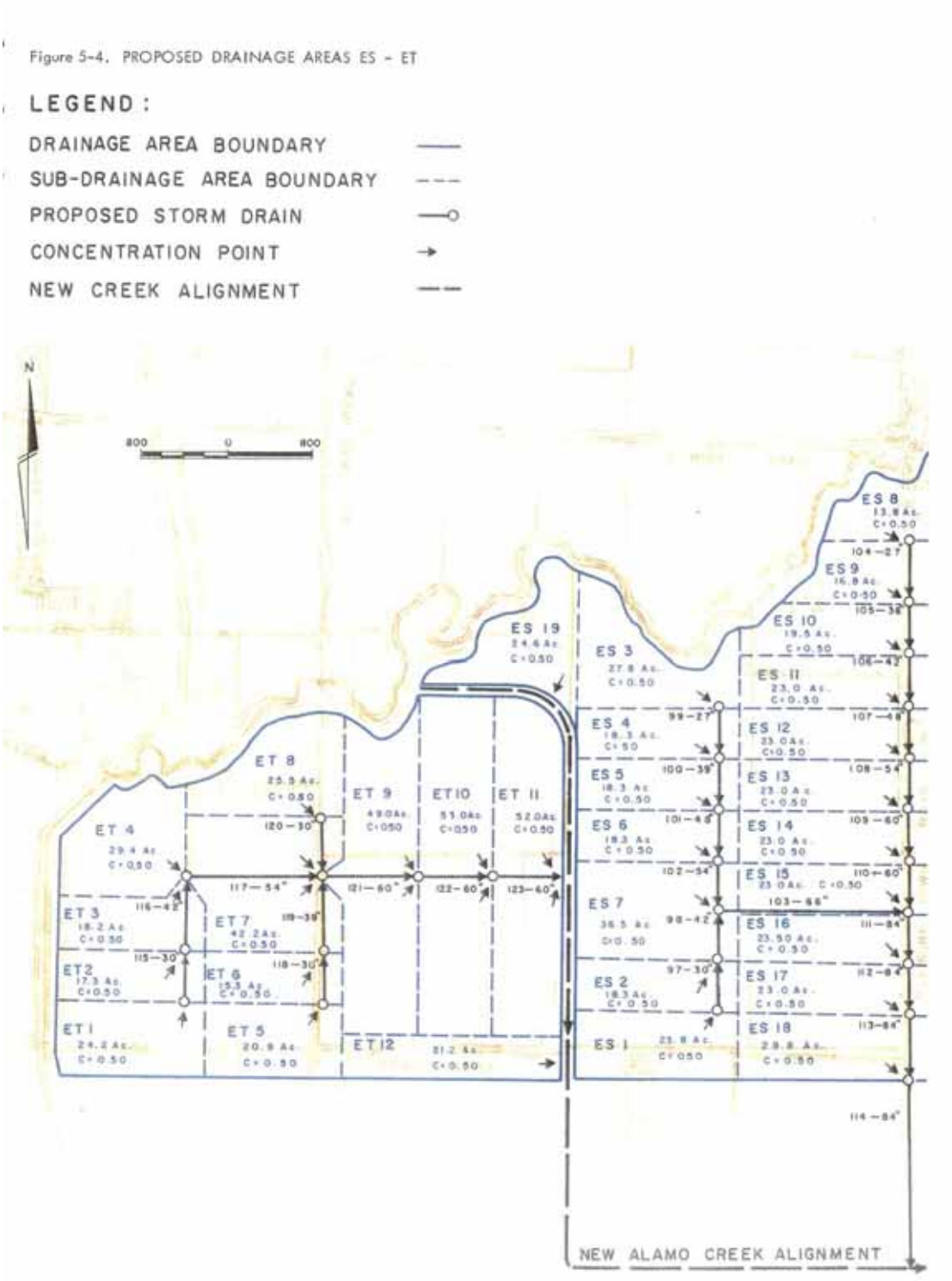
Hence, it is clear from Ulatis Soil Conservation District et al. (1961) and Yoder Associates (1965) that what is called "New Alamo Creek" today is an engineered, realigned, constructed channel that serves as an integral component of an overall storm drainage/flood control plan. Likewise, segments of present-day Ulatis Creek were engineered and realigned for the same purpose. Today, the physical characteristics of these channels, and the waters they convey, reflect their origins.

Based on the information presented above, it is apparent that structural modification made to the UAA study segments were not merely limited to armoring of banks and levees and channelization to improve natural water body conveyance, as occurs on many natural water courses in the State and throughout the Nation. Rather, the structural measures implemented under the Ulatis Creek Watershed Work Plan were highly engineered facilities that included improved inlets, gravity drain and pump structures, flood-control flap gates, newly constructed trapezoidal channels, and concrete gradient control structures.



Source: Yoder Associates 1965.

Figure 19. Proposed storm drain routes for the drainage areas south of Ulatis Creek and west of Leisure Town Road.



Source: Yoder Associates 1965.

Figure 20. Proposed storm drain routes for the drainage areas south of Alamo Creek and west of Leisure Town Road.

These facilities were designed to work in concert to effectively collect and convey local runoff from developed urban and agricultural lands into the newly aligned and constructed channels with expanded flow capacities. To effectively convey local runoff in perpetuity, this designed system required that an agency be assigned operations and maintenance responsibility, which initially was assigned to the Solano County Flood Control and Water Conservation District. As such, the information presented above demonstrates that the UAA study segments have been modified to collect and convey storm water runoff and, therefore, satisfy the conditions defined for exception 2a to Resolution No. 88-63.

These designed systems have been intensively managed and maintained since their construction to collect and convey storm water runoff and, over time, have become increasingly important in their role to convey agricultural irrigation and return waters to further support agriculture on adjacent lands.

7 MUN USE DESIGNATION AND RESOLUTION NO. 88-63 EXCEPTION

7.1 MUN Use Designation

The CWA factors for allowing a State to remove a designated use are listed in 131.10(g). This UAA has demonstrated that the MUN use in the UAA study segments is neither an existing use nor an attainable use. The MUN use has never occurred in the segments since November 28, 1975, nor has water quality within the segments been suitable to support the use since November 28, 1975. Because the use is not an existing use, it can be dedesignated if it can be demonstrated that one or more of the 40 CFR § 131.10(g) factors precludes attainment of the use. It has been demonstrated (see Section 5.2 of this UAA) that attaining the MUN use is not feasible because:

- factor 40 CFR § 131.10(g)(2) is satisfied during the non-precipitation period of the year, and
- factor 40 CFR § 131.10(g)(3) [as affected, in part, by factor 40 CFR § 131.10(g)(4)] is applicable year-round.

The primary sources of water to the segments throughout the year produce pathogen, nitrate, organic carbon, and uncertain pesticide and other contaminant loadings that result in water quality conditions such that the use of these waters for MUN is ill advised and discouraged. This is particularly true when adequate higher quality alternative MUN water supplies are available within the area to both individual homeowners and municipalities.

Because this UAA report finds that the MUN use is neither an existing nor attainable use in the UAA study segments of New Alamo Creek and Ulatis Creek, and no lesser type and degree of the use is occurring or expected to occur in the future, it is recommended that the MUN use be dedesignated for these segments. This UAA did not address segments of New Alamo Creek or Ulatis Creek upstream of the upper end of the defined study segments, nor does this UAA assess whether MUN is an existing or attainable use in Alamo Creek or its tributaries Encinosa Creek and Laguna Creek.

7.2 Resolution No. 88-63 Exception

Based on the information presented in Section 6 of this report, it is concluded that water in the UAA study segments flows:

- within channels where, "*There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices.*" [exception 1b], and

- within, "…*systems designed or modified to collect…storm water runoff*." [exception 2a]

As such, and consistent with the conclusions and recommendation presented in Section 7.1, it is recommended that the UAA study segments be exempted from State Water Board Resolution No. 88-63 pursuant to exceptions 1b and 2a.

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