TURLOCK GROUNDWATER BASIN

Groundwater Management Plan

Prepared for:

Turlock Irrigation District
333 East Canal Drive/P.O. Box 949
Turlock, CA 95381

March 18, 2008

Prepared by:

Turlock Groundwater Basin Association

RESOLUTION NO. 2008-8

RESOLUTION ADOPTING THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN TO AMEND AND SUPERSEDE THE EXISTING PLAN, FINDING THAT THE PLAN IS EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT, AND AUTHORIZING FILING OF NOTICE OF EXEMPTION

WHEREAS, the Board of Directors of the Turlock Irrigation District (District) on October 14, 1997 adopted the Turlock Groundwater Basin Groundwater Management Plan ("Plan") for lands within the District's irrigation service area pursuant to Water Code Sections 10750 et seq.; and

WHEREAS, the Plan was designed to be a living document that needs to be updated occasionally to best reflect the current conditions within the basin; and

WHEREAS, the Turlock Groundwater Basin Association, of which the Turlock Irrigation District is a member, has developed an update of the Plan pursuant to Water Code Sections 10750 et seq., and staff participated in the development of the Plan; and

WHEREAS, staff recommends that this Board adopt the Plan; and

WHEREAS, the California Environmental Quality Act ("CEQA") exempts certain projects from the environmental review process; and

WHEREAS, staff has conducted a review of the Plan and CEQA and has presented that review to the Board;

NOW, THEREFORE, be it resolved, as follows:

1. The findings and evidence set forth in Attachment A are hereby adopted.

2. The Board finds that the project is exempt from CEQA and the Secretary of the Board is authorized and directed to sign and file a notice of exemption for the project pursuant to the requirements of CEQA.

3. The Plan is hereby adopted and the 1997 Turlock Groundwater Basin Groundwater Management Plan is superseded.

Moved by Director Santos, seconded by Director Short, that the foregoing resolution be adopted.

Upon roll call the following vote was had:

Ayes:	Directors Short, Berryhill, Santos, Fernandes
Noes:	Directors None
Absent:	Director Fiorini

The President declared the resolution adopted.

I, Tami Wallenburg, Deputy Secretary of the Board of Directors of the TURLOCK IRRIGATION DISTRICT, do hereby CERTIFY that the foregoing is a full, true and correct copy of a resolution duly adopted at a regular meeting of the said Board of Directors held the 18th day of March, 2008.

Deputy Secretary of the Board of
Directors of the Turlock Irrigation District

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Acronyms and Abbreviations

AB	Assembly Bill
AF	Acre-feet
AF/yr	Acre-feet per year (1,120 AF/yr = 1 MGD)
BCWD	Ballico-Cortez Water District
BMO	Basin Management Objective
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CSD	Community Services District
CVRWQCB	Central Valley Regional Water Quality Control Board
CWC	California Water Code
CWD	County Water District
DBCP	Dibromochloropropane
DCWD	Delhi County Water District
DEH	Division of Environmental Health (Merced Co.)
DER	Department of Environmental Resources (Stanislaus Co.)
DHS	Department of Health Services
dS/m	deciSiemens per meter
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment & Protection
EC	Electrical Conductivity
EDB	Ethylene dibromide
EPA	United States Environmental Protection Agency (also U.S. EPA)
EWD	Eastside Water District
ft	feet
GAMA	Groundwater Ambient Monitoring & Assessment
GIS	Geographic Information Systems
GMP	Groundwater Management Plan
GPD	gallons per day
GPM	gallons per minute
GW	groundwater
HCWD	Hilmar County Water District
ID	Irrigation District
LAFCO	Local Agency Formation Commission
MCL	Maximum Contaminant Level
MGD	million gallons per day (1 MGD = 1,120 AF/yr)
mg/L	milligrams per liter = ppm
Merced ID	Merced Irrigation District
mmhos/cm	millimhos per centimeter
MOU	Memorandum of Understanding
mS/cm	milliSiemens per centimeter
msl	mean sea level
NAWQA	National Water Quality Assessment

NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PBE	Physical Barrier Effectiveness
PCA	Potential Contaminating Activity
PCE	Perchloroethylene
ppb	parts per billion = µg/L
ppm	parts per million = mg/L
psi	pounds per square inch
RWQCB	Regional Water Quality Control Board
RWQCF	Regional Water Quality Control Facility (City of Turlock)
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SOI	Sphere of Influence
SMSA	South Modesto Service Area
SW	surface water
SWRCB	State Water Resources Control Board
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TGBA	Turlock Groundwater Basin Association
TID	Turlock Irrigation District
TMDL	Total Maximum Daily Load
µg/L	micrograms per liter = ppb
µmhos/cm	micromhos per centimeter
USACE	U.S. Army Corps of Engineers
µS/cm	microSiemens per centimeter
USGS	U.S. Geological Survey
UST	Underground storage tanks
VOC	Volatile organic compound
WPA	Wellhead Protection Area
WSA	Water Supply Assessment

EXECUTIVE SUMMARY

This Groundwater Management Plan (Plan) provides an overview of the local agencies, land uses, and status of groundwater resources in the local groundwater basin, the Turlock Subbasin. The local water agencies, through the Turlock Groundwater Basin Association (TGBA or Association), have taken a cooperative, basin-wide approach to coordinate groundwater management activities and prepare this Plan. The overall goal of the Association is to ensure that groundwater remains a reliable, safe, efficient, and cost-effective water supply for the local area. This Plan presents the basin-wide management objectives proposed to achieve this goal, and concludes with recommended measures that can be drawn from to meet the basin management objectives and the long-term goal of ensuring the viability of the groundwater supply.

THE TURLOCK GROUNDWATER BASIN ASSOCIATION

Many local agencies are eligible to participate in groundwater management within the local groundwater basin. These agencies include the Turlock and Merced irrigation districts; the cities of Ceres, Turlock, Modesto and Hughson; the Hilmar and Delhi county water districts; the Keyes, Denair and Ballico community services districts; the Eastside and Ballico-Cortez water districts; and Stanislaus and Merced counties. These agencies have been cooperating on groundwater management activities in the Turlock Groundwater Basin since the mid-1990s.

A formal group for coordinating groundwater management activities, the Turlock Groundwater Basin Association (TGBA or Association), was initiated in 1995. The TGBA developed the first basin-wide Groundwater Management Plan in 1997. Although the founding Memorandum of Understanding expired upon completion of the Groundwater Management Plan, TGBA members continued to meet and discuss basin-wide planning activities. In 2001 the TGBA was formally reestablished to provide a mechanism to implement groundwater management activities and provide guidance for the management, preservation, protection, and enhancement of the Turlock Subbasin.

The TGBA has prepared this updated Plan to reflect current knowledge and to comply with changes to the Groundwater Management Act (California Water Code Section 10750 et seq.) resulting from the enactment of Senate Bill 1938 in 2002.

LAND USE IN THE TURLOCK GROUNDWATER BASIN AREA

The Turlock Subbasin lies on the eastern side of California's San Joaquin Valley, and encompasses portions of both Stanislaus and Merced counties. The groundwater system is bounded by the Tuolumne River on the north, the Merced River on the south, and the San Joaquin River on the west. The eastern boundary of the system is the western extent of the outcrop of crystalline basement rock in the foothills of the Sierra Nevada. Land uses in the Turlock Subbasin are diverse and include agriculture, urban, and commercial or industrial uses distributed in a mosaic throughout the region.

The Turlock Subbasin underlies an area of approximately 347,000 acres, with irrigated crops (245,000 acres), native vegetation (69,000 acres), and urban development (20,000 acres) as the predominant land uses. The general trend in land use throughout the Subbasin has been an increase in urbanization from less than 4,000 acres in 1952 to approximately 20,000 acres in

2006. The majority of this urbanization has occurred within the cities and unincorporated urban areas within the Turlock Irrigation District boundary. Lands in the Eastside Water District, Ballico-Cortez Water District, and Merced Irrigation District have not seen the substantial increase in urbanization that has occurred in other portions of the Subbasin. However, in the Eastside Water District, there has been a shift from non-irrigated lands to irrigated agriculture as the principal land use. The majority of this agricultural development occurred between 1952 and 1984; land use patterns in the Eastside Water District have generally stabilized since the mid-1980s. The shift to irrigated agriculture has occurred to a lesser extent in the Ballico-Cortez Water District. Land use patterns in the foothill areas in the eastern portion of the Subbasin have also shifted from non-irrigated to irrigated agriculture, but most of this shift has occurred in recent years. Between 1952 and 1992, irrigated agriculture in the foothills non-district area increased gradually from 8,600 acres to 10,800 acres. Following 1992, the irrigated area nearly doubled, reaching 19,500 acres in 2006.

Urban land uses, irrigators in the Eastside and Ballico-Cortez water districts, and irrigators in the foothills and other non-District areas depend on groundwater for water supply. Increases in these types of land uses throughout the Turlock Subbasin increase the demands on the groundwater supply. Consequently, evaluating the status of the groundwater supply and continuing coordination of water agencies are essential for maintaining the viability of the groundwater basin.

WATER RESOURCES IN THE TURLOCK SUBBASIN

Both surface water and groundwater supplies are used to meet the water needs in the management area. The local groundwater source is the Turlock Subbasin, which is a subunit of the San Joaquin Valley Groundwater Basin. The Turlock Subbasin lies in the eastern portions of Stanislaus and Merced counties and has an areal extent of approximately 347,000 acres. As described above, the Subbasin is bounded by the Tuolumne River to the north, the Merced River to the south, the San Joaquin River to the west, and by crystalline basement rock of the Sierra Nevada foothills to the east. Groundwater supplies municipal, industrial, and agricultural demands of the region. Surface water from the Tuolumne River and to a lesser extent, the Merced River, supplies a large proportion of agricultural irrigation demands within the Turlock Subbasin. The following sections summarize the Subbasin hydrogeology, water balance, and water quality issues described in the Groundwater Management Plan.

Hydrogeologic Setting

The primary hydrogeologic units in the Turlock Subbasin consist of either consolidated or unconsolidated sedimentary deposits. The consolidated deposits include the Ione Formation, the Valley Springs Formation, and the Mehrten Formation. The Ione and Valley Springs formations lie beneath the Mehrten Formation and typically contain saline water of marine origin. These consolidated deposits are found at shallower depths in the eastern portion of the Subbasin and generally yield small quantities of water to wells. The Mehrten Formation, however, yields greater quantities of water and is an important water source for the eastern portion of the Turlock Subbasin.

The unconsolidated deposits of the Turlock Lake, Riverbank, and Modesto formations overlie the consolidated deposits. These deposits generally yield moderate to large quantities of water to wells and are the main water-yielding units of the Subbasin. Fine grained deposits within the

Modesto and Turlock Lake formations do not transmit substantial quantities of water and function as aquitards. In the western portion of the Subbasin, where surface deposits are of the Modesto Formation, a discontinuous shallow aquitard creates areas of shallow groundwater. The Corcoran Clay aquitard also occurs in the western portion of the Subbasin within the Turlock Lake hydrogeologic unit. The Corcoran Clay aquitard separates groundwater in the Turlock Subbasin into an upper, unconfined aquifer and a lower, confined aquifer.

The unconfined aquifer is generally 150 feet in thickness and is the water-table aquifer, except in western portions of the Subbasin that are locally confined by the shallow aquitard. The unconfined aquifer is used for both private domestic supply and agricultural supply in the western part of the Subbasin. Wells less than 200 feet in depth draw from this aquifer. The confined aquifer, which is contained under pressure by the Corcoran Clay, occurs in the deeper hydrogeologic units of the Subbasin. In the eastern part of the Turlock Subbasin, the confined aquifer is only semi-confined. The confined aquifer provides extensive municipal and agricultural supplies to the Subbasin. Wells greater than 200 feet deep draw from the confined aquifer, but also may receive flow from the unconfined aquifer.

Below the principal water bearing units of the Turlock Subbasin is a deeply buried confined aquifer that contains saline brine. This saline confined aquifer is under sufficient hydraulic pressure to push water up toward the land surface. This phenomenon results in the migration of saline brines in certain areas (e.g., in groundwater wells or along cracks, fissures, and faults), sometimes as far upward as the unconsolidated sediments. Upwelling also occurs near the San Joaquin River, resulting in elevated concentrations of total dissolved solids (TDS) in groundwater near the river. The saline confined aquifer can be found from depths as shallow as 100 feet in the western portion of the Subbasin to as deep as 1,500 feet in the eastern portion of the Subbasin. Although the saline confined aquifer is not used as a source of supply, migration of the saline brines results in high TDS groundwater that may not be of sufficient quality for agricultural or municipal use where mixing occurs.

Water Balance in the Turlock Basin

A water balance study of the Turlock Subbasin was prepared in 2003 and updated in 2007 to estimate the inflows and outflows from the Subbasin between 1952 and 2006. Outflows from the Subbasin result from municipal, domestic, and agricultural supply and drainage well pumping, discharge to the local rivers, discharges from subsurface agricultural drains, and consumption by riparian vegetation. The estimated average total outflow for the 1997-2006 period is 541,000 AF/yr. The majority of outflow comes from estimated agricultural, municipal and rural residential, and drainage well pumping, which collectively averaged 457,000 AF/yr for the 1997-2006 period.

Inflows to the Subbasin result primarily from deep percolation of agricultural and landscape irrigation water and infiltration of precipitation. The estimated average total inflow for the 1997-2006 period is 519,000 AF/yr. Approximately 72 percent of this quantity occurs on 245,000 irrigated acres of cropland within the Subbasin.

Most of the inflows and outflows can be estimated for the Turlock Basin. The net discharge to rivers is an unknown outflow and must be derived through a mass balance calculation of the known inflows, outflows, and storage change in the Basin. Storage change is calculated from the groundwater contour maps derived from local monitoring data, and confirmed using the groundwater model.

The contour maps used in the water budget study indicate that estimated groundwater storage decreased by approximately 21,500 AF/yr between 1997 and 2006. Recent reductions in the California Department of Water Resources (DWR) monitoring network have introduced uncertainty in the measurement of groundwater levels. Uncertainty in the estimated groundwater elevation translates into uncertainty in storage estimates. Therefore, the magnitude and direction of changes in groundwater storage cannot be fully characterized through an analysis based solely on the groundwater contours. The Turlock Subbasin groundwater model was used to supplement this analysis and confirm that groundwater storage has decreased slightly in recent years, particularly between 2002 and 2006.

The estimated reduction in storage between 2002 and 2006 suggests that the Subbasin may no longer be in the equilibrium state that existed in the 1990s. Increases in land use types that rely on groundwater for supply have increased the net discharge from the Subbasin. Slight decreases in storage are likely to continue if urban or irrigated land uses are developed in areas dependent upon groundwater.

In any groundwater basin, groundwater storage will fluctuate both seasonally and annually, depending upon the water year classification, distribution of rainfall, and numerous other physical and biological factors. Alternating periods of decline and recovery in groundwater levels are a response to this natural variation. Long-term declines in storage without recovery could be a concern and represent net declines in storage. Continued monitoring by the local public agencies will be important for tracking changes in groundwater conditions and evaluating whether additional management actions should be considered. As part of the Association's goals and objectives, the Association should consider the need to evaluate changes in land use patterns to understand the range of potential impacts to the groundwater supply. The TGBA has initiated a study to evaluate future land use change scenarios and the potential impacts to groundwater resources. This study will help the Association understand how groundwater storage may change in the future and what types of management actions may be appropriate for maintaining adequate storage in the groundwater basin.

Deep percolation of irrigation water is the largest inflow to the groundwater basin and plays an important role in maintaining groundwater storage. Surface water from the Turlock Irrigation District, and to a lesser extent, the Merced Irrigation District is used to supply more than half of the total irrigation water applied within the Basin. Hence, under current conditions the continued use of surface water for agricultural irrigation is vital for sustaining recharge in the Subbasin. Future changes to inflows or outflows resulting from shifts in land use patterns have the potential to reduce recharge and create reductions in groundwater storage.

Water Quality in the Turlock Subbasin

Groundwater quality in the Turlock Subbasin remains high throughout most of the region. Current knowledge indicates that salinity, nitrates, iron and manganese, boron, arsenic, radionuclides, bacteria, pesticides, trichloroethylene, and other trace organics have been found in the Turlock Subbasin. The U.S. Geological Survey, in coordination with numerous state and federal agencies, is conducting an extensive investigation of groundwater quality in the local area through the Groundwater Ambient Monitoring and Assessment Program. This study evaluates a broader range of constituents and will provide additional information on water quality issues in the Subbasin.

Some of the constituents described above and in detail in this Groundwater Management Plan occur naturally, while others have been introduced into groundwater from anthropogenic sources. Where the constituent concentrations have exceeded drinking water limitations, the municipal water purveyors have implemented actions ranging from wellhead protection to well closure to maintain viable supplies.

Protecting water quality is as important to maintaining the local groundwater supply as sustaining groundwater recharge. The Groundwater Management Plan is intended to create a framework for coordinating actions among different agencies with management authority to protect both the quality and quantity of groundwater resources.

GROUNDWATER MANAGEMENT PLAN

The local agencies within the Turlock Subbasin agree that groundwater and surface waters within the Turlock Subbasin are vitally important resources that provide the foundation for maintaining current and future water needs. Preservation of these resources is essential to maintaining the economic viability and prosperity of the Subbasin area. It is the overall goal of the local water agencies that groundwater will continue to be a reliable, safe, efficient, and cost-effective water supply. This Groundwater Management Plan includes seven Basin Management Objectives (BMOs) to meet this goal. The BMOs serve as targets to guide the groundwater management actions of the local water agencies. The BMOs described in this Groundwater Management Plan include:

1. Maintain an adequate water level in the groundwater basin.
2. Protect groundwater quality and implement measures, where feasible, to reduce the potential movement of existing contaminants.
3. Monitor groundwater extraction to reduce the potential for land subsidence.
4. Promote conjunctive use of groundwater and surface waters.
5. Support and encourage water conservation.
6. Develop and support alternate water supplies, and educate users on the benefits of water recycling.
7. Continue coordination and cooperation between the TGBA members and customers.

Water agencies in the Turlock Subbasin, individually and collectively, are pursuing water management strategies under each of the BMOs to ensure that groundwater continues to be a reliable, safe, efficient, and cost-effective water supply.

GROUNDWATER PROTECTION MEASURES

The water agencies within the Turlock Subbasin are committed to protecting the quantity and quality of groundwater resources. The TGBA has assembled a number of activities of the local water agencies that can be coordinated through the TGBA to support the BMOs of protecting groundwater quality and quantity. These groundwater protection measures are ongoing activities that local agencies may be engaged in, or that agencies may implement in the future. Although the TGBA does not have authority for implementing these actions, the TGBA can serve as a forum for sharing and researching information, and members can provide feedback and guidance to the local agencies involved with these actions. The groundwater protection measures described in the Plan include:

1. Identification and management of wellhead protection areas.
2. Regulation of the migration of contaminated groundwater.
3. Identification of well construction policies.
4. Administration of well abandonment and destruction programs.
5. Mitigation of overdraft conditions.
6. Replenishment of groundwater extracted by water producers.
7. Construction and operation of recharge, storage, conservation, water recycling, and extraction projects.
8. Control of saline water intrusion.

IMPLEMENTATION OF THE GROUNDWATER MANAGEMENT PLAN

The Groundwater Management Plan is intended to provide a flexible, adaptive plan for achieving the overall goal that groundwater will continue to be a reliable, safe, efficient, and cost-effective water supply. The Plan presents numerous potential actions that can be undertaken by local water agencies and coordinated through the TGBA. The following measures are proposed as suggested management actions that the local agencies may draw from to achieve the Basin Management Objectives:

1. **Protection of natural recharge areas** through mapping and identification, education of the public and planning entities, and encouraging the maintenance of land use practices that promote groundwater recharge.
2. **Feasibility evaluation of artificial recharge projects,** by building upon mapping efforts to protect natural recharge and investigating additional water supplies for percolation, and promoting in-lieu recharge.
3. **Management and optimization of well field operations** to reduce well interference, control the migration of contaminant plumes, and optimize supply blending programs.
4. **Support of public health programs** to protect water quality through proper well construction and destruction.
5. **Water quality management**, beginning with conducting a hydrogeologic assessment to identify contaminant sources and develop strategies to control the migration and movement of poor quality water into or within the Basin.
6. Continue the **groundwater monitoring and subsidence monitoring program** and evaluate the effectiveness of the groundwater level and quality monitoring programs as well as the database used to store and manipulate the data.

7. Provide a forum for **policy assessment** and coordination of regional programs with policy implications or requirements.
8. Continue **promoting coordination and cooperation between water agencies** on regional issues, outreach programs, and actions to implement the BMOs.
9. **Identification and feasibility study of conjunctive use projects** to increase supply flexibility and promote recharge in years when water is available.

The implementation of several of these recommended actions is contingent upon securing funding. Both grant funding and local funding options will be evaluated. Local funding may be especially important for grant eligibility because of matching or local contribution requirements. Availability of funding for groundwater management activities, as well as future regulatory requirements, will influence the speed and level to which each of the measures is evaluated and implemented.

Progress on implementing the BMOs will be evaluated through periodic reports. The reports will also summarize the condition of the groundwater basin and discuss groundwater management activities. The reports may be prepared by the TGBA as a group or by individual agencies. The reporting process will also provide an opportunity to review the Groundwater Management Plan and determine whether the Plan requires modification to meet the goal of ensuring the viability of groundwater resources in the Turlock Basin.

1 INTRODUCTION – GROUNDWATER MANAGEMENT WITHIN THE TURLOCK GROUNDWATER BASIN

The following sections provide a brief introduction to groundwater management and related issues pertinent to the Turlock Groundwater Basin, including: the agencies situated within the Basin and participating in the groundwater management process, historic groundwater management efforts, and other relevant information.

The California Department of Water Resources (DWR) website[1] includes information on Bulletin 118 (2003), the publication in which DWR identifies and describes the various groundwater basins and subbasins within the state. The website and available information from Bulletin 118 (2003) were utilized, along with other documentation, in preparing this report.

It is important to note that the Turlock Groundwater Basin, or Turlock Subbasin, is referenced in a variety of ways within the report. DWR Bulletin 118 (2003) identifies the area covered under this plan as the Turlock Subbasin of the San Joaquin Valley Groundwater Basin. For the purposes of this document, the name “Turlock Subbasin,” “Turlock Groundwater Basin,” “Basin,” and “Subbasin” are used interchangeably to represent the same geographic area. All other groundwater basins referenced in this document are listed by their proper name.

In addition, although this document is titled the “Turlock Groundwater Basin Groundwater Management Plan,” it is also referred to as the “Turlock Groundwater Management Plan,” the “Groundwater Management Plan” or merely the “Plan.”

1.1 GEOGRAPHIC SETTING

The Turlock Subbasin lies on the eastern side of California’s San Joaquin Valley, and encompasses portions of both Stanislaus and Merced counties. The groundwater system is bounded by the Tuolumne River on the north, the Merced River on the south, and the San Joaquin River on the west, as shown in Figure 1. The eastern boundary of the system is the western extent of the outcrop of crystalline basement rock in the foothills of the Sierra Nevada.

1.2 LOCAL AGENCIES

Local agencies eligible to participate in a groundwater management plan situated within the Subbasin are: the Turlock and Merced irrigation districts; the cities of Ceres, Turlock, Modesto and Hughson; the Hilmar and Delhi county water districts; the Keyes, Denair and Ballico community services districts; the Eastside and Ballico-Cortez water districts; as well as Stanislaus and Merced counties. Figure 2 shows the location of the various entities within the Subbasin and their respective political boundaries.

It is understood that each local water agency may adopt the groundwater management plan to manage groundwater resources within their jurisdiction. If a county adopts the groundwater management plan, the plan shall apply to those areas lying outside other agencies’ boundaries.

[1] At *http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs_desc/5-22.03.pdf*

1.3 TURLOCK GROUNDWATER BASIN ASSOCIATION

In 1995 the Turlock Groundwater Basin Association (TGBA) was formed for the purposes of studying and evaluating the condition of the Basin, and developing a groundwater management plan for the preservation, protection, and enhancement of the Basin. The Turlock Groundwater Basin Groundwater Management Plan was adopted by the local public agencies between October and December of 1997. At this time, the 1995 Memorandum of Understanding terminated by its founding provisions.

Following the dissolution of the TGBA in 1997, the local public agencies continued to meet on a regular basis in their efforts to cooperatively manage groundwater resources within the Turlock Basin.

In 2001 the TGBA reformed to provide a mechanism for the local public agencies to collectively implement the Plan. The following purposes and goals were set forth in the resulting Memorandum of Understanding (MOU):

- "To provide a mechanism to coordinate the implementation of the Plan and other groundwater management activities;
- To create an association of the Parties to enhance the ability to obtain funding to carry out the Plan and related groundwater management projects; and
- Provide information and guidance for the management, preservation, protection and enhancement of the Basin."

The MOU is based upon the premise that "non-coordinated action by water providers and users within the Basin could result in counterproductive competition for finite resources resulting in adverse impacts to the groundwater and surface water supplies within the Basin," and that the "creation of an Association for water suppliers within the Basin is important to protect the groundwater and surface water resources and will assist in meeting the needs of all users of such resources within the Basin." In addition, it was clear that local management of water resources was desirable in order to maintain local control of these resources.

The purpose of the TGBA is to provide a forum in which the local public agencies can work cooperatively, to combine the available talent of the respective agency staffs, and to accomplish the purposes of the MOU. As such, the TGBA is not a separate governmental entity. It is designed such that it does not duplicate any services, duties, or authority of any other agency. The TGBA does not have any enforceable regulatory authority over any local agency's facilities or their respective surface water or groundwater supplies or water rights. The local water agencies, individually and collectively, are pursuing water management strategies outlined in this Plan to ensure that groundwater continues to be a reliable, safe, efficient, and cost-effective water supply.

A copy of the MOU is attached to this report in Appendix C.

1.4 ONGOING GROUNDWATER MANAGEMENT-RELATED ACTIVITIES

1.4.1 Historical Perspective

An initial Turlock Groundwater Basin Groundwater Management Plan was developed and adopted by the local public agencies in 1997. Groundwater supply, demand, quality and other issues pertinent to groundwater management change over time. As a result, it is understood that a groundwater management plan must be updated occasionally to reflect current conditions and requirements. The TGBA has developed this Plan, which is intended to update and supersede the 1997 Plan. This update includes the pertinent information contained within the original plan, with additional or updated data inserted as needed to comply with the current groundwater management requirements.

1.4.2 Previous Efforts

The agencies within the Turlock Groundwater Basin have been meeting to coordinate groundwater management efforts since 1995. These meetings resulted in the development of the 1997 version of the Turlock Groundwater Basin Groundwater Management Plan. Following the adoption of the Plan, the agencies continued to meet monthly to discuss groundwater management related issues, including:

- Development of a preliminary groundwater level and water quality monitoring program;
- Identification of groundwater management activities being conducted by the local agencies and coordination needed to accomplish the Plan goals;
- Formation of the Turlock Groundwater Basin Association;
- Contracting with a hydrologist in 2003 to conduct a groundwater balance study for the Basin;
- Contracting with a hydrologist in 2006-2007 to conduct an ongoing study of the potential impacts of land use changes on groundwater resources; and
- Supporting individual groundwater management related efforts by local agencies, as appropriate.

1.4.3 Efforts of Individual Agencies

The local public agencies within the Basin have historically provided a variety of ongoing groundwater management related services including:

- **Well Abandonment or Destruction Programs:** There are existing programs in place at the city or county level. Proper well abandonment or destruction of an old well can be made a condition of installing a new well. Education programs have been implemented to advise well owners of the importance of proper well destruction.
- **Well Construction Standards:** The cities and counties have established well construction standards that are consistent with, or in some cases more stringent than, the State of California Water Well Standards, Bulletin 74-81 and its supplements (DWR 1981a). These standards regulate the installation and abandonment for any new wells installed within the Basin.

- **Public Education Programs:** Many local public agencies have implemented public education programs related to water quality, wellhead protection, water conservation and other water issues.
- **Land Use Planning:** The cities and counties have land use planning programs in place to evaluate and reduce potential impacts to groundwater resources due to proposed development and other land use changes.
- **Regulation of Mitigation of Contaminated Groundwater:** The regulatory agencies responsible for water quality have been the key agencies responsible for this item, with local public agencies coordinating efforts with the regulatory agencies as needed.
- **Development of Relationships with Local, State, and Federal Agencies:** The TGBA provides a mechanism for interaction and coordination among local agencies, as well as communication with state and federal agencies. In addition, the local agencies maintain individual relationships with the various state and federal agencies associated with groundwater management related issues.
- **Funding:** Individual agencies have applied for and secured grants to study a variety of groundwater management related issues, including:
    - In October 2001, the Eastside Water District (EWD) submitted an application for a grant from the Assembly Bill (AB) 303 Local Groundwater Assistance Fund (AB 303) to the DWR Division of Planning and Local Assistance. The proposal was for an "Eastside Water District Groundwater & Multiple Resources Integration Planning Study." The grant was approved and EWD received the final signed contract on September 23, 2002. The amount of the grant was $200,000. The EWD contribution was approximately $100,000. The study examined options for acquisition of additional water supplies as well as alternatives for conveyance of the water to EWD. The study was completed in October 2003.
    - In September 2003, the Denair Community Services District (CSD) was awarded a grant from the AB 303 fund for $200,000. Denair CSD constructed a nested monitoring well with the funds from this grant. Information from this test well and other existing wells will be used to support advancement of a hydrogeologic model of the producing groundwater system and to monitor the quality and quantity of groundwater produced from the alluvial aquifer sequences underlying Denair CSD.
- **Groundwater Monitoring:** The local agencies conduct a variety of groundwater quality and level monitoring. Urban agencies and others providing drinking water to local residents are required to monitor for a variety of water quality constituents. To a lesser extent, agricultural agencies conduct water quality monitoring. Water level measurements are conducted by both agricultural and urban entities. In addition, the following special projects have been implemented:
    - Denair CSD developed its groundwater management program in 2001 with the drilling of a test hole, subsurface interpretations of favorable aquifer sequences, and by creating formal guidelines for residential developers to use to construct Denair CSD-required test and monitoring wells. Due to inadequate funding,

Denair CSD's program is currently limited to residential developers' activities. The first well constructed under the new guidelines was completed in 2002.

  - Denair CSD also obtained funding to a nested monitoring well for the purpose of water quality monitoring (see "Funding" section above).

- **Groundwater Recharge:** The EWD, in conjunction with the Turlock Irrigation District (TID), conducted a recharge study, in which a 0.25 acre basin was installed and operated from 1998 through 2000. These districts are currently working on a potential expanded study, in which several larger basins could be installed and operated to further evaluate the potential recharge opportunities within the Subbasin. Testing of a new recharge site began in May 2007.

2 NEED FOR GROUNDWATER MANAGEMENT PLANNING

2.1 DEFINITION OF GROUNDWATER MANAGEMENT

DWR Bulletin 118 (2003) defines "groundwater management" as "the planned and coordinated management of a groundwater basin with a goal of long-term sustainability of the resource." A "groundwater management plan" is defined as a "comprehensive written document developed for the purpose of groundwater management and adopted by an agency having appropriate legal and statutory authority." A "groundwater management program," as defined by the California Water Code (CWC) Section 10752(e), is a "coordinated and ongoing activity undertaken for the benefit of a groundwater basin, pursuant to a groundwater management plan" adopted as specified in the CWC. Sections of the CWC related to groundwater management are provided in Appendix H.

2.2 PURPOSE OF THE GROUNDWATER MANAGEMENT PLAN

The CWC Section 10752(d) defines a groundwater management plan as a "document that describes the activities intended to be included in a groundwater management program." The TGBA developed this Plan for the purposes of documenting:

- Groundwater Basin conditions;
- The areas managed by the local entities and the legal authorities to do so;
- Groundwater management goals and objectives;
- Historic, ongoing and planned future groundwater management activities; and
- Stakeholder involvement processes.

The local public agencies within the Subbasin have developed this Plan to comply with the State of California groundwater management planning requirements under both the CWC and DWR Bulletin 118 (2003). Additionally, the TGBA designed this Plan to create a framework for coordinating groundwater management activities to achieve the individual and collective goals of the various local public agencies within the Basin, as described later in this Plan.

2.3 LEGAL AUTHORITY

The following discussion describes the legal authority for local agencies to develop groundwater management plans and participate in groundwater management related activities.

2.3.1 AB 3030

The Groundwater Management Act (AB 3030) was passed by the State legislature during the 1992 session and became law on January 1, 1993. The Groundwater Management Act, as codified in CWC Section 10750 et seq., identifies groundwater as a valuable resource that should be managed to ensure both its safe production and its quality (Appendix H). AB 3030 also encourages local agencies to work cooperatively to manage groundwater resources within their jurisdiction.

AB 3030 applies to all groundwater basins identified in DWR Bulletin 118 (dated September 1975, and any amendments to this bulletin), except those already subject to groundwater management by a local agency or watermaster pursuant to other law, court order, judgment or decree, unless the local agency or watermaster agrees. Bulletin 118 specifically identifies the Turlock Groundwater Basin, making it eligible for groundwater management under AB 3030.

The law provides that any district or other political subdivision of the state that is authorized to provide water service and exercises that authority may adopt and implement, by ordinance or resolution, a groundwater management plan within all or a portion of its service area. The law also indicates that a local public agency that provides flood control, groundwater management, or groundwater replenishment, or a local agency formed pursuant to the CWC for the principal purpose of providing water service that has not yet provided that service, may establish an AB 3030 groundwater management plan within its boundaries, provided that those areas are not served by another local agency.

The act also authorizes a local public agency to exercise the specified powers of a water replenishment district, subject to the approval of the voters within the agency's service area.

2.3.2 Other Legislation

Senate Bill (SB) 1938 was enacted in 2002, further refining the CWC Sections related to groundwater management. SB 1938 made a variety of modifications to groundwater management plan requirements, primarily concerning public participation and requirements for State grant applications. Language added to the CWC by SB 1938 requires agencies developing a groundwater management plan to prepare a public notice that describes the manner in which interested parties may participate in the development of that plan. The bill also requires local agencies, which elect to apply for certain types of State grant funding, to prepare and implement a groundwater management plan that contains specific components, including basin management objectives and certain monitoring protocols. Table 1 provides a listing of these components, along with the location of each component in this document.

2.4 GROUNDWATER MANAGEMENT PLAN COMPONENTS

This Groundwater Management Plan (GMP) includes the following required and recommended components:

- CWC Section 10750 et seq. (seven mandatory components). The SB 1938 amendments (effective January 1, 2003) to CWC Section 10750 et seq. require GMPs to include seven components to be eligible for the award of funds administered by DWR for the construction of groundwater projects or groundwater quality projects.
- DWR Bulletin 118 (2003) components (seven recommended components).
- CWC Section 10750 et seq. (12 voluntary components). CWC Section 10750 et seq. includes 12 specific technical issues that could be addressed in GMPs to manage the basin optimally and protect against adverse conditions.

Table 1 in Appendix B lists the section(s) in which each component is addressed.

3 WATER RESOURCES SETTING

3.1 LAND AND WATER USE WITHIN THE BASIN

The Turlock Subbasin is comprised of approximately 347,000 acres, including roughly 245,000 acres of irrigated crops, 20,000 acres of urban development, and 69,000 acres of native vegetation. Figure 2 shows the Turlock Subbasin and the boundaries of five subareas for which land-use acreages have been estimated. Four of the subareas include the areas within the TID, EWD, Ballico-Cortez Water District (BCWD), and Merced Irrigation District (Merced ID). Regions outside the boundaries of a water agency are combined into a fifth subarea.

The TID subarea represents the district's irrigation service area boundaries and includes the communities of Ceres, Delhi, Denair, Hickman, Hilmar, Hughson, Keyes, south Modesto and Turlock. Land uses within the TID service area include irrigated agriculture (using either groundwater or surface water supplies), on-farm non-irrigated lands (e.g., buildings, farm roads, equipment yards, etc.), other non-irrigated lands (e.g., grazing land, non-irrigated cropland, etc.), city urban lands (urbanized areas within a city's political boundaries), non-city urban lands (urbanized areas outside the political boundaries of a city), and highways and roads (highways, roads, canal and railroad right-of-ways).

Figure 3 illustrates the changes in land use within the TID between 1952 and 2006. While the total acreage within the irrigation service area has remained the same, the proportions of irrigated, urban, and other land uses have changed. Most notable is the recent urbanization of the area, characterized by an increase in urban areas, with a corresponding decrease in irrigated agricultural land. In addition, a small number of acres have shifted from the use of canal water to groundwater for irrigation, typically combined with a change from flood irrigation to drip and micro irrigation systems.

Irrigated land within the TID utilizes mainly surface water supplies for irrigation, which is the main source of recharge within the Subbasin. Municipalities currently rely entirely upon groundwater for their water supply. In the future, if urban areas continue to utilize groundwater, the reliance upon groundwater will increase while recharge through agricultural use will decrease as agricultural lands are converted to urban uses. This scenario is likely to result in a reduction in groundwater storage within the Subbasin. Similarly, a significant movement from the use of surface water to groundwater supplies on agricultural lands within the TID also could reduce the sustainable yield of the Subbasin.

Figures 4a through 4c depict the historical changes in land use within the EWD, BCWD, and Merced ID boundaries. These areas have not had the substantial urbanization that has occurred within the TID subarea. However, in the EWD there has been a shift in land use from non-irrigated lands to irrigated agriculture. The majority of the agricultural development occurred between 1952 and 1984. The shift to irrigated agriculture from non-irrigated lands has occurred to a lesser extent in the BCWD.

Irrigated agriculture within the Eastside and Ballico-Cortez water districts is dependent upon groundwater for their water supply. Unless additional land use changes occur within these subareas, the main changes in water needs will likely come from improvements in water use efficiency practices or changing cropping patterns.

Figures 4d through 4g illustrate the land use changes for those areas located outside the boundaries of a water agency. Figure 4d shows changes in land use within the foothill non-district area (those areas to the east of EWD and BCWD). In these areas there was a slight increase in irrigated agriculture between 1952 and the early 1990s, and a marked increase between 1992 and 2006. Between 1992 and 2006, the irrigated acreage in the foothills non-district area nearly doubled. As of 2006, there were approximately 48,000 acres of non-irrigated lands in the foothill area and nearly 20,000 acres of irrigated lands. If this trend continues, the irrigated acreage within this area potentially could triple in size, resulting in a corresponding increase in groundwater usage. However, studies have not been conducted to determine the availability of groundwater in the foothill non-district areas. Anecdotal information from individuals who have attempted to find water in the area suggests that water of a quality suitable for irrigation is limited. Thus, continued conversion of non-irrigated lands to irrigated land uses at the recent rate is uncertain.

Figures 4e through 4g show land use patterns in the non-district areas adjacent to rivers. In all three regions, irrigated agricultural acreage expanded considerably between 1952 and the mid-1980s. Land use in the non-district areas near the San Joaquin River have changed very little between 1990 and 2006. Within the Merced and Tuolumne river non-district areas, however, the irrigated acreage has decreased slightly in recent years. This change can be attributed to a variety of factors, such as rural residential development or expansion of agricultural facilities like machinery yards or shop buildings.

A study, begun in late 2006, will evaluate the impacts of future land use changes anticipated within the Basin on local groundwater resources. The land use study will serve as a planning tool that will help local public agencies determine what types of management actions may be appropriate for maintaining adequate storage in the groundwater basin should groundwater-dependent land uses continue to expand.

3.2 MAJOR WATER PURVEYORS AND OTHER AGENCIES WITHIN THE BASIN

The following section provides a description of the various types of water agencies within the Basin, their histories of formation, water sources, and other pertinent information. Each water agency is an independent entity and is described individually, but the physical boundaries of an agency may include several different types of water users. Within the service boundaries of agricultural water agencies there also are a variety of municipal agencies that provide domestic water to their communities. Those agencies, described in section 3.2.2 below, represent the areas within their jurisdiction. Domestic use in the agricultural water agencies' service areas may be through a private well supplying an individual residence, or through a small public water system. Both rely entirely on groundwater. The small public water systems are regulated through the Merced County Division of Environmental Health or the Stanislaus County Department of Environmental Resources.

It is important to note that there are several other agencies that represent areas within the Subbasin that are mainly rural in nature; however, these agencies do not supply water in their respective service areas. These agencies are described in Section 3.2.3 below.

3.2.1 Purveyors of Agricultural Water Supplies

The Turlock and Merced irrigation districts described below supply irrigation water to growers within the Turlock Subbasin. The irrigation districts represent areas that are mainly rural in nature, and are comprised of small communities, ranches, farms, private residences, etc. In addition to the water supplied by these local agencies, some growers located within an irrigation district's boundaries have their own private irrigation well that they use in lieu of, or in addition to, any water supplied by the local public agency.

In addition to domestic and irrigation uses, water may be pumped for use for other agricultural purposes on dairies and other agricultural facilities located within the areas represented by the irrigation districts.

3.2.1.1 Turlock Irrigation District

The TID was formed in 1887 under the provisions of the Wright Act (CWC Section 20500 et seq.). It supplies irrigation water to approximately 150,000 acres, electricity to a 662 square mile service area, and municipal water to the community of La Grange, California. The TID irrigation service area, represented on Figure 2, covers a significant portion of the Turlock Subbasin.

TID's canal system begins at La Grange Dam on the Tuolumne River, where water is diverted into TID's Upper Main Canal for conveyance to Turlock Lake. Turlock Lake acts as a canal regulating reservoir. From Turlock Lake, water is released into the Main Canal for distribution to downstream growers for irrigating mainly high value, non-subsidized crops.

TID owns and operates approximately 230 miles of canals and laterals, most of which have been concrete-lined. Water that is not utilized for irrigation purposes flows to the river system. Canal spills occur through spill gates or over weirs located at the end of canals, and at several median locations within the canal system. Releases either flow directly to the river or through a drain that then flows to the river.

TID utilizes groundwater pumped from drainage and rented wells to supplement its surface water supplies. In dry years, when less surface water is available, groundwater makes up a larger portion of the overall water supply. Conversely, in wet years, less groundwater is utilized. TID-owned drainage wells are used to help lower groundwater levels, as well as supplement surface water supplies. The groundwater pumped for drainage purposes is utilized as much as possible for irrigation supply. Rented wells are private or improvement district wells that are rented by the TID to supplement irrigation supplies. The actual number and location of wells rented each year varies depending upon a variety of factors, including the anticipated amount of rented pumping needed, condition of the well, quality and quantity of the water pumped, etc. Water pumped from drainage and rented wells either discharges directly into the canal, into a pipeline that flows back to the canal, or into a pipeline from which it is utilized for irrigation purposes.

3.2.1.2 Merced Irrigation District

The Merced ID became a legal entity on December 8, 1919. The Merced ID covers an irrigation service area of 164,394 gross acres and includes approximately 10,000 acres within the Turlock Subbasin. The Merced River provides the principal renewable water supply for Merced ID. Water is diverted from the river into the portion of the Merced ID within the Turlock Subbasin by the North Side Canal. The North Side Canal draws from a pool in the Merced River created by Merced Falls Dam, east of the town of Snelling.

The Merced ID owns and operates approximately 26 miles of open earthen channels within the Turlock Subbasin. Water that is not used for irrigation passes through one concrete overpour weir and discharges to the Merced River.

The Merced ID operates three small domestic wells within the Turlock Subbasin that provide water for recreation area facilities. The Merced ID does not own or operate irrigation water supply wells within the Turlock Subbasin, but there are an unknown number of privately owned irrigation water supply wells within the area.

3.2.2 Purveyors of Municipal Water Supplies

The municipal water purveyors, described below, currently rely entirely on groundwater for their supply. Some local agencies, however, are continuing to evaluate the potential for utilizing surface water supplies to supplement groundwater resources.

In addition to drinking water supplies, many of these agencies provide wastewater treatment services to the homes and industries located within their boundaries. The majority of wastewater is discharged to surface waters, a portion is used for agricultural or landscape irrigation, and the remainder is evaporated or percolated back into the groundwater system (Table 4).

3.2.2.1 City of Turlock

Turlock was founded on December 22, 1871 and incorporated as a city in 1908. The City of Turlock water system has always used groundwater wells to supply water to its citizens. As growth occurred, the city added new wells as needed, to accommodate the additional demand. The City of Turlock currently serves a population of over 67,000 residents with 24 active groundwater wells and more than 230 miles of water distribution lines. The wells can produce a maximum of 53 million gallons of water per day (MGD), or 59,360 acre-feet per year (AF/yr).

Over the last ten years, potable water use has increased at an average rate of 3.5% per year, with water use in 2006 totaling 8.3 billion gallons. In spite of recent population growth, the total water use for 2004 through 2006 has remained constant at 8.3 billion gallons. The average static groundwater levels over the last twenty years have declined 14 feet in Turlock wells; however, the current levels still remain 8 feet above the record low of 75 feet below ground surface, encountered during the 1988-1989 drought year.

In the last ten years, four city wells have been closed due to contamination. Nitrate contamination was the cause for two of the well closures and is a major threat to wells in the City of Turlock. Average nitrate levels in the City of Turlock's wells have increased over the last twenty years from 12 ppm to 20 ppm (as NO_3).

The City of Turlock also operates a regional wastewater treatment facility, the Regional Water Quality Control Facility (RWQCF). This facility discharges an average 12 MGD (13,440 AF/yr) to the Harding Drain, which flows into the San Joaquin River. Influent flows to the facility are from the City of Turlock, Denair CSD, Keyes CSD and the City of Ceres. Since May 1, 2006, the RWQCF has provided full tertiary treatment to the wastewater entering the facility.

The treated wastewater is currently used for a variety of reuse functions including landscape and agricultural irrigation as well as disposal into the San Joaquin River. Future plans for the treated wastewater include use in industrial cooling towers, irrigation of City of Turlock owned open space, and provision to private users.

3.2.2.2 City of Modesto

The City of Modesto was founded in October 1870 and incorporated as a city in 1884. There are approximately 6,600 City of Modesto water service customers located within the Turlock Groundwater Subbasin, including South Modesto, the community of Hickman, and parts of the cities of Turlock and Ceres. The South Modesto Service Area (SMSA) includes portions of the City of Modesto that are south of the Tuolumne River, portions of unincorporated Stanislaus County contiguous to Modesto, and parts of Ceres that were part of the former Del Este service area.

Currently, the only source of domestic water to the City of Modesto's customers in the Turlock Groundwater Subbasin is groundwater. Groundwater is supplied by 12 wells in the SMSA, two wells in Hickman, and four wells in the Turlock area.

The current annual average (2000-2004) groundwater production of the SMSA is 4,246 AF/yr, while total water demands are 6,793 AF/yr. The SMSA's water demands are supplemented with water from groundwater wells north of the Tuolumne River. Recent population projections indicate that water demands could increase to 8,733 AF/yr by the year 2025. Annual water production is approximately 220 AF for the Hickman wells and 541 AF for the Turlock wells. Both the Hickman and Turlock water service areas are considered to be built-out.

There are groundwater quality concerns in the SMSA, such as radionuclides and nitrates. Currently, there are 4 wells off-line due to water quality issues. Three of the active wells in the SMSA are currently being blended, while another has recently been put back in operation with wellhead treatment. The Hickman and Turlock water supply wells do not have any significant water quality problems at this time. However, the Turlock wells could be affected if the arsenic maximum contaminant level (MCL) is lowered below 10 parts per billion (ppb).

The City of Modesto is currently investigating alternatives to maintain existing supplies, as well as increase the water supplies to the SMSA, including drilling wells in new developments, developing wellhead treatment opportunities, and possibly purchasing treated surface water.

The City of Modesto also provides sewer service to properties in the SMSA that are either within the Modesto Municipal Sewer District No. 1 or have sewer service agreements. The remaining properties are assumed to be on septic tanks.

The City of Modesto Wastewater Treatment Facilities are located on two sites, separated by approximately 7 miles. The Sutter Avenue primary plant (headworks, primary clarification, and solids handling) is adjacent to the Tuolumne River. The Jennings Road secondary plant (oxidation ponds, storage, and ranchlands) is adjacent to the San Joaquin River.

All domestic wastewater produced within the City of Modesto and SMSA is initially treated at the primary treatment plant. After primary treatment, effluent from the primary plant is pumped approximately 7 miles to the secondary plant through twin 60-inch outfall pipelines, where it is treated further. While a portion of the secondary treated effluent is disposed of as ranchland irrigation, the majority of the effluent is stored in ponds and is seasonally discharged to the San Joaquin River.

3.2.2.3 City of Ceres

The City of Ceres, incorporated in 1918, supplies drinking water to approximately 35,000 customers from groundwater pumped by the city's wells. The City of Ceres' wells are capable of pumping a maximum of 17.5 MGD (19,600 AF/yr). During 2006, water production was 3.3 billion gallons (10,165 AF).

The City of Ceres collects, treats, and disposes of approximately 1.0 billion gallons of wastewater each year. A portion of the disposal (636 million gallons, or 1,952 AF) takes place in 108 acres of percolation ponds. The City currently pumps 345 million gallons (1,059 AF) of treated wastewater to the City of Turlock for disposal, freeing up additional disposal capacity in the City of Ceres percolation ponds. The remaining portion of the City of Ceres' wastewater (72 million gallons, or 221 AF) is used for landscape irrigation purposes.

3.2.2.4 City of Hughson

The City of Hughson was founded in 1907 and incorporated as a city in 1972. Hughson is the smallest city in Stanislaus County, with a population that has grown from 3,259 residents in 1990 to 6,127 residents in 2006. The City of Hughson uses groundwater to provide domestic water to approximately 1,900 connections within its 1.42 square mile service area.

The current annual production within the Hughson service area is 1,888 AF/yr (615 million gallons/year). Recent population projections indicate that water demands could increase to 4,764 AF/yr (1,552 million gallons/yr) by the year 2023.

At the direction of the California Department of Health Services (DHS), the City of Hughson has increased source capacity by adding an additional supply well, Well Number 7, and installing 750,000 gallons of storage tank capacity.

The City of Hughson also provides wastewater services to properties within its service area. All domestic wastewater goes through primary and secondary treatment processes, and is disposed of through percolation ponds.

3.2.2.5 Hilmar County Water District

The Hilmar County Water District (HCWD) was founded in 1965 pursuant to the California Government Code. HCWD provides municipal water, sewer, and wastewater treatment services to the unincorporated community of Hilmar in northern Merced County. HCWD operates in accordance with Permit No. 03-91-032 issued by the DHS Office of Drinking Water. HCWD encompasses approximately 625 acres, of which approximately 20 acres remain to be developed.

The Merced County Planning Department is currently conducting a study to update the Specific Urban Development Plan for the Hilmar area. The results of the study, anticipated to be completed in early 2008, could lead to possible expansion of the HCWD boundaries.

Within its current service area, HCWD provides domestic water and sewer services to 1,559 connections, and a population of approximately 4,850 residents (as of the 2000 census). Current demand for water reaches nearly 2.0 MGD during the summer months with a peak hour flow demand close to 3,000 gallons per minute (GPM). Annual production of domestic water from HCWD's three wells for the year 2006 totaled 1,311 AF (427 million gallons). In order to accommodate growth, the HCWD master plan calls for construction of storage facilities and additional well development.

HCWD also provides wastewater services to properties within its service area. HCWD treats sanitary sewage utilizing the Advanced Integrated Wastewater Pond System (AIWPS). The wastewater facility is permitted to treat up to 0.55 MGD (616 AF/yr). The current average daily flow is 0.43 MGD (482 AF/yr). In 2005, the annual flow of treated effluent to 17 acres of percolation ponds was 495 AF (161 million gallons).

3.2.2.6 Delhi County Water District

The Delhi County Water District (DCWD), governed by a locally elected Board of Directors, provides municipal water and sewer services to a majority of the community of Delhi. DCWD provides potable water to approximately 2,060 customers. Delhi residents that do not receive water from the DCWD are supplied by individual groundwater wells.

Groundwater is the only existing or planned source of domestic water provided by DCWD. At present the DCWD operates five groundwater wells. All of the wells are located within the DCWD boundaries. The DCWD wells draw water from approximately 150 to 500 feet below ground surface, and have a collective pumping capacity of 5,150 GPM (8,308 AF/yr). The overall water quality of existing wells meets State of California Title 22 requirements.

In DCWD's water system, water is pumped, chlorinated, and conveyed to residents through a pressurized water system with hydrants available for fire protection. Existing water mains and wells are adequate to meet present demands and fire flows in Delhi, although pressure varies throughout the water distribution system. The southeast section of Delhi experiences the lowest water pressure in the system because of its distance from current well sites. Nevertheless, DCWD's water pressure meets the DHS minimum standard of 20 pounds per square inch (psi).

Historically, DCWD has been able to meet all water demands with available groundwater supplies. Total pumping in 2006 was 1,866 AF (608 million gallons). Projected demand in 2025 is estimated to be 3,300 AF/yr (Brown, 2004). DCWD's current wells have a total production capacity of 8,308 AF/yr. However, the current system is not capable of supporting the 2025 projected maximum day flow and fire demands.

3.2.2.7 Denair Community Services District

The Denair CSD is a community water system located in the unincorporated town of Denair approximately four miles northeast of Turlock, in central southern Stanislaus County.

The Denair CSD was formed on October 3, 1961 pursuant to California Government Code Section 61000 et seq., and is under the regulatory jurisdiction of the DHS Stockton District Office. Denair CSD has 1,250 non-metered active service connections and 10 commercial metered connections at various locations. The Denair CSD provides domestic water supply to approximately 3,300 residents, according to the 2000 census. In 2006, total municipal pumping was 1,580 AF (515 million gallons).

All of the water for Denair CSD is supplied from five deep wells. The water produced from these wells has continuously met all State of California Title 22 drinking water requirements. The objective of the Denair CSD is to maintain the highest quality of water to meet all customers' needs in the most efficient and financially sound manner.

Denair CSD does not provide wastewater services to the community of Denair. Wastewater generated from the community is transported to the City of Turlock for treatment and disposal.

3.2.2.8 Keyes Community Services District

The Keyes CSD was formed on June 20, 1955 pursuant to California Government Code, Section 61000 et seq. The Keyes CSD is located in the unincorporated community of Keyes, near the City of Turlock. The boundaries of the Keyes CSD encompass approximately 467 acres, while the Stanislaus County Local Agency Formation Commission (LAFCO) approved Sphere of Influence (SOI) includes a total of 804 acres.

The Keyes CSD provides sewer, water, and street lighting services to the community of Keyes. The Keyes CSD has a contractual agreement with the City of Turlock for sewer disposal services. According to a February 25, 2004 LAFCO report, the Keyes CSD serves 1,274 customers with municipal water and 1,317 customers with sewer service. The 2004 report also indicated that the Keyes CSD is operating its sewer service at capacity and must negotiate with the City of Turlock to purchase additional capacity to serve future development within its SOI.

Since 2004, the Keyes CSD has utilized four groundwater wells to provide domestic water to areas within its boundaries. The Keyes CSD opted out of the TID Regional Surface Water Supply Project after receiving a cost estimate based on a 35% design. As of January 2006, community water suppliers have been required to observe the 10 ppb (10 µg/L) MCL for arsenic. As published in the Keyes CSD 2004 Consumer Confidence Report, average arsenic concentrations in these wells were 11.2 ppb, with detections ranging from 4.4 ppb to 17.5 ppb. Keyes CSD has hired a consultant to investigate options for treating wells with arsenic levels greater than the federal standard. Further, Keyes CSD is in the process of hiring a hydrogeologist to explore alternative water supply options.

3.2.2.9 Ballico Community Services District

The small, rural community of Ballico is located approximately 8 miles southeast of Turlock, and 2 miles north of the Merced River. The community has approximately 65 residences, a small number of businesses, and an elementary school. It has a community public water system operated by the Ballico CSD, but at this time there is no community sewer system available. The community is not large enough at this time for a community sewer system, and it is not able to consolidate with another community due to distance.

The Ballico CSD was formed in the late 1980s for the purpose of constructing a public water system. The system began operation in July 1989. The District currently has one well serving the community. Ballico has grown slightly since the formation of the Ballico CSD; however, future growth in the community depends upon obtaining an additional water supply.

Given the very small size of the community, it is often difficult to find a sufficient number of residents willing to volunteer to serve as members of the Ballico CSD Board of Directors. When there are no volunteers to maintain the needed number of board members, the Merced County Board of Supervisors appoints persons from the area at-large to serve.

3.2.3 Other Local Public Agencies Participating in Groundwater Management Activities

This section provides a description of the other local public agencies situated within the Turlock Subbasin that play a role in groundwater management. There are two water districts that represent rural areas within the Subbasin, the Eastside and Ballico-Cortez water districts. These agencies do not provide water supplies to their customers, but represent these areas in water-related issues.

In addition, the Turlock Subbasin is bisected by Merced and Stanislaus counties. The counties, should they choose to adopt the Plan, will represent the areas within the Subbasin that are not located within the boundaries of another local public agency. Regardless of whether a county adopts the Plan to officially “represent” those areas, the counties are members of the TGBA, and will continue to participate in groundwater management activities within the Subbasin.

Groundwater makes up the majority of water utilized for domestic and agricultural purposes within the areas represented by the agencies described below. There are some lands, located adjacent to the irrigation districts described in Section 3.2.1 above, which utilize small amounts of surface water supplies provided by an adjacent irrigation district, when possible. The availability of the surface water supplies is subject to a variety of constraints including hydrologic, operational, and regulatory issues. In addition, some local agricultural operations have riparian water rights and pump surface water from the rivers adjacent to the Subbasin. Only those parcels located directly adjacent to the river are able to utilize this supply.

3.2.3.1 Eastside Water District

The EWD is comprised of approximately 54,000 acres in Merced and Stanislaus counties, on which high-value, non-subsidized crops are farmed using highly efficient irrigation methods. Most of the land within EWD is agricultural and irrigated with groundwater. Groundwater within the vicinity has dropped dramatically since the mid 1950s. The only other source of water supply is a very limited amount of surface water from purchases in wet years from the Turlock and Merced irrigation districts’ canals adjacent to EWD. In addition, parcels with riparian water rights along the Tuolumne and Merced rivers can utilize surface water for irrigation.

The EWD presently does not supply water. EWD was formed specifically to address declining groundwater levels. It may at some point supply water, however, EWD does not own or operate any water conveyance or storage facilities.

EWD was formed in 1985, after about twenty years of struggle, in recognition that if the overdraft was allowed to continue unabated there could come a time when pumping groundwater for irrigation would no longer be economical, or the quality of water pumped would not be satisfactory for irrigation. EWD was formed by election of landowners within the District, under California Law, as a legal body to address water needs of the area. EWD is governed by an elected five-person Board of Directors whose members serve alternating four year terms.

Since the late 1980s EWD has conducted a number of studies with the objective of identifying ways to stabilize groundwater levels. In 1994, the District completed a Groundwater Management Plan under California Assembly Bill 3030. On a year-to-year basis since 1995, EWD has developed and funded an incentive program to encourage irrigators to use available wet year water from the Turlock and Merced irrigation districts. In 1996, EWD began investigation of the potential of recharging the aquifer using constructed recharge basins. After boring test holes at various locations in the EWD, a site adjacent to the TID Highline Canal, just south of Monte Vista Avenue was selected for construction of the Monte Vista Pilot Recharge Basin. Operation of the basin in 1998, 1999 and 2000 proved to be successful. EWD and TID are currently working on an expanded study, in which several larger basins could be installed and operated to further evaluate the potential recharge opportunities within the Basin. EWD has identified a new site and began testing of the site in May 2007.

The District has joined other agencies that pump water from the common Turlock Groundwater Basin in developing and adopting this Basin-wide Groundwater Management Plan with the objective of coordination and joint efforts to stabilize groundwater levels.

3.2.3.2 Ballico-Cortez Water District

The Ballico-Cortez Water District (BCWD), located in Merced County, is comprised of about 6,700 acres of high-value, non-subsidized crops. Most of the land within BCWD is agricultural and irrigated with groundwater. The only other source of supply is a very limited amount of surface water from purchases in wet years from the Turlock and Merced irrigation districts' canals lying adjacent to BCWD. The groundwater within the vicinity has dropped dramatically since the mid 1950s.

BCWD currently does not supply water. Like the EWD, BCWD was formed to address declining groundwater levels. BCWD does not own or operate any water conveyance or storage facilities, but may supply water in the future.

The District was formed in the 1960s in recognition that if the overdraft was allowed to continue unabated there could come a time when pumping groundwater for irrigation would no longer be economical, or the quality of water pumped would not be satisfactory for irrigation. BCWD was formed, by election of landowners within the District under California Law, as a legal body to address the water needs of the area. BCWD is governed by a five person Board of Directors elected to serve alternating four-year terms.

3.2.3.3 Stanislaus County

The Stanislaus County Department of Environmental Resources (DER) provides a variety of services to protect the environment including conducting inspections of food establishments, labor camps, substandard housing, water supplies, and sewage and solid waste disposal problems. The DER strives to promote a safe and healthy environment and improve the quality of life in Stanislaus County through a balance of science, education, partnerships and environmental regulation. Partnering with the TGBA in Basin-wide groundwater management is consistent with the Stanislaus County Board of Supervisors' priority of ensuring a safe and healthy community, facilitating economic development, and achieving multi-jurisdictional cooperation.

Stanislaus County has oversight responsibility for land use planning activities, water well construction and destruction, groundwater contamination remediation, small public water systems, individual on-site sewage disposal systems, and hazardous material within its jurisdiction. Therefore, Stanislaus County's participation in development of this groundwater management plan facilitates coordination of Plan objectives with the following county-level activities:

- Stanislaus County could represent water uses within their jurisdiction not served by participating water purveyors.
- Stanislaus County participation ensures the interaction between groundwater management activities and county land use planning.
- Stanislaus County DER enforces the California Model Well Standards (Bulletin 74-81) and all supplements (DWR, 1991 and DWR, 1981a), as required by the California Water Code, in unincorporated areas.
- The DER issues permits for wells that supply small public water systems.
- The DER issues permits and inspects well construction and destruction in the unincorporated areas (for wells outside of a city's boundaries) and maintains a record of drilling logs of permitted wells.
- Groundwater elevations near contamination sites are reported to the DER.
- The DER has periodically mapped groundwater levels.
- The DER regulates, monitors, and inspects small public water systems for Title 22 compliance to ensure that safe, adequate and dependable water supplies are available for domestic use. DER maintains a database and file records containing water quality monitoring for small public water systems. The DER currently administers 200 small public water systems.
- The DER identifies soil and groundwater contamination associated with leaking underground storage tanks and other point sources and monitors groundwater contamination at 61 sites in the Subbasin.
- The DER is responsible for regulating septic tanks and wastewater disposal in unincorporated areas.

3.2.3.4 Merced County

The Merced County Division of Environmental Health (DEH) was established in 1952. The DEH conducts inspections of food establishments, labor camps, substandard housing, water supplies, sewage, and solid waste disposal problems. The DEH also responds to citizens' complaints relating to nuisances such as flies and odors. Additionally, the DEH has been instrumental in establishing community sewer and public water systems for many communities in Merced County.

The DEH adopted a water well ordinance in 1975. Since that time, it has issued well construction and destruction permits, and began conducting inspections of new water installations and destructions. The DEH also issues permits and conducts inspections of sewage disposal system installations and repairs.

Over the years, the DEH has added and expanded environmental health programs to include land use planning, dairy and animal confinement, underground fuel storage tanks, hazardous materials, childhood lead exposure, medical waste disposal, tattoo and body piercing facility inspections, backflow prevention, and abandoned vehicle abatement. The programs involve ensuring that federal, state, and local standards are being met, and taking enforcement action when necessary to achieve compliance.

The DEH recognizes the prime importance of protecting and conserving the groundwater supply for quantity as well as quality. The DEH has been an active participant in the local groundwater associations within both the Turlock and Merced subbasins since their inception.

3.3 LAND USE PLANNING AND OTHER RELATED ACTIVITIES

The various agencies within the Subbasin participate in a variety of land use planning activities which serve to ensure water supply availability, groundwater protection, and other groundwater management related activities. Section 1.4.3 above describes some of these activities, and a summary of member agency programs affecting groundwater is provided in Table 2 of Appendix B.

3.3.1 Agencies' Spheres of Influence

A Local Agency Formation Commission (LAFCO) is a county-wide entity in each county that ensures the orderly growth of cities, decides on proposed annexations, and whether district or agency boundaries can be expanded or changed. A LAFCO defines the limits of a city or service district and the sphere of influence for each city and local public agency in the state.

The sphere of influence of a local public agency's land use planning activities are generally consistent with their political boundaries. Figure 2 shows the political boundaries of the local public agencies. In addition, activities outside of an agency's boundaries, which can impact land and water uses within its boundaries, also can be of interest to the agency.

3.3.2 Planning for Growth

Local agencies within the Subbasin have a variety of planning practices to ensure they are able to meet the needs of their constituents. Local cities conduct their own planning activities, while the local county planning department, under the direction of a municipal advisory council, fulfills this role for the unincorporated areas (i.e., any urban area that is not a "city"). Planning efforts, as they relate to groundwater management activities, are described in Section 1.4.3 and Table 2 of Appendix B.

3.3.3 Potential Future Annexations

As urban growth continues, municipal agencies will continue to annex lands historically represented by other local public agencies into their agency. As a result, the sphere of influence of the various agencies is anticipated to change as growth occurs. Further, as urban growth occurs, there is likely to be a corresponding decrease in agricultural lands within the Subbasin boundaries.

3.3.4 Other Land Use Planning or Regulatory Activities

Land use changes on privately owned properties are planned by the individual property owner. Growers, for example, determine the water supply use, irrigation method, cropping patterns, and other issues for their lands. Unless a permit is required to install buildings, wells, or other structural improvements, the modifications are not part of a larger land use planning process.

Within this area of the State, the Central Valley Regional Water Quality Control Board (CVRWQCB) is responsible for protecting water quality. Although the majority of regulatory programs are surface water-related, the CVRWQCB is responsible for the protection of both surface water and groundwater resources. An example of programs designed to protect water quality include: permitting of wastewater treatment plants, industries, and other point sources discharges; the irrigated lands waiver and urban stormwater runoff programs designed to address non-point source discharges; Basin Plan Amendments implemented to address water quality impairments in surface waters; and a new dairy permitting program.

4 WATER RESOURCES IN THE TURLOCK SUBBASIN

Locations of water agencies within the Turlock Subbasin are shown in Figure 2. Water purveyors within this area utilize both surface water and groundwater supplies. Some rely exclusively on groundwater, while others use a combination of surface water and groundwater to meet their needs. The groundwater and surface water supplies available to the region are summarized below.

4.1 GROUNDWATER SUPPLIES

DWR Bulletin 118 (2003) defines a groundwater basin as an alluvial aquifer or a stacked series of alluvial aquifers with reasonably well defined boundaries in a lateral direction with a definable bottom. In its text, Bulletin 118 further defines a groundwater basin as an area underlain by permeable materials capable of furnishing a significant supply of groundwater to wells or storing a significant amount of water. The bulletin defines a groundwater subbasin as a subdivision of a groundwater basin created by dividing the basin using geologic and hydrologic conditions or institutional boundaries.

The following sections describe the Turlock Subbasin, its geographical location, the geology and hydrogeology of the Subbasin, as well as groundwater facilities, usage, recharge, quality and other groundwater supply related issues.

4.1.1 Turlock Subbasin Location and Description

A map showing the area of the Turlock Subbasin, as defined in DWR Bulletin 118 (2003) is presented in Figure 1. It is important to note that groundwater basins and subbasins are three-dimensional and include both the surface extent and all of the subsurface fresh water yielding material. However, available data used by DWR to determine the groundwater basin and subbasin boundaries, only permits two-dimensional delineation of groundwater basins. The current DWR groundwater basin maps, including the maps used to identify the Turlock Subbasin and the adjacent areas depict a surface expression of groundwater basin boundaries and it should not be interpreted that these boundaries extend downward in a three-dimensional fashion.

As defined in DWR Bulletin 118 (2003), the Turlock Subbasin is a portion of the San Joaquin Valley Groundwater Basin. The San Joaquin Valley is bounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada Foothills and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. Drainage within the San Joaquin Valley flows in two directions. The northern portion of the valley drains toward the Delta by the San Joaquin River and its tributaries, the Fresno, Merced, Tuolumne, and Stanislaus rivers. The southern portion of the valley is internally drained by the Kings, Kaweah, Tulare, and Kern rivers that flow into the Tulare drainage basin, including the beds of the former Tulare, Buena Vista, and Kern lakes.

The Turlock Subbasin lies within the eastern portion of Stanislaus and Merced counties and covers approximately 347,000 acres or 542 square miles. The Subbasin is situated between the Tuolumne and Merced rivers and is bounded on the west by the San Joaquin River and on the east by crystalline basement rock of the Sierra Nevada foothills. The Subbasin's northern, western, and southern boundaries are shared with the Modesto, Delta-Mendota, and Merced Groundwater subbasins, respectively.

The following sections provide a description of the geologic and hydrogeologic conditions of Turlock Subbasin.

4.1.1.1 Hydrogeologic Setting and Water Bearing Deposits

As stated above, DWR Bulletin 118 (2003) defines the groundwater basin boundaries and provides a description of the hydrogeologic setting for the San Joaquin Valley Groundwater Basin and the Turlock Subbasin. The description provided below is primarily taken from DWR Bulletin 118 (2003), and supplemented with addition information as it was available.

The San Joaquin Valley represents the southern portion of California's Central Valley. The valley is a structural trough up to 200 miles long and 70 miles wide, filled with up to 32,000 feet of marine and continental sediments of Cretaceous age (140 million years ago) through Quaternary age (through today). The valley geologic formations were deposited due to the periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively. Continental deposits originating from the surrounding mountains form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough.

The Turlock groundwater basin represents a subbasin of the San Joaquin Valley Groundwater Basin. The primary hydrogeologic units in the Turlock Subbasin include both consolidated and unconsolidated sedimentary deposits that are as much as 16,000 feet in thickness within the western portion of the Subbasin (California Division of Mines and Geology, 1966a). Figures 5 and 6 show the generalized extent, thickness and stratigraphic position for the hydrogeologic units of the Turlock Subbasin.

The consolidated deposits include the following formations, listed in order from the oldest to youngest deposits: the Ione Formation of Eocene epoch, the Valley Springs Formation of Miocene epoch, and the Mehrten Formation, which was deposited during the Miocene to Pliocene epochs. Water within the Valley Springs and Ione Formations is typically saline due to the marine shales contained within these formations. The consolidated deposits lie in the eastern portion of the Subbasin and generally yield small quantities of water to wells, except for the Mehrten Formation, which is an important aquifer.

Unconsolidated deposits, including continental deposits, older alluvium, younger alluvium, and flood-basin deposits, overlie the Mehrten Formation. Those units are known as the Turlock Lake, Riverbank and Modesto formations. Both the Turlock Lake and Modesto formations contain lake and floodplain deposits. Where those fine-grained deposits occur within the Turlock Lake Formation, they are referred to in this report as the shallow aquitard. Lacustrine and marsh deposits, which constitute the Corcoran or E-clay aquitard, underlie the western half of the Subbasin at depths ranging between about 50 and 200 feet (DWR, 1981b). The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits. The lacustrine and marsh deposits and the flood-subbasin deposits yield little water to wells. The younger alluvium, in most places, probably yields only moderate quantities of water.

4.1.1.2 Geologic Formations

The following paragraphs describe in more detail each of the water bearing formations within the Turlock Subbasin. Information utilized to prepare this section of the report was derived from the Turlock Groundwater Basin Water Budget (Durbin, 2003), as well as information contained within DWR Bulletin 118 (2003). As noted above, Figures 5 and 6 show the generalized extent, thickness, and stratigraphic position for the hydrogeologic units comprising the groundwater system, including the Corcoran Clay and the shallow aquitard.

The Modesto Formation, which is of late Pleistocene age (about 1 million years ago), outcrops in the western one-third of the Subbasin (Figures 5 and 6) and is as much as 120 ft in thickness. The formation consists of gravel, sand, and silts with rapid coarseness changes, which yields moderate to large quantities of water to wells. The shallow aquitard member of the Modesto Formation occurs only within the western part of that formation (Figure 5), and does not crop out at the land surface (Figure 6). The shallow aquitard is comprised of silt and clay with some sand. This unit is encountered 30 to 50 ft below the land surface, and is as much as 15 feet in thickness.

The Riverbank Formation, which is of middle Pleistocene age (about 1.5 million to 1 million years ago), underlies the extent of the Modesto Formation and crops out in the central portion of the Turlock Subbasin (Figures 5 and 6). The thickness of the unit increases westward, but the thickness generally is less than 200 ft. The formation consists primarily of sand with scattered gravel and silt lenses, and yields moderate to large quantities of water to wells. The unit tends to coarsen upward (Marchand and Allwardt, 1981).

The Turlock Lake Formation, which is of early Pleistocene and late Pliocene age (2.5 million to 1.5 million years ago), underlies the Riverbank Formation and crops out in the eastern part of the Turlock Subbasin (Figures 5 and 6). The thickness of the unit increases westward, but the thickness generally is less than 600 feet. The formation consists of mostly fine sand and silt (Marchand and Allwardt, 1981), and yields moderate to large quantities of water to wells.

The Corcoran Clay aquitard portion of the Turlock Lake Formation (Figures 5 and 6) ranges in thickness from 10 to 80 feet, and is typically found at depths ranging between 50 to 200 feet. The Corcoran Clay lies in the upper part of the Turlock Lake Formation. The unit does not crop out, and occurs only within the western portion of the Turlock Subbasin. The United States Geological Survey (USGS) recently conducted a comprehensive review of lithologic and hydrologic data for an update of the Modesto Subbasin hydrogeologic model (Burow et al., 2004). As a result of this investigation, the USGS revised the eastern extent of the Corcoran Clay in both the Modesto and Turlock subbasins. The proposed shift in the Turlock Subbasin, shown in Figure 7, is to the west of the existing eastern boundary of the Corcoran Clay modeled in the Turlock Subbasin Water Budget (Durbin, 2003). Due to the uncertainties expressed in the USGS report and after examining the recent data for the Turlock Subbasin, it was decided not to revise the extent of the Corcoran Clay in the Turlock Groundwater Basin Model (Velayas et al., 2005).

The Mehrten Formation, which is of Miocene to late Pliocene age (5 million to 2.5 million years ago), underlies the Turlock Lake Formation and crops out on the eastern edge of the Turlock Subbasin (Figures 5 and 6). The thickness of the unit increases westward, but the thickness generally is less than 800 ft. The formation consists of claystone, tuff siltstone, breccia, sandstone, and conglomerate (Page and Balding, 1973); yields small to moderate quantities of water to wells; and is saline at lower elevations within the western and central parts of the Turlock Subbasin.

The Valley Springs Formation, which is of Miocene age (24 million to 5 million years ago), underlies the Mehrten Formation and crops out on the eastern edge of the Turlock Subbasin (Figures 5 and 6). The thickness of the unit increases westward, but the thickness generally is less than 500 ft (Page and Balding, 1973). The formation consists of siltstone and claystone deposited mostly by rivers with occasional ash deposits, and yields small quantities of water to wells due to the fine ash and clay matrix (Page, 1986).

The Ione Formation, which is of late Eocene age (40 million to 34 million years ago), underlies the Valley Springs Formation and crops out on the eastern edge of the Turlock Subbasin (Figures 5 and 6). The thickness of the unit increases westward, but the thickness generally is less than 200 ft (Page and Balding, 1973). The formation consists of clay, sand, sandstone, and conglomerate and yields only small quantities of water to wells. The Ione Formation is saline throughout much of the Turlock Subbasin (Page, 1986).

4.1.1.3 Aquifers

Groundwater within the Turlock Subbasin occurs under unconfined and confined conditions. As described in DWR Bulletin 118 (2003) a portion of the Basin is underlain by the Corcoran Clay which separates the groundwater into two zones; an upper, unconfined aquifer and a lower, confined aquifer (see Figure 6). There is also a deeply buried confined aquifer containing saline brine that extends upward into the unconsolidated sediments. The presumed origin of the saline brine is the connate water sourced with the Upper Cretaceous marine shales that underlie the Pleistocene and Holocene sediments.

The following sections describe in more detail the various aquifer conditions found within the Turlock Subbasin.

Unconfined Aquifer

An unconfined aquifer is an aquifer in which the groundwater is not under pressure. In the Turlock Subbasin, the unconfined aquifer occurs in unconsolidated sedimentary deposits, mainly within the Modesto and Riverbank formations, situated above and to the east of the Corcoran Clay. In the area underlain by the Corcoran Clay, the top of the clay is the base of the aquifer. To the east of the clay, the top of the consolidated rocks is the base of the aquifer. Above and to the east of the Corcoran Clay, the top of the unconfined aquifer is the water table. The unconfined aquifer has areas, particularly in the western portion of the Subbasin, which are locally confined by clay layers that are not continuous over long distances. This area is referred to as the shallow aquitard and is described further below.

With the exception of those areas containing the shallow aquitard, the unconfined aquifer is the water-table aquifer. It is about 150 feet in thickness, and the depth to its surface ranges from less than 10 feet in the western part of the Subbasin to 50 feet within the central part of the Subbasin. Within the western part of the Subbasin, the unconfined aquifer is used as an agricultural supply. The unconfined aquifer also may be used as a potable supply for private residences. Wells less than 200 feet in depth draw from the unconfined aquifer.

The direction of regional groundwater flow in the unconfined aquifer is mainly westward and southward towards the axis of the valley trough, with the exception of the eastern portion of the Subbasin where there is a localized cone of depression (Figure 7). The direction of groundwater flow is controlled by the elevations of the Tuolumne, Merced and San Joaquin rivers. The elevation of the water table is maintained along these rivers at the local elevation of the water surface within the river. Groundwater levels are maintained by exchanges of water between the river and the groundwater system.

Freshwater Confined Aquifer

A confined aquifer is an aquifer in which the groundwater is contained under pressure. The aquifer referred to in this report as the confined aquifer is contained within the unconsolidated deposits of the Turlock Lake and Mehrten formations. The top of the consolidated rocks is the base of the unconsolidated deposits. The freshwater confined aquifer is confined by the Corcoran Clay member of the Turlock Lake Formation within the western part of the Subbasin. The top of the confined aquifer in this area is the bottom of the Corcoran Clay. The aquifer is semi-confined within the eastern part of the Subbasin, where the Riverbank Formation directly overlies it. It is unconfined in the eastern part of the Subbasin, where the Turlock Lake and Mehrten formations crop out.

The freshwater confined aquifer is approximately 1,300 feet in thickness, and the depth to its surface ranges from 200 feet in the western portion of the Subbasin to 100 feet within the eastern portion of the Subbasin. The freshwater confined aquifer is used extensively as an agricultural and municipal water supply. Wells greater than about 200 feet draw from the freshwater confined aquifer. However, such wells will also draw from the unconfined aquifer, if the depth to the top of the well perforations is less than 200 feet.

Based on general hydrologic considerations, the direction of groundwater flow in the confined aquifer is probably similar to that in the unconfined aquifer, westward and southward. Under historical conditions, the hydraulic head in the confined aquifer was greater than that of the unconfined aquifer, which caused water to flow upwards through the Corcoran Clay from the confined to the unconfined system. Under present conditions, the pumping that has occurred in the unconfined aquifer would tend to maintain an increase in the upward gradient (head differential) between the aquifers. However, because of the lack of information on the conditions in the confined aquifer, an upward gradient across the Corcoran Clay cannot be confirmed.

Saline Confined Aquifer

Fresh groundwater in the San Joaquin Valley is underlain by a saline brine groundwater body. The saline confined aquifer occurs within the Valley Springs and Ione formations. The aquifer is confined except where the formations crop out. The saline confined aquifer is about 600 feet in thickness, and the depth to its top ranges from as low as 1,500 feet in the eastern portion of the Turlock Subbasin to as high as 100 feet within the western portion of the Subbasin. The deep aquifer is used little as a water supply.

Some gas exploration wells were drilled into the deep marine rocks along the Tuolumne River near Waterford and Ceres. The wells were artesian, flowing wells which produced saline brines without pumping for many years, until they were plugged in the 1970s. The artesian conditions indicate that the deep, saline groundwater is under sufficient hydraulic head (pressure) to push water up to the land surface. This head will cause the saline water to migrate upwards where movement is possible. This upwelling can occur in wells and along cracks, fissures, and faults. Saline brines are migrating upward and mix with the shallow fresh groundwater to form high total dissolved-solids (TDS) groundwater at a certain depth below the surface. The base of the fresh water is extremely variable and often occurs in the unconsolidated sediments.

The deep, saline groundwater flows, as does all the groundwater in the valley, from the valley's sides towards its trough. Upwelling occurs at the trough where the flows from the opposite sides of the valley meet, and the only direction for the water to go is up. On the surface, the San Joaquin River occupies the valley trough. Water for the river flow is derived in the same way. Groundwater flows from the opposite sides of the valley meet and move upwards providing water to the river.

Shallow Aquifer

The discontinuous shallow aquitard and an overlying shallow aquifer that occur within the unconfined aquifer result in a high groundwater table in the western portion of the Subbasin. The low vertical permeability of the shallow aquitard restricts the downward percolation of infiltrated precipitation and irrigation applications. The shallow aquifer is a water table aquifer. The depth to groundwater can be less than 6 feet in these areas. The aquifer is about 40 feet in thickness, and the shallow aquitard forms its base. The shallow aquitard is approximately 15 feet in thickness.

4.1.2 Groundwater Usage

Discharges from the Turlock Basin occur from well pumping, groundwater seepage to the Tuolumne, Merced, and San Joaquin rivers, discharges from subsurface agricultural drains, and water use by riparian vegetation. A water budget study conducted by the Turlock Groundwater Basin Association in 2003 and updated in 2007 resulted in the water usage information described throughout this subsection.

Groundwater is utilized to supply the water needed by both agricultural and urban users within the Basin. Between 1997 and 2006 it is estimated that an average of 457,000 AF/yr was pumped by agricultural and urban agencies, as well as small domestic water systems and private property owners, for domestic or agricultural uses. The following sections further describe these uses.

4.1.2.1 Agricultural Groundwater Pumping

Turlock ID supplements its surface water supply with groundwater to satisfy crop-water requirements, the extent of which varies from year to year depending on the availability of surface water. TID pumps groundwater directly into canals from both TID-owned drainage wells and rented wells for distribution to users within its irrigation service area. In addition, some individual growers within the District pump groundwater to supplement their surface water allotments, while others use groundwater to meet their entire crop-water requirement.

Like TID, Merced ID supplements its surface water supply with groundwater to satisfy crop-water requirements. The extent of groundwater supplementation by Merced ID varies from year to year depending on the availability of surface water. Merced ID pumps groundwater directly into canals, laterals and pipelines exclusively from Merced ID-owned irrigation and drainage wells. All of Merced ID's wells are located outside the area of the Turlock Groundwater Basin. Even so, Merced ID incorporates pumped groundwater into its total supply and makes deliveries to lands in the area of the Turlock Groundwater Basin on the same basis as it delivers to the other lands within its boundaries. Only in severe drought conditions does Merced ID permit the discharge and wheeling of groundwater from privately owned wells into the Merced ID water conveyance system. In some areas of Merced ID, growers meet their crop-water requirements from their own groundwater supplies.

Growers within the Eastside and Ballico-Cortez water districts have limited access to surface water supplies for irrigation purposes, and rely upon the groundwater to supply their crop-water requirements. Within these districts there are individual properties with access to occasional surface water deliveries from either TID or Merced ID. This type of water is not available on a consistent basis, being dependent upon both surface water availability and system capacity constraints. Therefore, due to the unreliability of this type of water, it is appropriate to assume that the growers within the Eastside and Ballico-Cortez water districts must rely on groundwater to supply their crop-water requirements.

There are agricultural areas located outside of the local water agency boundaries that also utilize groundwater to irrigate their crops. This occurs in a fairly large area located on the eastern boundary of the Basin. Between 1992 and 2006 this area, called the “foothill non-district” subarea in Section 3.1, has had significant conversions from non-irrigated to irrigated lands.

In addition to agricultural irrigation water, groundwater is pumped for a variety of agricultural operational needs. A portion of this use ultimately may be used for irrigation supply purposes. For example, groundwater is pumped to meet the water supply needs of dairy operations. A portion of the water may find its way into the lagoon and later be blended with surface water for irrigating dairy feed crops. This water use is considered small compared to the total amount of irrigation water use within the Subbasin.

The total annual application of groundwater for irrigation purposes varies from year to year depending on the availability of surface water. In wet years, less groundwater is needed to supplement irrigation supplies. Drainage pumping to help lower groundwater levels also varies depending on the weather conditions. For the period between 1997 and 2006, the average drainage pumping within the Basin was about 65,000 AF/yr, while the average total agricultural pumping totaled 344,000 AF/yr.

Growers within the TID utilize groundwater to supplement canal deliveries or for use on farm for purposes other than irrigation. Between 1997 and 2006, the average pumping from private and improvement district owned wells for various agricultural purposes is estimated to be 22,000 AF/yr. Figure 8 shows the annual estimated pumping from these wells.

TID uses groundwater pumped for drainage purposes, as well as rented wells to supplement its surface water supplies. Rented pumping by TID varies depending on surface water supplies and operational constraints. Figure 9 show the annual rented pumping between 1977 and 2006. From 1997-2006 the average rented pumping was approximately 18,000 AF/yr.

Some growers within the TID choose not to receive surface water and irrigate with groundwater instead. The average pumping from these types of wells was estimated to average 9,600 AF/yr during the recent 1997-2006 time period. This type of pumping increased from an estimated 2,000 AF/yr in 1997 to about 13,500 AF/yr in 2006. Figure 10 provides a graphical illustration of this type of pumping between 1952-2006. The majority of these lands have switched from flood to drip/micro irrigation methods. Should additional lands choose to make a similar switch and not utilize surface water supplies, the demand upon groundwater will increase.

Growers within the portion of the Merced ID that falls in the Turlock Subbasin also utilize a combination of groundwater and surface water supplies. As with the TID, there are some growers within the Merced ID that choose not to receive surface water and irrigate with groundwater instead. The estimated amount of private groundwater pumping for agricultural purposes within the Turlock Subbasin portion of the Merced ID ranges from approximately 100 AF/yr to over 400 AF/yr. Figure 11 provides a graphical illustration of the extent of this type of pumping between 1952-2006.

Growers within Eastside and Ballico-Cortez water districts pumped a combined estimated 180,000 AF/yr between 1997-2006. With the exception of those properties adjacent to the rivers that have riparian water rights, these areas rely upon groundwater for their entire water supply. Figures 12 and 13 illustrate the estimated water usage in these areas between 1952 and 2006.

It is estimated that growers within the non-district areas, located along the river margins and east of the Eastside and Ballico-Cortez water districts, pumped an average of 115,000 AF/yr between 1997 and 2006. With the exception of those properties adjacent to the rivers that have riparian water rights, these areas rely exclusively upon groundwater for their water supply. Figure 14 shows the estimated groundwater usage in these areas between 1952-2006. As agricultural development continues in these areas, the dependence upon groundwater likely will increase.

4.1.2.2 Urban Groundwater Pumping

Presently municipal, industrial, and individual domestic water users rely solely on groundwater. While the supply has been adequate, the groundwater quality has deteriorated in some areas to the point where treatment is required to make it suitable for these uses.

The communities of Ceres, Delhi, Denair, Hickman, Hilmar, Hughson, Keyes, south Modesto, and Turlock pump, collectively, from approximately 75 wells. The average pumping from municipal wells was about 44,000 AF/yr during the 1997 through 2006 period. Figures 15a through 15i show the annual pumping for municipal wells for each community from 1952 to 2006. As urban development continues, the demands upon groundwater supplies will increase unless alternative supplies are considered.

There are an estimated 3,700 residences within the Turlock Basin that are not connected to a municipal water system that pump groundwater for domestic supply. The average pumping rural residential areas averaged 4,000 AF/yr between 1997 and 2006.

4.1.2.3 Other Groundwater Outflows

Groundwater discharges occur along the lower reaches of the Tuolumne and Merced rivers, and along the entire reach of the San Joaquin River. Along the upper reaches of the Tuolumne and Merced rivers, groundwater is recharged by streamflow. However, under current conditions, the net effect is that the groundwater discharge to the rivers exceeds the streamflow recharge to the groundwater system. Between 1997 and 2006, the net groundwater discharge to rivers averaged nearly 30,000 AF/yr.

High groundwater levels are known to occur in mainly the western and southern portions of the Subbasin. Water levels that encroach into the crop root zone can reduce crop yields. As a result, some local growers have installed subsurface drains to lower the groundwater table on their lands. Between 1997 and 2006, subsurface drains removed approximately 12,000 AF/yr of high groundwater.

Lastly, phreatophytes, plants that live along the river system with their roots below or near the water table extract their water requirements directly from the saturated zone. There are approximately 18,500 acres of native phreatophytes along the Tuolumne, Merced and San Joaquin rivers. The average groundwater consumption of riparian phreatophytes was estimated to be 41,500 AF/yr between 1997 and 2006.

4.1.3 Groundwater Recharge

Groundwater recharge occurring within the Basin is mainly the result of the irrigation of crops and landscape vegetation, precipitation, percolation from the Tuolumne and Merced rivers, leakage from Turlock Lake, underflow from the Sierra Nevada foothills, and upward seepage from deep geologic fractures. A recent water budget study commissioned by the TGBA (Durbin, 2003) and updated in 2007 resulted in the estimates of recharge occurring within the Basin from 1997 to 2006 discussed throughout this subsection. The total recharge from the various sources within the Basin was calculated to be approximately 520,000 AF/yr between 1997 and 2006.

The majority of recharge results from irrigation practices. Recharge occurs when the applied irrigation water and effective precipitation exceed the consumptive use of agricultural crops or landscape vegetation. The excess water infiltrates below the crop root zone and then percolates downward into the groundwater table. It is estimated that urban and agricultural irrigation produces groundwater recharge of nearly 393,000 AF/yr. Recharge from croplands was estimated to be 375,000 AF/yr, while recharge from landscaping within urban areas is approximately 18,000 AF/yr.

Groundwater recharge from precipitation on dry, undeveloped land occurs when the effective precipitation exceeds the consumptive use of the annual or perennial vegetation. For the 1997 through 2006 period, recharge on non-irrigated lands averaged 22,000 AF/yr.

Turlock Lake, a regulating reservoir on TID’s canal system, receives water from the Tuolumne River. The reservoir has a surface area of approximately 3,300 acres. Because Turlock Lake is underlain by the moderately permeable sediments of the Mehrten Formation, water leaks from the lake into the underlying and adjacent groundwater system. The average leakage from Turlock Lake was estimated to be approximately 62,000 AF/yr for the 1997 through 2006 period. Seepage also occurs throughout TID’s 230-mile canal distribution system, which is 90% lined. Seepage estimates for the 1997-2006 period averaged nearly 38,000 AF/yr.

The Basin is also recharged from subsurface inflows that enter the groundwater basin across its eastern boundary and the base of the groundwater system. Recharge from both these sources was calculated to be about 3,000 AF/yr.

As indicated in Section 4.1.2.3 above, streamflow from the Tuolumne and Merced rivers provide recharge to the Turlock Basin, mainly along the upper reaches of the rivers. However, within the lower reaches of the Tuolumne and Merced rivers, as well as where the San Joaquin River borders the Basin, groundwater typically discharges to the rivers. Within the water budget study, streamflow-groundwater interactions were expressed in terms of the net groundwater discharge to the rivers (Durbin, 2003). The actual groundwater inflow or outflow by river reach was not calculated. The estimated net discharge to local rivers during the 1997-2006 period was approximately 30,000 AF/yr. Therefore, discharge to the river system from the Basin significantly exceeded recharge.

4.1.4 Groundwater Conditions

Groundwater conditions within the Basin vary. Levels in the eastern areas have declined significantly since the 1960s. Levels in the western areas of the Basin are high to the point of requiring pumping in certain areas to keep the groundwater from encroaching into the root zone of agricultural crops. A water budget or water balance calculation is a tool that can be used to evaluate Basin-wide storage conditions and changes in groundwater levels over time. This section summarizes the methods used to evaluate groundwater conditions in the Basin and describes groundwater storage trends over the last ten years.

4.1.4.1 Water Budget Study Description

The Turlock Groundwater Basin Water Budget study (Durbin, 2003) was commissioned by the TGBA and recently updated to evaluate storage changes within the Basin between 1952 and 2006. The Basin water budget is based on a mass balance calculation, where:

[Total Inflows] – [Total Outflows] = [Change in Groundwater Storage]

Outflows are based on estimates or records of pumping for each of the local public agencies and Non-District areas in the Basin. Other outflows result from discharge to rivers and consumption by riparian vegetation. Water use by riparian vegetation can be estimated from land use maps and climate data. The net discharge to rivers cannot be estimated and is an unknown outflow in the equation.

Groundwater recharge, or total inflows to the Basin, is estimated based on a series of assumptions regarding land use types, rooting depths, effective precipitation, irrigation efficiencies, and surface water use. Recharge can be estimated for each of the local public agencies and Non-District areas in the Basin. Other inflows include seepage from surface water distribution systems and flows from beneath the basin and across the eastern boundary. Each of these inflows can be estimated in the water budget.

The third component, change in groundwater storage, must be estimated to solve the water budget equation, because the net discharge to rivers term is unknown. Storage change is estimated using groundwater contour maps for the Basin. The water budget study uses DWR groundwater level monitoring data to construct these maps. The quality of each map is influenced primarily by the number and timing of measurements. In general, more data points and more coordinated monitoring events lead to better contour maps. As monitoring points are lost and the time between measurements increases, the estimated groundwater elevation becomes more uncertain.

For example, an area of 25 mi^2 may have 12 monitoring wells, or approximately one monitoring point for every two square miles. If seven monitoring wells are lost, each well then represents the groundwater elevation for a five square-mile area. The net result is that estimated groundwater elevations cover a greater percentage of area within the Basin. Further, if there is error in a single measurement, the error influences a greater proportion of area within the Basin.

4.1.4.2 Water Budget Study Results

Figures 16a through 16e show the series of groundwater elevation contours between 1960 and 2005 that were developed for the water budget update. The figures illustrate the cone of depression that has formed on the eastern side of the Basin, largely due to pumping groundwater to irrigate lands east of TID, where surface water supplies are not available.

Figures 16d and 16f show that the cone of depression had generally stabilized between 1998 and 2002. The recent elevation data shown in Figure 16f suggests that groundwater levels appear to have declined after 2002, particularly in the eastern portion of the Subbasin. Overall these declines are relatively small and may be within the range of error for the estimate of groundwater levels.

The update of the water budget study revealed that there has been a significant change in the DWR monitoring network that is used to create the contour maps. Decreases in funding have reduced the frequency of monitoring and the number of locations monitored during each event. Additionally, numerous monitoring points have been lost due to aging wells that can no longer be accessed. Consequently, the reduction in the number of monitoring points has led to increased uncertainty in estimated groundwater levels in the Turlock Subbasin.

The basin-wide groundwater model was used to evaluate the storage changes derived from the groundwater contour maps. The model was developed and calibrated with additional monitoring points from periods when the DWR monitoring program covered more of the local area, and is considered more representative of the Subbasin. Consequently, using the groundwater model to evaluate current estimates of inflows and outflows provides another estimate of storage changes in the Basin. The groundwater model confirms that the slight declines in storage have occurred between 2002 and 2006.

Analysis of the water level readings from several individual wells also helps provide an understanding of the changes in water levels. Figure 17 provides the general location of the historic and active monitoring wells within the Subbasin. Figures 18a through 18d provide hydrographs of the groundwater levels at four representative monitoring points highlighted in Figure 17. Analysis of the well data shows that groundwater levels have declined since the 1960s, particularly in the eastern portion of the Subbasin. Data for more recent years show that groundwater levels stabilized or recovered during the 1990s. The most recent data suggest that groundwater levels in the central and eastern areas appear to have declined slightly since 2002 (Figures 18b and 18c).

The average inflows and outflows for the 1997-2006 period are summarized in Figure 19. The water budget study estimates that storage decreased by an average of 21,500 AF/yr during that ten year period. Increases in storage occurred in 1998, 2000, and 2001, but were offset by declines in storage in 1997, 1999, and 2002 through 2006. The observed declines in groundwater storage could fall within the natural operations of the Subbasin. In any groundwater basin, groundwater storage will fluctuate both seasonally and annually, depending upon the water year classification, distribution of rainfall, and numerous other physical and biological factors. Alternating periods of decline and recovery in groundwater levels are a response to this natural variation. Long-term declines in storage without recovery could be a concern and represent net declines in storage. Continued monitoring by the local public agencies will be important for tracking changes in groundwater conditions in the Turlock Subbasin and evaluating whether additional management actions should be considered.

It is important to note that a balanced storage condition in the Basin is strongly influenced by irrigation practices. The majority of recharge occurs on agricultural land. It is estimated that groundwater recharge on agricultural lands is nearly 375,000 AF/yr, or 72% of total recharge within the Basin. Nearly 230,000 AF/yr, or 44% of total recharge occurs on lands that are irrigated by surface water. Changes in irrigation practices from surface water to groundwater sources can lead to declines in storage. Other factors that may result in storage declines are changes in cropping patterns, the expansion of irrigated agriculture in areas dependent upon groundwater, and increases in pumping due to urban growth, particularly when agricultural lands are converted to urban uses.

4.1.5 Groundwater Quality

Groundwater is an important component of the local water supply, and accordingly, the quality of local groundwater is important for its sustained use. The following section describes ongoing monitoring programs, water quality within the Basin, and the various issues and concerns facing the local agencies.

4.1.5.1 Groundwater Quality Monitoring

Water quality monitoring requirements for public water systems are set by Title 22, Chapter 15, of the California Code of Regulations (CCR) and vary depending upon the type of water system. Large public water systems (greater than 200 service connections) are regulated by the State of California. Wells at large public water systems must be sampled for general mineral, physical, inorganic, organic, and radiological analyses. Small public water systems (less than 200 service connections) are regulated by local county environmental health agencies. Sampling of small public water systems is dependent upon type of water system: small community, non-transient non-community, transient non-community, or state small water systems. Public water systems are required to perform routine bacteriological analyses, usually from water distribution systems. Frequency of bacteriological analyses is defined in Title 22, Chapter 15 CCR, and varies depending upon the specific type of water system.

Groundwater contamination sites are also monitored within the Subbasin. The Merced County DEH and Stanislaus County DER take different roles in monitoring groundwater contamination in their respective boundaries. In Merced County, facility operators or property owners are directly responsible for working with the CVRWQCB to monitor groundwater contamination. The Stanislaus County DER takes a more active role in groundwater contamination activities, with 61 active monitoring sites within its boundaries. These sites are monitored for groundwater quality on a quarterly basis. Depending on the type of constituent contamination present, groundwater is monitored for petroleum constituents, chlorinated solvents such as TCE and PCE, metals, and various other analytes based on site-specific target needs.

A standardized monitoring system has not been established for private domestic wells or the agricultural community. Individual domestic well owners, farmers and agricultural agencies do monitor groundwater quality; however, the monitoring frequency and constituents monitored vary throughout the Basin. In most cases, the water quality data for the private domestic and agricultural wells sampled is not publicly available.

4.1.5.2 Water Quality Conditions

There are numerous constituents found in the Basin’s groundwater supply. Some constituents occur naturally, while others have been introduced into the groundwater from human activities.

Many constituents found in groundwater do not have the potential to impact groundwater usage within the Basin according to current water quality standards. These constituents are not addressed in this section. The constituents identified in this section either currently impact groundwater usage within the Basin, or have the potential to impact the Basin's future groundwater usage.

Additional data and interpretations of groundwater quality conditions in the Turlock Subbasin should be available in 2008 as a result of water samples taken for the Groundwater Ambient Monitoring and Assessment (GAMA) Program being implemented by the USGS, in coordination with the State Water Resources Control Board (SWRCB) DHS, DWR, and Lawrence Livermore National Laboratory.

Salinity

Salinity can be of concern for both irrigation and municipal uses. Salinity levels are expressed as a total salt concentration or total dissolved solids (TDS), or electrical conductivity (EC). Salinity is a measure of the total sum of dissolved inorganic ions and molecules. The most common salts found in water include sodium chloride (NaCl, also referred to as "table salt"), calcium sulfate ($CaSO_4$, better known as "gypsum"), magnesium sulfate ($MgSO_4$ or "Epsom salt"), and sodium bicarbonate ($NaHCO_3$,also known as "baking soda"). Salts dissolve in water and form positive ions (cations) and negative ions (anions). The most common cations are calcium (Ca^{2+}), magnesium (Mg^{2+}), and sodium (Na^+) while the most common anions include chloride (Cl^-), sulfate (SO_4^{2-}), and bicarbonate (HCO_3^-). Potassium (K^+), carbonate (CO_3^{2-}), boron (B^{3+}) and nitrate (NO_3^-) also exist in water supplies.

TDS is usually expressed in milligrams of salt per liter (mg/L) of water. This represents the total number of milligrams of salt that would remain after 1 liter of water is evaporated completely. The higher the TDS, the higher the salinity of the water.

EC is another means of describing salinity levels. Salts dissolved in water conduct electricity, and therefore, the salt content in the water is directly related to the EC. Units of EC reported by laboratories are usually in millimhos per centimeter (mmhos/cm) or deciSiemens per meter (dS/m). One millimhos per centimeter is equivalent to one deciSiemens per meter.

Often conversions between EC and TDS are made, but should be done with caution because conversion factors depend both on the salinity level and composition of the water. A typical conversion factor is as follows:

$$\text{TDS (mg/L)} = 640 \times \text{EC (dS/m)}, \text{ when EC} < 5 \text{ dS/m}$$
$$\text{TDS (mg/L)} = 800 \times \text{EC (dS/m)}, \text{ when EC} > 5 \text{ dS/m}$$

In addition, sulfate salts do not conduct electricity in the same way as other types of salts. Therefore, if water contains high levels of sulfate salts, the conversion factors are invalid and must be adjusted upward.

The recommended municipal supply limit for salinity is 500 mg/L (TDS) with 1,000 mg/L being the highest allowable limit for long term use. Municipal wells in the Basin with depths of 184 to 550 feet have produced water between 175 and 810 mg/L TDS.

Agricultural crops vary in sensitivity to salinity levels. Beans, for example, are one of the most salt sensitive crops. Technically, sodium salts are largely responsible for most of the crop injury or yield loss due to elevated salinity. Salinity reduces crop yield primarily by reducing the ability of the plant roots to absorb water. In essence, even though the field appears to have plenty of water, the plants wilt because insufficient water is absorbed by the roots to replace that which was lost from transpiration.

The TDS levels in groundwater in the eastern two-thirds of the Basin are generally less than 500 mg/L. TDS in groundwater increases westward towards the San Joaquin River and southward towards the Merced River. In these areas, high TDS water is found in wells deeper than 350 feet. Better quality groundwater (less than 1,000 mg/L TDS) in these areas is found at shallower depths.

Within the confined aquifer, groundwater with high TDS concentrations is principally the result of the migration of a deep, saline water body that originates in regionally deposited, marine sedimentary rocks that underlie the San Joaquin Valley. The depth of this saline water body within the Basin boundaries is very shallow compared to other parts of the Valley.

Groundwater with high TDS concentrations is present beneath the entire Basin at depths from about 400 feet in the west to over 800 feet in the east. The shallowest high TDS groundwater occurs in zones five to six miles wide adjacent and parallel to the San Joaquin River and the lower part of the Merced River west of Hilmar, where high TDS groundwater is upwelling.

Under natural pressure, the saline groundwater body is migrating upward. Brines move up through permeable sedimentary rocks and also up through wells, faults and fractures. The chemistry of groundwater in the Basin indicates that mixing is occurring between the shallow, fresh groundwater and the brines. This process produces the high TDS groundwater observed near the San Joaquin and Merced rivers. Pumping of deep wells in the western and southern parts of the Basin may be causing these saline brines to upwell and mix with fresh water aquifers more rapidly than under natural conditions. In addition, the presence of saline soils in the western portion of the Turlock Subbasin (NRCS, 2007) may have an influence on salinity levels in the unconfined aquifer.

The Corcoran Clay has provided a natural impediment to the migration of high TDS groundwater from the confined aquifer into the unconfined aquifer. High permeability pathways through the clay from the confined to the unconfined aquifer may be created by wells perforated in both the unconfined and confined aquifers.

A variety of salts are represented in measured salinity levels within the Basin, including nitrates. As described in the subsection that follows, there are areas within the Basin where the shallow aquifer has higher nitrate concentrations, and therefore higher salinity levels.

Nitrates

Nitrate is an important constituent in drinking water, and in some cases may affect crops. Nitrate can be from both natural and anthropogenic sources, and is widespread in groundwater in many parts of the San Joaquin Valley. High concentrations of nitrate in groundwater are mostly a concern for potable water supplies. The MCL for nitrate in public drinking water supplies is 45 mg/L (as NO_3).

Communities within the Basin, including Ceres, Turlock, Keyes, Delhi, Hilmar, Denair and South Modesto have had wells that test high in nitrate concentrations, either close to or exceeding the current MCL. No specific areas containing higher concentrations of nitrates have been identified by the urban agencies. The presence of nitrates in the confined aquifer, which is utilized by the urban agencies for water supply, appears to be sporadic. To date, the only means of determining the potential water quality for a new well site is to drill a test hole and draw samples.

The City of Modesto has implemented ion exchange wellhead treatment for a few of the wells that are high in nitrates. In this process, the contaminated groundwater is pumped into the ion exchange unit, where the nitrate levels are reduced below the MCL. The treated water is then introduced back into the water distribution system. The City of Modesto has installed systems at City Well No. 100 in South Modesto and locations outside of the Turlock Subbasin.

Nitrate in irrigation water is not a major concern for many crops because it acts as a fertilizer. However, permanent crop production, including grape vineyards, may be adversely affected by excess nitrate concentrations. In addition, nitrates in groundwater pumped into the canal system for irrigation supply can contribute to aquatic weed growth. Aquatic weeds can clog irrigation systems and impede the flow of irrigation water, impacting irrigation water deliveries.

High nitrate concentrations are typically found in shallower groundwater zones. This pattern has been attributed to various sources, such as agricultural fertilizers, sewer effluent, septic tank disposal, and animal wastes.

Groundwater studies are currently being conducted by the USGS and others to evaluate nitrate sources and potential impacts. The results of these studies were not available for inclusion in this report. The TGBA is coordinating with the agencies conducting these studies and will examine the data as it becomes available.

Iron and Manganese

Groundwater in several areas within the Basin has elevated iron and manganese levels. Some wells in the cities of Ceres and Turlock and in the SMSA have encountered problems due to manganese. Generally "reducing conditions" (lack of oxygen) may lead to elevated iron and manganese levels in groundwater. Also, shallow groundwater near streams often has high manganese and sometimes high iron concentrations.

No specific areas where iron and/or manganese have been identified by the urban agencies. The presence of these constituents in the confined aquifer, utilized by the urban agencies for water supply, is episodic with no distinct affected region. To date, the only means of determining the potential water quality for a new well site is to drill a test hole and draw samples.

Boron

Currently, boron is an unregulated chemical requiring monitoring by the California DHS (Title 22 CCR Section 64450). Unregulated chemicals have notification levels and response levels rather than formally regulated MCLs. The notification level is the level at which the drinking water supplier must notify the governing body of the local agency where water users reside when a constituent is detected at a concentration above the notification level. The response level is the concentration at which DHS recommends removing the water source from service. The notification level for boron is 1 mg/L, while the response level is 100 mg/L (DHS, 2006). Boron is not currently a concern for public drinking water suppliers within the Basin.

Boron is found in most waters used for irrigation in the United States. Although traces of boron are essential for all plant growth, concentrations above the plant tolerance level can cause damage to the plant and reduce crop production. Plant tolerances for crops currently grown within the Basin vary from 0.5 mg/L for the most sensitive crops to approximately 10.0 mg/L for the most tolerant crops. Current boron concentrations in irrigation water are within plant tolerance levels and do not adversely impact crop production.

Arsenic

Arsenic is naturally present in rocks and minerals in the earth's crust, and is naturally present in groundwater. Concentrations higher than current and contemplated standards have been found in the U.S., especially in the western states. Arsenic is also found in some pesticides, which can be leached to groundwater. Arsenic has been linked to lung and bladder cancer in humans. As a result, the U.S. Environmental Protection Agency (EPA) has promulgated a new, more stringent arsenic rule, lowering the MCL from 50 µg/L to 10 µg/L (10 ppb), effective January 2006. The State of California DHS has considered establishing a lower standard for California; however, it is understood that DHS will conform to the EPA MCL requirements at this time.

Arsenic concentrations in water from public water supply wells in the Basin are typically below the old standard, but some are higher than the new MCL. As a result, urban agencies are considering options available to reduce arsenic levels, including utilizing surface water supplies or installing costly wellhead treatment technologies. Should the State of California adopt new, more stringent standards, most local urban water supplies will be impacted.

Under the new arsenic rule, the City of Turlock has two wells that are, on occasion, slightly over the limit. If this trend continues, it is likely that the wells will have to be placed on standby status and will only be used in an emergency. The arsenic levels in the City of Modesto's water supply wells vary from non-detect to 10 µg/L (10 ppb). If the California DHS lowers the arsenic MCL in the future, several Modesto wells, including a few of its wells in the Turlock Subbasin, could exceed the MCL and would be removed from the domestic water system.

Arsenic levels within the City of Hughson system average around 11 µg/L (11 ppb). A treatment assessment study has been conducted by Carollo Engineers (available on the City of Hughson website at www.hughson.org) to determine suitable treatment options to meet the new arsenic MCL. Hughson is working toward the development and implementation of a treatment system to achieve this goal.

Keyes CSD also has wells that occasionally exceed the new MCL for arsenic, with detections ranging from 4.4 µg/L (4.4ppb) to 17.5 µg/L (17.5 ppb). Keyes CSD has hired a consultant to investigate options for treating wells with arsenic levels greater than the federal standard. Further, Keyes CSD has hired a hydrogeologist to explore alternative water supply options.

Radionuclides

Radionuclides are produced as a result of radioactive decay of certain elements. These parameters are primarily from natural sources and can affect drinking water supplies. The drinking water standard for "gross alpha," the general measure of the potential for radioactive substances to be in water, is 15 picoCuries per liter. Additional testing is required for specific radioactive species, if radiological constituents above the MCL are detected. The MCL for uranium is 20 picoCuries per liter.

Sampling in the Basin for radiological constituents has generally been limited to public water systems. Groundwater with high uranium activities has been detected in the Hilmar, Hughson, Ceres, South Modesto, Denair, and Keyes areas. The occurrences are indicated to be natural and are based on available data.

The City of Modesto's gross alpha levels vary from non-detect to 35 picoCuries per liter, while uranium levels vary from non-detect to 40 picoCuries per liter. A number of City of Modesto wells, including a few in South Modesto, have been removed from water production due to gross alpha and/or uranium contamination.

Within the City of Hughson, uranium was found in one of the production wells in 1986. The well was subsequently closed and remains out of service.

The EPA has discussed establishing a standard for radon in drinking water. Depending on how low this standard is set, natural activities of radon could be a concern in the future.

Bacteria

Bacteriological quality in the Basin is generally acceptable in deep groundwater aquifers. Bacteriological quality of groundwater pumped by individual wells can not be generalized and depends on many factors pertaining to the well and surrounding conditions.

Inadequately constructed and improperly located, destroyed or abandoned water wells may contribute to bacteriological contamination of groundwater. Some of the factors that may influence contamination of water wells include location with respect to sources of contamination, inadequate well construction features, general deterioration and/or inadequate maintenance of wells, and improper use of water wells for disposal of wastes.

Bacteriological contamination of groundwater is a health concern because groundwater is used for drinking water. Water wells used to supply drinking water are routinely tested for pathogenic microorganisms. The City of Ceres, for example, tests its wells weekly.

Pesticides

Two pesticides with contamination issues have been identified in the Turlock Subbasin, resulting from past agricultural activities. Additional data on pesticide contamination will be available from ongoing USGS and SWRCB groundwater studies in the region. These data will be evaluated as they become available.

Dibromochloropropane (DBCP)

Pesticide contamination is primarily the result of the widespread use of the agricultural nematicide Dibromochloropropane (DBCP) on crop lands for several decades before it was banned in 1977. DBCP in groundwater is usually associated with vineyards or orchards where the pesticide was used. DBCP is a carcinogen at very low concentrations in water, and is a concern for potable water supplies. It moves freely with the groundwater and persists for long periods. The MCL for DBCP is 0.2 micrograms per liter (µg/L). DBCP has been found in two wells in the Turlock area at extremely low levels, just above the detection limit of 0.01 µg/L (ppb), pursuant to Title 22 CCR Section 64445.1. DBCP has also been found in public water supply wells in the South Modesto, Keyes, and Ceres areas at levels either close to or exceeding the MCL. In the case where the DBCP levels exceed the MCL, wellhead treatment is being utilized.

Ethylene dibromide (EDB)

Another pesticide that has been detected in the Basin's groundwater is ethylene dibromide (EDB). EDB is also an agricultural nematicide, used primarily on vineyards. EDB was banned in the early 1980s. This pesticide has been detected in one public water supply well in the Turlock area.

Trichloroethylene

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a sweet odor and is used as a solvent for dyes and rug cleaners, as well as a degreaser for metal parts. Improper storage and disposal have made TCE a major contaminant of groundwater supplies in California; however, the extent of TCE contamination within the Turlock Groundwater Basin is currently unknown. TCE is known to contaminate water wells close to refineries, metal processing plants, chemical manufacturers, military bases, and electroplating operations. The contamination is persistent due to TCE's long half-life in groundwater which typically ranges from 9 months to 3 years.

The California Drinking Water Action Level of 5 ppb (5 µg/L) for TCE is based upon what is considered a negligible risk level for cancer. In other words, if one million people drank about 2 liters of water containing TCE at this level every day over a 70 year lifetime, theoretically there would be no more than one additional case of cancer in the million people exposed.

Other Trace Organics

Other trace organic compounds have been detected in the groundwater Basin, including, but not limited to, carbon tetrachloride, perchloroethylene, and hydrocarbon-based products. Improper use, storage, and accidents have resulted in unauthorized releases of these substances.

Volatile organic compounds (VOCs) derived primarily from solvents have contaminated the groundwater in some areas. Some contamination can be attributed to industries that handle, store, and use solvents. Perchloroethylene (PCE) has been detected at one time or another in some of the Basin's public water supply wells. Industrial wastes and dry cleaners are a recognized source of PCE in groundwater in some municipal areas, such as the City of Turlock.

Carbon tetrachloride is often attributed to auto repair shops, which have historically used it as a solvent or degreaser. One well within the City of Turlock was closed in 1999 due to levels of carbon tetrachloride exceeding the MCL of 0.5 µg/L in public water supply wells. It is not clear if this compound was in the groundwater or was a contaminant of the oil used to lubricate the pump.

Several unauthorized releases from underground storage tanks (UST) have occurred in the Basin. Most of these cases are very localized in nature in terms of groundwater impacts, and public water supply wells are not known to have been affected. The Stanislaus County DER and, to a lesser extent, the Merced County DEH, are involved in monitoring and regulating the clean-up of sites involving many VOC and UST spills. The county agencies have a contract with the State Water Resources Control Board to oversee clean-up of releases originating from USTs.

4.1.5.3 Areas of Concern

Agricultural and municipal agencies within the Basin are concerned about maintaining adequate supplies of groundwater within the Basin. Groundwater is the primary source of water for the agricultural agencies on the eastern side of the Basin. As a result, they are concerned about the continued decline of groundwater levels on that side of the Basin. The municipalities, which also rely on groundwater for their source of water, are not as concerned about the present quantities of water as they are about the future quantities of water that will be needed as the cities continue to expand.

Agencies within the Basin are also concerned about maintaining the Basin's groundwater quality. The Basin generally has good quality groundwater. As a result, the municipalities are not currently required to provide significant water treatment. In most cases, treatment is limited to chlorination. However, there are some areas of water quality concern. For example, saline brines continue to migrate upward from the saline confined aquifer, resulting in increased salinity levels. In addition, constituents such as PCE, DBCP, EDB, uranium, nitrates, manganese and iron have been found in a few water supply wells within the Basin. In a few cases, these constituents have impacted the municipalities' ability to utilize the wells to supply potable water and resulting in the wells being retired, or requiring some form of treatment. In the future, the municipalities within the Basin may be required to investigate various options, such as well head treatment, to meet increasingly stringent minimum water quality requirements. An example of one such substance of concern is arsenic. New EPA and state standards likely will impact most local agencies.

Additionally, it is important to note, that the San Joaquin River is listed by the State of California as impaired for salt and boron. The CVRWQCB adopted a Basin Plan Amendment to implement a control plan in the form of a Total Maximum Daily Load (TMDL) to address both salt and boron concentrations in the river. The water quality objectives at Vernalis are as follows:

Salinity:	0.7 mmhos/cm during the irrigation season 1.0 mmhos/cm during the non-irrigation season
Boron:	0.8 mg/L during the irrigation season 1.0 mg/L during the non-irrigation season

In addition, the Regional Board plans to adopt salinity standards upstream of Vernalis.

The Basin Plan Amendment recognizes the interaction between groundwater and surface water flows, and therefore, that groundwater is a component of the salt loading in the river system. As a result, if implementation measures to control surface water inputs do not result in the required improvements, the CVRWQCB has committed to developing a groundwater control plan to improve the salinity contributions from groundwater sources.

4.2 SURFACE WATER SUPPLIES

4.2.1 Surface Water Sources

The Turlock and Merced irrigation districts are the only entities within the Basin with access to firm supplies of developed surface water. During wet years, TID and Merced ID may provide water to irrigators situated along the districts' canals but outside of the districts' boundaries. In addition, there are some individual property owners with riparian rights that utilize water from the bordering rivers. The extent of this type of usage is undocumented.

The TID's main source of water is through surface water diversions from the Tuolumne River. TID and the Modesto Irrigation District (which operates outside of the Turlock Subbasin) jointly operate the Don Pedro Reservoir on the Tuolumne River to store winter and spring runoff for agricultural and municipal uses. The surface water available to growers within TID is based on the runoff each year coupled with its share of carry-over storage from Don Pedro.

The Merced ID's main source of surface water is the Merced River. Merced ID operates Lake McClure to store winter and spring runoff for summer irrigation. The surface water available to Merced ID each year is based on the runoff for that year coupled with the Merced ID's direct diversion rights and stored water from Lake McClure.

Surface water supplies more than 50% of the total irrigation water applied to land in the Subbasin boundaries. The average volume of surface water imported into the Subbasin between 1997 and 2006 was 540,000 AF/yr. A significant part of applied irrigation water percolates past the root zone to become groundwater recharge. As illustrated in Figure 19, deep percolation of applied surface water is the largest single component of groundwater recharge. When deep percolation of applied surface water is combined with canal seepage and recharge from Turlock Lake, surface water makes up the majority of recharge to the Subbasin. Therefore, a majority of recharge originates from the Tuolumne River, and to a much lesser extent, the Merced River.

4.2.2 Surface Water Quality

As described earlier, surface water is diverted from the Tuolumne and Merced rivers for irrigation purposes. The quality of this surface water supply is exceptionally high. Similar water is diverted on the north side of the Tuolumne River, treated, and delivered to the City of Modesto for drinking water purposes.

4.3 OTHER SUPPLIES

Although surface water diversions are the main water supply within the Subbasin, other sources of water are utilized. These sources are described in the subsections that follow.

4.3.1 Precipitation

Within the Basin, precipitation alone does not satisfy urban and agricultural water supply requirements. The Basin is characterized by a Mediterranean-type climate with hot, dry summers and cool, wet winters. The majority of precipitation falls between November and March. The amount of precipitation in this part of the Central Valley also varies widely from year to year. According to DWR Bulletin 118 (2003), the average annual precipitation is estimated to be 11 to 13 inches, increasing eastward, with 15 inches in the Sierra Nevada foothills. Records for the Turlock area show annual precipitation totals ranging from roughly 5.5 inches to 27 inches (Table 3 of Appendix B). The long-term average rainfall for the 1952-2006 period for the Turlock area is approximately 12 inches (data not shown).

Because the majority of precipitation falls in the winter, most landscaping, crops and orchards are dependent upon irrigation during the growing season. While precipitation does not fully satisfy water demands, it does contribute to groundwater recharge. Therefore, the groundwater system contains some portion of water that originated from the direct infiltration of precipitation.

Stormwater ponds and dry wells are facilities designed to help manage urban stormwater runoff generated when precipitation falls on impervious areas or in excess of the land's ability to readily absorb the water. These facilities also provide a means for stormwater to percolate down into the groundwater system. Most communities have stormwater ponds. Dry wells, an older means of disposing of stormwater, are found in many communities within the area.

4.3.2 Recycled Water

The major municipal water suppliers in the Basin, in the course of disposing of treated wastewater effluent, are in the practice of reclaiming water for either reuse or percolation. Many agencies utilize percolation ponds to dispose of wastewater, while others utilize the water for irrigation purposes. Table 4 in Appendix B summarizes the various methods of treated effluent reuse, recharge, and disposal within the Basin.

The City of Modesto recently completed a Recycled Water Feasibility Study for their area of influence. A number of other agencies are continuing to evaluate the use of recycled water for landscape irrigation and other purposes.

4.3.2.1 Reuse

Table 4 of Appendix B provides a summary of treated wastewater effluent use and disposal within the Turlock Subbasin. The City of Modesto sends its wastewater to the Jennings Road secondary plant for additional treatment and disposal. For example, between 2000 and 2004 it imported an average of 10.16 billion gallons per year (31,167 AF/yr). From this volume, an average of 4.59 billion gallons per year (14,087 AF/yr) were utilized for irrigation purposes on 2,526 acres of land adjacent to the San Joaquin River. The remainder was stored in ponds and seasonally discharged to the San Joaquin River or lost due to evaporation. In 2005, 3.67 billion (11,265 AF) gallons of treated effluent were used for agricultural irrigation.

The City of Turlock has a permit from the CVRWQCB for the reuse of a portion of its wastewater effluent to irrigate 300 acres of farmland in the Subbasin. In 2005, 47 million gallons (144 AF) were used for agricultural irrigation on this parcel. No effluent was used for irrigation on this parcel in 2006, but this use may continue in the future under the existing permit.

The City of Turlock RWQCF was recently upgraded to provide tertiary treatment. In the future, up to two MGD (2,240 AF/yr) of this effluent is anticipated to be used by the new TID Walnut Energy Center, which came on-line in early 2006. Plans are also being made to use the tertiary treated effluent for irrigation of parks, medians, landscaping, and additional crop irrigation. Use of recycled water will offset the need for additional groundwater supplies.

The City of Ceres reuses its treated effluent for landscape irrigation purposes at the wastewater treatment plant. Landscape uses total approximately 72 million gallons per year (221 AF), or 300,000 GPD during summer months and 100,000 GPD during winter months.

4.3.2.2 Percolation

The cities of Ceres and Hughson and the Hilmar and Delhi county water districts utilize percolation ponds as a means of disposing of treated effluent. Through these facilities a portion of the water evaporates, while the remaining water percolates into the groundwater system. Approximately 1,302.9 million gallons (3,998 AF) of treated effluent is delivered to percolation ponds each year. As these communities continue to grow, the amount of water percolated through this process will increase proportionately. The 2005 quantities of percolated treated wastewater effluent for the Turlock Subbasin are described for each agency in Table 4 in Appendix B.

4.4 FACILITIES AND OPERATIONS

Public agencies and individual property owners have facilities they own, operate and maintain to provide water for their needs.

4.4.1 Facilities Owned by Local Public Agencies

Turlock and Merced irrigation districts own and operate a water delivery system of canals and laterals that transport surface water to local growers. The majority of the time, water flows by gravity to the irrigated land. Most land within the districts are irrigated using flood irrigation techniques. However, some growers have moved to drip/micro or other more advanced technologies. Water is managed within the canal system to minimize spills to the river and maximize the efficient use of water within these districts' facilities.

The urban agencies within the Subbasin currently rely exclusively on groundwater for their supplies. Some agencies utilize chlorination and a variety of storage tank options, while others do not. Wells, storage tanks, and distribution lines are designed to meet the needs of each individual community.

Urban agencies utilize the general planning process to evaluate the facilities and resources needed to supply the projected population growth within their community. As communities grow, they continue to consider the best combination of water supply and infrastructure improvements to meet their needs.

4.4.2 Other Public Facilities

There are small community water supply systems that are operated by the community and regulated by the local county environmental health agency. These communities rely entirely upon groundwater for their supplies.

4.4.3 Privately Owned Facilities

All irrigation facilities within the Eastside and Ballico-Cortez water districts are privately owned and operated. Growers have installed irrigation supply wells, as needed, to irrigate their crops.

Privately owned irrigation supply wells and domestic wells are installed in locations throughout the Subbasin to provide irrigation and on-farm water, as well as private domestic supplies to rural homes and businesses. These facilities are installed, operated, and maintained and on an as-needed basis to meet the individual needs of the property owner.

5 GROUNDWATER MANAGEMENT PLAN

5.1 DEFINITION OF THE GROUNDWATER BASIN

The California Water Code Section 10752 defines a groundwater basin as "any basin identified in… Bulletin 118… but does not include a basin in which the average well yield, excluding domestic wells that supply water to a single-unit dwelling, is less than 100 gallons per minute." The Turlock Groundwater Subbasin is a groundwater basin pursuant to this definition. The geographical setting and hydrogeology of the Subbasin are described in detail in Section 4.1.1.

5.2 AGENCIES COVERED UNDER THE GROUNDWATER MANAGEMENT PLAN, THEIR BOUNDARIES, AND GROUNDWATER MANAGEMENT AREAS

As described in Section 1.2, there are a wide variety of agencies located within the Turlock Groundwater Subbasin. The Subbasin has been divided into Groundwater Management Areas or "subareas," defined by the political boundaries of the local public agencies. Each agency represents the lands within their boundaries. In the event that a city, county water district, community services district or other municipal water supply agency lies within an irrigation district or other entity's boundaries, the municipal water supply agency will represent the overlapping areas. Similarly, although both Merced and Stanislaus counties together cover the entire Subbasin, the counties' management areas are defined as those areas not contained within another agency's boundaries.

This document, developed by the TGBA, is designed to cover the entire Subbasin. However, each agency is required to adopt the Plan for their respective agency. As a result, only those areas within the boundaries of the agencies that adopt the Plan, are covered. Appendix G lists the agencies that have adopted the Plan, as well as a copy of the resolutions pertaining to those actions.

It is important to note that agencies that may choose not to adopt the Plan still will be encouraged to continue to participate in the TGBA, work with the other local agencies in groundwater management related activities, and consider adopting the Plan in the future.

5.3 BASIN MANAGEMENT GOALS AND OBJECTIVES

The water agencies in the Turlock Subbasin agree that the groundwater and surface waters within the Turlock Groundwater Basin are a vitally important resource that provides the foundation for maintaining current and future water needs. Preservation of these resources is essential in order to maintain the economic viability and prosperity of the Basin area. It is the goal of the member agencies that groundwater will continue to be a reliable, safe, efficient, and cost-effective water supply. The agencies, individually and collectively, are pursuing and will continue to pursue water management strategies to maintain viable local sources of water supply. The following Basin Management Objectives (BMOs) have been developed by the TGBA for the purpose of meeting this goal:

1. Maintain an adequate water level in the groundwater basin.
2. Protect groundwater quality and implement measures, where feasible, to reduce the potential movement of existing contaminants.

3. Monitor groundwater extraction to reduce the potential for land subsidence.
4. Promote conjunctive use of groundwater and surface waters.
5. Support and encourage water conservation.
6. Develop and support alternate water supplies. Educate users on the benefits of water recycling.
7. Continue coordination and cooperation between the TGBA members and customers.

The local water agencies, individually and collectively, are pursuing water management strategies under each of the BMOs to ensure that groundwater continues to be a reliable, safe, efficient, and cost-effective water supply. The TGBA will support individual actions of local agencies to meet the BMOs. The following sections describe the BMOs in greater detail and provide a framework of potential actions the local water agencies can follow to support each objective.

5.3.1 Maintain Groundwater Levels

Groundwater conditions within the Basin vary. Levels in the eastern areas have declined significantly since the 1960s. Levels in the western area of the Basin are high to the point of requiring pumping in certain areas to help keep the groundwater from encroaching into the root zone of agricultural crops. Recent data show that the groundwater levels stabilized during the 1990s, but appear to have declined slightly in localized areas between 2002 and 2006. Local declines in water levels have been noted on the east side of the Basin and in several cities as their use of water has increased with continued urbanization.

The following is a list of programs and policies that the local water agencies can implement to help maintain adequate groundwater levels in the Subbasin:

- Monitor groundwater for usage, quality and water levels.
- Evaluate the effectiveness of the current monitoring program and make improvements as necessary.
- Encourage conjunctive use policies that decrease the use of groundwater when surface water supplies are abundant.
- Develop a water budget within the Basin to establish if the basin or areas within the Basin are in overdraft.
- Continue efforts to study the potential effects of future land use changes on groundwater storage.
- Support a comprehensive approach to identify and protect natural recharge areas.
- Support and encourage water conservation programs to reduce groundwater usage.
- Evaluate feasibility of groundwater recharge projects.
- Capture storm water run off for recharge or use as an alternate water supply.

Additional information on measures to maintain groundwater levels, including mitigation of overdraft conditions, replenishment of groundwater extracted by producers, and construction and operation of recharge, storage, conservation, water recycling, and extraction projects, is included in Section 6, Groundwater Protection Measures.

5.3.2 Protect Groundwater Quality

Although water quality within the Basin is generally acceptable, there are many wells that have constituents of concern at levels impacting the use of the water. These water quality concerns primarily affect municipal water suppliers. Contamination is usually found first in public potable water sources because these wells are analyzed on a regular basis. Actions that may be taken by the local water agencies to protect groundwater quality or reduce the risk of movement of existing contaminants include the following:

- Continue to support a program to monitor area wells that are not currently required to test for water quality.
- Develop and maintain a database of water quality data for the use of the TGBA.
- Encourage sound well standards and well abandonment practices to protect groundwater quality.
- Promote land use practices that protect the groundwater recharge areas from contamination.
- Implement measures to stabilize groundwater levels to reduce the movement of contaminants.
- Evaluate the impact of urbanization on groundwater levels and quality.
- Where practicable, use recent hydrogeologic assessments to develop programs and to implement projects that control the migration of poor quality water.
- Where possible, reduce reliance on wells that may induce the upward movement of salts within the Basin.

Additional information on measures to protect groundwater quality, including identification and management of wellhead protection areas, regulation of the migration of contaminated groundwater, identification of well construction policies, administration of well abandonment and destruction programs, and control of saline water intrusion, is provided in Section 6, Groundwater Protection Measures.

5.3.3 Land Subsidence

Historically, land surface subsidence within the Basin has not been significant despite the changes in groundwater levels that occurred in the 1970s and 1980s. Inelastic subsidence has not been observed in the Subbasin, and it does not appear that subsidence will become a major problem in the future. The groundwater level monitoring activities undertaken by the local water agencies and coordinated through the TGBA are designed to evaluate the maintenance of groundwater levels. If substantial declines in groundwater levels occur and subsidence is reported, the TGBA member agencies will evaluate the reports and discuss potential management actions based on the results of the evaluation.

5.3.4 Conjunctive Use

The local water agencies, in conjunction with the TGBA, will continue to promote policies that permit groundwater banking and allow alternate surface water uses that benefit the local groundwater basin, including the following:

- **Using surface water for municipal water supply:** Agencies within the Basin are evaluating the potential for utilizing surface water to supply a portion of the potable water needs within the urban areas. The use of surface water for potable uses will reduce the quantity of groundwater extracted by the domestic water suppliers, thus resulting in in-lieu recharge that helps maintain adequate groundwater levels within these areas.
- **Continuing flood irrigation practices:** Flood irrigation in agricultural operations is useful in banking water for later use in dry years, both through in-lieu recharge and deep percolation of applied surface water. This practice also helps reduce salt buildup in the soil that may be detrimental to crops.
- **Conducting active groundwater recharge:** EWD and TID are conducting an expanded recharge study to evaluate the potential for groundwater recharge basins on the east side of the TID irrigation service area to help stabilize groundwater levels in the area. The study began during the 2007 irrigation season.

5.3.5 Water Conservation

There are several conservation programs that are available for both agriculture and domestic uses. The TGBA and local water agencies will promote conservation for all water users in the Basin, potentially drawing from the following activities:

- **Installation of domestic water meters:** Several studies have shown that meters reduce water use by 20-25%. Current legislation requires the installation of water meters for domestic users on all new residential construction. Recent legislation (AB 2572, September 2004) requires urban water suppliers to implement volumetric pricing for metered service connections beginning January 1, 2010. This legislation also requires urban water suppliers to install water meters on all municipal and industrial service connections by January 1, 2025.
- **Reevaluating water rate schedules:** As described above, recent legislation requires urban water suppliers to implement volumetric pricing for metered service connections beginning January 1, 2010.
- **Conservation education:** Educate users on the most efficient water use practices for agriculture, commercial, industrial, and domestic users that would result in reduced use of groundwater supplies, help maintain groundwater levels, and protect groundwater quality.

5.3.6 Alternate Water Supplies

The local water agencies, in conjunction with the TGBA, will support the development of additional water supplies such as the use of recycled water and storm water, when appropriate. These efforts should be implemented in a manner that is protective of groundwater quality. In addition, changing water quality regulations must be considered when implementing such programs.

Sources of alternate water supply could include:

- Wastewater effluent, when properly treated, can be used for agriculture, landscaping, and industrial cooling uses.
- Excessive landscape runoff captured by storm water systems could be contained and used for additional irrigation.
- Storm water could be captured and used for groundwater recharge or other uses.
- Reuse of non-potable water: Where feasible, groundwater that does not meet potable water regulations may be used for crops.
- The increased use of non-potable wells for irrigation of crops, landscaping and other non-potable uses could be promoted. These wells typically have been used to reduce high groundwater levels and to supplement irrigation. Other uses of this water could include industrial cooling water, decorative fountains, parks, and roadside landscaping.

5.3.7 Cooperation and Coordination

Members of the TGBA will continue coordination among its member agencies, local water agencies, and interested parties to manage the water supplies within the Turlock Groundwater Basin. The TGBA members will continue to cooperate and develop Basin-wide programs and projects to benefit the Basin's resources.

The TGBA meetings will continue to be a forum where regional, state, and federal agencies can meet to discuss ongoing and future regulatory issues.

5.4 GROUNDWATER MANAGEMENT SUBAREAS' GOALS AND OBJECTIVES

The BMOs for the Turlock Subbasin, described above, are supported by groundwater management goals and objectives for each of the subareas (i.e., each individual agency). In some cases, the Subbasin and subarea goals and objectives may be the same. In other cases, agencies may have additional goals and objectives they wish to pursue, beyond those of the Subbasin. The goals and objectives for each of the subareas are described in detail in Appendix F.

5.5 GROUNDWATER MONITORING PLAN

5.5.1 Groundwater Level Monitoring

Groundwater level monitoring is conducted by a variety of agencies within the Basin. DWR has a network of wells throughout the valley that are monitored on an annual or semi-annual basis. In addition, local agencies have developed a similar program, monitoring groundwater levels at local supply wells. The approximate location of the network of local agency and active DWR monitoring wells is shown in Figure 20. Table 5 of Appendix B presents a summary of the current monitoring efforts of the local water agencies.

Local monitoring activities are typically conducted in November and March of each year. The November measurement is meant to represent the “after irrigation season” measurement, when crops are going dormant, and irrigation is no longer occurring. Conversely, the March measurement is designed to illustrate the groundwater levels as the next irrigation season starts, and after much of the rainfall received has percolated into the soil. The TGBA has developed procedures for collecting groundwater level measurements to ensure the consistency of data collected by the local water agencies.

DWR has historically conducted similar monitoring of groundwater levels throughout the state, including numerous wells in the Turlock Subbasin. There have been significant changes in DWR’s monitoring program over the last ten years. The fall monitoring period has been eliminated or substantially reduced due to funding cuts, and numerous wells have been lost due to settling or other problems with aging. Currently, DWR monitors the majority of its wells in March of each year. Current and historical groundwater data are available on DWR’s website at *http://wdl.water.ca.gov/*.

The TGBA currently accumulates water level data from its members and compiles the data in a computer spreadsheet. This data is available for review by all members and an annual review of this data will provide useful information to the TGBA on the status of the groundwater basin.

5.5.2 Groundwater Quality Monitoring

Local cities and small community water systems conduct water quality monitoring of the wells utilized to supply drinking water. The DHS regulates the type of monitoring and frequency required to ensure the quality of local drinking water supplies. The information from these monitoring practices is available for review and analysis and is provided to consumers in the municipal subareas via each municipal supplier’s annual Consumer Confidence Report. To a lesser extent, agriculture has conducted limited monitoring of agricultural wells. The wells are typically constructed differently, and often draw from different aquifers than the municipal supply wells. The frequency and type of water quality monitoring efforts are shown in Table 5 (Appendix B). The locations of wells where water quality samples are taken are shown in Figure 20.

Water quality data from all of the major utilities and small water systems is available from the State of California DHS. These data will be obtained from DHS on a periodic basis and the local information will be analyzed to look for any trends.

Water quality data are also available from groundwater contamination monitoring in the Turlock Subbasin. The Merced County DEH and Stanislaus County DER take different roles in monitoring groundwater contamination in their respective boundaries. In Merced County, facility operators or property owners are directly responsible for working with the CVWRQCB to monitor groundwater contamination. The Stanislaus County DER takes a more active role in monitoring groundwater contamination within its boundaries. Currently the DER monitors 61 contamination sites within the Stanislaus County portion of the Subbasin. These sites are monitored for groundwater quality on a quarterly basis. Depending on the type of constituent contamination present, groundwater is monitored for petroleum constituents, chlorinated solvents such as TCE and PCE, metals, and various other analytes based on site-specific target needs. Groundwater is often monitored from shallow and deeper aquifers depending on geologic and hydrogeologic conditions. Water quality data relevant to most of the contaminated sites within both Stanislaus and Merced counties can be found on the SWRCB Geotracker website at *https://geotracker.waterboards.ca.gov*. These data can be obtained periodically and examined in conjunction with the data from small water systems to evaluate water quality trends within the basin.

In addition, a comprehensive assessment of statewide groundwater quality conditions, the GAMA study, is being conducted by USGS, in cooperation with SWRCB, DHS, Lawrence Livermore National Laboratory, and DWR. The GAMA study will yield substantial information on chemical constituents not normally available, allowing for the establishment of baseline water quality conditions and the early detection of contamination. Further, this study will provide data that TGBA member agencies can use to examine long-term trends in water quality. The TGBA member agencies are coordinating with the agencies conducting the GAMA study, and plan to evaluate the resulting data as it becomes available.

5.5.3 Subsidence Monitoring

Inquires with DWR have shown no documented occurrences of inelastic subsidence within the Turlock Subbasin (A. Steele, DWR, personal communication October 2004). The groundwater level monitoring activities by the local water agencies are designed to evaluate changes in groundwater storage that could influence land subsidence in the Subbasin. Should groundwater levels change and subsidence is reported, the local agencies will examine reports of land subsidence and discuss potential monitoring activities based on the results of the evaluation.

5.6 FACILITATING CONJUNCTIVE USE OPERATIONS

Conjunctive use of groundwater and surface water in a groundwater basin typically occurs when the surface water supply to the Basin varies from year to year and Basin water demand is relatively constant. In some years, the surface water supply is greater than the Basin water demand; in other years, the surface water supply is less than the Basin water demand. In the years of plentiful supply, surface water is utilized to recharge the groundwater aquifer. Recharge can occur either directly by surface recharge or injection well, or by using surface water in lieu of groundwater when it is available. In effect, the groundwater basin is utilized as a storage reservoir and water is placed in the reservoir during wet years and withdrawn from the reservoir during dry years.

Turlock and Merced irrigation districts have been practicing an informal form of conjunctive use for years as a means of making the best use of available resources. In wet years where more surface water is available, the districts rely more heavily on surface water to supply irrigation customers. In drier years, when less surface water is available, groundwater is used to supplement surface water supplies both by the irrigation districts as well as individual growers with access to wells. Because irrigation is the main source of recharge within the Subbasin, this form of conjunctive use results in surface water recharging the groundwater basin in wet years, making groundwater available in drier years when it is needed.

To a lesser extent, conjunctive use is facilitated by the districts through the sale of irrigation water to lands adjacent to their canals, but located outside the irrigation district service area.

When surface water is available, and there is sufficient canal capacity to deliver the water, TID and Merced ID sell surface water supplies to growers that would otherwise be required to pump groundwater to irrigate their crops. The extent that this program is utilized, as well as the amount of water available, varies from year to year. Although the overall amount of water delivered in this manner is small compared to total irrigation deliveries within the Subbasin, the amount of water utilized results in an equivalent amount of water remaining in the groundwater system for later use. Additional conjunctive use opportunities may be available. The local agencies will continue to explore these opportunities.

6 GROUNDWATER PROTECTION MEASURES

A high priority of the TGBA is the protection of groundwater resources. This will be accomplished through a series of actions, described below, to be implemented by the local water agencies and facilitated by the TGBA.

6.1 IDENTIFICATION AND MANAGEMENT OF WELLHEAD PROTECTION AREAS

The purpose of wellhead protection is to protect the groundwater used for public supply, thereby eliminating costly treatment to meet relevant drinking water quality standards. A Wellhead Protection Area (WPA), as defined by the Federal Wellhead Protection Program established by Section 1428 of the Safe Drinking Water Act Amendment of 1986, is “the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield.” The WPA may also be the recharge area that provides the water to a well or wellfield. Unlike surface watersheds that can be easily determined from topography, WPAs can vary in size and shape depending on subsurface geologic conditions, the direction of groundwater flow, pumping rates, and aquifer characteristics. WPAs are not directly an agricultural issue. However, in the Turlock Groundwater Basin, due to the relationship between agricultural and municipal water uses, some important considerations in delineating WPAs are as follows:

- Location of existing public supply wells
- Identification of probable locations of future public supply wells
- Present direction of groundwater flow
- Probable direction of future groundwater flow
- Construction characteristics of public supply wells (i.e., location of perforated intervals and specifications of annular seals)
- Subsurface geologic conditions (i.e., restricting layers, confining beds, and other features)
- Rate of current groundwater flow
- Pumping from up gradient areas
- Potential sources of contamination
- Forecasted future land use

Potential areas of water quality risk include:

- Areas without improved sewage collection systems
- Areas with leaky sewer pipes and septic systems
- Improperly constructed or abandoned wells
- Confined animal feedlots and dairies
- Agricultural practices where chemicals are used
- Areas with potential for spills of hazardous materials

Identification of WPAs is a component of the Drinking Water Source Assessment and Protection Program (DWSAP Program) administered by DHS. The Program established a goal for all water systems statewide to complete Drinking Water Source Assessments by December 31, 2002. All of the municipal water purveyors described in Section 3.2 have completed their required assessments (DHS, 2004) by performing the three major required components listed below:

- Delineation of capture zones around sources (wells)
- Inventory of Potential Contaminating Activities (PCAs) within protection areas
- Vulnerability analysis to identify the PCAs to which the source is most vulnerable

Delineation of capture zones includes using groundwater gradient and hydraulic conductivity data to calculate the surface area overlying the portion of the aquifer that contributes water to a well within specified time-of-travel periods. Typically, areas are delineated representing 2-, 5-, and 10-year time-of-travel periods. These protection areas need to be managed to protect the drinking water supply from viral, microbial, and direct chemical contamination.

Inventories of PCAs involve identifying the potential origins of contamination to drinking water sources and corresponding protection areas. PCAs may consist of commercial, industrial, agricultural, and residential sites, or infrastructure sources such as utilities or roads. Depending on the type of source, each PCA is assigned a risk ranking, ranging from *very high* for such sources as gas stations, dry cleaners, and landfills, to *low* for such sources as schools, lakes, and non-irrigated cropland.

Vulnerability analysis entails determining the most significant threats to the quality of the water supply by evaluating PCAs in terms of risk rankings, proximity to the well being surveyed, Physical Barrier Effectiveness (PBE), and whether contaminants have previously been detected. PBE takes into account factors that could limit infiltration of contaminants including type of aquifer, aquifer material (for unconfined aquifers), well operation, and well construction. The vulnerability analysis is based on a scoring system that assigns point values for PCA risk rankings, PCA locations within the wellhead protection area, and well area PBE. The PCAs to which drinking water wells are most vulnerable are identified based on the results of the vulnerability scoring.

6.1.1 Actions

The following actions may be implemented by local water agencies individually or in conjunction with the TGBA to address State WPA requirements:

- A component of the DWSAP Program is an assessment of vulnerability of groundwater sources to quality degradation. The TGBA member agencies providing drinking water should obtain proper clearances for the release of information and prepare vulnerability summaries from the DWSAP Program to be used for guiding management decisions in the Basin.
- Contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and “lessons learned” regarding establishing WPAs.
- Attend groundwater conferences and technical workshops and meetings to learn more about groundwater management practices.

6.2 REGULATION OF THE MIGRATION OF CONTAMINATED GROUNDWATER

The migration and remediation of contaminated groundwater is of primary concern to local urban water supply agencies, including the cities of Modesto, Ceres, Turlock, and Hughson. Also of concern is the localized contamination of groundwater by industrial point sources such as dry cleaning facilities, food processors and the numerous fuel stations throughout the Basin.

While the TGBA does not have authority or responsibility for remediation of this contamination, it is committed to coordinating with responsible parties and regulatory agencies to keep the local water agencies informed of the status of known groundwater contamination in the Basin.

6.2.1 Actions

The following actions may be implemented by the local water agencies individually or in conjunction with the TGBA to address groundwater contamination:

- Coordinate with the USGS and/or other appropriate agencies to expand the network of monitoring wells to provide for an early warning system for public supply wells.
- If detections occur in existing or future monitoring wells, facilitate meetings between the responsible parties and potentially impacted water agency(ies) to develop strategies to minimize the further spread of contaminants. Specifically, a water agency could consider altering groundwater extraction patterns or altering production wells in the vicinity of a pollutant plume to change the groundwater gradient.
- Provide a forum to share all information on mapped contaminant plumes and leaking UST sites in order to develop groundwater extraction patterns and in site planning of future production or monitoring wells.
- Meet with representatives of the CVRWQCB staff to establish a positive relationship and identify ways to have open and expedient communications with the CVRWQCB staff regarding any new occurrences of contamination. Open communication channels are especially important when contamination is believed to have reached the water table.
- Track upcoming regulations on septic systems, National Pollutant Discharge Elimination System (NPDES) Permits, agricultural discharges and other regulatory programs that pertain to water quality.

6.3 IDENTIFICATION OF WELL CONSTRUCTION POLICIES

Both the Stanislaus County DER and the Merced County DEH administer the well permitting program in the unincorporated areas of the Turlock Groundwater Basin within their respective boundaries. The standards for construction are consistent with those recommended in State Water Code Section 13801. This section requires counties, cities, and water agencies to adopt the State Model Well Ordinance as a minimum standard for well construction or a more rigorous standard, if desired.

Each city member of the TGBA has enacted a well ordinance adopting the California Well Standards, Bulletin 74-81 (DWR, 1981a), and all its supplements. This ordinance is utilized in wells constructed within the incorporated area of each city. Each city provides a review of well construction plans and specifications within the incorporated area.

The Stanislaus County DER has enacted well ordinances adopting the California Well Standards, Bulletin 74-81 and all its supplements for the unincorporated areas in its boundaries. Merced County DEH has also enacted well ordinances for the unincorporated areas of the county; however, Merced County has chosen to adopt a more rigorous standard. The Merced County Well Ordinance requires that the minimum annular seal for all wells, except monitoring and cathodic protection wells, be 50 ft. Further, the annular seal must extend to 20 ft above the top of the casing perforation, which significantly extends the depth of the annular seal for wells with perforations below 70 ft.

Both Stanislaus and Merced counties also review well permit applications, including construction plans and specifications, and issue permits for wells constructed or destroyed in unincorporated areas. As a part of that process, the counties require and maintain well logs and water well driller reports for constructed wells.

Standards also exist for contractors involved in well construction. Section 13750 of the California Water Code requires that well drillers possess a C-57 Water Well Contractors License. Section 13751 requires well drillers to file a well completion log with DWR for every production or monitoring well constructed.

The number of service connections to a well determines whether operating permits for public drinking water are provided through DHS or by Stanislaus County DER or Merced County DEH. DHS has jurisdiction over public water system wells with over 200 service connections. Wells that serve public water systems with fewer than 200 service connections fall under the jurisdiction of the Stanislaus County DER or Merced County DEH.

6.3.1 Actions

The following actions may be implemented by the local water agencies individually or in conjunction with the TGBA to address well construction policies:

- Ensure that all member agencies are provided a copy of the applicable county well construction ordinance and understand the proper well construction procedures.
- Coordinate with local water agencies to provide guidance, as appropriate, on well construction to prevent creating conduits through regionally confining beds. Where feasible and appropriate, this could include the use of USGS lithologic data prior to construction of the well to assist in well design.

6.4 ADMINISTRATION OF WELL ABANDONMENT AND DESTRUCTION PROGRAMS

There are many unknown, obsolete, or abandoned water supply wells within the Turlock Groundwater Basin. These wells provide potential locations for monitoring of groundwater levels, but more frequently serve as a source of contamination and should be abandoned following proper destruction standards.

One of the primary concerns of local agencies is the groundwater contamination risk posed by unused wells that have not been properly destroyed. Section 21 of DWR Bulletin 74-81 (DWR, 1981a) and revisions contained in Part II of Bulletin 74-90 (DWR, 1991) allow classification of unused wells into two types, abandoned and inactive. An abandoned well is defined as one, which has not been used for a period of one year, and whose owner has declared the well will not be used again. If the well has not been used during the past year, but the owner demonstrates his/her intention to use the well again for supplying water, the well is considered inactive. Four criteria must be met in order for a well to maintain the inactive, rather than abandoned, classification. These criteria are:

- The well has no defects
- The well is securely covered
- The well is clearly marked
- The surrounding area is kept clear of brush and debris

Failure to meet these criteria could result in the well being classified as abandoned under current regulations. All abandoned wells, exploration or test holes, and monitoring wells must be destroyed as stated in Section 22 of Bulletin 74-81 (DWR, 1981a) and revisions contained in Bulletin 74-90 (DWR, 1991).

An abandonment program should focus on those wells that pose the greatest threat to groundwater; however, numerous factors make the abandonment and destruction of wells difficult. These factors include lack of consistency in records regarding well construction, location, and use; cost of well destruction; and the defined classification for abandonment of wells (i.e., abandoned versus inactive status). Well construction within the Subbasin has taken place for nearly a century, with records and standards altered over time. Recent records pertinent to construction and location of new wells are more complete than earlier records, which are often inconsistent. The lack of financial incentive for well owners to declare a well as abandoned also reduces the effectiveness of the well abandonment program.

Stanislaus County DER and Merced County DEH administer the well destruction program within the unincorporated areas of the Turlock Basin. The cities administer the well destruction program within the incorporated areas. The standards for destruction are identified in the county codes and are based on State of California standards. As with well construction standards, the State has established minimum standards, however, local agencies have the option of requiring more stringent standards to meet the local needs. For example, Merced County has adopted additional sealing requirements for wells that lack information on subsurface geology (i.e., a driller's report or log).

6.4.1 Actions

The following actions may be implemented by the local water agencies individually or in conjunction with the TGBA to address well abandonment and destruction issues:

- Ensure that member agencies are provided a copy of each municipality's code, understand the proper destruction procedures, and support implementation of these procedures.
- Follow up with local water agencies on reported abandoned and destroyed wells to confirm information collected from DWR and to provide information on abandoned and destroyed wells to fill gaps in county records.
- Seek funding to develop and implement a program to assist well owners in the proper destruction of abandoned wells.

6.5 MITIGATION OF OVERDRAFT CONDITIONS

The TGBA supports activities to reduce the dependency on groundwater to help minimize any potential localized overdraft. The TGBA also supports actions by agricultural water suppliers to encourage irrigation customers to receive surface water deliveries, when available, so that growers do not turn to groundwater as a more flexible source of irrigation supply during periods when surface water is abundant.

6.5.1 Actions

The following actions may be implemented by the TGBA and/or its individual members to address mitigation of groundwater overdraft:

- Support programs that relieve aquifer overdraft through substitution of surface water for groundwater.
- Continue implementation of water conservation programs that will reduce reliance on groundwater pumping.
- Continue and enhance groundwater monitoring and groundwater use to maintain groundwater storage.
- Support programs by agricultural water agencies to provide surface water to irrigators who may otherwise irrigate with groundwater because of the greater operational flexibility achievable through individual pumps.
- Seek funding for programs and projects that would identify and mitigate potential condition of overdraft in the Basin.

6.6 REPLENISHMENT OF GROUNDWATER EXTRACTED BY WATER PRODUCERS

A component of wellhead protection and an important groundwater management strategy is the protection of major recharge and withdrawal zones. This strategy has far-reaching effects in the Turlock Basin because of the significant groundwater recharge occurring as a result of agricultural irrigation. Groundwater recharge must be adequate to replenish extracted groundwater, while withdrawal zones need protection from up gradient sources to ensure that the quality of extracted groundwater meets the standards established for the intended use.

A comprehensive approach to the protection and management of the major recharge and withdrawal zones is much more appropriate than the use of individual zoning techniques. Communities, in cooperation with neighboring towns and in unincorporated areas, must develop comprehensive land and water resource management programs that go beyond simple zoning approaches for the protection of agricultural and urban areas.

6.6.1 Actions

The following actions may be implemented by the local water agencies individually or in conjunction with the TGBA to address groundwater recharge issues:

- Communicate with DWR and other governmental agencies studying groundwater and river interactions.
- Support programs that preserve agricultural land uses in groundwater recharge areas.

- Evaluate projected impacts to groundwater recharge when analyzing development projects on agricultural land.

6.7 CONSTRUCTION AND OPERATION OF RECHARGE, STORAGE, CONSERVATION, WATER RECYCLING, AND EXTRACTION PROJECTS

Various water agencies in the Turlock Subbasin share responsibility for development and operation of recharge, storage, conservation, water recycling, and extraction projects. The role of the TGBA is to promote cooperation and sharing of information between the agencies sponsoring water management projects and other local water agencies. To the extent feasible, the TGBA also will support measures to coordinate development and optimize operation of facilities to improve Basin-wide effectiveness and efficiency of water management.

6.7.1 Actions

The following actions may be implemented by the local water agencies individually or in conjunction with the TGBA to address recharge, storage, conservation, water recycling, and extraction construction projects:

- Share information on project planning, design, and operation among local water agencies.
- Promote a coordinated approach toward project development and operation to lower the costs and increase the benefits of water management efforts.
- Seek funding for projects and programs that will contribute to water conservation, recycling, and recharge of the groundwater Basin.

6.8 CONTROL OF SALINE WATER INTRUSION

Saline water intrusion from the San Joaquin River or from the west side of the San Joaquin Valley (including intrusion from the marine layers) is not well documented in the Turlock Groundwater Basin. Groundwater elevations prevalent in the Basin have historically maintained a positive gradient preventing significant migration of saline water associated with groundwater from the western San Joaquin Valley. Maintaining the positive groundwater gradient will continue to prevent induced flow from the river or from groundwater west of the San Joaquin River.

6.8.1 Actions

The following actions may be implemented by the local water agencies individually or in conjunction with the TGBA to address saline water intrusion issues:

- Collect groundwater quality data along the San Joaquin River, and track the progression, if any, of saline water moving east from the San Joaquin River.
- Communicate with DWR's San Joaquin District Office on a biennial basis to check for significant changes to TDS concentrations in wells. DWR has a regular program of sampling water quality in selected domestic, agricultural, and monitoring wells throughout the Basin. These wells may be augmented by additional monitoring wells to develop an early warning system able to detect saline water intrusion from the river.

- The Groundwater Monitoring Program described in the Plan will supplement the program of monitoring for intrusion of saline water. The program includes provisions for monitoring groundwater levels and quality.
- Observe TDS concentrations in public supply wells that are routinely sampled under the DHS Title 22 Program.

7 STAKEHOLDER INVOLVEMENT

7.1 AGENCY INVOLVEMENT

The TGBA was formed to facilitate agency involvement in groundwater management activities within the Turlock Subbasin. The majority of local agencies with jurisdiction in the Subbasin have joined the TGBA. Those that have elected not to join are encouraged to participate in TGBA activities. The MOU utilized to form the TGBA provides a process for additional entities to join (A copy of the MOU is provided in Appendix C). Any local public agency, whose service area includes land located within the Subbasin, which uses groundwater, or is authorized to provide groundwater, groundwater quality management, or groundwater replenishment within its service area, and whose service area includes all or a portion of the Turlock Subbasin, may apply for membership. Application is subject to approval by existing TGBA members, and the joining entity must pay any back contributions, if any, as determined by the TGBA governing body.

7.2 ADVISORY COMMITTEE

TGBA representatives currently serve in an advisory role for groundwater management activities within the Subbasin. Additional committees, including an Advisory Committee, will be formed as necessary. The MOU includes language specifying that the TGBA Board may establish any committees it deems as necessary or desirable.

7.3 COORDINATION WITH OTHER AGENCIES

The TGBA provides a mechanism for local public agencies to coordinate groundwater management activities. Meetings are scheduled on a monthly basis to work through groundwater management issues. In addition to action items included on the agenda, time is allotted at each meeting for participants to provide updates on groundwater and related issues not specifically identified.

In addition, TGBA member agencies have coordinated the planning process with other neighboring water agencies and subbasins. The City of Modesto and Stanislaus County participate in the groundwater management efforts within the Modesto Subbasin. Similarly, Merced ID and Merced County participate in groundwater management efforts occurring within the Merced Subbasin. These agencies have communicated with the associations and other agencies within the Merced and Modesto subbasins, to help to facilitate the coordination of groundwater management efforts taking place within the adjacent subbasins. Additional coordination efforts include development of ongoing and future relationships with State and Federal agencies. These activities are described in Section 7.5 below.

7.4 PUBLIC INVOLVEMENT PROCESS

Prior to developing this plan, local agencies held public hearings, noticed pursuant to Section 6066 of the Government Code. As noticed, the intent of these meetings was to inform the public that an update of the Plan was being developed and to provide an opportunity for the public to provide input on the issues that should be considered in the Plan. All comments received in this process were reported back to the TGBA and considered in the development of the Plan.

All TGBA meetings are open to the public and held pursuant to the Brown Act. Agendas are posted and available for public review. Agendas are submitted directly to interested individuals upon request, as well as each of the local public agencies within the Subbasin. As noticed on the agendas, and documented in meeting minutes, the update of the Plan was discussed regularly during TGBA meetings, providing additional opportunities for interested individuals to participate in the process.

A second public hearing, noticed pursuant to Section 6066 of the Government Code is required for a local public agency to adopt a groundwater management plan. Each agency that adopted this Plan was required to conduct this public hearing independently before adopting the Plan. This hearing created an additional opportunity for the public to provide input on whether or not the agency should adopt the updated Plan.

In addition to these opportunities, the public can participate in the ongoing groundwater management activities of the TGBA. A public comment period is included at each TGBA meeting, where time is allotted for any interested parties to raise issues or concerns. Due to specific Brown Act requirements, items discussed during the public comment period may not be acted upon at that time. However, those issues identified through this forum may be brought back to the TGBA for consideration and action at a future meeting.

7.5 DEVELOPING RELATIONSHIPS WITH STATE AND FEDERAL AGENCIES

Local public agencies that make up the TGBA have relationships with various State and Federal agencies. These individual relationships will continue to be fostered and utilized, as necessary, to implement subarea and Subbasin groundwater management activities.

The TGBA will periodically develop a report documenting its activities, which will be submitted to the DWR. This process will assist in fostering an ongoing relationship with DWR. Additional relationships will be developed with other State and Federal agencies, as necessary.

7.6 DISPUTE RESOLUTION PROCESS

The TGBA has been used effectively as a tool for the resolution of groundwater management issues in the Basin. Discussion of issues in the TGBA meetings is an open and transparent process, which has resulted in cooperative relationships between water agencies representing the various water users within the Basin. The TGBA will continue to provide a forum for discussion and early resolution of the Basin’s groundwater issues.

8 PLAN IMPLEMENTATION

Key features of the plan are the linkages that have been established among program actions. These linkages provide a cohesive program in which the whole is greater than the sum of its parts. These linkages are described throughout the text, including Sections 5 and 6, which provide a discussion of groundwater management measures and activities, and in the implementation measures described below.

The Implementation Plan presents suggested management actions that can assist the TGBA in meeting the Basin Management Objectives (Section 5.3). The overarching purpose of the BMOs and associated actions is to encourage a balance of surface water and groundwater use to protect the resources of the Basin and maximize the reliable supply of high quality water to meet the Subbasin's current and future needs.

It is also important to note that groundwater management requirements and responsibilities, as dictated by the California Code of Regulations, may change over time. Individual agencies, as well as the TGBA, will evaluate regulatory changes and determine how best to address those changes, when and if they occur. The recommendations and implementation priorities may change over time, to accommodate the changing regulatory framework.

8.1 IMPLEMENTATION PLAN

8.1.1 Basin-Wide Management Actions

The following Basin-wide management actions are provided as suggested measures for facilitating the achievement of the BMOs described in Section 5.3:

- Protection of natural recharge areas
- Feasibility evaluation of artificial recharge projects
- Management and optimization of well field operations
- Support of public health programs
- Water quality management
- Groundwater monitoring and subsidence monitoring program
- Policy assessment
- Promoting coordination and cooperation between water agencies
- Identification and feasibility study of conjunctive use projects

The following discussion provides additional information regarding each of the suggested implementation measures to support each management action. Availability of funding for groundwater management activities, as well as future regulatory requirements, will influence the speed and level to which each of the measures is evaluated and implemented.

8.1.1.1 Protection of Natural Recharge Areas

Groundwater recharge will likely diminish as a result of continued urban expansion and further use of more advanced agricultural irrigation practices. New irrigation technologies reduce the amount of irrigation water applied, and consequently reduce the deep percolation of applied irrigation water. These land use influences on percolation illustrate the need to identify and map the remaining natural recharge areas so that these areas can be protected. The objective is to develop specific planning actions that offer varying degrees of protection, depending on an area's significance as a source of recharge. Types of protection could include:

- Programs to educate the public and planning entities about the importance of protecting recharge areas.
- Pricing and incentive programs to encourage the continued use of surface water for flood irrigation. Because irrigation of agricultural land is currently the largest contributor to groundwater recharge within the Subbasin, pricing and incentive programs could encourage the continuation of this type of recharge within the Basin.

The first steps in implementing this management action would be to identify recharge areas within the cities and counties, develop a GIS-based map of natural recharge areas, inform planning entities of the importance of these areas, and make recommendations for the protection of these areas.

8.1.1.2 Feasibility Evaluation of Artificial Recharge Projects

If future studies or updates of the Subbasin groundwater budget indicate that the Subbasin is in overdraft or is likely to fall into overdraft, two broad options are available for sustaining and enhancing recharge. The first option is to maintain natural recharge by protecting the natural recharge areas. This option is described above in Section 8.1.1.1.

The second option is to augment natural recharge through an artificial recharge program. The evaluation of artificial recharge projects would begin by mapping potential recharges sites, building upon the mapping of natural recharge sites described previously. Existing planning efforts are evaluating using surface water supplies in artificial recharge basins; however, using stormwater flows for artificial recharge also could be evaluated.

An enhanced recharge management action also would evaluate in-lieu recharge projects. These projects would look at opportunities to reduce groundwater demand by supplying surface water to areas now served by groundwater. Such projects could include incentives for TID or Merced ID irrigators to continue irrigating with surface water instead of groundwater, or other approaches available to the irrigation districts to promote groundwater recharge and reduce overdraft.

Additional projects that could be evaluated include development or expansion of conjunctive use projects in urban areas with poor groundwater quality (i.e., supplement the urban water supply with surface water in order to reduce its reliance on groundwater, improve groundwater levels and reduce the movement of contaminants in the basin) as well as a program to evaluate the potential for stormwater recharge.

8.1.1.3 Management and Optimization of Well Field Operation

A component of improved groundwater management could be the optimization of well operations to accomplish specified management objectives. For example, each well in a well field could be instrumented and controlled so that the group of wells is operated to meet single or multiple objectives. Examples of potential implementation measures for this management action include:

- Minimize the overall pumping costs
- Maintain groundwater levels within specified ranges
- Reduce or eliminate well interference
- Control the migration of contaminant plumes
- Enhance control of pumping into irrigation canals in response to delivery and cutoff orders, hence creating opportunities to conserve water by reducing spillage

In addition, well field optimization can be used to support management of water quality within irrigation canals, by controlling the quantity of poorer-quality water discharged from wells that blends with surface water deliveries. TID uses groundwater pumping to lower groundwater levels and supplement surface water supplies. Groundwater is blended with surface water supplies and utilized for irrigation supply. Urban wells that do not meet drinking water standards could potentially be used to supplement agricultural supplies while helping to manage contaminant migration. The agencies within the Basin could evaluate modifications to the blending program to lower the high groundwater table, manage contaminant migration, and provide good quality water for irrigation supply.

8.1.1.4 Support of Public Health Programs

Well construction and demolition standards are designed specifically to protect groundwater quality. Implementation measures to assist local agencies in complying with public health standards may include:

- Installation of sanitary well seals on all new wells in accordance with the California Well Standards (or a more strenuous standard as determined necessary by the County or other applicable water agency to protect groundwater quality)
- Abandonment of wells in accordance with the California Well Standards (or a more strenuous standard as determined necessary by the County or other applicable water agency to protect groundwater quality)

This management action is particularly valuable in unincorporated areas not served by a water purveyor.

8.1.1.5 Water Quality Management

The protection of groundwater quality is an increasing concern because the Basin’s population is continuing to grow. This management action would involve conducting a detailed hydrogeologic assessment of the Basin, focusing on the areas with poor water quality to identify the sources of contaminants. This assessment would result in a GIS-based map of areas with poor water quality. The information could be used in conjunction with the recharge area mapping described above and used to develop strategies to control the migration and movement of poor quality water into and/or within the Basin.

8.1.1.6 Groundwater Monitoring and Subsidence Monitoring Program

Groundwater monitoring, data analysis, and archiving of collected data are essential for any groundwater management plan. Data are needed to understand conditions within the Basin, evaluate trends, facilitate the implementation of management actions, and evaluate their effectiveness.

As described in Section 4.1.4, reductions in DWR groundwater monitoring have resulted in greater uncertainty in the measurement of groundwater levels in the Basin. These data are required to estimate groundwater storage and changes in storage over time. The TGBA should evaluate the current condition and effectiveness of the groundwater level and quality monitoring programs, the database used to store and manipulate the data, and make improvements as necessary.

In addition, the TGBA could consider monitoring inelastic land surface subsidence within the Basin. Given that there have not been subsidence issues in the past, it appears unlikely that inelastic land subsidence would occur if current groundwater conditions are maintained. The ongoing efforts within the Basin to prevent groundwater overdraft further reduce the potential for subsidence. However, the TGBA could consider monitoring and documenting any future changes in land surface elevations. If subsidence is observed, appropriate actions could be recommended.

8.1.1.7 Policy Assessment

Several of the technical management actions introduced above have clear policy requirements and implications. The development of consistent policies could be assisted by a regional groundwater forum, such as the TGBA. This forum would foster coordination and cooperation among participating agencies that manage the Turlock Basin, and would provide a framework for formulation of regional projects and programs for the protection and use of groundwater resources.

For example, TGBA members are mutually concerned about protecting natural recharge areas from pollutants. Local water agencies could work through the TGBA forum to inform other members about land use practices that may contribute to groundwater degradation.

8.1.1.8 Promoting Cooperation and Coordination Between Water Entities

The TGBA will continue to coordinate water management activities within the Basin and work cooperatively to implement the agreed-upon BMOs. The local water agencies also may work together to develop a coordinated outreach program to educate Subbasin residents and groundwater users on groundwater management issues.

8.1.1.9 Identification and Feasibility Study of Conjunctive Use Programs

Conjunctive use programs optimize the use of groundwater resources in combination with surface water supplies to maximize water supply and minimize the potentially adverse effects of using a single source. The overall strategy in conjunctive use is to store water in the groundwater basin for use in drier years by recharging the basin during years when water is more abundant. Groundwater storage activities can include both active (e.g., recharge basins) and passive (e.g., in-lieu recharge) projects.

Many of the implementation measures described in this section of the Plan can be viewed as components of a broader conjunctive management program. The goal of this program would be to balance surface water and groundwater uses to support the BMOs. Implementation of this management action will involve continuing the current conjunctive management activities described in Section 5.6, in addition to the identification and feasibility study of the implementation measures described throughout this section. Ongoing monitoring coordinated through the TGBA provides a means of tracking the success of existing conjunctive management strategies and identifying if additional or alternative strategies should be evaluated.

8.2 GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION REPORT

Periodic reports will be produced, as necessary, to comply with groundwater management requirements. Reports will be designed to summarize groundwater basin conditions, and describe groundwater management activities. These reports may be prepared by the TGBA as a group, or by individual agencies. Reports generated by individual agencies will be coordinated through the TGBA.

The periodic reports may include the following types of information:

- A summary of monitoring results, including historical trends;
- A summary of management actions implemented;
- A summary, supported by monitoring results, of whether management actions are meeting the management goals and objectives;
- A summary of proposed management actions; and
- A summary of any proposed changes to this Plan, including addition or modification of management measures.

8.3 FINANCIAL PLANNING FOR RECOMMENDED ACTIONS/PROJECT IMPLEMENTATION

Progress toward the implementation of recommended actions is contingent upon securing funding for elements of this Plan. Two avenues that are available for funding include grant programs and funds generated internally by the TGBA members.

8.3.1 Grant Funding

Grant funding programs are continually changing. As the TGBA and/or individual agencies implement the recommended actions, funding sources will be evaluated. Grant funding may be secured by the TGBA (likely under the management of a member agency on behalf of the TGBA), or by individual agencies. As has been the practice in the past, the TGBA also will continue to support efforts by local agencies to secure grant funding that is consistent with the TGBA's goals and objectives and furthers groundwater management related issues within the Basin.

8.3.2 Funding through Local Agency Budgeting

Funding from local agencies is a second source of funding available for implementation of the plan. The ability to fund plan implementation locally will be dependent upon available resources and is subject to an individual agency's budgetary process. It is important to note, however, that local financial support or contributions are often required by state grant programs or other sources of outside funding. Therefore, local contributions may aid in the acquisition of outside funding to implement the plan.

8.4 PERIODIC REVIEW OF THE GROUNDWATER MANAGEMENT PLAN

As indicated in Section 8.2, one of the issues to be evaluated in the periodic reports is whether this Plan requires modification. Hence, when the TGBA develops periodic summary reports, it will also consider whether or not an update of the Plan is warranted. To maintain consistency and encourage coordination among local water agencies, it is the intent of the TGBA that updates of the Plan continue to be a Basin-wide activity.

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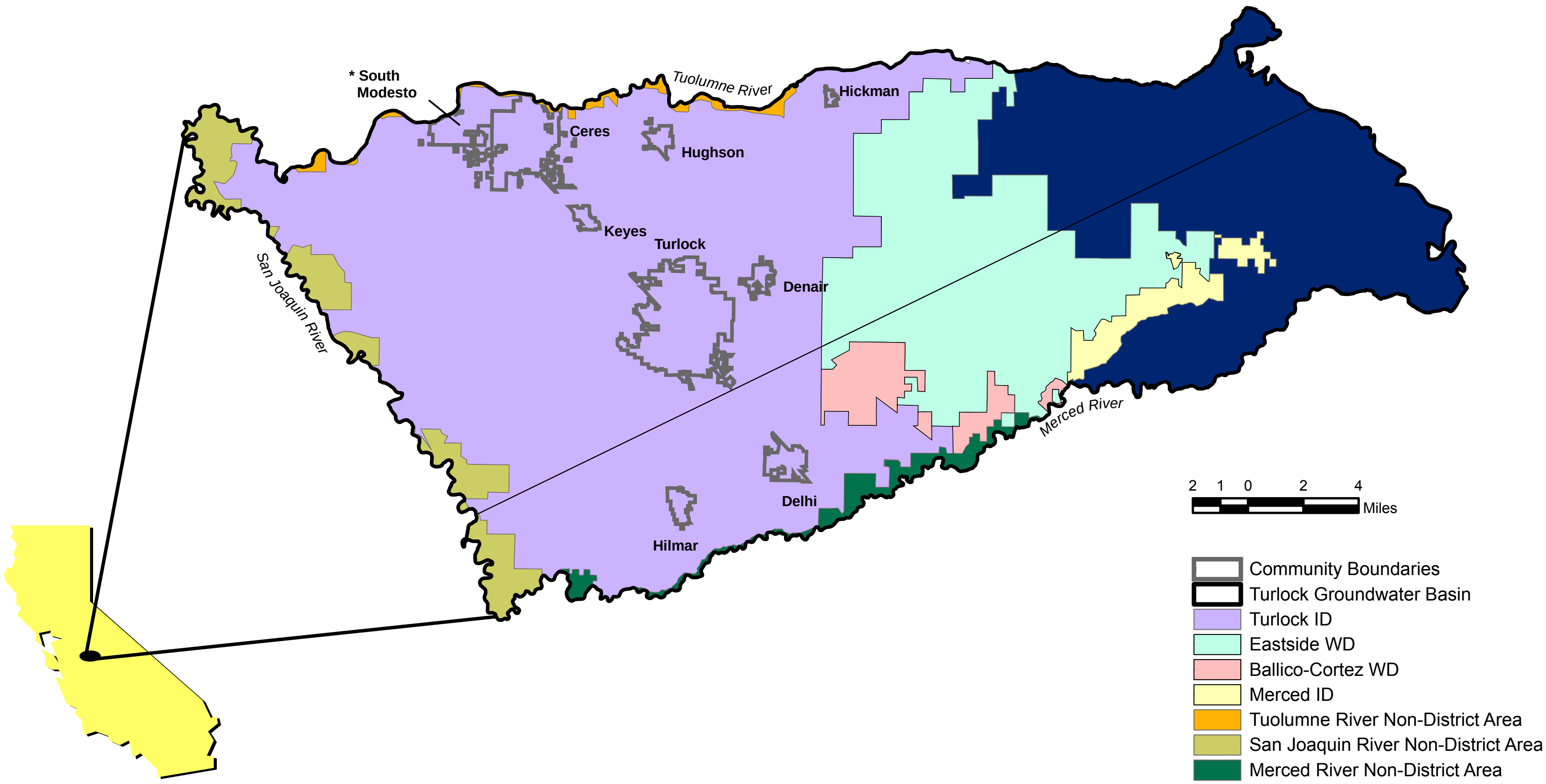
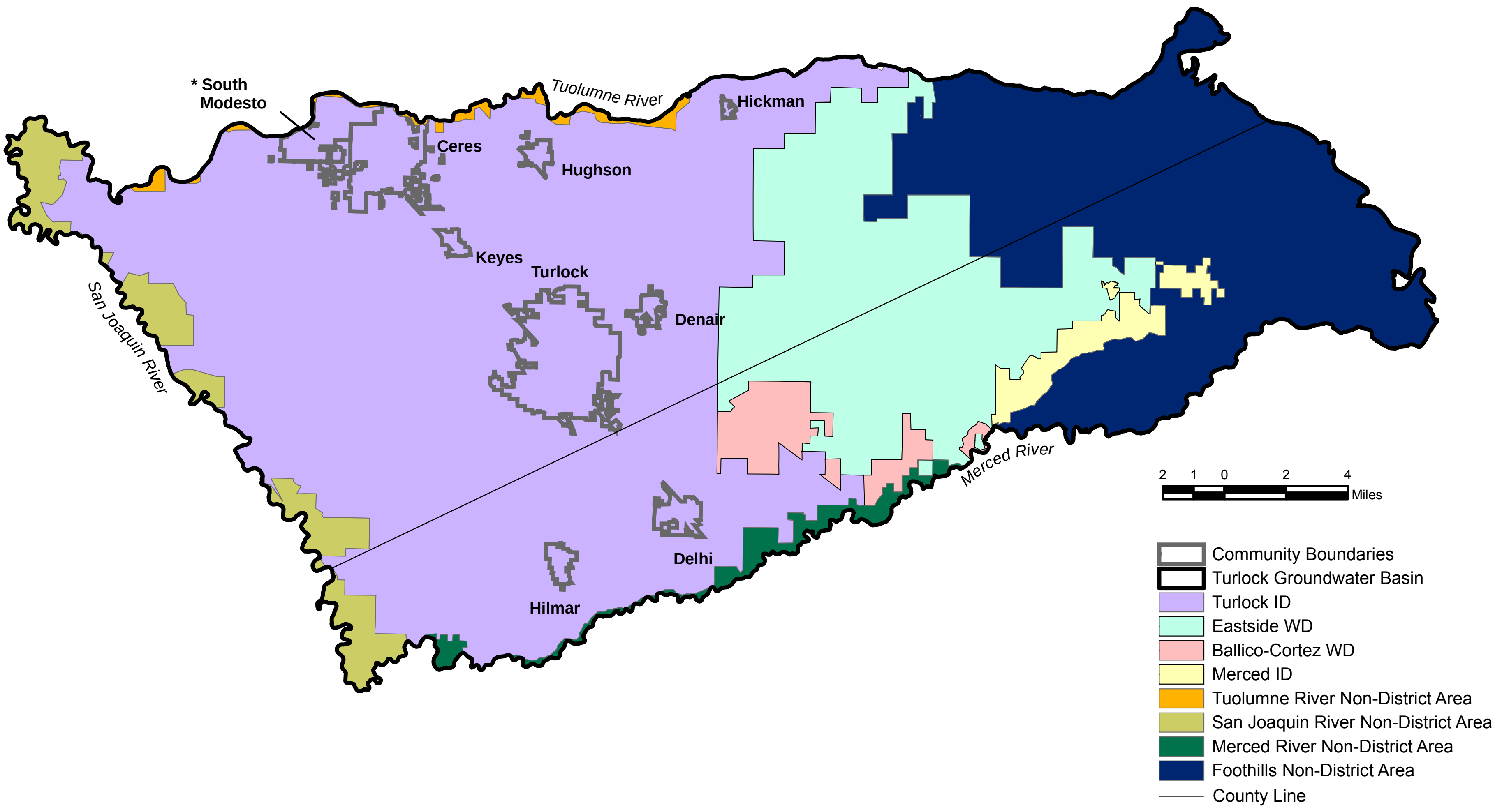
Appendix A

Figures



* South Modesto represents the City of Modesto Service Area South of the Tuolumne River

Figure 1. Turlock Groundwater Basin Location and Boundaries



* South Modesto represents the City of Modesto Service Area South of the Tuolumne River

Figure 2. Urban Areas, Irrigation Districts, and Non-District Areas within the Turlock Groundwater Basin

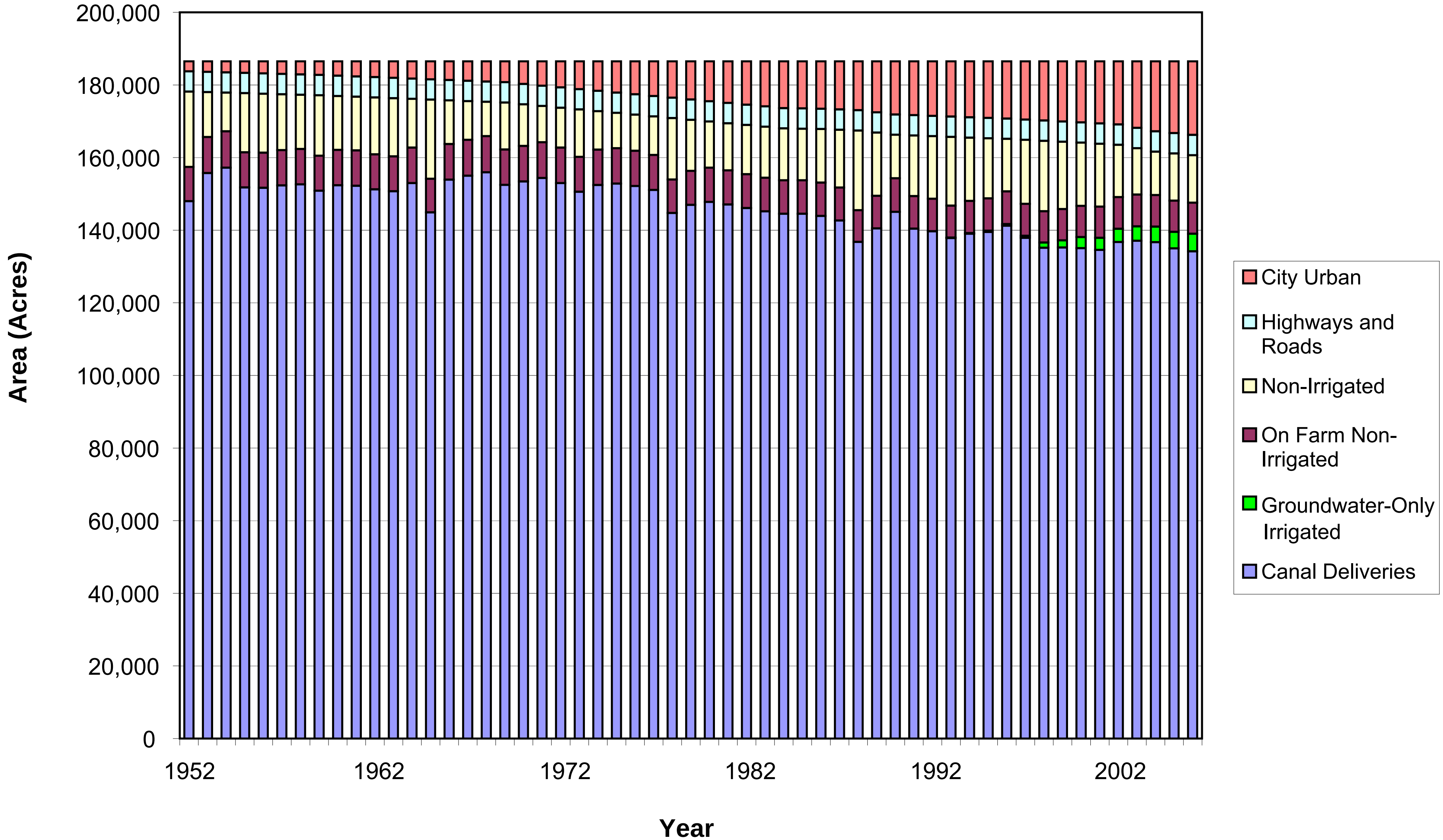


Figure 3. Land Use within the Turlock Groundwater Basin, 1952-2006, for Turlock Irrigation District

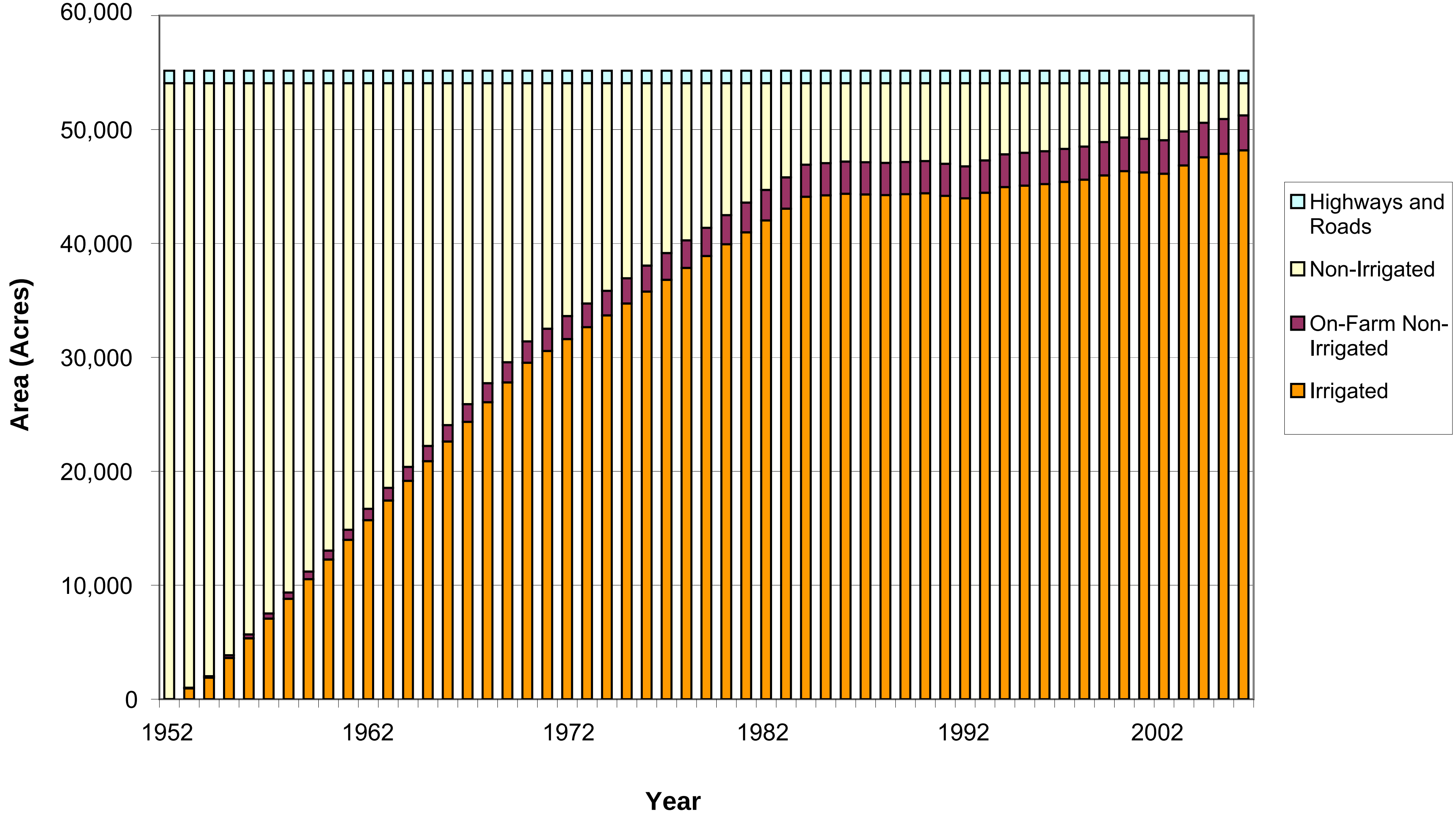


Figure 4a. Agricultural and Other Land Uses within Eastside Water District, 1952-2006

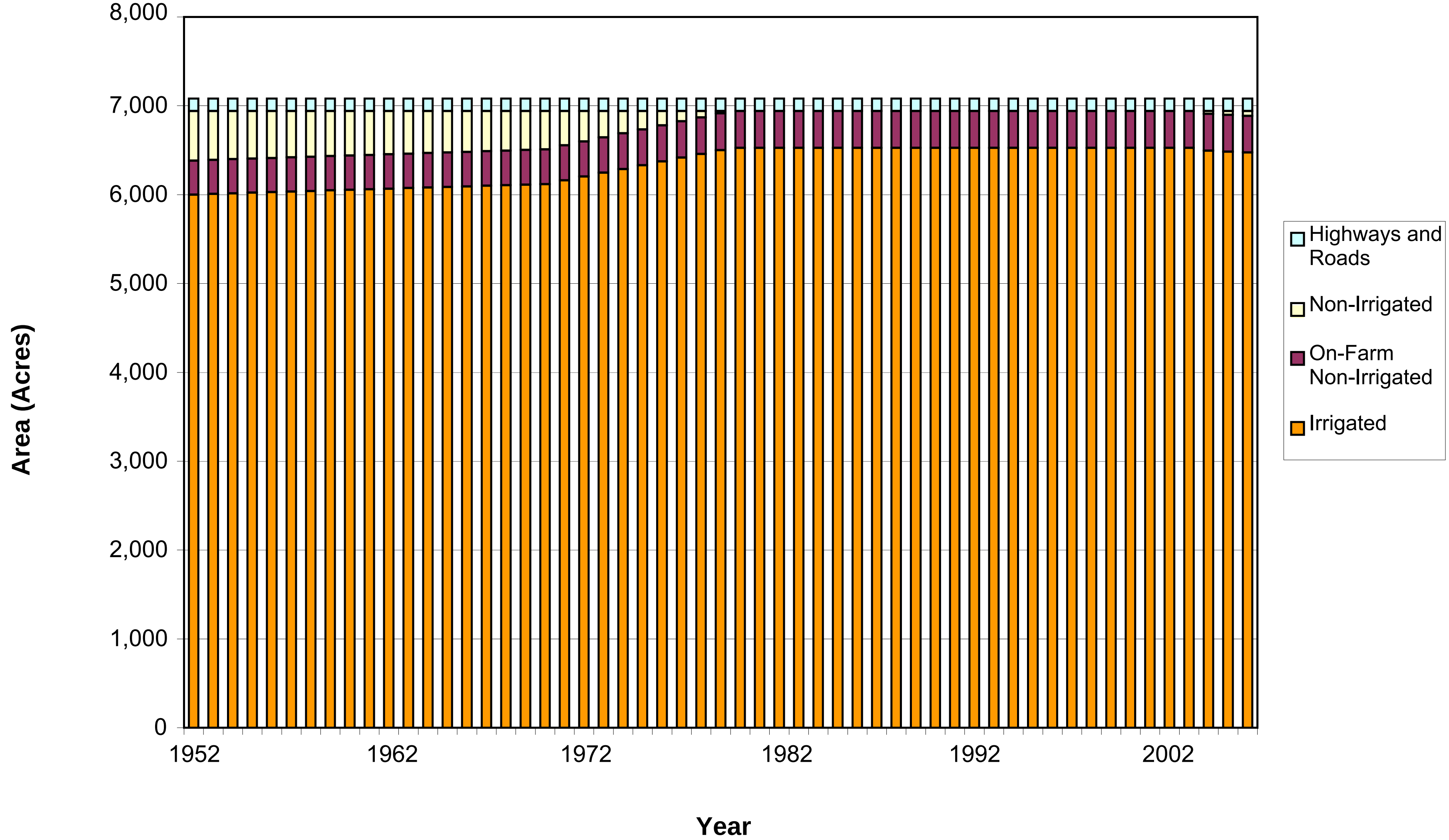


Figure 4b. Agricultural and Other Land Uses within Ballico-Cortez Water District, 1952-2006

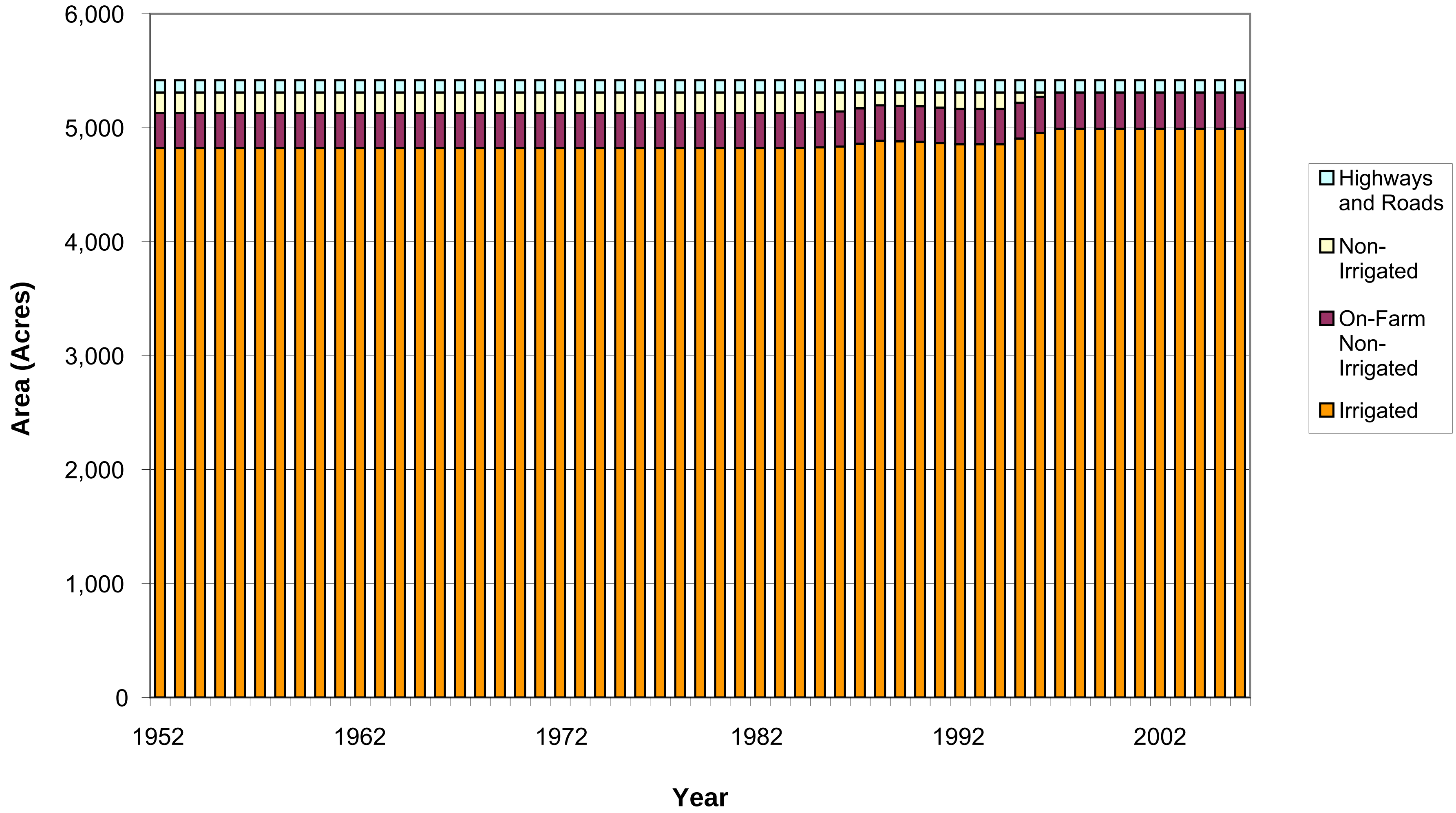


Figure 4c. Agricultural and Other Land Uses within Merced Irrigation District, 1952-2006

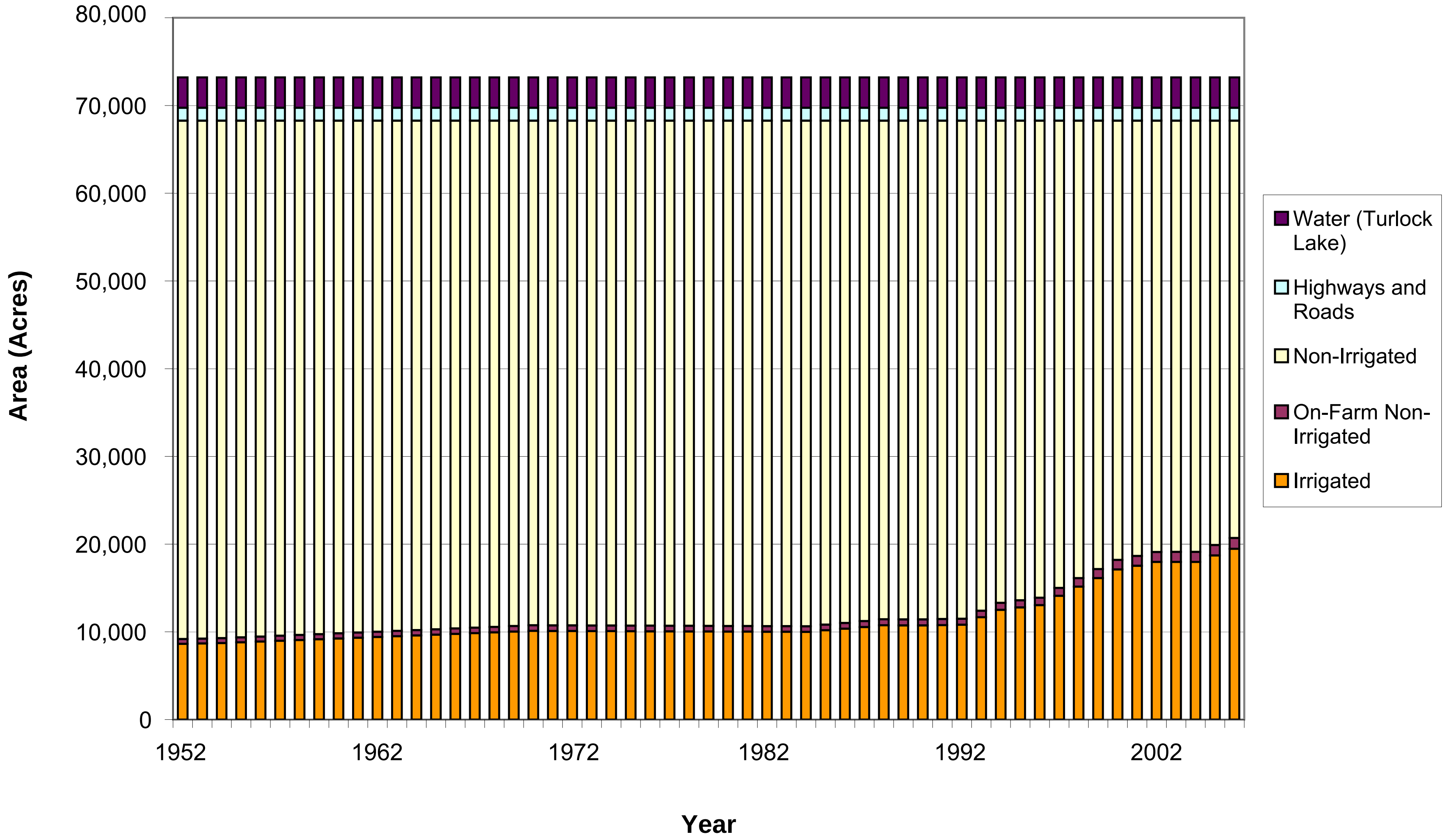


Figure 4d. Agricultural and Other Land Uses within Foothills Non-District Area, 1952-2006

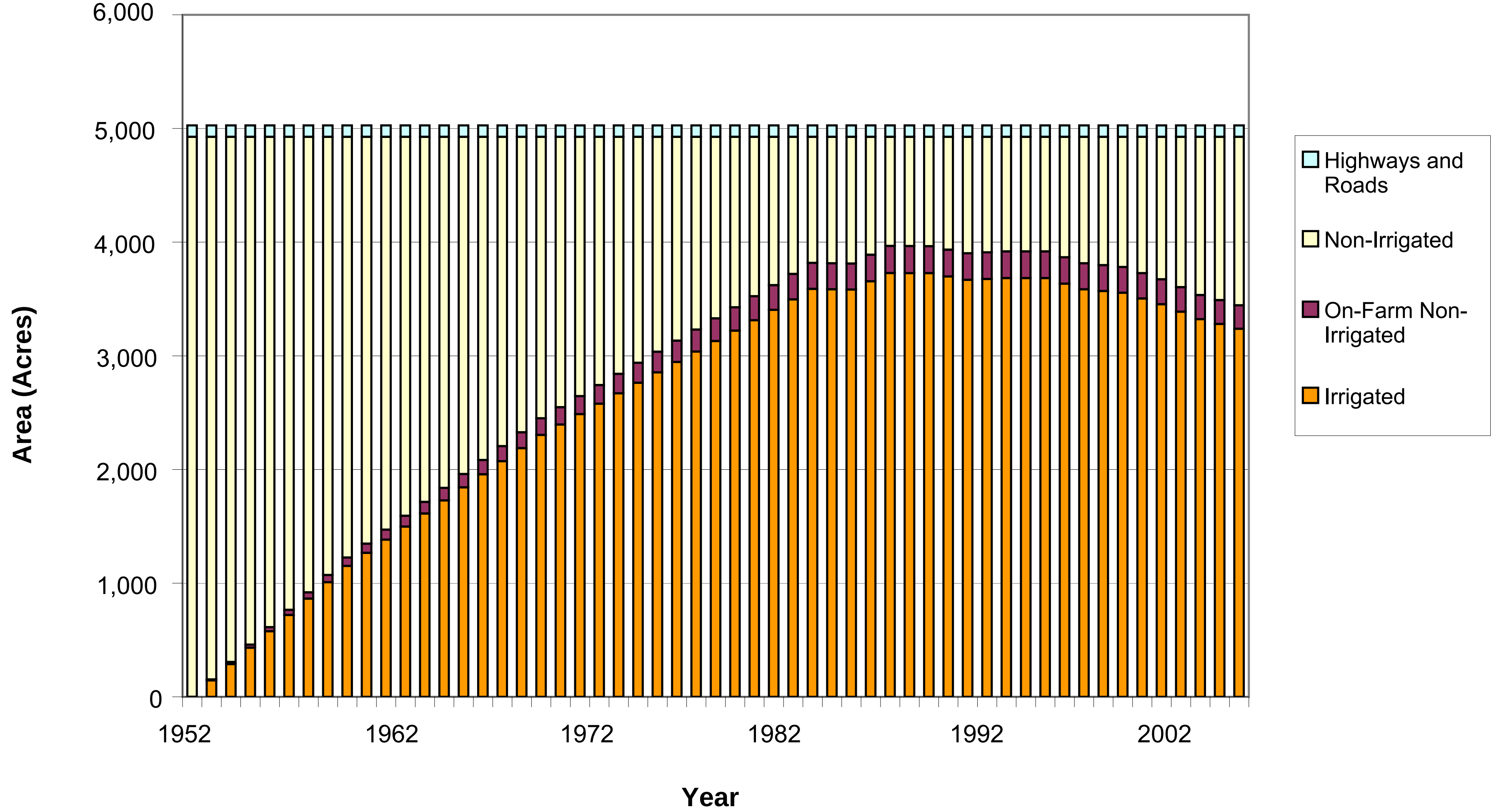


Figure 4e. Agricultural and Other Land uses within Merced River Non-District Area, 1952-2006

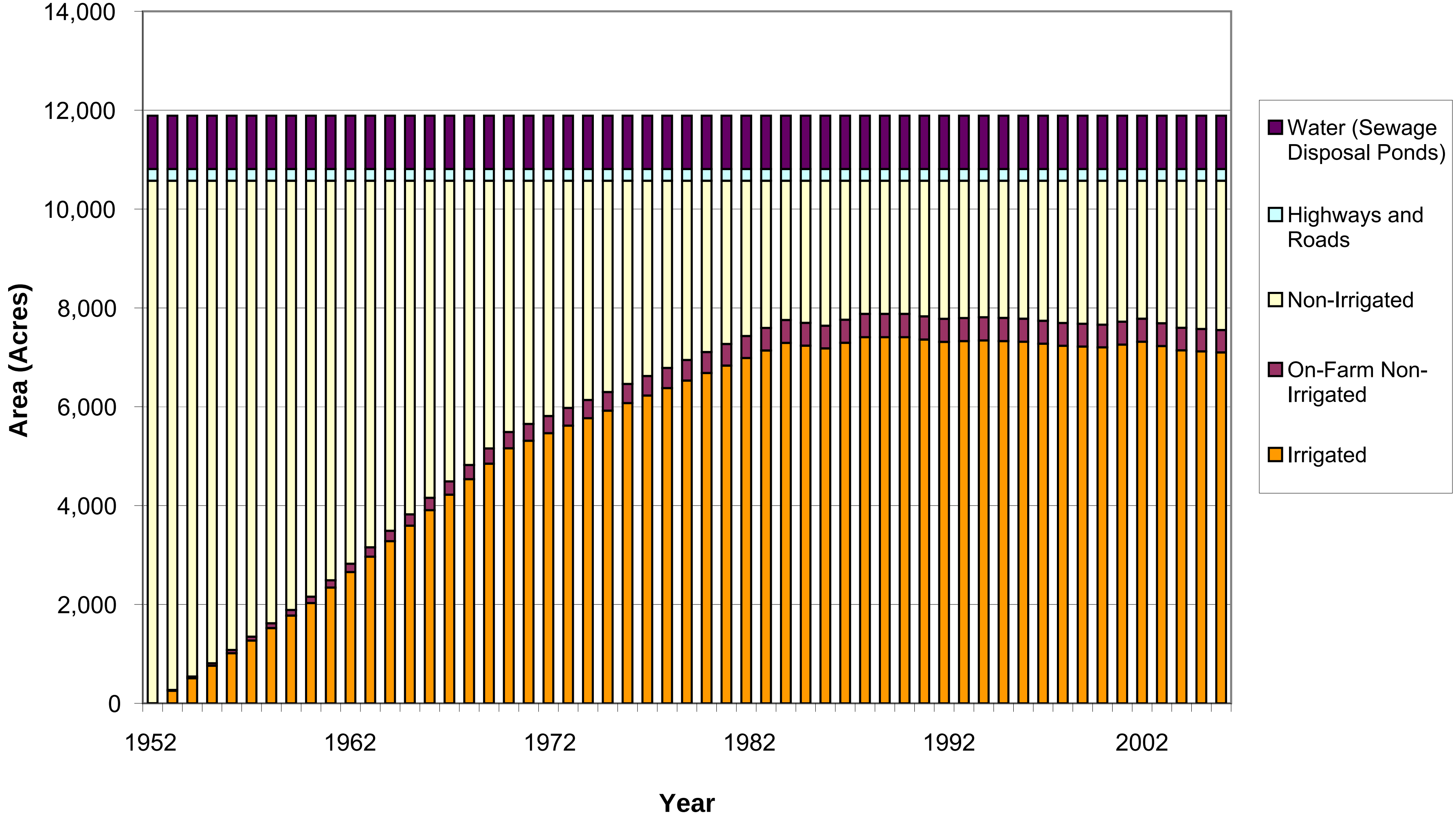


Figure 4f. Agricultural and Other Land Uses within the San Joaquin River Non-District Area, 1952-2006

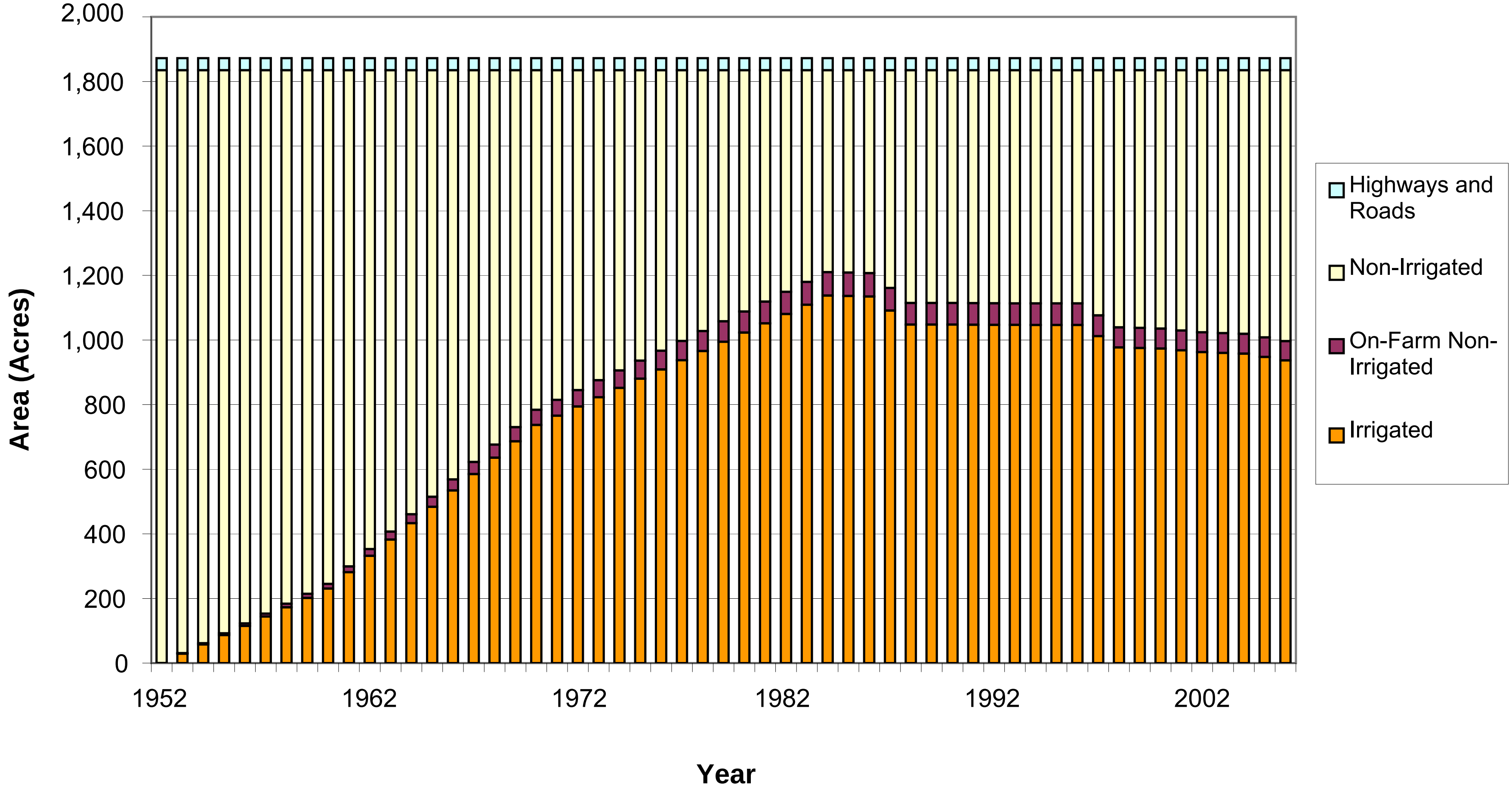


Figure 4g. Agricultural and Other Land Uses within Tuolumne River Non-District Area, 1952-2006

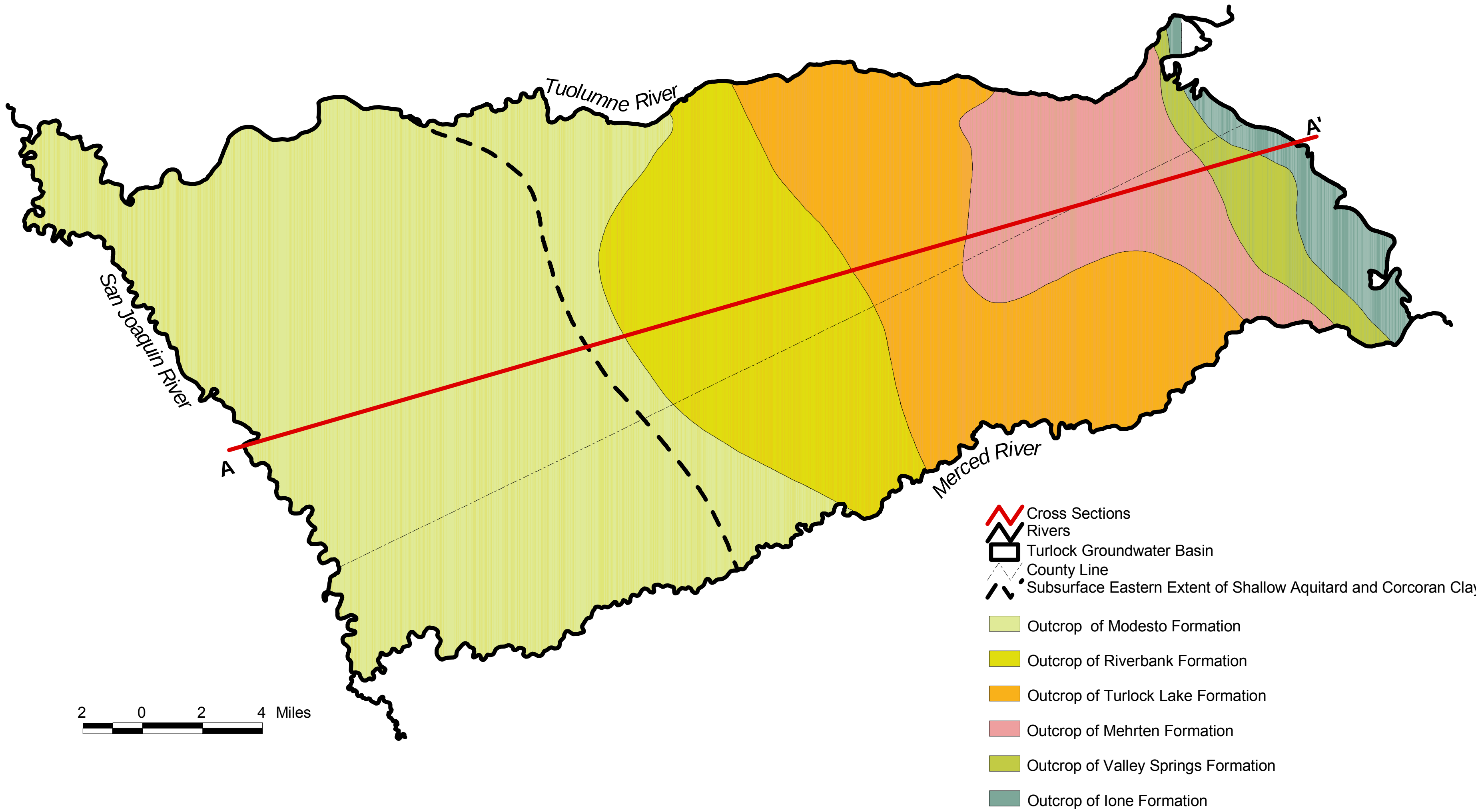


Figure 5. Hydrogeologic Units Represented within the Groundwater Model

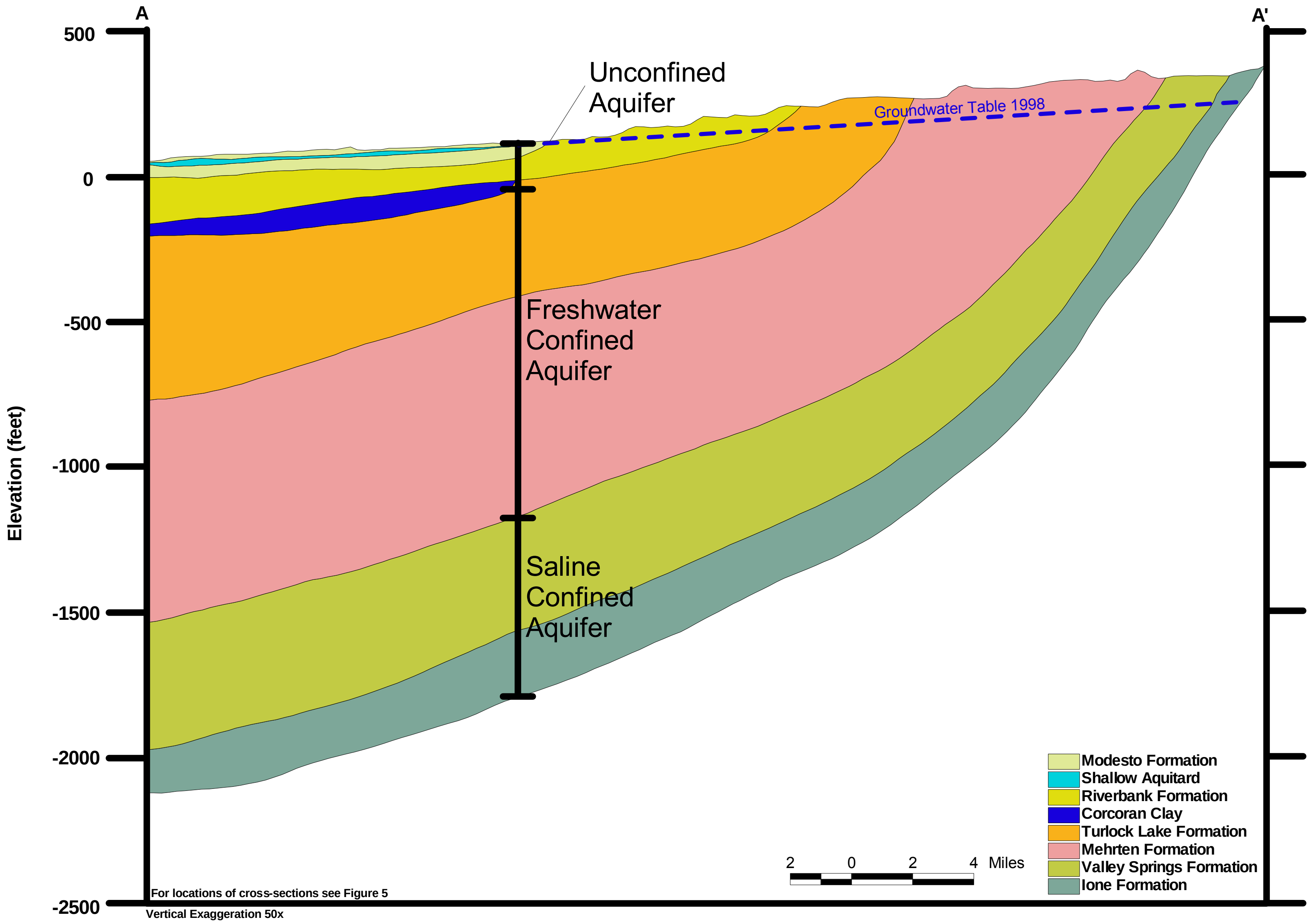


Figure 6. East-West Cross-Section Showing Hydrogeologic Units within the Groundwater Basin

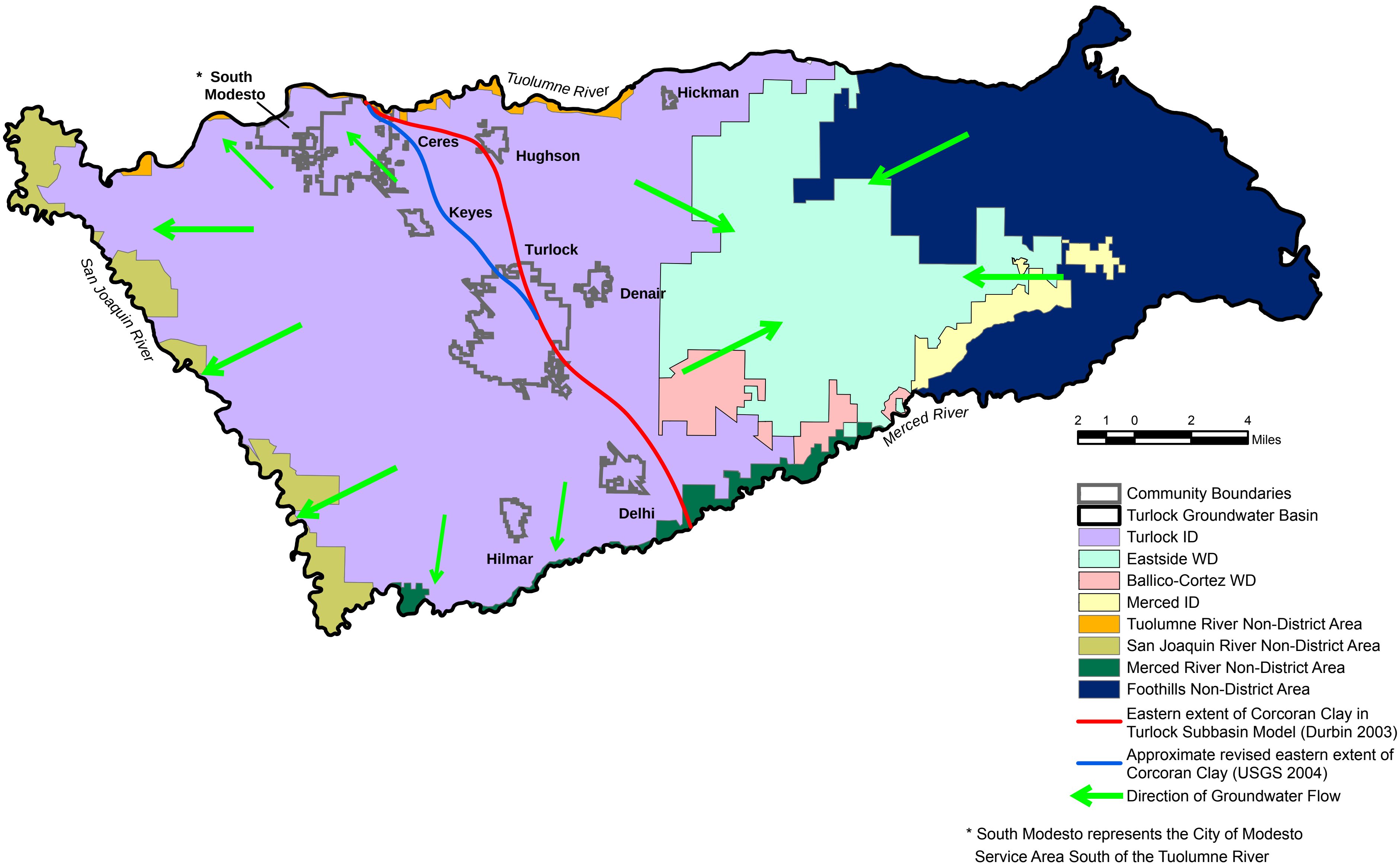


Figure 7. Groundwater Movement within the Basin

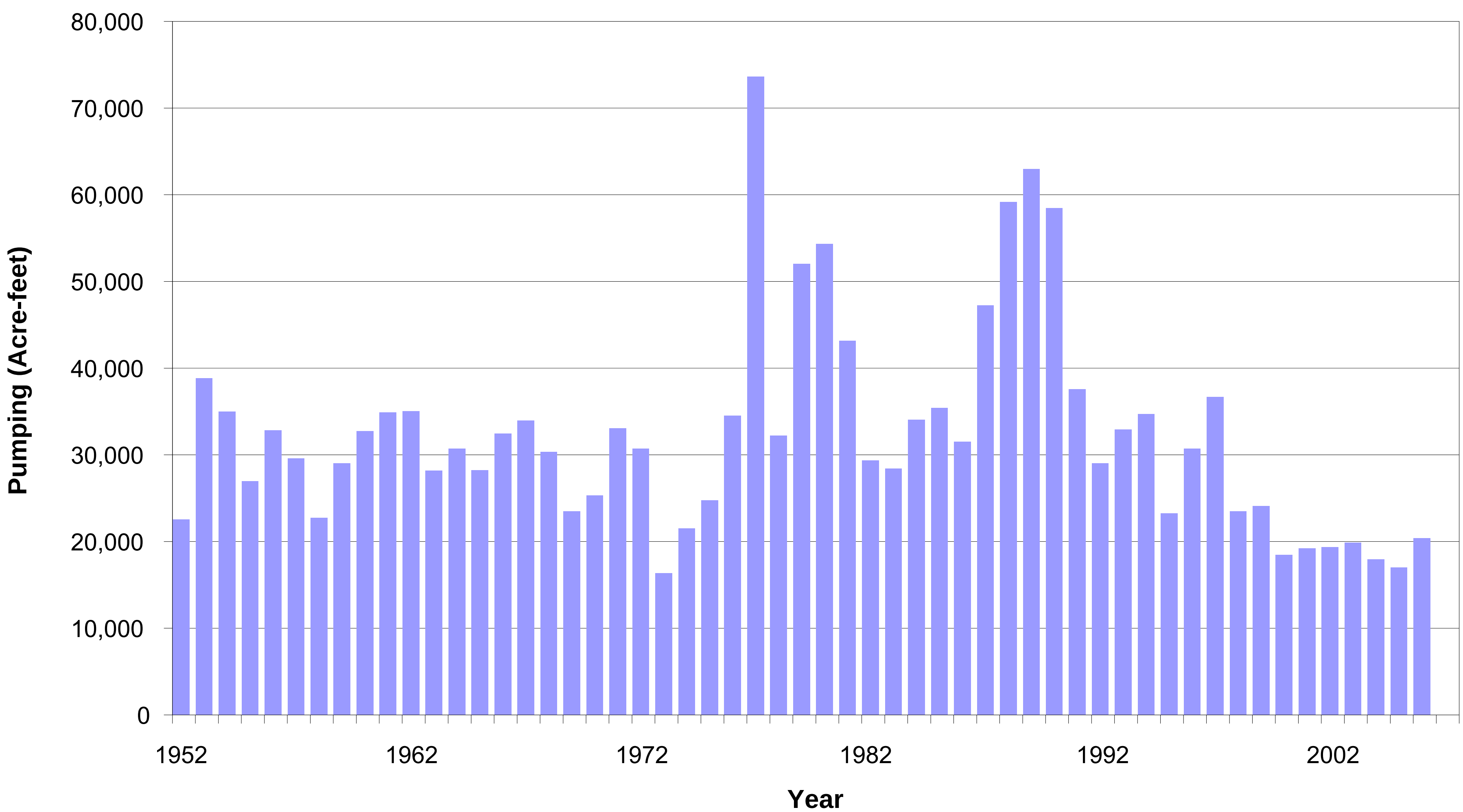


Figure 8. Annualized Pumpage from Supplemental-Source Private and Improvement District Irrigation Wells within TID, 1952-2006

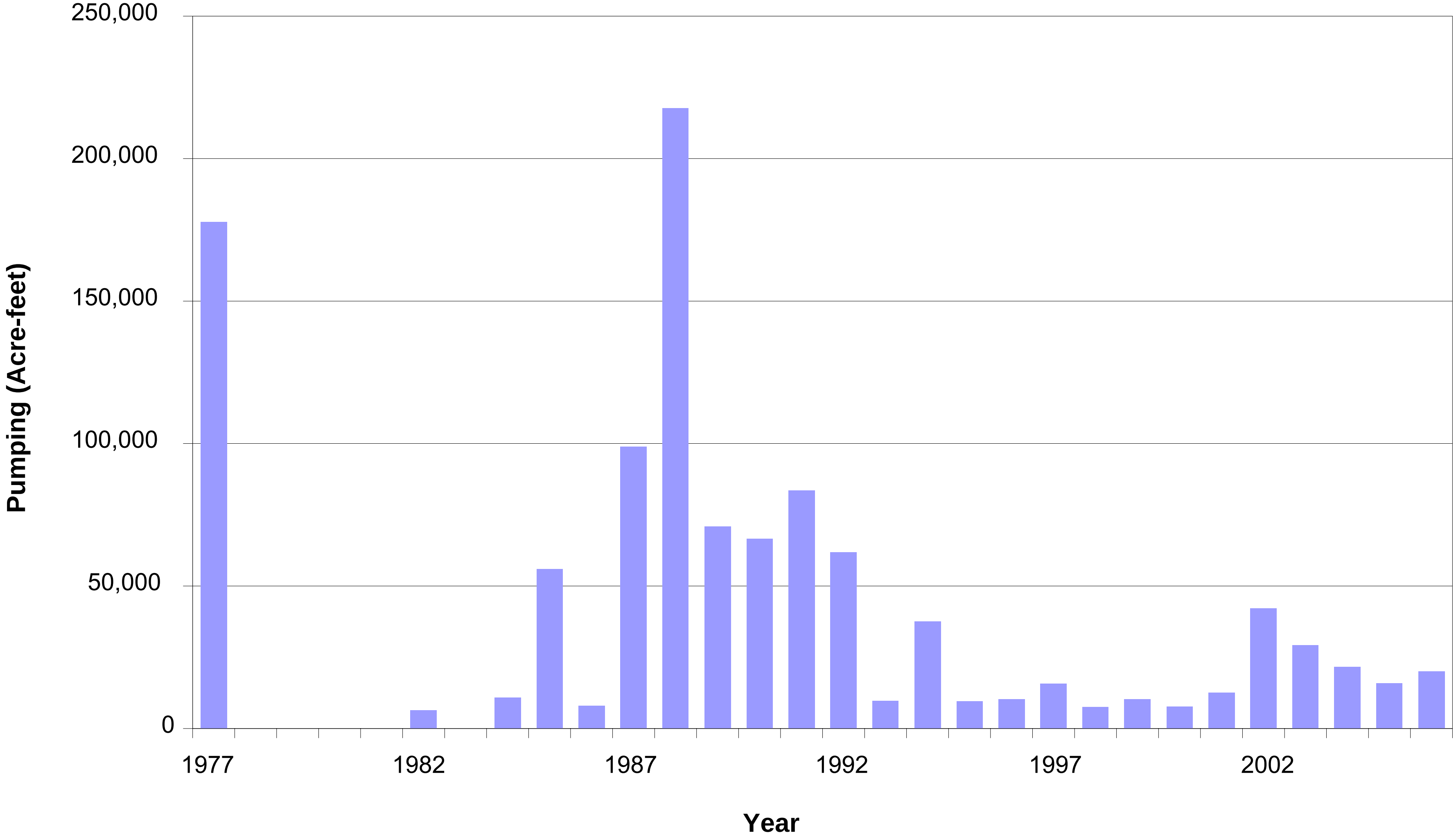


Figure 9. Annualized Supplemental-Source Private and Improvement District Irrigation Wells Rented by TID, 1977-2006

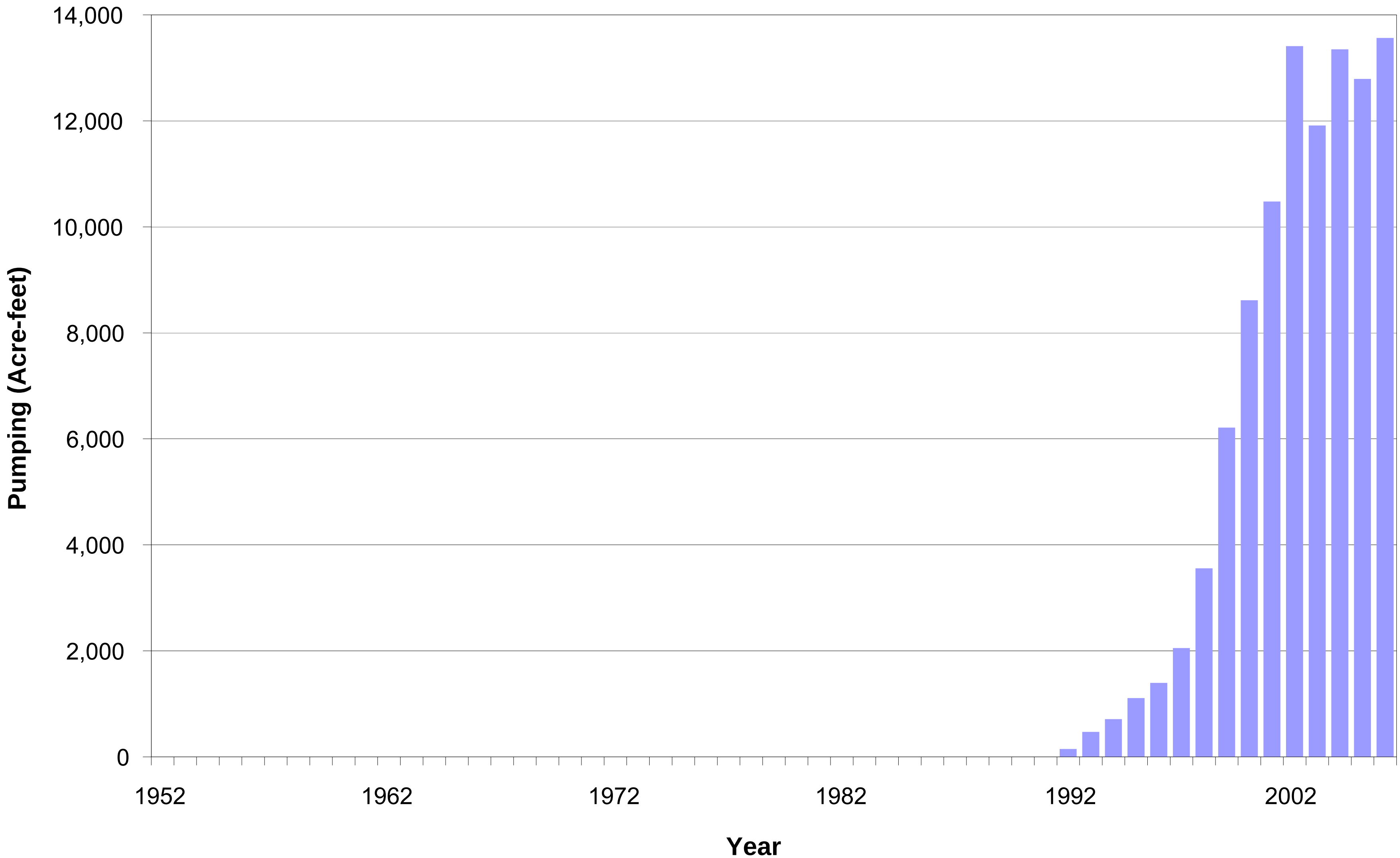


Figure 10. Annualized Pumpage from Primary-Source Private Irrigation Wells within TID, 1952-2006

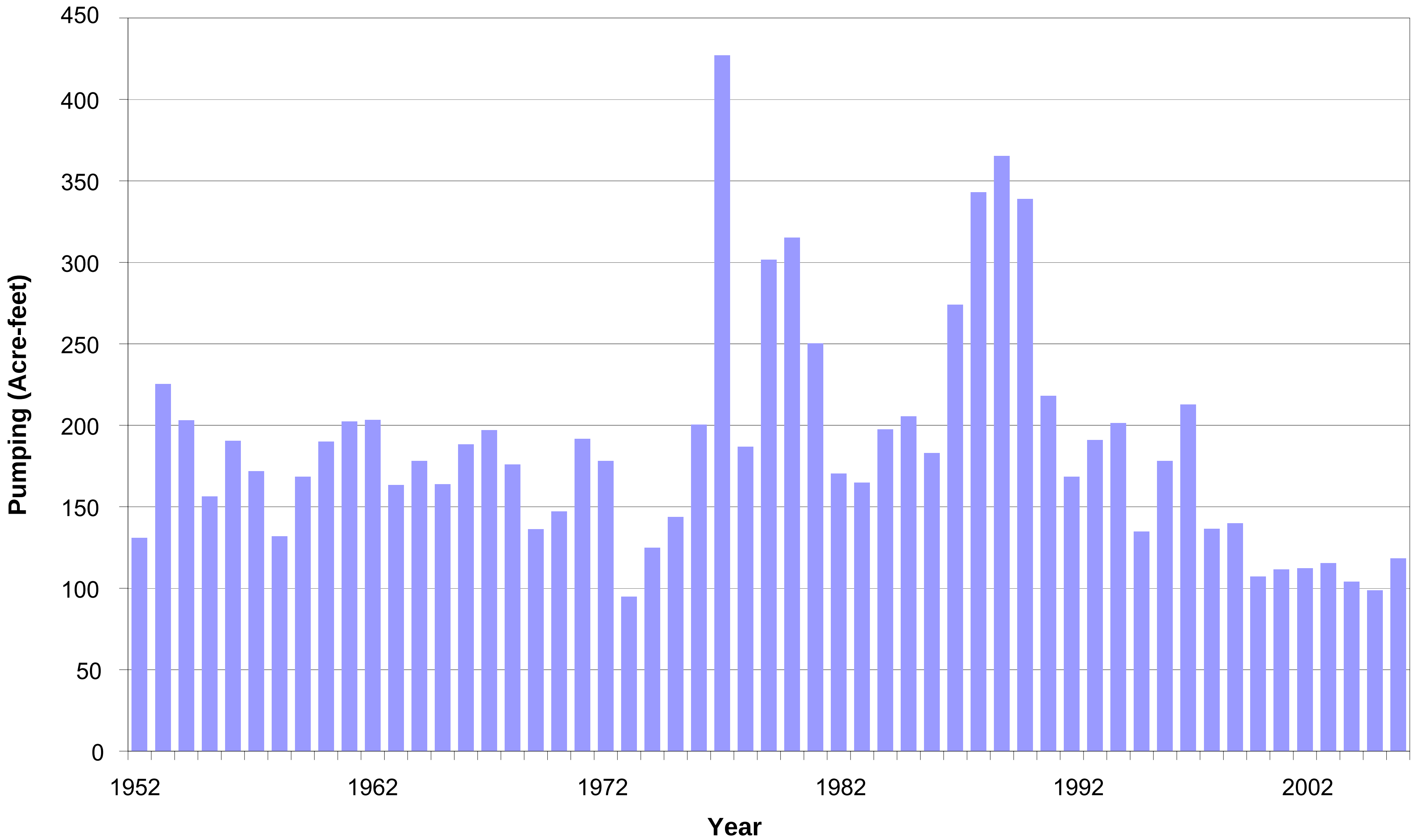


Figure 11. Estimated Annualized Pumpage for Private Irrigation Wells within Merced Irrigation District, 1952-2006

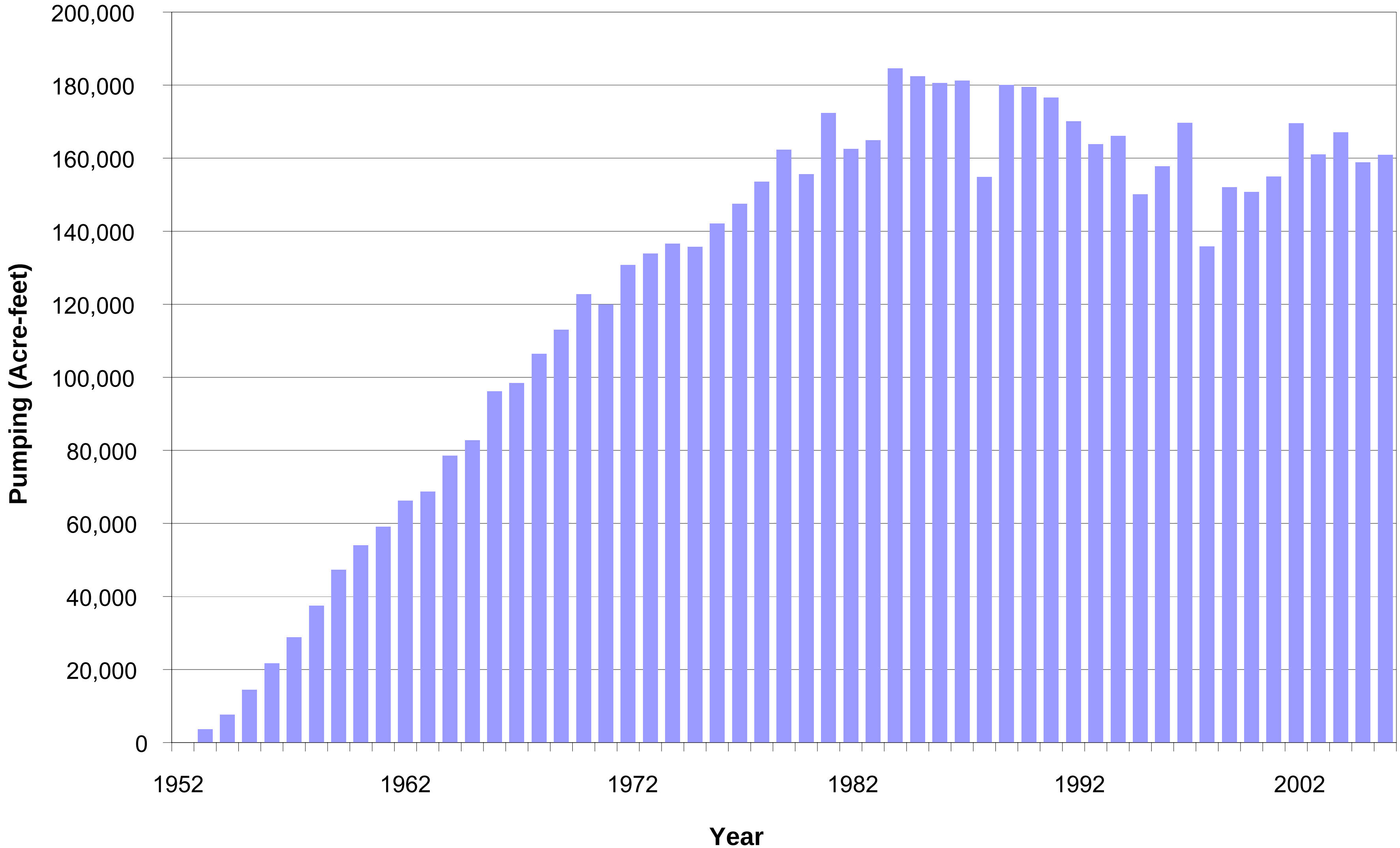


Figure 12. Annualized Pumpage from Private Irrigation Wells within Eastside Water District, 1952-2006

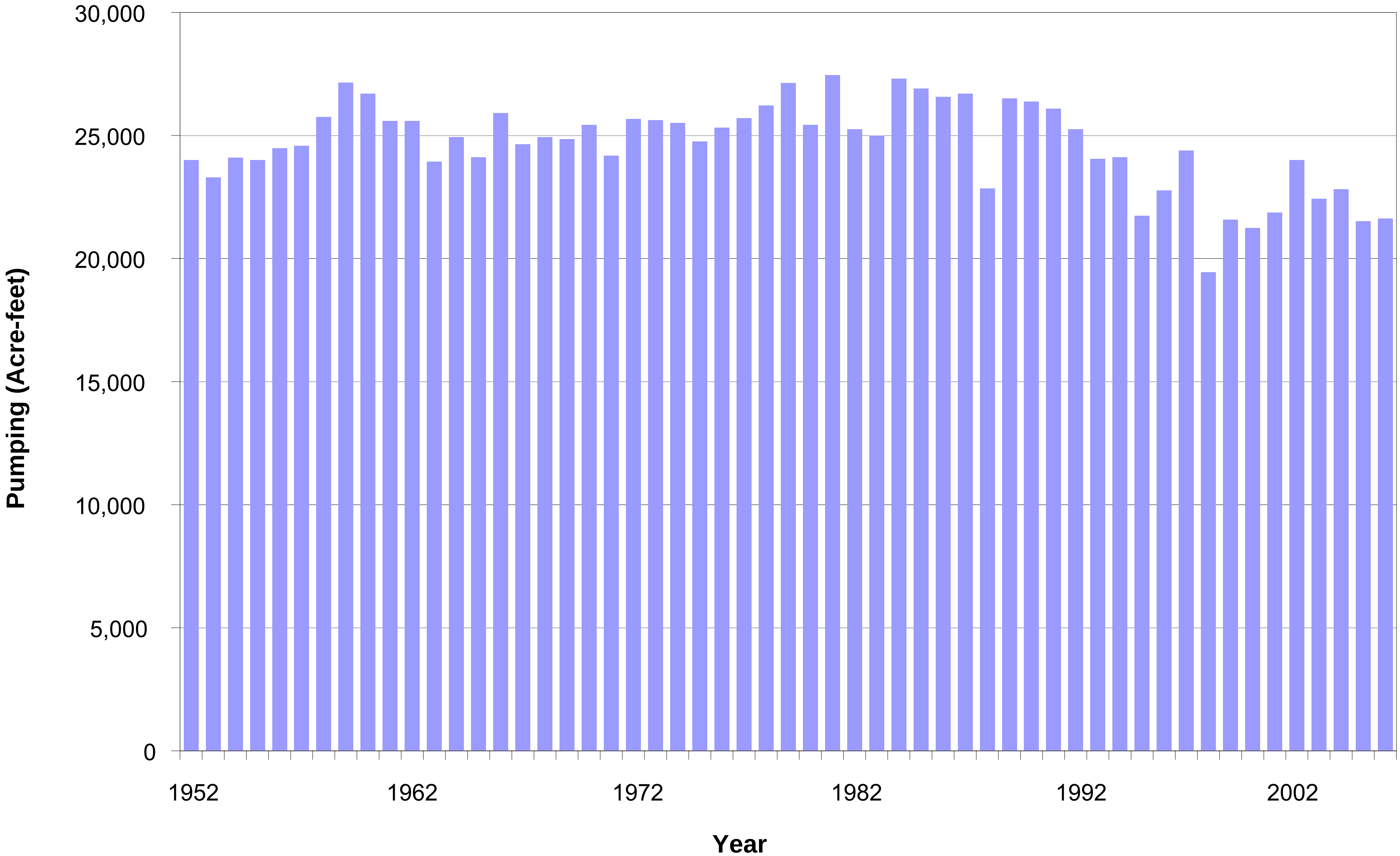


Figure 13. Annualized Pumpage from Private Irrigation Wells within Ballico-Cortez Water District, 1952-2006

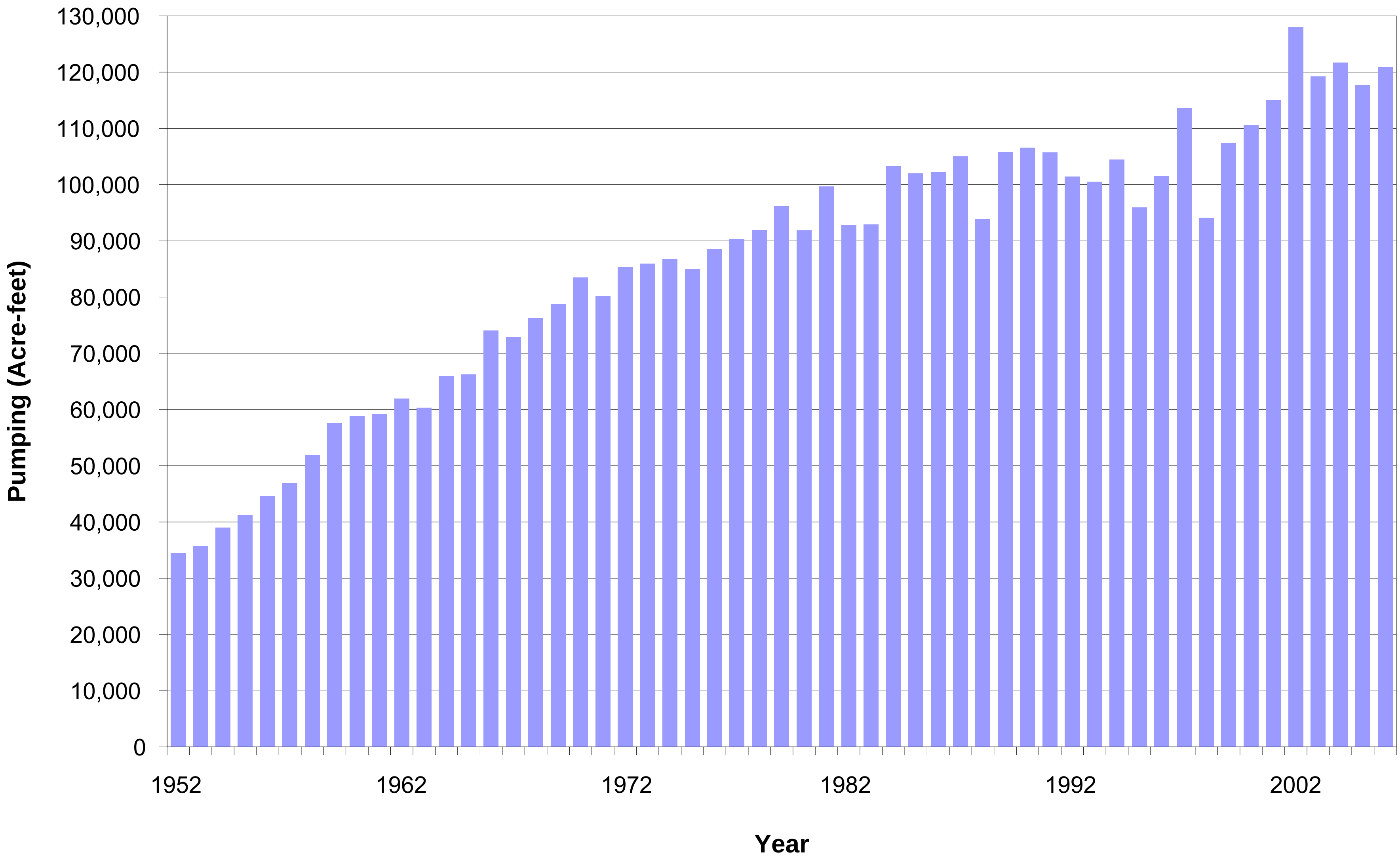


Figure 14. Annualized Pumping for Private Irrigation Wells within Non-District Areas, 1952-2006

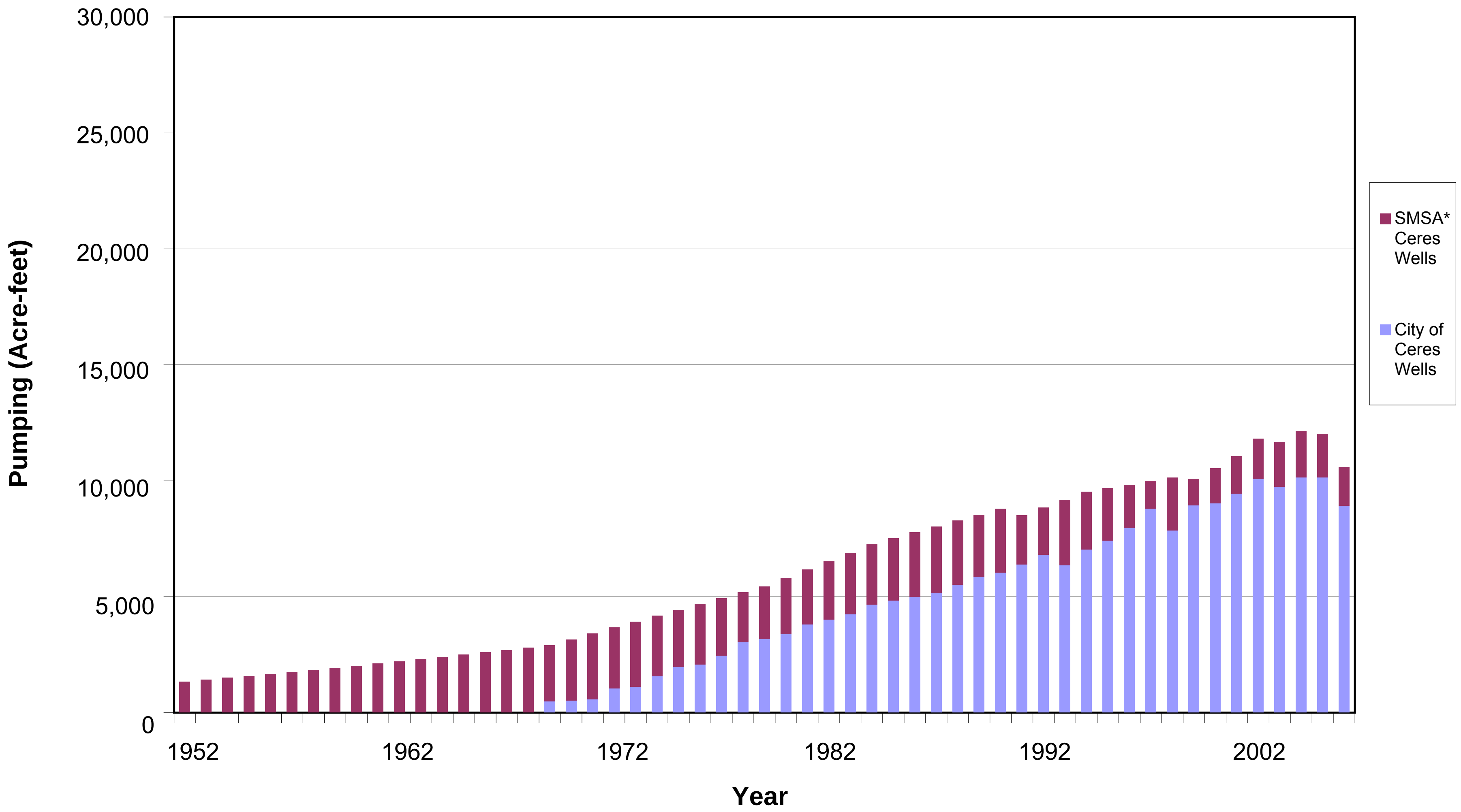


Figure 15a. Annual Pumpage from Municipal Wells for Ceres, 1952-2006

*SMSA (South Modesto Service Area) Ceres Wells are within the City of Ceres and operated by the City of Modesto

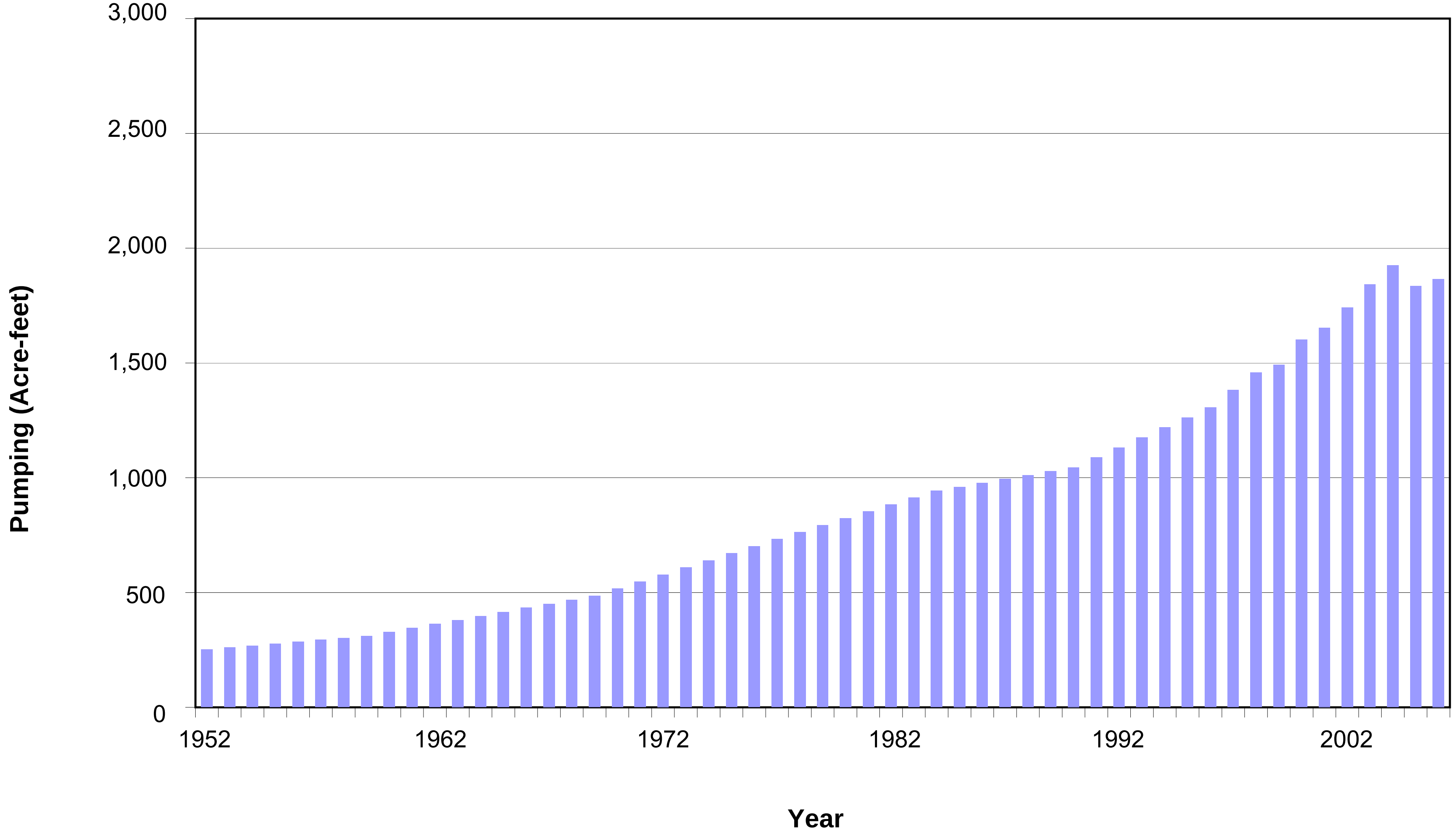


Figure 15b. Annual Pumpage from Municipal Wells for Delhi, 1952-2006

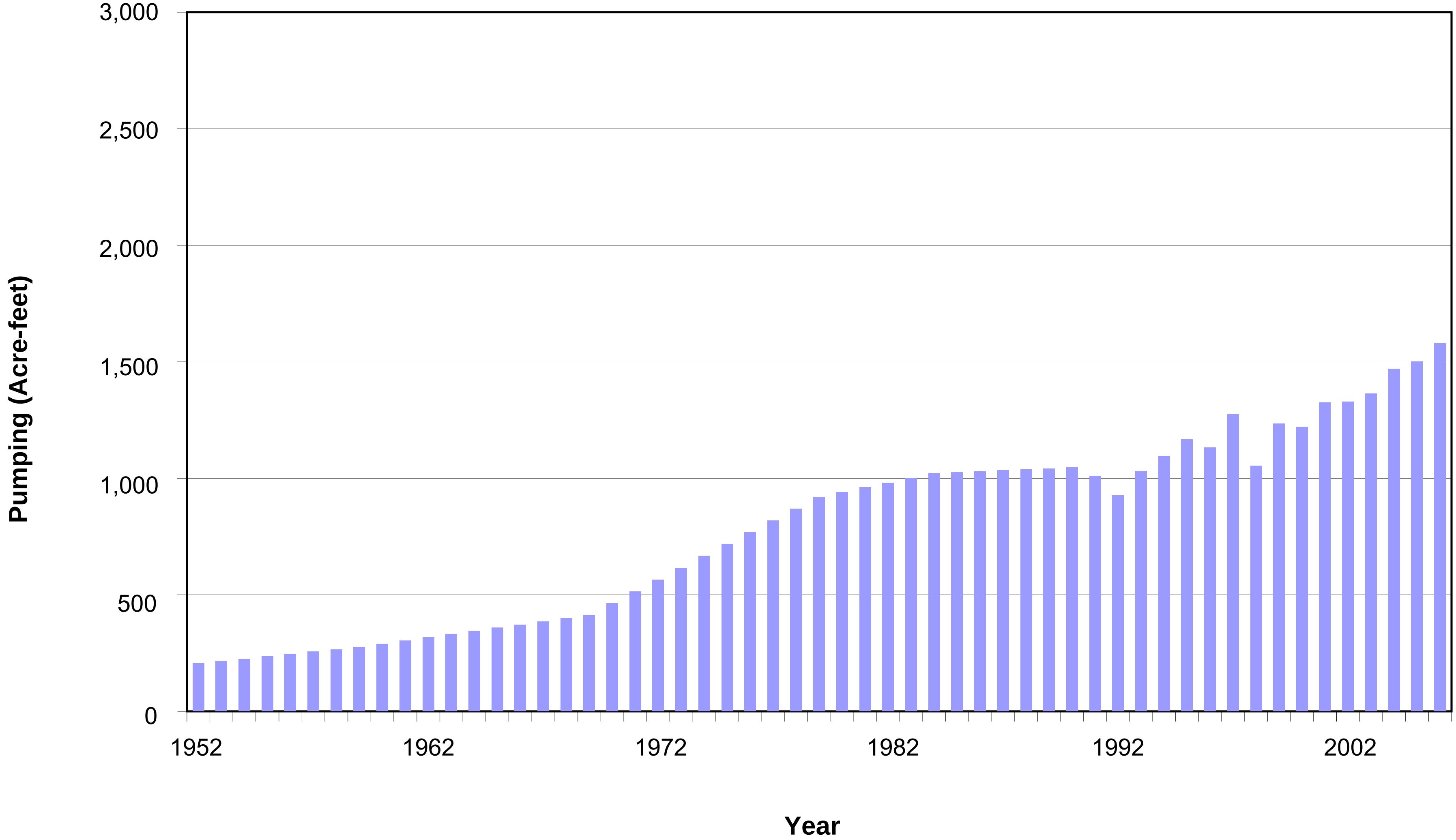


Figure 15c. Annual Pumpage from Municipal Wells for Denair, 1952-2006

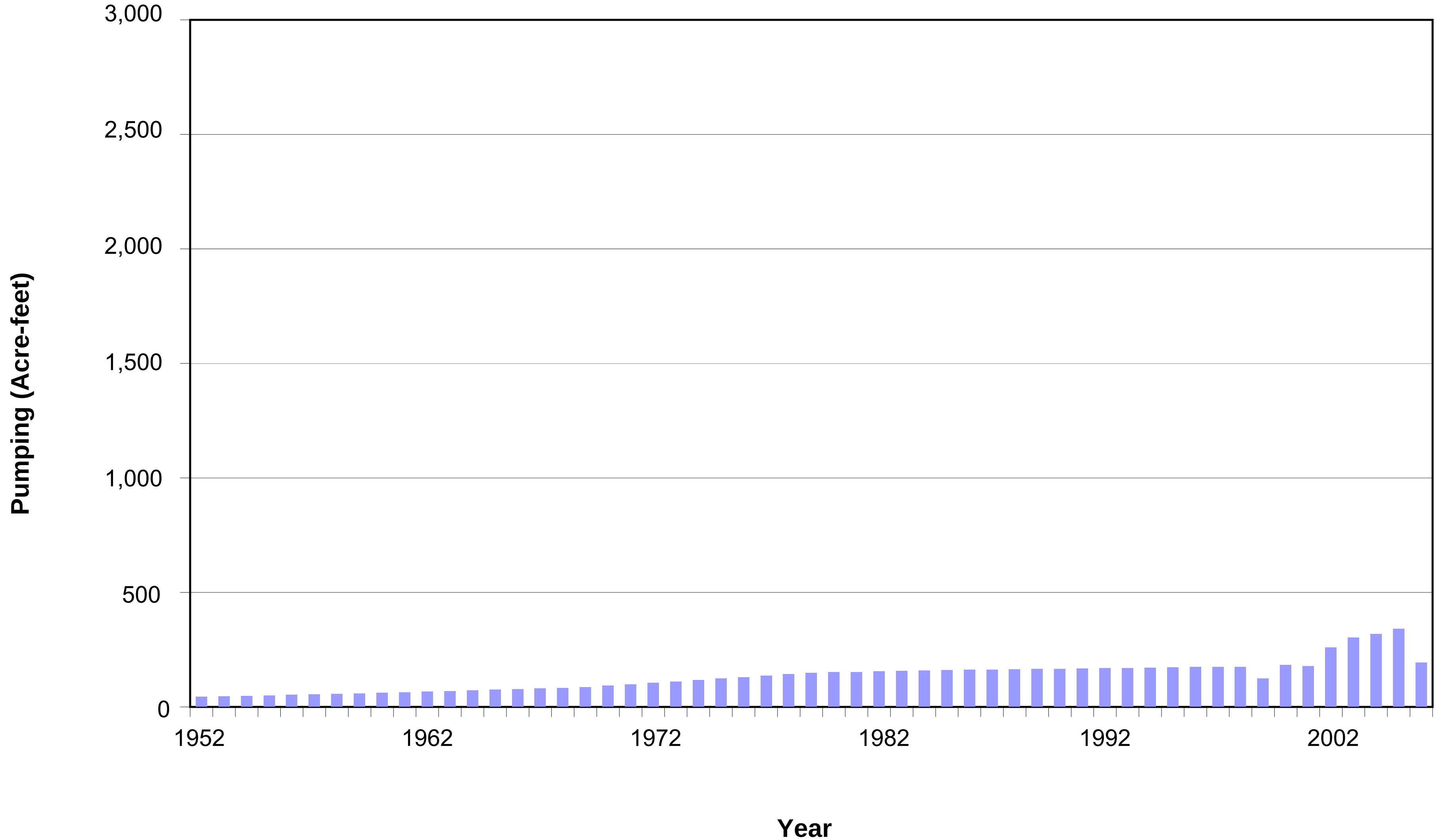


Figure 15d. Annual Pumpage from Municipal Wells for Hickman, 1952-2006

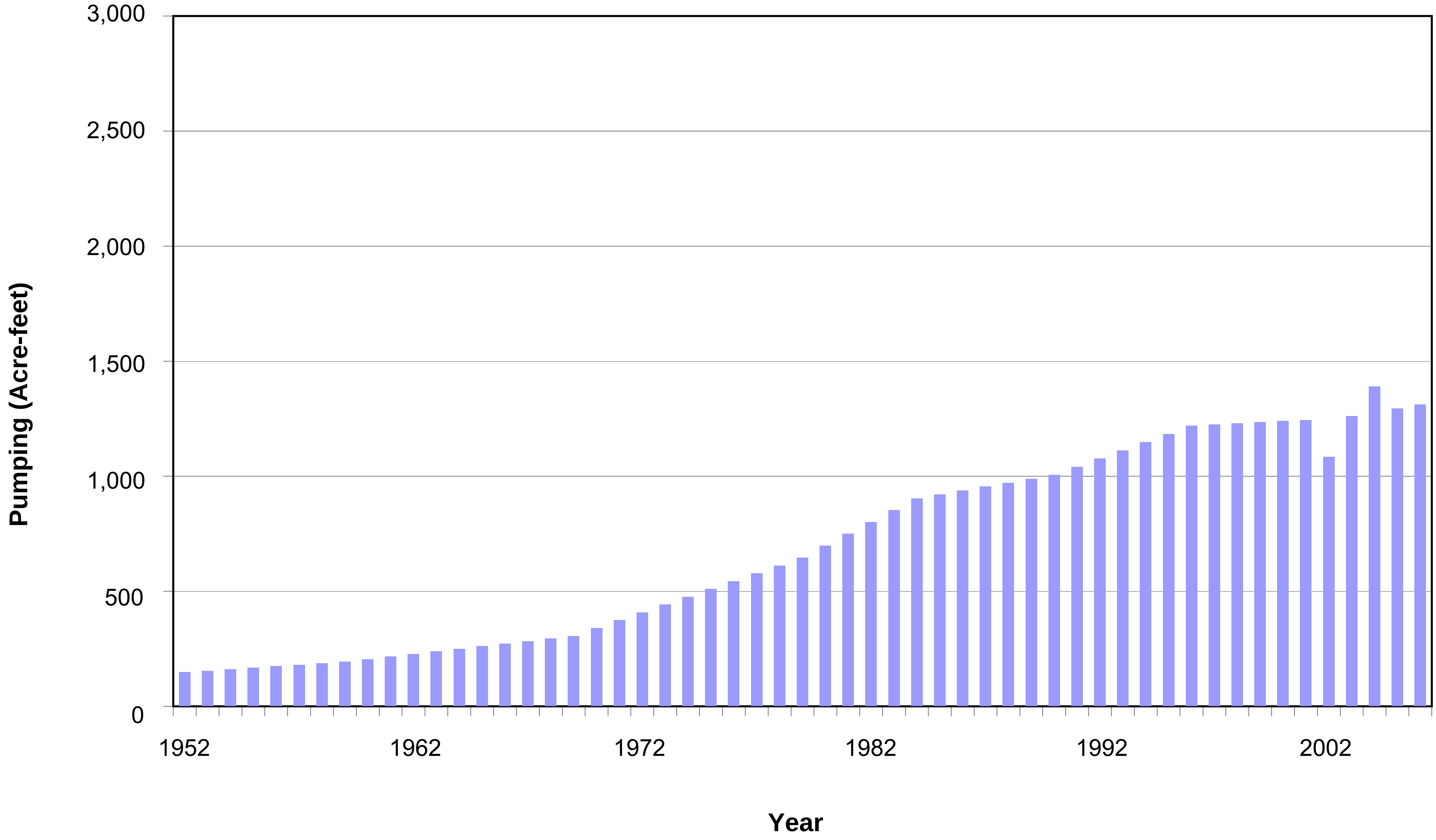


Figure 15e. Annual Pumpage from Municipal Wells for Hilmar, 1952-2006

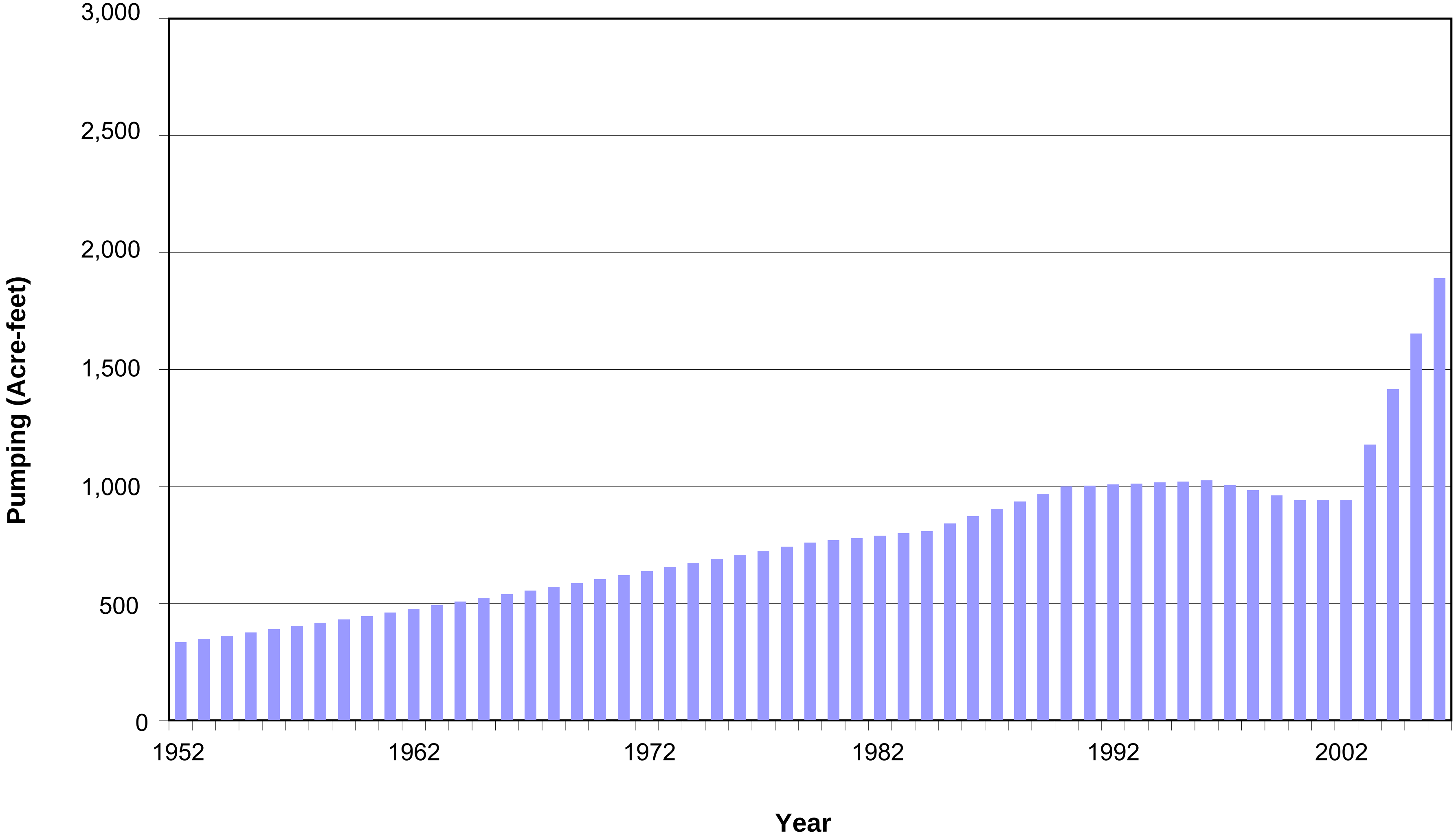


Figure 15f. Annual Pumpage from Municipal Wells for Hughson, 1952-2006

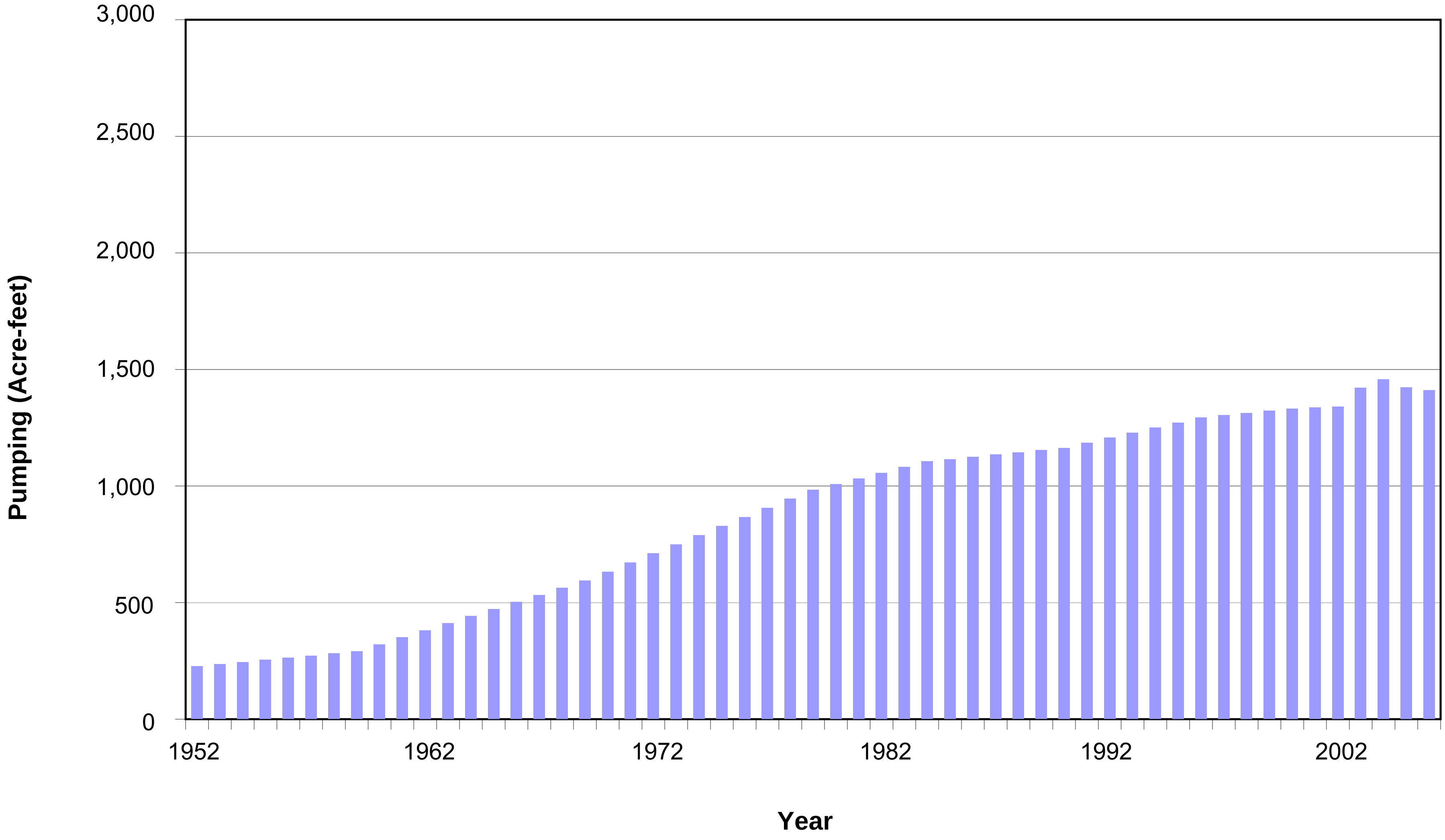


Figure 15g. Annual Pumpage from Municipal Wells for Keyes, 1952-2006

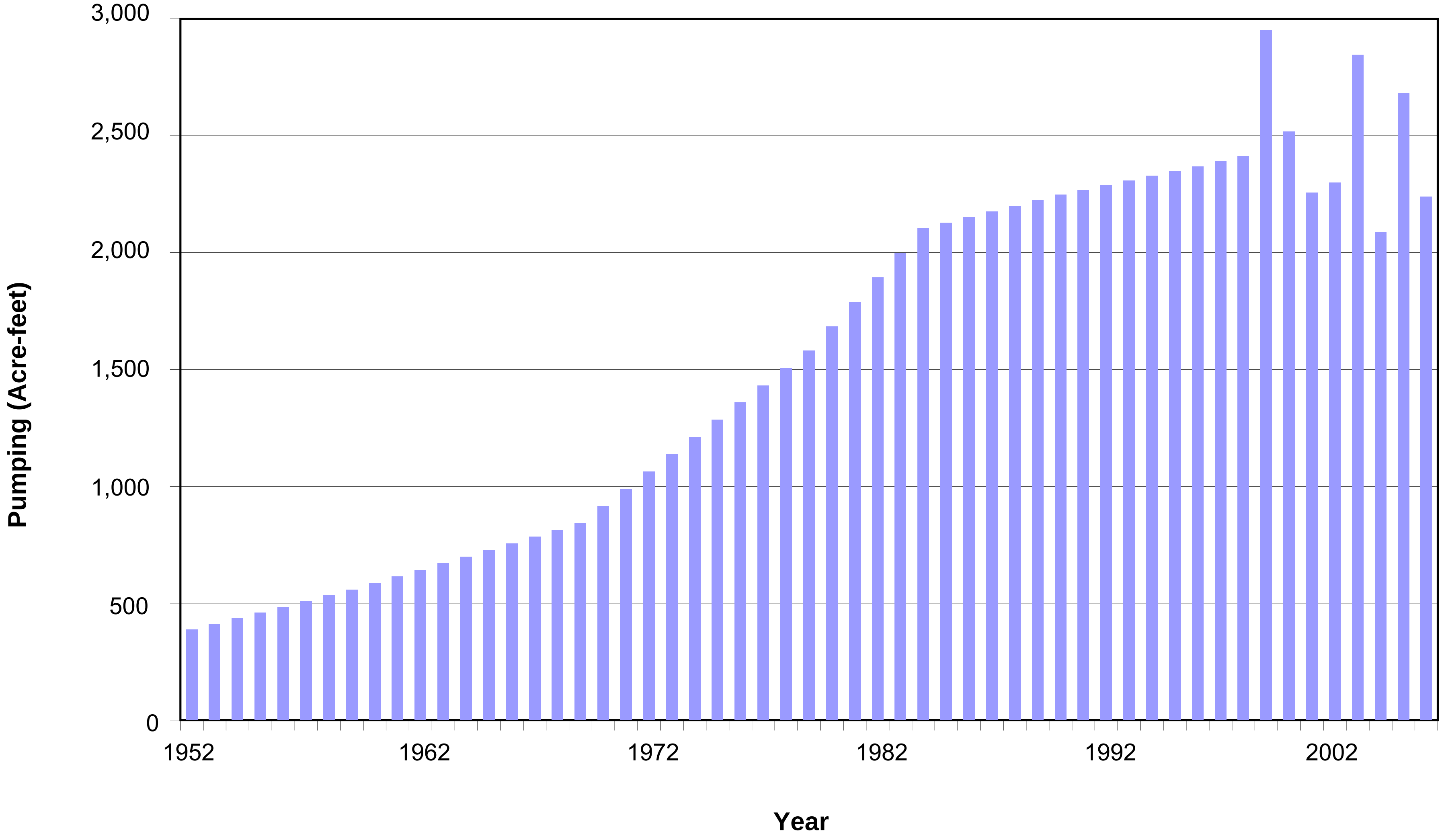


Figure 15h. Annual Pumpage from Municipal Wells for South Modesto, 1952-2006

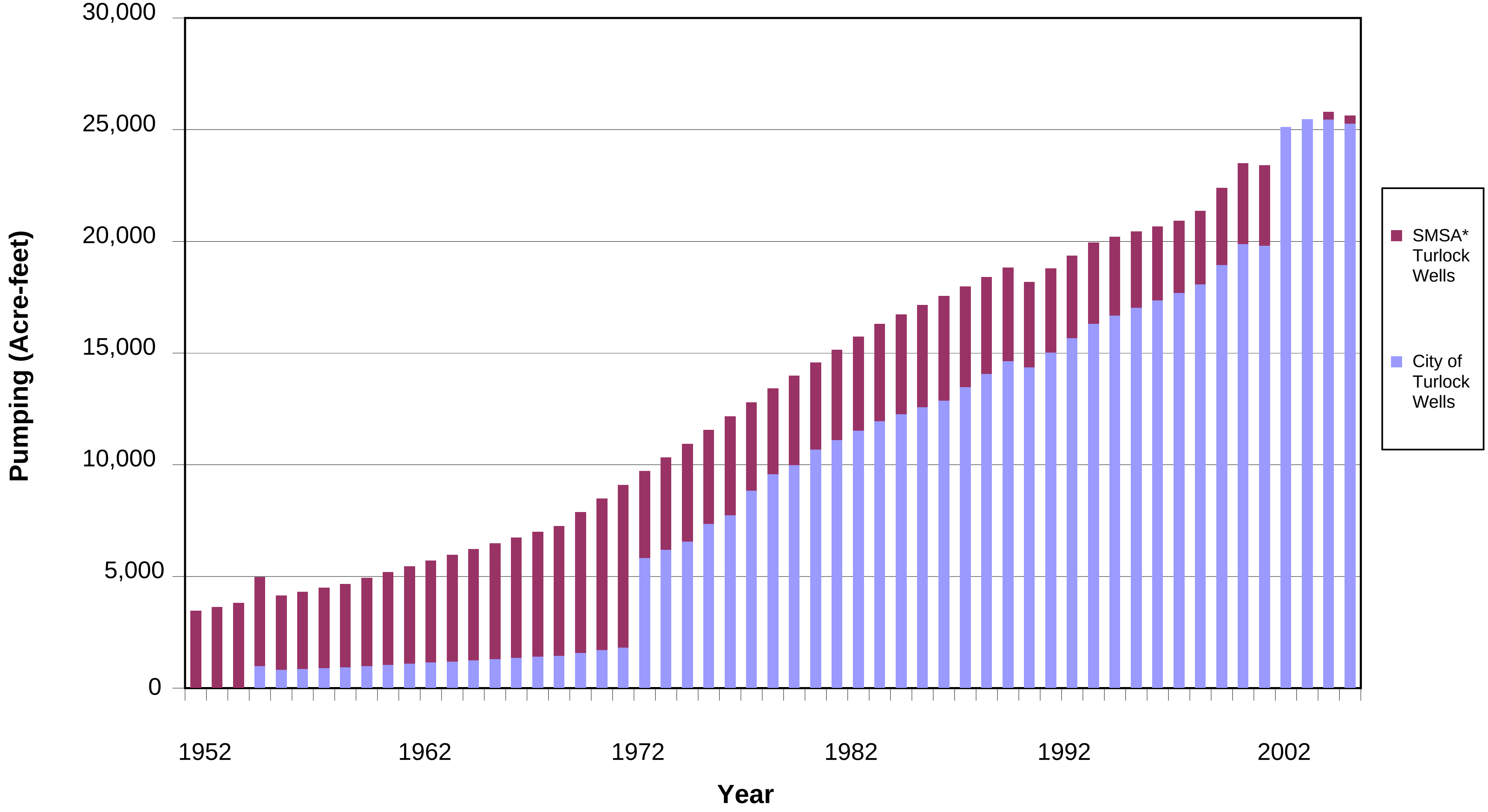


Figure 15i. Annual Pumpage from Municipal Wells for Turlock, 1952-2006

*SMSA (South Modesto Service Area) Turlock Wells are within the City of Turlock and operated by the City of Modesto

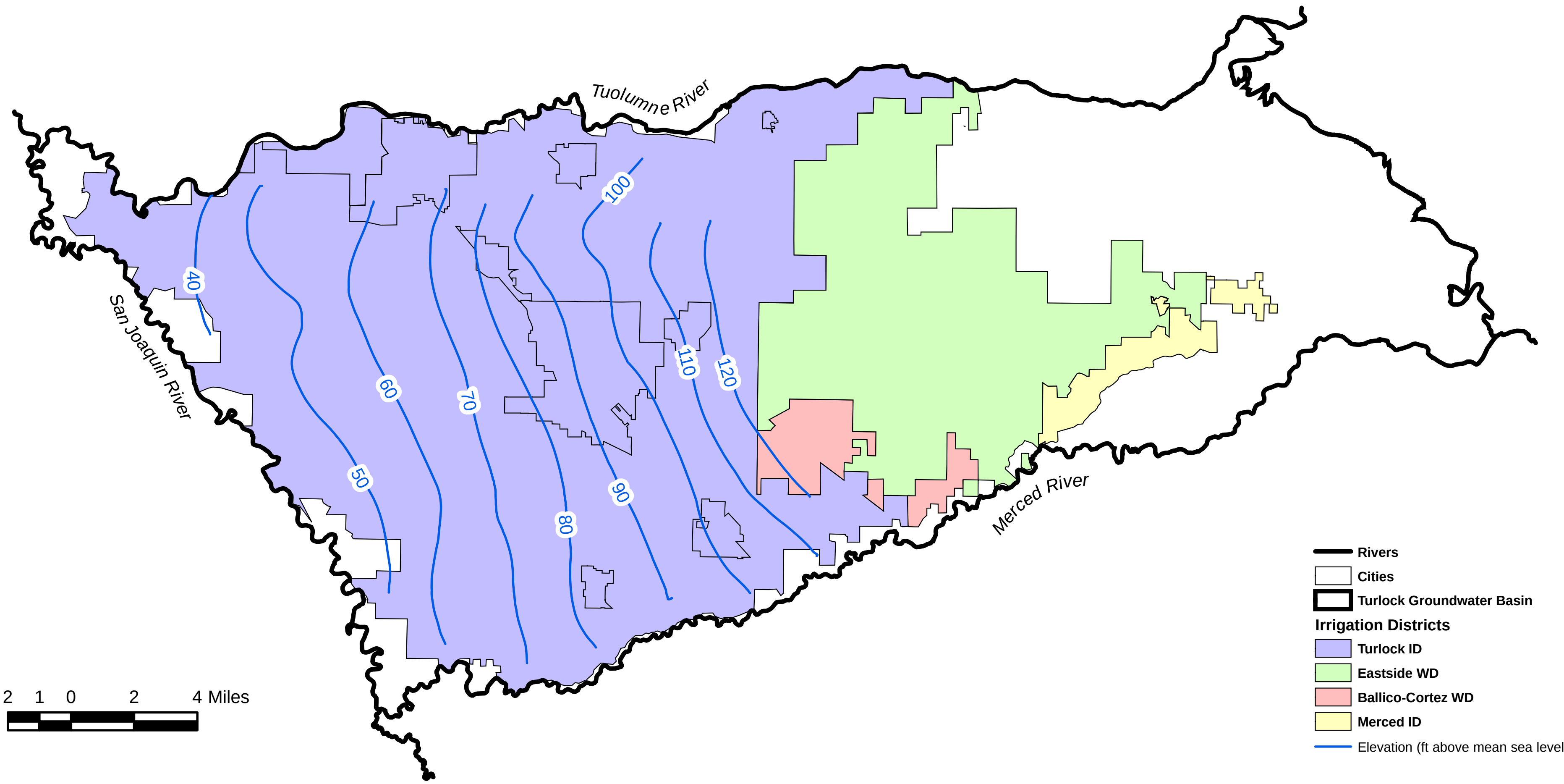


Figure 16a. Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1960

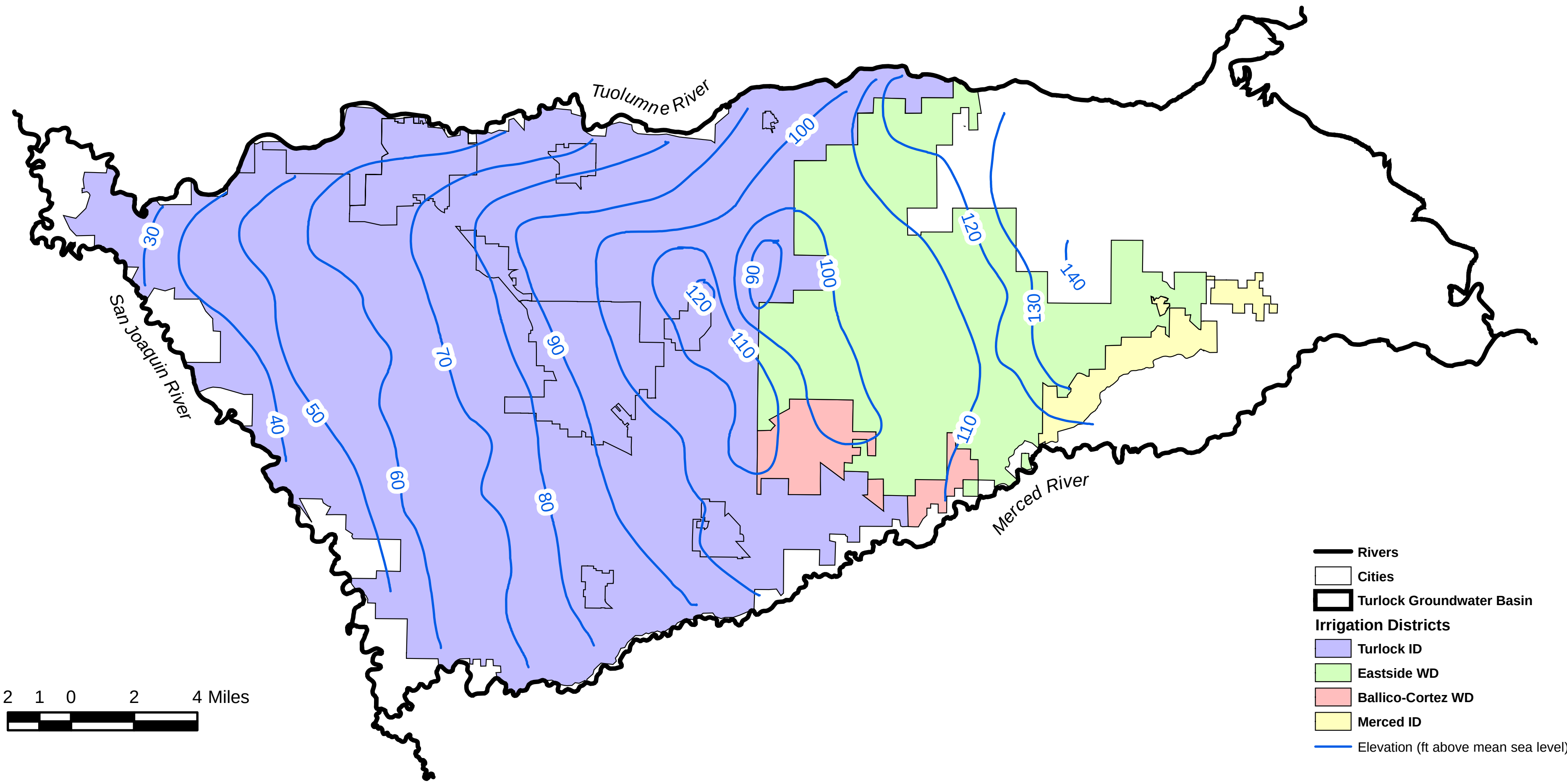


Figure 16b. Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1974

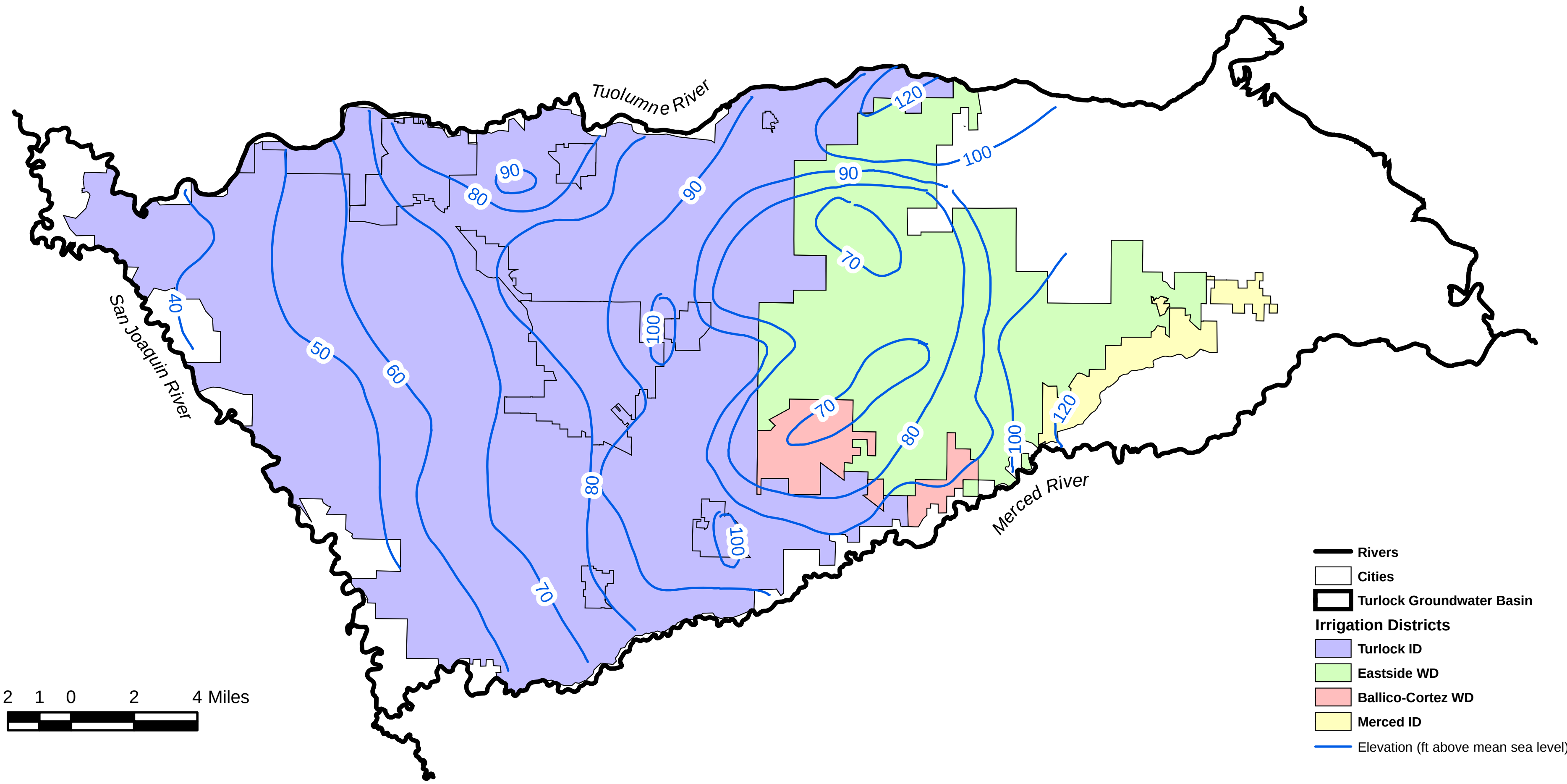


Figure 16c. Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1986

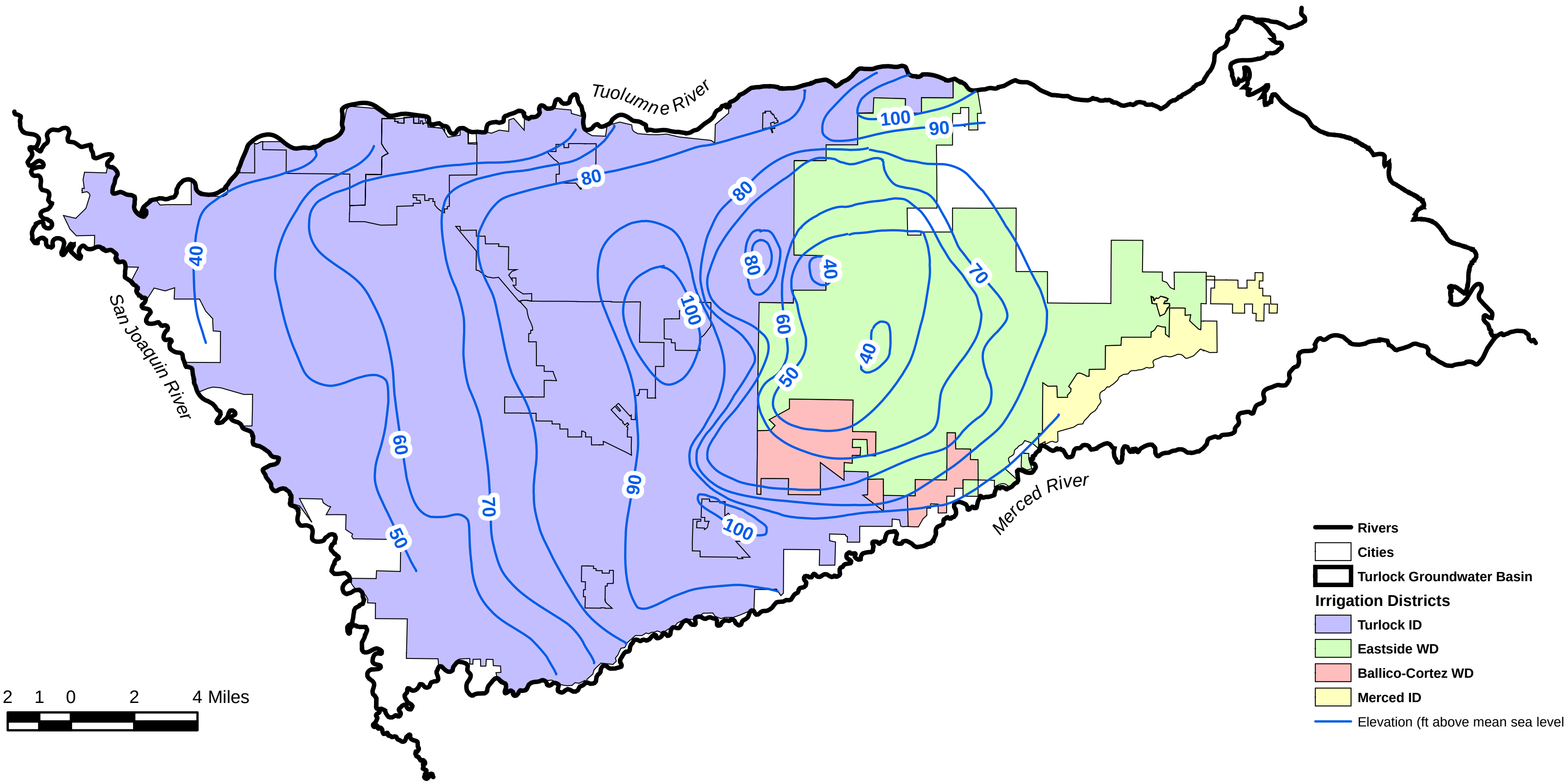


Figure 16d. Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1998

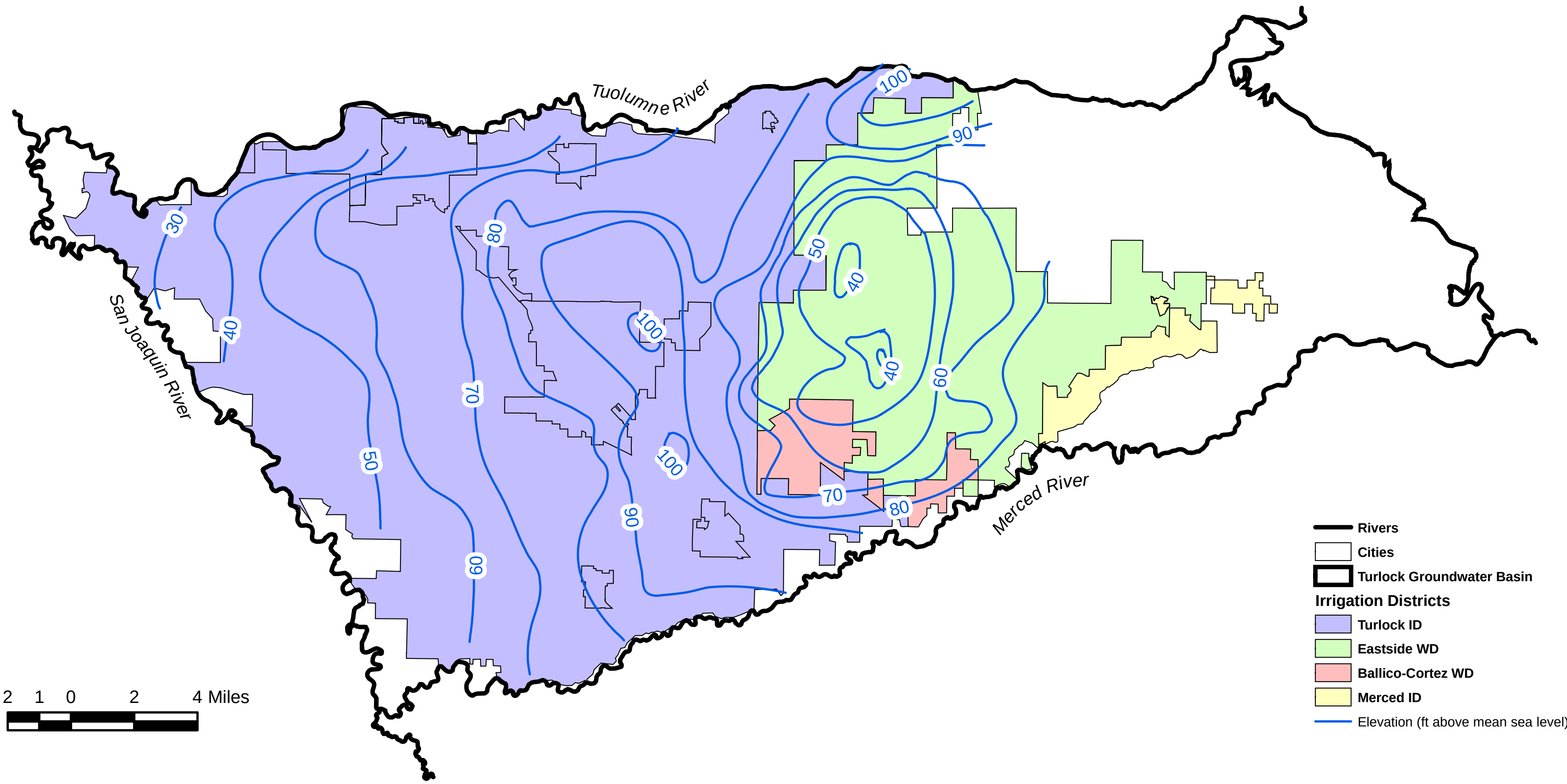


Figure 16e. Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 2002

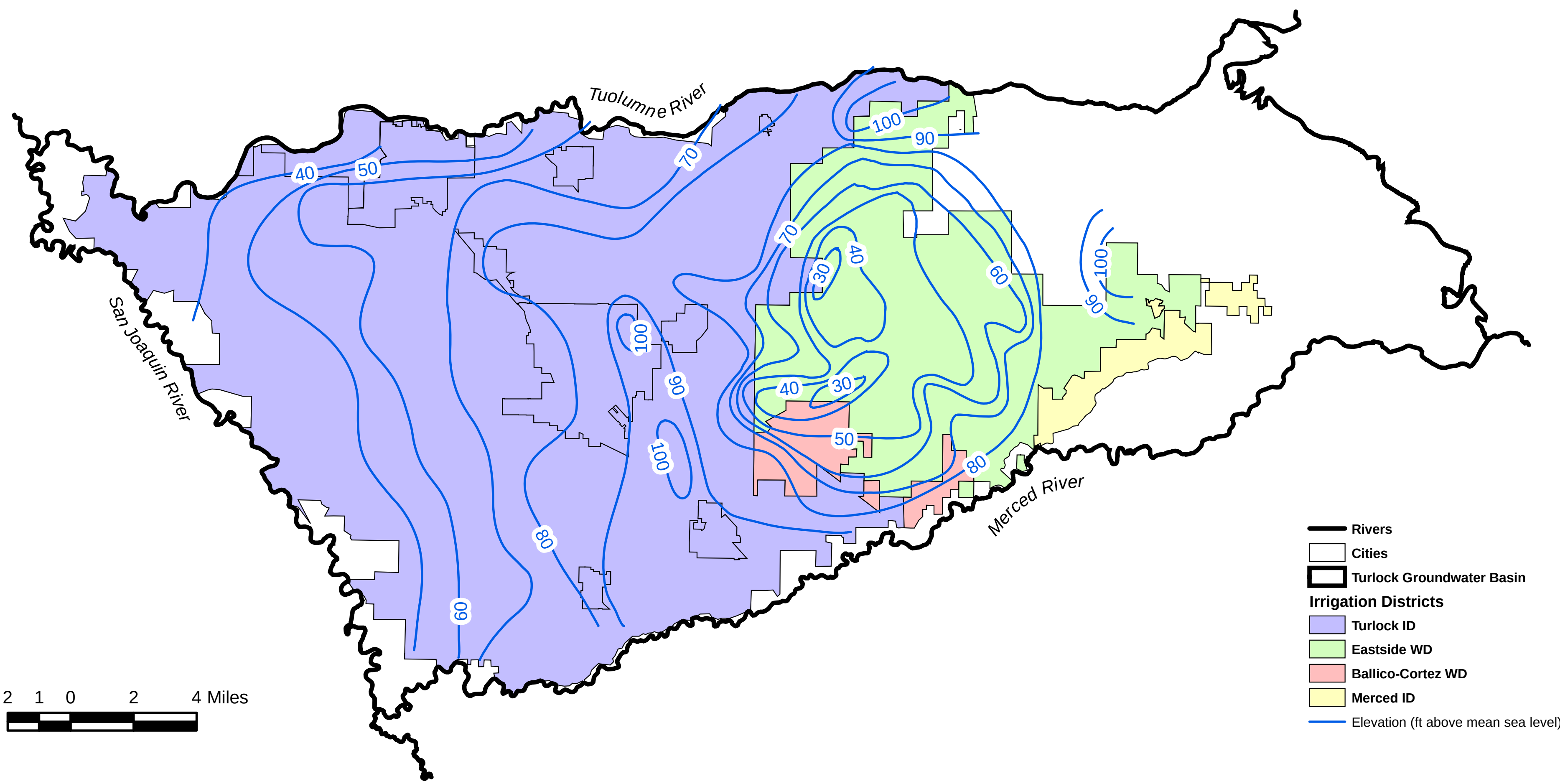


Figure 16f. Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 2005

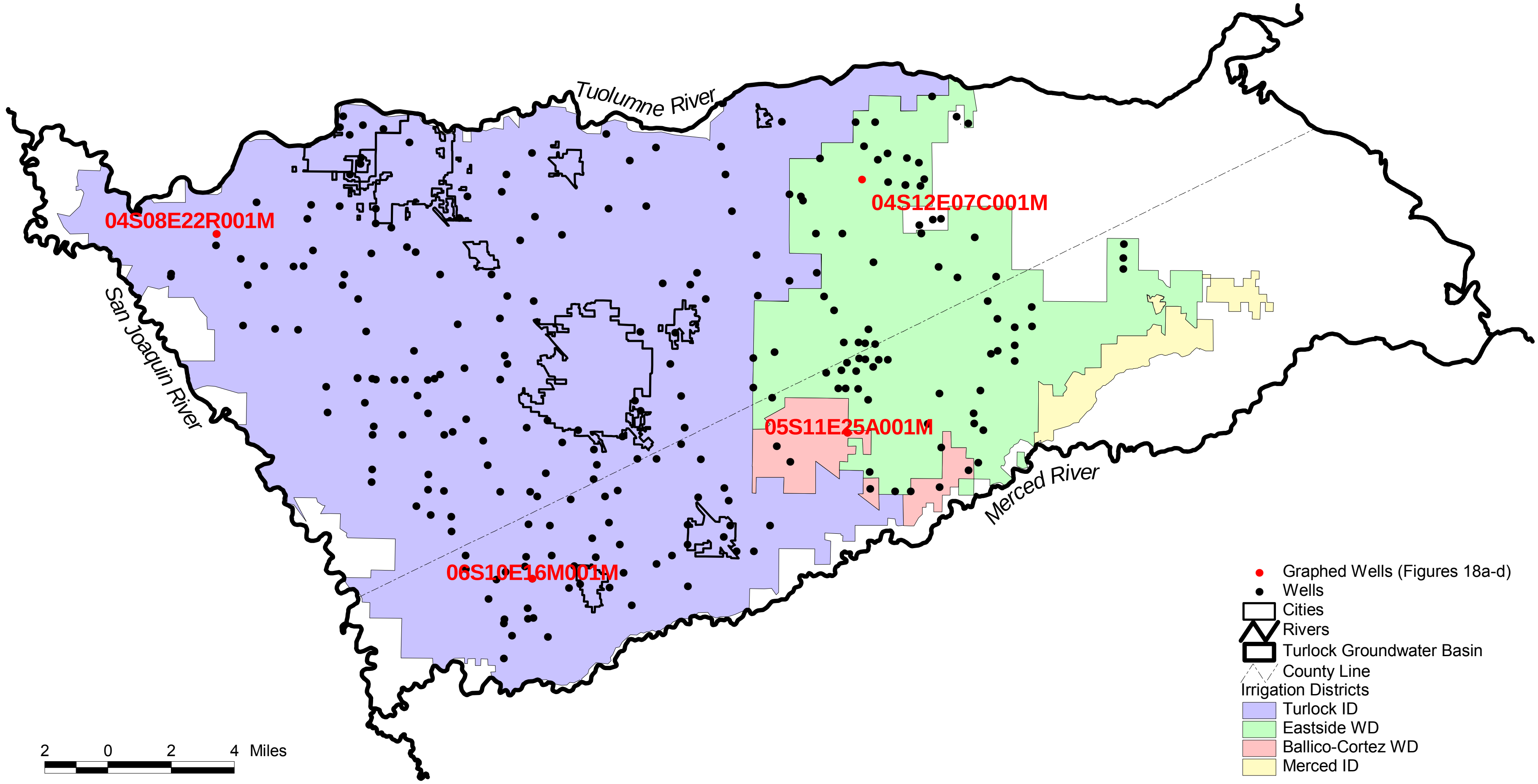


Figure 17. Locations of Intermediate-Depth Monitoring Wells

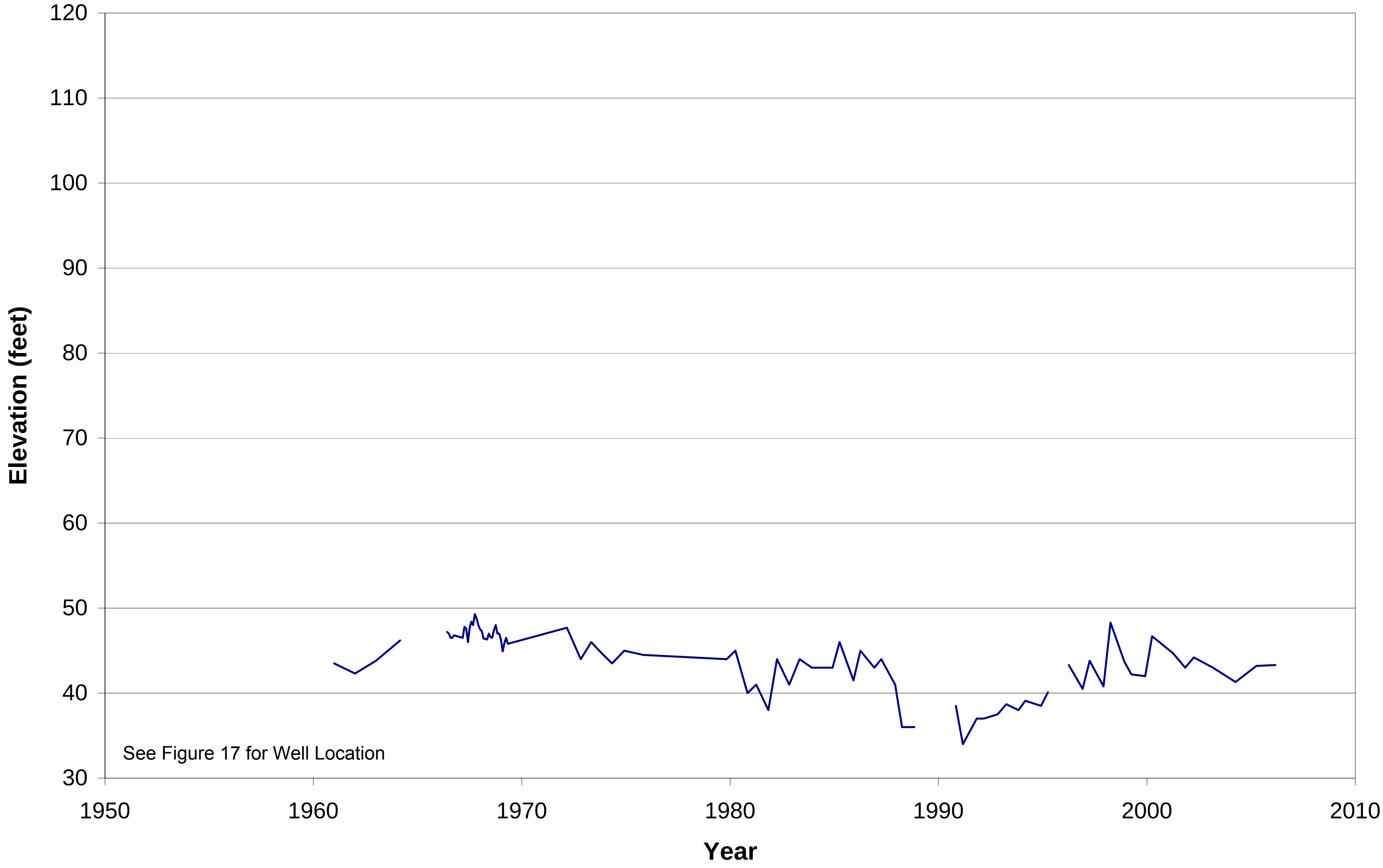


Figure 18a. Measured Temporal Groundwater Levels in Monitoring Well 04SO8E22R001M

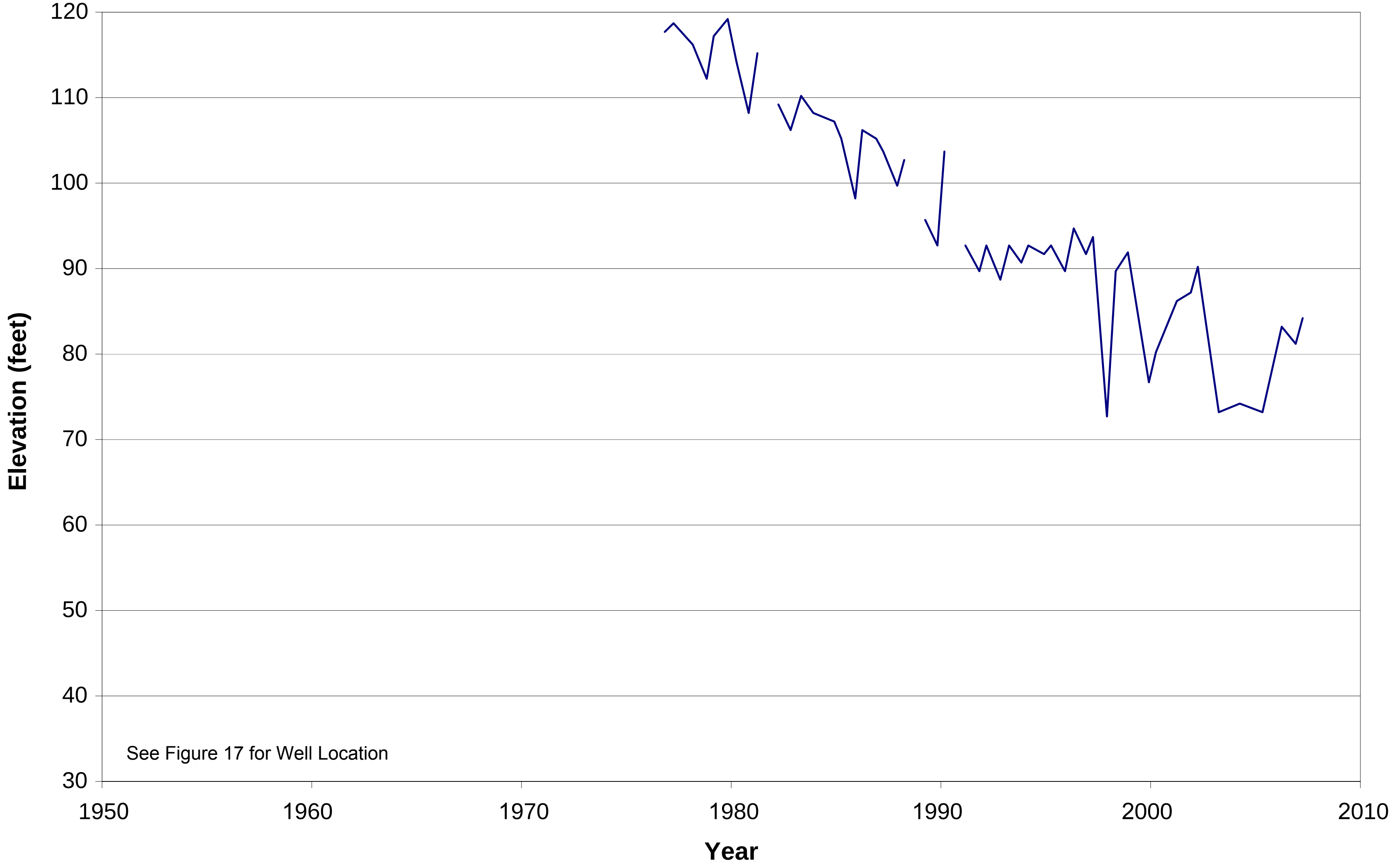


Figure 18b. Measured Temporal Groundwater Levels in Monitoring Well 04S12E07C001M

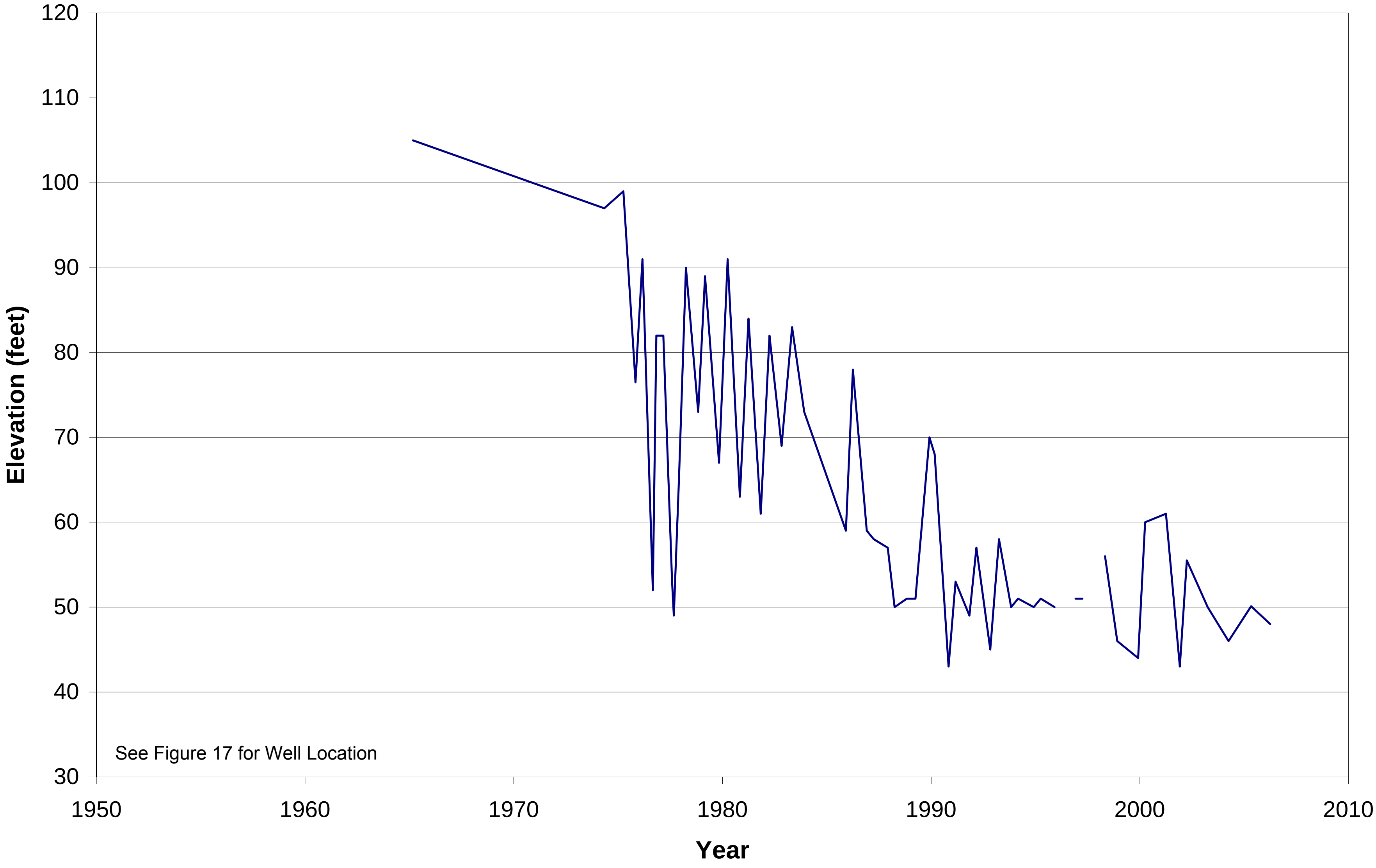


Figure 18c. Measured Temporal Groundwater Levels in Monitoring Well 05S11E25A001M

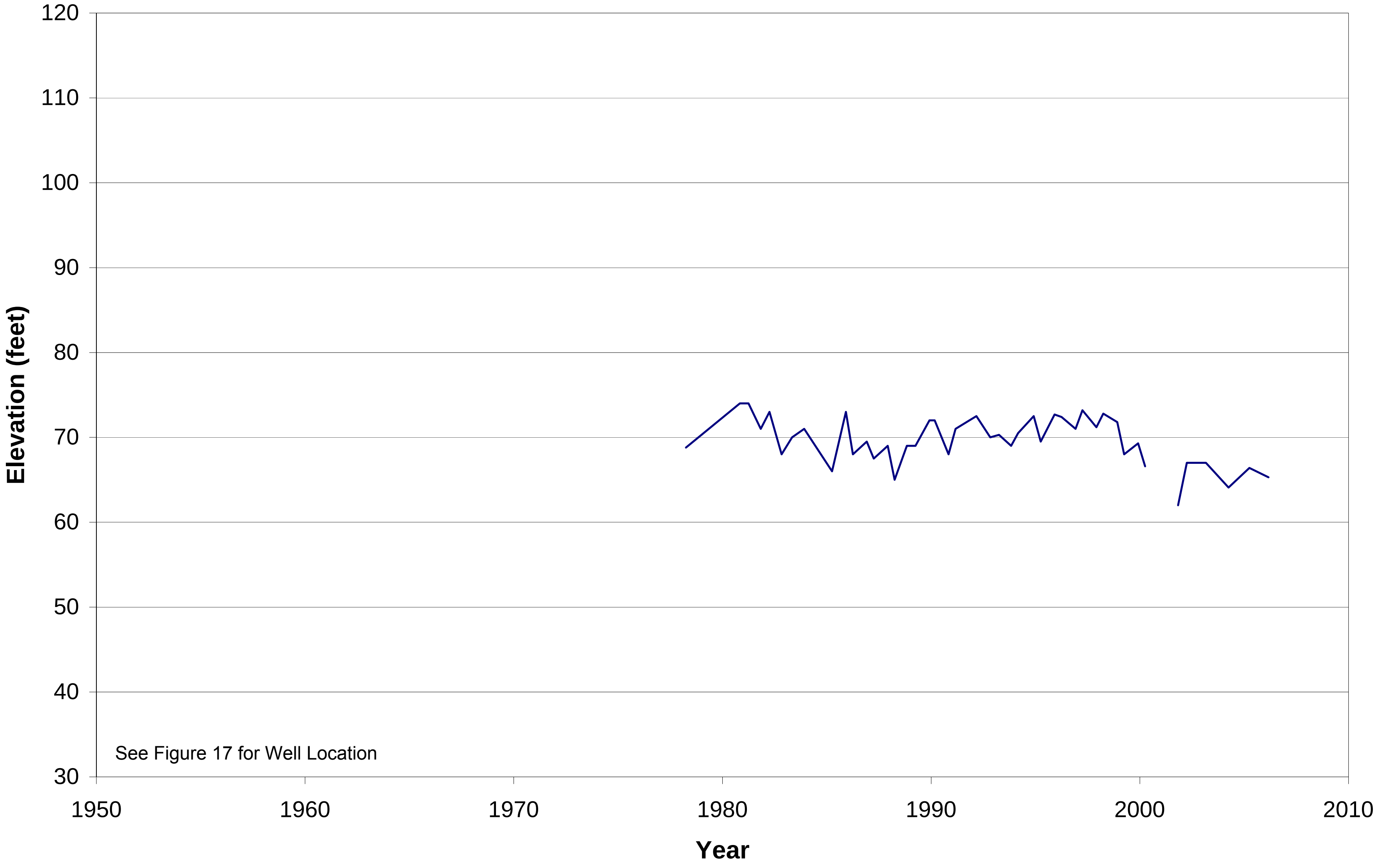


Figure 18d. Measured Temporal Groundwater Levels in Monitoring Well 06S10E16M001M

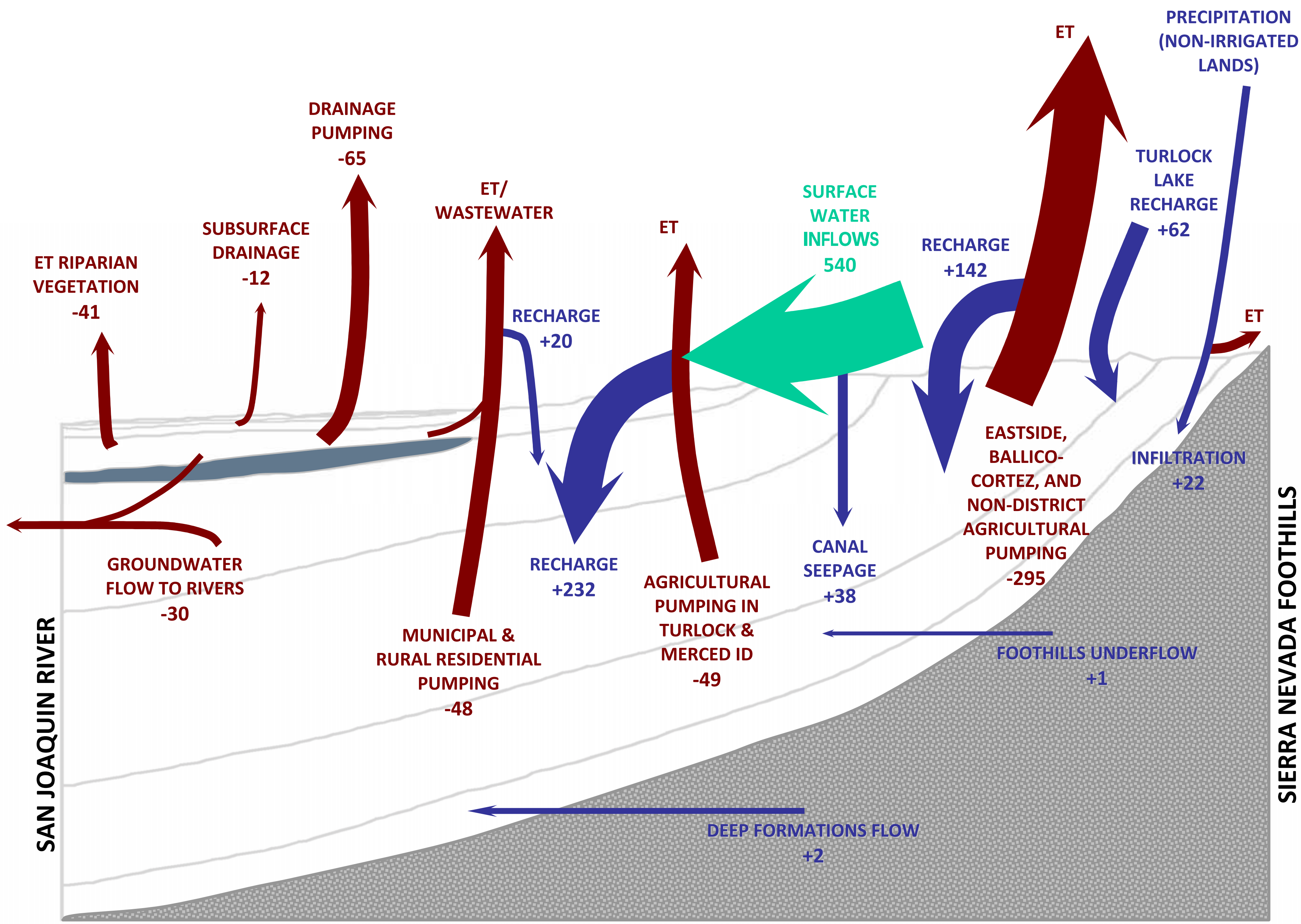
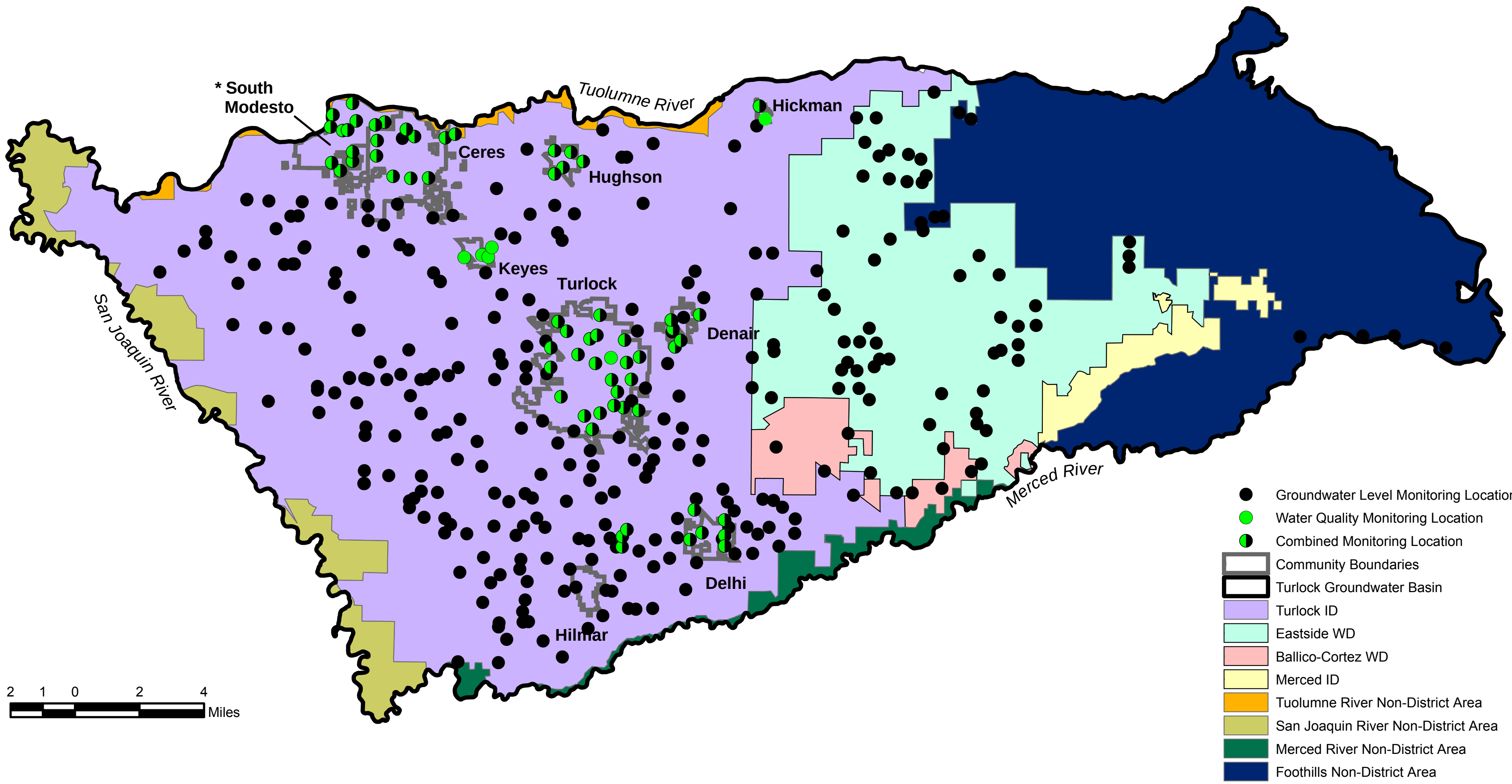


Figure 19. Estimated Turlock Groundwater Basin Water Budget, 1997-2006 (Thousands of Acre-Feet per Year)



* South Modesto represents the City of Modesto Service Area South of the Tuolumne River

Figure 20. Local Water Agency Groundwater Level and Water Quality Monitoring Locations in the Turlock Groundwater Basin

Appendix B

Tables

Table 1. Location of TGBA GMP Components

Description	Section(s)
CWC Section 10750 et seq. Mandatory Components	
1. Documentation of public involvement statement.	7.4
2. Basin Management Objectives (BMOs).	5.3
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping.	5.5-5.6 & 6.1-6.8
4. Plan to involve other agencies located within groundwater basin.	7.1-7.3 & 7.5
5. Adoption of monitoring protocols by basin stakeholders.	5.5-5.6
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118.	1.1-1.2 & 4.1.1
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principles.	N/A
DWR Suggested Components	
1. Manage with guidance of advisory committee.	7.2
2. Describe area to be managed under GMP.	5.2
3. Create link between BMOs and goals and actions of GMP.	8.1
4. Describe GMP monitoring program.	5.6
5. Describe integrated water management planning efforts.	3.3 & 5.7
6. Report on implementation of GMP.	8.2
7. Evaluate GMP periodically.	8.4
CWC Section 10750 et seq. Voluntary Components	
1. Control of saline water intrusion.	6.8
2. Identification and management of wellhead protection areas and recharge areas.	6.1
3. Regulation of the migration of contaminated groundwater.	6.2
4. Administration of well abandonment and well destruction program.	6.4
5. Mitigation of conditions of overdraft.	6.5
6. Replenishment of groundwater extracted by water producers.	6.6
7. Monitoring of groundwater levels and storage.	5.5-5.6
8. Facilitating conjunctive use operations.	5.7
9. Identification of well construction policies.	6.3
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	6.7
11. Development of relationships with state and federal regulatory agencies.	7.5
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	3.3

Table 2. Major Programs Affecting Groundwater Within the TGBA Agencies' Boundaries

Facility or Operation	Involved Member(s)
Conjunctive use for irrigated agriculture	TID and Merced ID
Domestic water supply	Urban Agencies[1] and Counties[3]
Groundwater monitoring	All members
Storm water recharge basins	Urban Agencies[1]
Dry wells	Modesto and Turlock
Water conservation	All members
Drainage wells	TID
Review and permitting of well construction	Counties[3] and Cities[2]
Detection of soil and groundwater contamination	Counties[3]
Pilot wellhead protection demonstration project	Counties[3]
Regulation of small public water systems	Counties[3]
Land use planning	Counties[3] and Cities[2]
Wastewater management	Counties[3], Cities[2], and CWDs[4]
Flood control	Counties[3] and TID

Notes:

1 Urban Agencies include: Cities of Modesto, Ceres, Turlock, and Hughson; Denair, Keyes and Ballico community services districts; Delhi and Hilmar county water districts.

2 Cities include: Modesto, Ceres, Turlock, and Hughson

3 Counties include: Stanislaus and Merced

4 CWDs include: Hilmar and Delhi county water districts

Table 3. Monthly Precipitation in the Turlock Subbasin[1], 1970-2006 (Inches)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1970	3.20	0.76	1.59	0.23	0	0.07	0	0	0	0.36	4.87	2.49	13.57
1971	0.63	0.24	1.32	0.89	0.56	0	0	0	0.01	0.31	1.44	3.26	8.66
1972	0.41	0.39	0.01	0.68	0	0	0	0	0	0.53	3.97	1.31	7.30
1973	3.20	5.28	2.62	0.12	0	0.03	0	0	0	2.22	1.18	3.22	17.87
1974	1.49	0.40	2.23	1.10	0	0.15	0.60	0	0	1.01	0.68	2.34	10.00
1975	0.56	2.67	3.28	1.04	0	0	0	0.55	0.01	1.16	0.28	0.10	9.65
1976	0.15	1.07	1.01	0.65	0	0.03	0	0.35	0.49	0.07	0.84	0.87	5.53
1977	0.85	0.41	0.92	0.03	1.29	0.06	0	0	0.04	0.10	0.52	1.87	6.09
1978	4.39	3.09	4.35	3.96	0	0	0	0	0.69	0	2.27	0.66	19.41
1979	3.37	3.51	1.75	0.36	0.08	0	0.09	0	0	0.96	1.09	2.13	13.34
1980	3.45	3.94	1.10	0.53	0.62	0	0.05	0	0	0.06	0	1.08	10.83
1981	4.31	0.73	3.51	0.58	0.02	0.06	0	0	0	1.14	3.74	0.90	14.99
1982	1.95	1.80	3.89	2.54	0.02	0.11	0	0	1.20	1.11	2.73	1.67	17.02
1983	5.24	3.36	5.03	2.44	0.24	0	0	0	2.68	0.53	4.03	3.48	27.03
1984	0.18	1.12	0.65	0.24	0	0.04	0	0	0	1.13	2.78	1.71	7.85
1985	0.42	0.54	1.54	0.19	0	0.14	0	0	0.23	0.76	2.81	1.29	7.92
1986	1.27	3.10	3.14	0.56	0.01	0	0	0	1.02	0.01	0.03	0.68	9.82
1987	1.68	2.07	3.71	0.10	0	0	0	0	0	1.31	1.13	2.35	12.35
1988	1.95	0.56	0.08	2.06	0.24	0.05	0	0	0	0	1.65	2.27	8.86
1989	0.48	1.13	1.50	0.03	0	0	0	0	1.64	1.04	0.70	0	6.52
1990	2.19	1.64	1.20	0.29	1.99	0	0	0	0	0.11	0.22	0.70	8.34
1991	0.17	2.06	4.59	0.48	0.03	0.31	0	0.01	0	1.16	0.26	1.21	10.28
1992	1.12	5.56	1.97	0.02	0	0.08	0.05	0	0	0.54	0.10	2.87	12.31
1993	5.33	3.32	2.72	0.20	0.97	0.29	0	0	0	0.37	0.83	1.10	15.13
1994	2.15	2.11	0.39	1.28	1.15	0	0	0	0.01	0.16	1.56	0.88	9.69
1995	7.22	0.65	6.46	1.32	1.52	0.16	0	0	0	0	0	4.03	21.36
1996	3.15	3.54	1.06	0.99	1.69	0.02	0	0	0	1.65	1.88	4.87	18.85
1997	5.68	0.18	0.09	0.30	0.04	0.09	0	0	0.01	0.08	2.78	1.91	11.16
1998	4.03	8.47	2.07	1.33	2.65	0.20	0	0	0.01	1.12	1.26	0.85	21.99
1999	2.54	2.39	1.07	0.74	0.20	0	0	0	0	0	0.94	0.21	8.09
2000	3.30	4.88	0.72	1.52	0.72	0.09	0	0.21	0.01	2.23	0.24	0.36	14.28
2001	3.95	2.58	2.00	1.43	0	0.01	0.07	0	0.23	0.09	1.87	3.92	16.15
2002	1.57	0.81	1.32	0.03	0.08	0	0	0	0	0	2.24	3.61	9.66
2003	0.63	0.70	1.06	1.52	0.59	0	0.02	0.05	0	0.04	0.55	3.31	8.47
2004	1.08	3.02	0.73	0.08	0.20	0.01	0.02	0.01	0.42	0.70	1.18	3.26	10.71
2005	2.68	2.91	1.97	0.77	1.10	0.14	0	0.03	0.31	0.18	0.37	2.97	13.43
2006	2.98	1.03	3.54	2.40	0.84	0	0	0	0	0	1.05	2.12	13.96
Min	0.15	0.18	0.01	0.02	0	0	0	0	0	0	0	0	5.53
Max	7.22	8.47	6.46	3.96	2.65	0.31	0.60	0.55	2.68	2.23	4.87	4.87	27.03
Mean	2.40	2.22	2.06	0.89	0.46	0.06	0.02	0.03	0.24	0.60	1.46	1.94	12.39

[1] Values from 1970-2002 are from National Oceanic & Atmospheric Administration (NOAA) Turlock #2 Station; 2003-2006 values are from the California Irrigation Management and Information System (CIMIS) Station #168 (Denair).

Table 4. Year 2005 Treated Wastewater Effluent Use and Disposal

Agency	Annual Totals (million gallons)[1]				
	Percolation Ponds	Agricultural Irrigation	Discharged to River	Other Uses[6]	Total
Ballico[2]	--	--	--	--	--
Ceres[3]	635.7	--	--	72	707.7
Delhi	242.0	--	--	--	242.0
Denair[4]	--	--	--	--	
Hilmar	161.2	--	--	--	161.2
Hughson	264.0	--	--	--	264.0
Keyes[4]	--	--	--	--	--
Modesto[5]	--	3,670.7	4,671.6	--	8,342.3
Turlock[4]	--	47.0	4,336.0	--	4,383.0
TOTAL	1,302.9	3,717.7	9,007.6	72	14,100.2

Notes:

1 1,000,000 gallons = 3.0689 AF

2 Customers within the Ballico Community Services District use septic tank systems for wastewater disposal.

3 TID's Almond Power Plant discharges about 50% of the process water to the City of Ceres percolation ponds. A portion of Ceres wastewater flow is discharged to the City of Turlock.

4 Keyes and Denair CSDs and the City of Ceres contract with the City of Turlock for wastewater treatment and disposal. The wastewater produced by these agencies is included in the City of Turlock's totals reported above.

5 The City of Modesto's effluent flows to agricultural land in the Turlock Basin includes effluent from areas both north and south of the Tuolumne River.

6 The City of Ceres utilizes effluent for landscape irrigation.

Table 5. Current Level of Monitoring Efforts

Local Agency	Total Number of Wells	Pumping Totals Monthly	Number of Wells Where Groundwater Levels are Measured			Number of Wells Where Groundwater Samples are Analyzed for Water Quality	Water Quality Analyses Performed
			Monthly	Semiannual	Annual	Monthly to Every Three Years	
Merced ID	5			5			
Turlock ID	24			24			
City of Ceres	8	8	8	8		8	Per Title 22 and DHS
City of Hughson	5	5		5		5	Per Title 22 and DHS
City of Modesto	20	20	20	20		19	Per Title 22 and DHS
City of Turlock	27	23	27			24	Per Title 22 and DHS
Delhi CWD	5	5	5			5	Per Title 22 and DHS
Hilmar CWD	3	3	3			3	Per Title 22 and DHS
Ballico CSD						1	Per Title 22 and DHS
Denair CSD	5	5	5			5	Per Title 22 and DHS
Keyes CSD	4	4				4	Per Title 22 and DHS
Total	106	73	68	62		69	

Source: Pers. comm. with local water agencies, March 2007.

Local Agency	Total Number of Wells	Pumping Totals Monthly	Number of Wells Where Groundwater Levels are Measured			Number of Wells Where Groundwater Samples are Analyzed for Water Quality	Water Quality Analyses Performed
			Monthly	Semiannual	Annual	Monthly to Every Three Years	
DWR (including cooperators)	307			307			
DHS (including cooperators)	163					163	Per Title 22 and DHS

Source: DWR, 2003.

Appendix C

MEMORANDUM OF UNDERSTANDING ESTABLISHING THE TURLOCK GROUNDWATER BASIN ASSOCIATION

MEMORANDUM OF UNDERSTANDING
ESTABLISHING THE TURLOCK GROUNDWATER BASIN ASSOCIATION

1. PARTIES:

The parties to the Memorandum of Understanding (“MOU”) are: City of Ceres, a California Public Agency; Keyes Community Services District, a California Public Services District; Denair Community Services District, a California Public Services District; City of Turlock, a California public agency; Hilmar County Water District, a California Public Services District; Delhi County Water District, a California Public Services District; City of Hughson, a California public agency; City of Modesto, a California public agency; Merced Irrigation District, a California Irrigation District; Ballico Community Services District, a California Public Services District; County of Merced, a Political Subdivision of the State of California; County of Stanislaus, a Political Subdivision of the State of California; Eastside Water District, a California Water District; Ballico-Cortez Water District, a California Water District; and Turlock Irrigation District, a California Irrigation District.

2. RECITALS:

This MOU is entered into with regard to the following facts and circumstances, among others:

2.1 Groundwater and surface water resources within the Turlock Groundwater Basin are vitally important resources, in that they provide the foundation to maintain current and fulfill future agricultural, domestic, municipal and industrial needs, as well as other needs, and to maintain the economic viability and prosperity of the Basin area.

2.2 The Stanislaus/Merced County area is one of the world's foremost agricultural areas; and the agricultural industry has played a major role in the development of the economy of Stanislaus/Merced County area. In an era of increasing competition for the area's finite water resources, it is important to understand and plan for the utilization of all the area's water resources in order to preserve all elements of the local economy vital to the area's well-being.

2.3 The Parties entered into a Memorandum of Understanding on or around July 14, 1995, for the purposes of studying and evaluating the condition of the Basin, and developing a groundwater management plan for the preservation, protection and enhancement of the Basin. The Turlock Groundwater Basin Groundwater Management Plan was adopted by the Parties on or about October 1997. The 1995 Memorandum of Understanding terminated by its own terms on December 31, 1997.

2.4 The Parties desire to form an association, which will be known as the Turlock Groundwater Basin Association, to provide a mechanism for the Parties to collectively implement the Plan and the purposes and goals of this Memorandum of Understanding.

2.5 Purposes and Goals: The purposes and goals for the formation of the Association are:

2.5.1 To provide a mechanism to coordinate the implementation of the Plan and other groundwater management activities;

2.5.2 To create an association of the Parties to enhance the ability to obtain funding to carry out the Plan and related groundwater management projects; and

2.5.3 Provide information and guidance for the management, preservation, protection and enhancement of the Basin.

2.6 The Parties believe that non-coordinated action by water providers and users within the Basin could result in counter productive competition for finite resources resulting in adverse impacts to the groundwater and surface water supplies within the Basin.

2.7 The Parties believe that creation of an Association for water suppliers within the Basin is important to protect the groundwater and surface water resources and will assist in meeting the needs of all users of such resources within the Basin.

2.8 Because of the enactment of Water Code Sections 10750 et seq., it is clear to the Parties that local management of water resources is desirable in order that local control be maintained over such resources.

2.9 The Parties hereto desire to enter into this MOU in order to form an association to promote the stated goals and provide coordinated implementation of the Plan to make the best use of available water resources to meet the needs of their respective constituents and service territories.

2.10 In forming the Association, it is the Parties' desire that the Association not be formed as a separate governmental entity, nor have any enforceable regulatory authority over any Party's facilities or any Party's respective surface water or groundwater supplies or rights, nor duplicate any services, duties or authority of any other agency.

3. AGREEMENT:

The Parties agree as follows:

4. DEFINITIONS:

The following terms, whether in the singular or the plural, and when used herein with initial capitalization, shall have the meanings specified in this Section 4:

4.1 **Basin:** The Turlock Groundwater Basin, which is geographically defined as that area in the State of California bounded on the west by the San Joaquin River; on the north by the Tuolumne River, on the east by the base of the Sierra Nevada foothills; and on the south by the Merced River, and includes the area of land overlying that basin and all tributaries therein.

4.2 **Board:** That body, consisting of one representative from each of the Parties, which governs the Association, as established pursuant to Section 5.2 of this MOU.

4.3 **Chairperson:** The presiding officer of the Association as elected by the Board.

4.4 **Governing Bodies:** The legislative bodies of the governmental Parties to this MOU.

4.5 **MOU:** This Memorandum of Understanding Establishing the Turlock Groundwater Basin Association.

4.6 **Parties:** Each of those entities named in Section 1 of this MOU, or those Parties added pursuant to Section 5.4 of this MOU.

4.7 **Plan:** The Turlock Groundwater Basin Groundwater Management Plan, adopted on or about October 1997.

5. <u>THE ASSOCIATION:</u>

5.1 **Powers and Purposes:** The Parties to this MOU hereby form the Turlock Groundwater Basin Association.

5.1.1 The purpose of the Association is to provide a forum in which the Parties can work cooperatively; to combine the available talent of the Parties' respective staffs; and to accomplish the purposes described in Section 2 of this MOU.

5.1.2 This Association shall have no enforceable regulatory authority over any person or entity, including Parties or Parties' facilities or rights.

5.2 **Board:** The Association shall be governed by a Board whose membership, duties and responsibilities are set forth herein.

5.2.1 Each Party shall designate one person to serve as a member of the Board, and one or more alternates. Each member of the board, and each alternate, shall serve at the pleasure of the Party appointing such member. A Party's alternate may serve in the place of that Party's member in the absence of such member and, in such case, the alternate shall have the powers of the member.

5.2.2 The Board, at its first meeting, shall elect a chairperson and vice-chairperson from its members. Such officers shall serve at the pleasure of the Board and in such capacities until the first meeting of the Board in 2002 at which time the Board shall elect new officers. Thereafter, the Board shall elect a chairperson and vice-chairperson from its members at the first meeting of each even numbered calendar year. The Chairperson shall be responsible for presiding over meetings of the Board, and shall notify committee members of meetings of the Board. The Board shall establish a date, time and place for its regular meetings, and may hold special meetings when required for the proper transaction of business. All meetings of the Board shall be held in accordance with the provisions of the Brown Act, California Government Code §54950 et seq. The Board shall prescribe such procedures for the conduct of its business as it deems appropriate.

5.2.3 A quorum shall consist of a majority of the Voting Members of the Board, except that less than a quorum may adjourn meetings of the Board. Alternatively, the Chairperson may adjourn a meeting of the Board to a specified time, date and place if there is less than a quorum of members present for a meeting.

5.2.4 The Board shall have the following duties and responsibilities:

a. Develop and implement the activities, including work schedule, designated to achieve the objectives of the Association as set forth in Section 2 of this MOU.

b. Monitor work activities of the Association.

c. Establish such committees as may be necessary or desirable to carry out the purposes of the Association, and to exercise general supervision over such committees.

5.2.6 Except for actions for which a different approval standard is set forth in this MOU, all actions of the Board shall be approved by a majority of the members present.

5.3 **Staff; Employees:** The Association may have employees upon a decision by the Board, and/or may obtain staff and support services through the Parties.

5.4 **New Parties:** New Parties may join the Association, provided that they meet the requirements set forth in this Section 5.4.

5.4.1 Any local public agency, whose service area includes land located within the Basin, which uses groundwater, or is authorized to provide groundwater, groundwater quality management, or groundwater replenishment within its service area, and whose service includes all or a portion of the Basin, may apply for membership in the Association.

5.4.2 Application for membership shall be subject to approval by the Governing Bodies of the Parties; approval shall require the affirmative vote of the Governing bodies of two-thirds (2/3) of the Parties.

5.4.3 Any new Party to this Agreement shall, as a condition of admission to the Association, be required to first pay its proportionate share of back contributions, if any, as determined by the Board.

6. COMMITTEES:

The Board may establish any committees it determines are necessary or desirable.

7. ASSOCIATION COSTS:

7.1 Costs incurred by any Party in connection with any functions of the Association, or any committee established by the Board, and expenses of a Party's personnel including, without limitations, the regular and alternate members appointed by a party to any committee while performing such functions, shall not be reimbursed by the Association except upon approval of the Board.

8. FUNDING AND VOTING PERCENTAGES:

8.1 It is anticipated that the Parties will fund their own staff work. However, outside funding may be available or the Parties, or any subgroup of the Parties, may make additional funding contributions, if necessary, upon agreement of those Parties participating in the funding.

8.2 **Voting Rights:** Each Party's representative on the Board shall be entitled to one vote.

8.3 **Modification by Party:** Funding percentages and/or voting percentages as indicated in Section 8.1 and 8.2 respectively, may be changed only upon the approval of the Governing Bodies of two-thirds (2/3) of the Parties.

9. RELATIONSHIP OF THE PARTICIPANTS:

9.1 **Each Party's Action is Independent of the Other:** The obligation of each Party to make payments under the terms and provisions of this MOU is an individual and several obligation and not a joint obligation with those of the other Parties. Each Party shall be individually responsible for its own covenants, obligations and liabilities under this MOU. No Party shall be under the control of or shall be deemed to control any other Party or the Parties collectively. No Party shall be precluded from independently pursuing any of the activities contemplated in this MOU. No Party shall be the agent of or have the right or power to bind any other Party without such Party's express written consent, except as expressly provided in this MOU.

9.2 **No Creation of a Joint Powers Agency:** The Parties agree that by this MOU they do not intend to provide for the creation of an agency or entity which is separate from the Parties pursuant to Chapter 5 (commencing with §6500) of Division 7 of Title 1 of the Government Code, relating to the joint exercise of powers.

10. TERMS OF THIS MOU: The term of this MOU shall commence on November 15, 2001 and shall continue until terminated by Board action.

Upon termination of this MOU, the Board shall determine the assets and liabilities of the Association; make every effort to satisfy all obligations within sixty (60) days of the termination of the MOU; and distribute the remaining fund balance equitably to each Party in proportion to each Party's funding contribution to the Association.

11. GENERAL PROVISIONS GOVERNING MOU:

11.1 **Invalidity of Any Term Not to Invalidate the Entire Memorandum:** In the event that any of the terms, covenants or conditions of this MOU or the application of any such term, covenant or condition shall be held invalid as to any Party, person or circumstance by any court of competent jurisdiction, all other terms, covenants or conditions of this MOU and their application shall not be affected thereby, but shall remain in full force and effect unless any such court holds that those provisions are not separable from all other provisions of this MOU.

11.2 **Construction of Terms:** This MOU is for the sole benefit of the Parties and shall not be construed as granting rights to any person other than the Parties or imposing obligations on a Party to any person other than another Party.

11.3 **Good Faith:** Each Party should use its best efforts and work wholeheartedly and in good faith for the expeditious completion of the objectives of this MOU and the satisfactory performance of the terms and provisions contained herein.

11.4 **Withdrawal or Termination of Membership:** Except in the event of the termination of this MOU pursuant to Section 10, a party who withdraws or terminates its membership in the Association shall not be entitled to a refund of its funding contributions. Any Party may terminate membership and withdraw from this Association upon thirty (30) days written notice of termination to the Association. If a Party withdraws from the Association when the Party is in arrears as to its funding contributions to the Association, that Party's entitlement to use any work product of the Association as provided for herein shall be determined by the Board.

11.5 **Amendment:** An amendment to this MOU must be approved by the affirmative vote of the Governing Bodies of two-thirds (2/3) of the Parties.

11.6 **Counterpart Execution:** This MOU may be executed in counterparts each of which shall be deemed an original but all of which together shall constitute one and the same instrument.

11.7 **Governance:** This MOU is made under and shall be governed by the laws of the State of California.

11.8 **Reasonable Delivery of Documents:** Each Party agrees upon request by the Chairperson or by the Board, to make, execute and deliver any and all documents reasonably required to implement this MOU.

IN WITNESS WHEREOF, the Parties have caused this MOU to be executed, each signatory hereto represents that he has been appropriately authorized to enter into this MOU on behalf of the Party for whom he/she signs.

IN WITNESS WHEREOF, City of Modesto has authorized the execution of this Memorandum of Understanding by its City Manager or designee.

CITY OF MODESTO,

____
JACK R. CRIST, City Manager

(Seal)

ATTEST:

By ______________________________
JEAN ZAHR, City Clerk

APPROVED AS TO FORM:

By ______________________________
MICHAEL D. MILICH, City Attorney

10/9/01 Res. 2001-514

County of Merced

By ______________________
Gloria Cortez Keene, Chairman
Board of Supervisors

Date DEC 11 2001

Approved as to Legality and Form
County Counsel

By ______________________
Deputy

Date: 11.30.2001

Signatory Page

MEMORANDUM OF UNDERSTANDING
ESTABLISHING
THE TURLOCK GROUNDWATER BASIN ASSOCIATION

DATE: November 6, 2001

MERCED IRRIGATION DISTRICT

Signed: ______________________

Ross Rogers, General Manager

Memorandum of Understanding Establishing the Turlock Groundwater Basin Association

Approved by the Turlock Irrigation District Board of Directors
by Resolution 2001-80, dated September 18, 2001

as attested to by:

Barbara A. Hetrick Secretary, Board of Directors	Larry Weis General Manager

Signature Page

**MEMORANDUM OF UNDERSTANDING
ESTABLISHING THE TURLOCK GROUNDWATER BASIN ASSOCIATION**

EASTSIDE WATER DISTRICT

Attest:	Approved:
William Carter Secretary	James G. Crecelius Chairman, Board of Directors

HILMAR COUNTY WATER DISTRICT

By: ______________________
David Anderson, President

As authorized by Resolution No. 395 adopted by the Board of Directors of the Hilmar County Water District on November 6, 2001.

Memorandum of Understanding
Turlock Groundwater Basin Association

DATE: October 9, 2001

BALLICO/ CORTEZ
Water District

Richard Severson, Chairman

ATTEST:

Eugene Kajioka, Recording Secretary

DENAIR COMMUNITY SERVICES DISTRICT

Under the authority of Resolution #2001- 3, which authorizes the Denair Community Services to join with other Turlock Groundwater Basin Association members in approving the Memorandum of Understanding Establishing a basin-wide groundwater management plan, pursuant to Water Code Section 10750 et seq; as adopted by the District Board of Directors on September 18, 2001.

Mildred A. DePalma, Chairman

Pamela J. Owens, Secretary

Dated: October 23, 2001

CITY OF TURLOCK,
a municipal corporation

By:: ______________________
Steven H. Kyte, City Manager

ATTEST:

By:
Rhonda Greenlee
____
Rhonda Greenlee, City Clerk
City of Turlock, County of
Stanislaus, State of California

APPROVED AS TO FORM:

By: ______________________
Richard C. Burton, City Attorney

Memorandum of Understanding
Turlock Groundwater Basin Association

DATE: September 10, 2001

CITY OF CERES
A Municipal Corporation

Louie Arrollo, Mayor

ATTEST:

Patsy Haley, Deputy

Brenda Scudder Herbert, City Clerk

SEAL IMPRESSED

APPROVED AS TO FORM:

Michael L. Lyions, City Attorney

CITY OF HUGHSON

By: *[signature]*
ROBERT E. WILBURN
Interim City Manager

ATTEST:

[signature]
MARY JANE CANTRELL, CMC, City Clerk

IN WITNESS WHEREOF, the County of Stanislaus has authorized the execution of this Memorandum of Understanding by the Board of Supervisors or designee.

COUNTY OF STANISLAUS

By:________________________

Thomas W. Mayfield, SEP 24 2002

Chair of the Board of Supervisors

"County"

ATTEST: Christine Ferraro Tallman

Clerk of the Board of Supervisors of the

County of Stanislaus, State of California

By:________________________

Deputy Clerk

APPROVE AS TO CONTENT:

Department of Environmental Resources

By:________________________

Kevin M. Williams,

Director of Environmental Resources

APPROVED AS TO FORM:

Michael H. Krausnick

County Counsel

By:________________________

Edward R. Burroughs

Deputy County Counsel

Appendix D

DEFINITIONS

AB 3030 - Assembly Bill 3030, the Groundwater Management Act (codified in California Water Code sections 10750 *et seq.*) was passed by the State legislature during the 1992 session, and became law on January 1, 1993.

Abandonment - See "Well Abandonment"

Association - Refers to the "Turlock Groundwater Basin Association"

Aquifer - A geologic formation that stores, transmits and yields significant quantities of water to wells and springs.

Basin - See "Turlock Groundwater Basin"

Conjunctive Use - A term used to describe operation of a groundwater basin in coordination with a surface water reservoir system. The purpose is to artificially recharge the basin during years of above-average precipitation so that the water can be withdrawn during years of below-average precipitation, when surface supplies are below normal.

Groundwater - Subsurface water occurring in the zone of saturation.

High Groundwater - Groundwater levels higher than 6 feet below ground level which can adversely impact crops. High groundwater can be caused by "perched" water, overall high groundwater conditions, or other factors.

Inactive Wells - An unused well that the owner demonstrates his intention to use the well again. The California Water Well Standards (Bulletins 74-81 & 74-90) includes specific guidelines for things the owner must do to show evidence of his intention to continued to use the well

Local county environmental health agencies - Merced County Division of Environmental Health and the Stanislaus County Department of Environmental Resources

Overdraft - The condition of a groundwater basin where the amount of water withdrawn from an aquifer or groundwater basin exceeds the amount of water replenishing the basin (net recharge) over a period of time.

Participating Agency - Any local agency within the Turlock Groundwater Basin which adopts this AB 3030 groundwater management plan. Also referred to as a "member agency."

Public Water System - A system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections OR regularly serves at least 25 individuals daily at least 60 days out of the year, including: 1) A **Community Water System** is a public water system that has 15 or more service connections used by year-long residents OR regularly serves at least 25 year-long residents of the area served by the system; 2) A **Noncommunity Water System** is a public water system that is not a community water system; 3) A **NonTransient-Noncommunity Water System** is a public water system that is not a community water system that regularly serves at least 25 of the same persons during six months of the year; and 4) A **Transient Noncommunity Water System** is a noncommunity water system that does NOT regularly serve at least 25 of the same persons during six months of the year.

Recharge - Flow to groundwater storage from precipitation, infiltration from streams, and other sources of water.

Reducing Conditions - A lack of oxygen in the groundwater.

Safe Yield - The maximum quantity of water that can be continuously withdrawn from a groundwater basin without adverse effect.

Saline - Consisting of or containing salts, the most common of which are potassium, sodium, or magnesium in combination with chloride, nitrate, or carbonate.

SCADA - Supervisory Control and Data Acquisition - a type of remote monitoring and control system.

State Small Water System - A system for the provision of piped water to the public for human consumption that serves at least five, but not more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year.

Subbasin - For the purposes of this document, the name “Turlock Subbasin,” “Turlock Groundwater Basin,” “Basin,” and “Subbasin” are used interchangeably to represent the same geographic area.

TDS - “Total dissolved-solids,” the quantity of minerals (salts) in solution in water, usually expressed in milligrams per liter (mg/L) or parts per million (ppm).

Turlock Groundwater Basin - A groundwater system located on the eastern side of the San Joaquin Valley bounded by the Tuolumne River on the north, the Merced River on the south, the San Joaquin River on the west, and the Sierra Nevada foothills (specifically the western extent of the low-permeability Valley Springs rock formation) on the east.

Unused Wells - Wells that are not being used are considered "unused." Wells that are not used for a period of one year are considered "abandoned," unless the owner demonstrates his intention to use the well again. (see "Inactive Wells")

Well Abandonment - According to the California State Well Standards *"a well is considered "abandoned"... if it has not been used for one year, unless the owner demonstrates intention to use the well again..."* All "abandoned" wells must be properly destroyed. (see "Well Destruction")

Well Destruction - All "abandoned" wells (see Well Abandonment") and exploration or test holes must be properly destroyed. The objective of well destruction is to restore subsurface conditions as nearly as possible to the conditions that existed before the well was constructed, taking into consideration any changes which may have occurred since the time of construction. Each of the counties and some of the cities within the Basin have established well standards which specify well destruction requirements.

WPA - Wellhead Protection Area defined by the Safe Drinking Water Act Amendments of 1986 as *"the surface and subsurface area surrounding a water well or well field supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water or well field."*

Appendix E

TABLE OF STANDARD CONVERSIONS

Table of Standard Conversions

Category	Unit	Equivalent Units	
Area	1 acre	=	43,560 square feet (ft^2)
		=	4,047 square meters (m^2)
		=	0.004047 square kilometers (km^2)
Volume	1 acre-foot (AF)	=	325,851 gallons
		=	43,560 cubic feet (ft^3)
		=	1,233.5 cubic meters (m^3)
Flow	1 million gallons per day (MGD)	=	365 million gallons per year
		=	1,120 acre-feet per year (AF/yr)
		=	1.547 cubic feet per second (cfs)
		=	694.4 gallons per minute (GPM)
	1 gallon per minute	=	1,440 gallons per day
	1 cubic foot per second	=	1.984 AF/day
		=	0.6463 MGD
		=	448.831 GPM
	1 AF per day	=	0.5042 cfs
		=	0.3259 MGD
Concentration	1 part per million (ppm)	=	1 milligram per liter (mg/L)
		=	1,000 ppb
	1 part per billion (ppb)	=	1 microgram per liter (µg/L)
Conductivity	1 deciSiemens per meter (dS/m)	=	1 milliSiemens per centimeter (mS/cm)
	1 mS/cm	=	1,000 microSiemens per centimeter (µS/cm)
		=	1 millimhos per centimeter (mmhos/cm)
	1 µS/cm	=	1 micromhos per centimeter (µmhos/cm)

Appendix F

SUBAREA GOALS AND OBJECTIVES FOR AGENCIES WITHIN THE TURLOCK GROUNDWATER BASIN

MERCED COUNTY - DIVISION OF ENVIRONMENTAL HEALTH

GOALS AND OBJECTIVES

The Merced County Division of Environmental Health endeavors to protect the quantity and quality of groundwater in Merced County.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

Wellhead Protection Program

- Issues well permits for the construction of all new wells in Merced County; samples all new domestic wells for Coliform bacteria, nitrates, DBCP/EDB, and general mineral/inorganics.
- Collects water samples at customer request upon payment of fees.
- Enforces the Merced County Well Ordinance to insure proper well location, setback distances, and proper well construction for all wells in Merced County.
- Maintains a program to identify all possible sources of contamination that may threaten groundwater.
- Operates the small public water system program for all water systems with fewer than 200 service connections.
- Oversees the cleanup of leaking underground fuel storage tank sites.
- Operates the dairy/poultry animal confinement program; also operates the sludge management program, and the food processing waste program.
- Conducts water quality monitoring in areas where there is known contamination and water quality degradation.
- Responds to well emergencies such as floods, droughts, and other conditions which threaten the quality or quantity of drinking water.

Abandoned Well Destruction Program

- Issues well destruction permits for all inactive, inoperative, and abandoned wells in Merced County.
- Conducts a program to find, identify, and destroy old wells needing to be properly destroyed.

Other Activities

- Participates in, and supports, local efforts to protect the groundwater basins in Merced County, and adjacent counties where basins cross county lines.
- Serves as a resource for the general public (individuals and groups) to provide accurate information and some limited technical assistance in dealing with questions regarding water supply, wells, and related groundwater issues.

CITY OF HUGHSON

GOALS AND OBJECTIVES

In the General Plan adopted on December 12, 2005, the City set forth specific Policies, Goals and Actions relevant to groundwater management in the Turlock Subbasin. These elements are discussed in the following section.

Goal PSF-6

Provide sufficient water supplies and facilities to serve the City in the most efficient and financially-sound manner, while maintaining the highest standards required to enhance the quality of life for existing and future residents.

Goal PSF-6 Policies

- **Policy PSF-6.1:** The City will continue to expand its water treatment and distribution facilities to provide good quality drinking water to current and future residents and businesses. Expansion may include the construction of additional storage facilities and/or additional wells.
- **Policy PSF-6.2:** The potable water distribution and storage system shall be sized to serve development allowed by the General Plan and shall not provide for additional growth and development beyond that anticipated under the General Plan.
- **Policy PSF-6.3:** Planning for the water system will be limited to the city limits and the City's Sphere of Influence.
- **Policy PSF-6.4:** The City will start planning and implementing additional improvements necessary to provide adequate water supply and storage for future demand anticipated by the General Plan at least two years in advance of reaching the capacity of existing facilities.
- **Policy PSF-6.5:** The City should consider exploring the possibility of creating a regional water supply partnership to identify alternative regional water supplies.
- **Policy PSF-6.6:** The approval of development shall be conditioned on the availability of sufficient water supply, storage and pressure requirements for the City.
- **Policy PSF-6.7:** The City will require the installation of water lines to occur concurrently with construction of new roadways to maximize efficiency and minimize disturbance due to construction activity.

Goal PSF-6 Actions

- **Action PSF-6.1:** Continue to participate in regional groundwater basin planning efforts to determine the carrying capacity of the groundwater aquifer and ensure that future demand for water does not overdraft the groundwater supply.
- **Action PSF-6.2:** Develop and institute a City-sponsored program of mandatory water conservation measures for new development.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

The City of Hughson is in the process to completing system upgrades, including production, storage, distribution, SCADA, converting the city to AMR Water Metering and other elements, preparing to review and update the Water Master Plan, preparing for a treated surface water supply, adding another new well to the system, revisiting the process for determining adequate utility capacity in advance to development projects. The City of Hughson adopted a water waste control ordinance, and is revisiting the administrative citation process. Hughson also completed a water rate studying in 2005 and established (flat) rates, which will be reviewed again in conjunction with a fully metered system.

CITY OF TURLOCK

GOALS AND OBJECTIVES

The objective of the City of Turlock's groundwater program is to maintain the highest quality of water to meet all customers' needs while protecting health and property and providing a sufficient quantity of groundwater well into the future.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- Closely monitor each potable water well to insure it meets or exceeds the water quality limits established by the EPA and State of California.
- Frequently test each well for nitrate and TDS data to determine if there is a trend that will result in a reduction of water quality.
- If a contaminant reaches 90% of the MCL for that compound at any well, initiate well head treatment, blending or other methods to insure the water leaving any well site does not exceed this limit.
- Check well water levels monthly to determine the status of underground water storage within the City. If the annual average static water levels are less than 40 feet msl for any three consecutive years, increase the mandated water conservation measures, i.e. go to Stage 2 from Stage 1.
- Maintain a strong City presence within the Turlock Groundwater Basin Association to encourage the replenishment and wise use of the basin's water resources.
- Within the next 10 years, find uses for all of the tertiary treated water produced by the Regional Water Quality Control Facility. This will reduce the need for groundwater extraction in the basin.
- By 2010, install water meters at all of the user connections in the water system and bill for actual water used.
- Find alternate water sources such as surface water to supplement local groundwater.
- Reduce extraction amounts at any well site where there is a trend of increasing TDS and/or nitrate.

CITY OF CERES

GOALS AND OBJECTIVES

- Insure that no constituents exceed the MCL for public drinking water.
- Insure a safe, sustainable supply of drinking water is available for the beneficial use of City of Ceres customers.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- Monitor groundwater levels monthly.
- Monitor groundwater quality as required by the DHS.
- Manage the groundwater resource to prevent contamination from above ground sources.

EASTSIDE WATER DISTRICT

GOALS AND OBJECTIVES

The primary goal of the Eastside Water District (EWD) is that groundwater will continue to be a reliable, safe, efficient and cost effective water supply.

Groundwater is a vitally important resource to all irrigators within the EWD. In the decades between the 1950s and 1990s water levels dropped dramatically, in significant part, as a result of pumping within the EWD. Groundwater levels appeared to have stabilized by the 1990s. Studies in 2003 confirmed that the aquifer had reached equilibrium, but appear to have declined between 2002 and 2006. The EWD Board of Directors recognize that in future years land uses and groundwater uses may change with the results that groundwater levels may again decline and groundwater quality may be adversely impacted.

The EWD recognizes that the Turlock Groundwater Basin is a shared resource and that it is important for all users in the basin to continue to manage groundwater for the benefit of all.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- **Water Levels:** Continue to participate in the Turlock Groundwater Basin Association water level monitoring program.
- **Water Quality:** Be alert to existing and changing agricultural and industrial activities within the EWD, which may adversely affect groundwater quality.
- **Conservation:** Continue to encourage irrigators to conserve groundwater by use of highly efficient irrigation methods and use of surface water purchased as available the Turlock and Merced Irrigation Districts.
- **Studies and Investigations:** Continue singularly and in cooperation with other agencies to study methods of avoiding and/or mitigating overdraft conditions.
- **Public Outreach:** Continue a program of public education, water conservation and awareness of basin groundwater issues.

CITY OF MODESTO

GOALS AND OBJECTIVES

Until 1995, the City of Modesto relied solely on groundwater for its service area. Groundwater degradation and more stringent drinking water quality standards resulted in the abandonment of a number of wells within the City of Modesto service area. Currently, Modesto is augmenting its groundwater supplies in its contingency service area north of the Tuolumne River with surface water received from Modesto Irrigation District. In addition, Modesto is also considering augmenting its water supply for its water service customers south of the Tuolumne River by participating in the development of a future regional surface water treatment facility with the Turlock Irrigation District.

In the meantime, however, groundwater quality issues, including elevated levels of uranium and arsenic, continue to threaten the City of Modesto's groundwater supply. To protect its groundwater and maintain groundwater as a viable drinking water source, Modesto has formulated the BMOs for its management area described below.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

Groundwater Quality Protection

The City of Modesto proposes to protect groundwater quality by developing and implementing specific actions to identify potential sources of contamination and to develop a management plan to control and curtail movement of contamination into and within the basin. The specific actions may include the following:

- Develop a database and populate it with water quality data. Using the database information, develop tools to map contaminated areas, as well as historic movement of the contaminants.
- Formulate and implement a geologic assessment to better understand the basin's aquifer characteristics and water movement and to evaluate and understand the sources of contaminants. Detect potential changes in water quality that could affect the long-term quality and quantity of the drinking water supply.
- Develop a well field management plan that will manage groundwater pumping to reduce or eliminate contaminate movement into and within the Basin. Develop well design criteria, including proper spacing and screening of wells to manage groundwater pumping and the movement of contaminants.

Groundwater Levels

Groundwater levels, historically, were declining in this management area. Since 1995, the importation of treated surface water to augment the groundwater supply has allowed the groundwater levels to recover north of the Tuolumne River. A proposed surface water supply may provide an opportunity for the recovery of the groundwater levels in the Turlock Subbasin. However, future population growth in and around the management area will increase groundwater consumption. To maintain groundwater levels in the management area, the City of Modesto formulated the following management objectives:

- Work with other entities in the subbasin to identify and protect potential groundwater recharge areas.
- Evaluate the feasibility of groundwater recharge and conjunctive use projects including the development of artificial recharge areas, conjunctive use projects, and storage tanks with transmission mains for added reliability to the system.
- Work with TID to evaluate the feasibility of developing a cooperative in-lieu recharge and/or water exchange programs including the following:
    - The use of surface water to augment the groundwater supply in the Turlock Subbasin.
    - Develop an exchange program to mix the groundwater of marginal quality (for drinking water) with surface water and deliver it for agricultural use, golf courses, parks, and other open space areas in exchange for a surface water supply for the City of Modesto.

Water Conservation and System Improvement

The City of Modesto, under its Urban Water Management Planning function, will continue to evaluate water conservation and metering opportunities to reduce water demands in the service area. Modesto also plans to undertake a conveyance system interconnection improvement project to connect isolated delivery systems to its delivery network. These actions will add flexibility to the system and enable the City of Modesto to reduce pumping from the areas of poor water quality and reduce movement of contaminants in the basin.

DENAIR COMMUNITY SERVICES DISTRICT

GOALS AND OBJECTIVES

The Denair Community Services District (CSD) is a community water system located in the unincorporated town of Denair approximately four miles northeast of Turlock, in central southern Stanislaus County.

The Denair CSD was formed on October 3, 1961 pursuant to California Government Code Section 61000, et. seq. The Denair CSD is under the regulatory jurisdiction of the Department of Health Services Stockton District Office. The Denair CSD has 1,250 non-metered active service connections and 10 commercial metered connections at various locations.

The Denair CSD has an approximate population of 3300 people, according to the 2000 census.

All of the water for Denair CSD is supplied from five deep wells. The Denair CSD has produced water, which continuously meets all State drinking water requirements. The objective of the Denair CSD is to maintain the highest quality of water to meet all customers' needs in the most efficient and financially sound manner.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

Funding

In September 2003, the Denair CSD was awarded a grant under the Local Groundwater Management Act of 2000 (AB 303) for $200,000.00.

With its AB 303 grant, Denair CSD constructed a nested monitoring (test) well. Information from this two test wells, and other existing wells, will be used to support advancement of a hydrogeologic model of the producing groundwater system and to monitor the quality and quantity of groundwater produced from the alluvial aquifer sequences underlying Denair CSD.

Groundwater Monitoring:

Denair CSD developed its groundwater management program in 2001 with the drilling of a test hole, subsurface interpretations of favorable aquifer sequences, and by creating formal guidelines for residential developers to use to construct Denair CSD-required test and monitoring wells. Due to inadequate funding, Denair CSD's program is currently limited to residential developers' activities.

Proponents of residential development in 2002 recently constructed a nesting monitoring well. This well was the first one constructed to meet the guidelines established by the Denair CSD as part of its groundwater management program.

The Denair CSD provides proponents of residential development with guidelines for nesting monitoring well construction. Denair CSD then approves or disapproves of the test well results before a production well is planned and constructed. These test wells are required by Denair CSD. Funding is also needed for Denair CSD to advance the characterization and test well program in areas where residential development is not currently underway.

DELHI COUNTY WATER DISTRICT

GOALS AND OBJECTIVES

- Maintain water quality that meets all Federal and State requirements.
- Provide and plan for an adequate amount of water to meet existing and projected future demands.
- Research methods which can help conserve water.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- Monitor each well to insure that its water meets or exceeds all State and Federal requirements.
- Check standing and pumping water levels on a regular basis to establish trends in groundwater levels.
- The Delhi County Water District meters all users. This has had a tremendous effect in conserving water supplies and eliminating waste.

KEYES COMMUNITY SERVICES DISTRICT

GOALS AND OBJECTIVES

- Maintain water quality that meets all Federal and State requirements.
- Provide and plan for an adequate amount of water to meet existing and projected future demands.
- Determine the feasibility of using treated surface water in conjunction with well water.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- Monitor each well to insure that its water meets or exceeds all State and Federal requirements.
- Check standing and pumping water levels on a regular basis to establish trends in the groundwater levels.
- Install water meters in the next few years to lower water usage. The installation of meters in other communities of this size has resulted in water savings of 20 to 30 percent. A reduction in water usage is needed to lessen the impact on groundwater levels and to reduce the amount of water that is treated for arsenic.
- Continue studies to determine the best method to remove arsenic from the well water. All four of the Keyes CSD's wells have arsenic levels that exceed the new Federal MCL of 10 ppb. Arsenic levels vary roughly between 12 to 20 ppb.

HILMAR COUNTY WATER DISTRICT

GOALS AND OBJECTIVES

The Hilmar County Water District (HCWD) was established in 1965 under Division 12 of the Water Code of the State of California for the purpose of providing potable water to the residents of the Hilmar community. The HCWD also provides wastewater collection and treatment for the community. The objective of the HCWD is "to provide safe, affordable and reliable drinking water, wastewater, and storm drainage service".

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- Closely monitor each potable water well to insure compliance with all water quality standards as established by the EPA and the State of California.
- HCWD's customer base is fully metered and conservation pricing is in place to encourage wise use of our water resource.
- Continued participation in the Turlock Groundwater Basin Association.

BALLICO COMMUNITY SERVICES DISTRICT

GOALS AND OBJECTIVES

The Ballico CSD is a community water system located in the unincorporated town of Ballico in central northern Merced County. The Ballico CSD water system consists of one well and a distribution system to serve approximately 50 residential connections. The objective of the Ballico CSD is to provide safe, affordable and reliable drinking water service.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

The Ballico CSD will closely monitor the water well to insure compliance with all water quality standards as established by the EPA and the State of California.

BALLICO-CORTEZ WATER DISTRICT

GOALS AND OBJECTIVES

The primary goal of the Ballico Cortez Water District (BCWD) is that groundwater will continue to be a reliable, safe, efficient and effective water supply.

Groundwater is a vitally important resource to all irrigators within the BCWD. In the decades between the 1950s and 1990s water levels dropped as a result of basin-wide pumping. Groundwater levels appeared to have stabilized by the 1990s. Studies in 2003 confirmed that the aquifer had reached equilibrium, but appear to have declined between 2002 and 2006. The Board of Directors recognize that in future years land uses and groundwater uses may change with the results that groundwater levels may again decline and groundwater quality may be adversely impacted.

The BCWD recognizes that the Turlock Groundwater Basin is a shared resource and that it is important for all users in the basin to continue to manage groundwater for the benefit of all.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- **Water levels:** Continue to participate in the Turlock Groundwater Basin Association water level monitoring program.
- **Water Quality:** Be alert to existing and changing agricultural and industrial activities within the BCWD, which may adversely affect groundwater quality.
- **Conservation:** Continue to encourage irrigators to conserve groundwater by use of highly efficient irrigation methods and use of surface water purchased as available from Turlock Irrigation District.
- **Studies and Investigations:** Continue singularly and in cooperation with other agencies to study methods of avoiding and/or mitigating overdraft conditions.
- **Public Out reach:** Continue a program of public education, water conservation and awareness of basin groundwater issues.

TURLOCK IRRIGATION DISTRICT

GOALS AND OBJECTIVES

The Turlock Irrigation District (TID) utilizes groundwater and surface water conjunctively. As such, it relies upon groundwater as a source of water in drier years, when surface water supplies are less abundant. The TID endeavors to protect the quantity and quality of groundwater in its irrigation service area, such that:

- Groundwater will continue to be a reliable, safe, efficient and cost effective water supply.
- Groundwater provides a high quality water supply to irrigation customers.

The TID recognizes that the Turlock Groundwater Basin is a shared resource and that it is important for all users in the basin to continue to manage groundwater for the benefit of all.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

Water Levels

- Continue to participate in the Turlock Groundwater Basin Association water level monitoring program.
- Continue to monitor shallow groundwater levels located at section corners.
- Continue to provide drainage, as appropriate, so long as it is in accordance with the TID rules and procedures, as well as the changing water quality regulatory requirements.

Water Quality

- Be alert to existing and changing activities within the Turlock Groundwater Basin which may adversely affect groundwater quality.
- Continue to monitor changes to regulatory requirements, and provide comments, as necessary, in these processes.
- Adjust practices, as necessary, to comply with regulatory requirements.

Conservation

- Continue to encourage the use of surface water supplies for irrigation purposes within the District.
- Support urban agencies' use of surface water supplies, where available, from the TID, in addition to or in lieu of groundwater, for urban uses.
- Continue to participate in the Agricultural Water Management Council, and maintain the TID Agricultural Water Management Plan.

Studies and Investigations

- Continue to study, both individually and collectively with other agencies, methods for protecting and preserving the quantity and quality of groundwater supplies within the Basin including:
  - avoiding and/or mitigating overdraft conditions;
  - groundwater quality and means of addressing water quality issues;
  - future water supply needs and availability;
  - water supply for urban uses; and
  - river interactions and the affects upon the groundwater basin.

Public Outreach

- Continue to provide public education on water related issues including, but not limited to, water conservation and awareness of basin groundwater issues.
- Continue participation in the Turlock Groundwater Basin Association.

MERCED IRRIGATION DISTRICT

GOALS AND OBJECTIVES

The Merced Irrigation District (Merced ID) shares the common goal of protecting the quantity and quality of groundwater within the Turlock Groundwater Basin. The Merced ID will continue to cooperate with other agencies in the Turlock Groundwater Basin to promote the efficient use of water. The main objective of participation in the TGBA is to attain stable groundwater levels and a reliable water supply.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

- Participate in the Turlock Groundwater Basin Association water level monitoring program.
- Provide an incentive program for Merced ID water users to use surface water instead of groundwater.
- Participate in Turlock Groundwater Basin Association activities.

STANISLAUS COUNTY

GOALS AND OBJECTIVES

The County of Stanislaus is represented by the Department of Environmental Resources (DER) at TGBA meetings. Partnering with the TGBA in basin-wide groundwater management is consistent with the Stanislaus County Board of Supervisors' priority of ensuring a safe and healthy community, facilitating economic development, and achieving multi jurisdictional cooperation. To meet these priorities, Stanislaus County promotes and participates in TGBA programs that:

- Preserve and protect the groundwater resource;
- Enhance the understanding of groundwater resources through the gathering and sharing of information; and
- Provide factual information that may serve as a basis for land use decisions in the groundwater basin.

ACTIVITIES CONDUCTED TO SUPPORT THESE OBJECTIVES

Public and Private Water Programs

- Issue well permits for the construction of all new wells in the unincorporated areas.
- Enforce the California Model Well Ordinance to insure proper well location, setback distances, and proper well construction for all wells.
- Serve as the Local Primacy Agency for the Stanislaus County small public water system program (water systems with fewer than 200 service connections).
- Oversee the cleanup of leaking underground fuel storage tank sites.
- Respond to water related emergencies such as floods, droughts, and other conditions which threaten the quality or quantity of drinking water.
- Issue well destruction permits for and makes inspections of abandoned wells.
- Conduct a program to inventory water wells and potential sources of contamination.

Other Activities

- Participate in, and supports, local efforts to protect the groundwater basins in Stanislaus County, and adjacent counties.
- Serve as a resource for the general public (individuals and groups) to provide accurate information and technical assistance in dealing with questions regarding water supply, wells, and related groundwater issues.
- Review and comments on land use activities that may impact groundwater resources.
- Review and comments on environmental studies for projects that may impact groundwater and surface water resources.

Appendix G

LIST OF AGENCIES THAT HAVE ADOPTED THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN AND COPIES OF THE ACTIONS TAKEN TO ADOPT THE PLAN

LIST OF AGENCIES THAT HAVE ADOPTED THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN

Agency Name	Action Date – *as of August 12, 2008*
Eastside Water District	January 17, 2008
City of Turlock	February 26, 2008
Turlock Irrigation District	March 18, 2008
Hilmar County Water District	April 1, 2008
City of Modesto	April 1, 2008
Delhi County Water District	May 7, 2008

RESOLUTION NO. 2008-02

RESOLUTION ADOPTING THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN TO AMEND AND SUPERSEDE THE EXISTING PLAN, FINDING THAT THE PLAN IS EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT, AND AUTHORIZING FILING OF NOTICE OF EXEMPTION

WHEREAS, the Board of Directors of the Eastside Water District on September 25, 1997 adopted the Turlock Groundwater Basin Groundwater Management Plan ("plan") for lands within the District's irrigation service area pursuant to Water Code Sections 10750 et seq.; and

WHEREAS, the plan was designed to be a living document that needs to be updated occasionally to best reflect the current conditions within the basin; and

WHEREAS, the Turlock Groundwater Basin Association, of which the Eastside Water District is a member, has developed an update of the plan pursuant to Water Code Sections 10750 et seq., and staff participated in the development of the plan; and

WHEREAS, staff recommends that this Board of Directors adopt the plan; and

WHEREAS, the California Environmental Quality Act ("CEQA") exempts certain projects from the environmental review process; and;

WHEREAS, staff has conducted a review of the plan and CEQA and has presented that review to the Board of Directors ;

NOW, THEREFORE, be it resolved, as follows:

1. The findings and evidence set forth in attachment A, California Environmental Quality Act Review are hereby adopted.

2. The Board of Directors finds that the project is exempt from CEQA and the Chairman, Board of Directors is authorized and directed to sign and file a notice of exemption for the project pursuant to the requirements of CEQA.

3. The plan is hereby adopted and the 1997 Turlock Groundwater Basin Groundwater Management Plan is superseded.

M Carter
SECRETARY
1-17-08

BEFORE THE CITY COUNCIL OF THE CITY OF TURLOCK

IN THE MATTER OF ADOPTING THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN, THEREBY AMENDING AND SUPERSEDING THE EXISTING TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN ADOPTED NOVEMBER 25, 1997, PURSUANT TO PART 2.75 (COMMENCING WITH SECTION 10750) OF DIVISION 6 OF THE CALIFORNIA WATER CODE	}	**RESOLUTION NO. 2008-047**

WHEREAS, the City Council of the City of Turlock on November 25, 1997 adopted the Turlock Groundwater Basin Groundwater Management Plan ("plan") for lands within the City of Turlock pursuant to California Water Code Sections 10750 et seq.; and

WHEREAS, the plan was designed to be a living document that needs to be updated occasionally to best reflect the current conditions within the basin; and

WHEREAS, the Turlock Groundwater Basin Association, of which the City of Turlock is a member, has developed an update of the plan pursuant to Water Code Sections 10750 et seq., and staff participated in the development of the plan; and

WHEREAS, staff recommends that the City Council of the City of Turlock adopt the plan; and

WHEREAS, the California Environmental Quality Act ("CEQA") exempts certain projects from environmental review and the adoption of the plan qualifies for various statutory and categorical exemption from the provisions of CEQA.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Turlock does hereby:

1. Find that the adoption of the Update to the Turlock Groundwater Basin Management Plan is exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to CEQA Guidelines Sections 15262, 15307, and 15308 and that the Municipal Services Director is authorized and directed to sign and file a notice of exemption for the project pursuant to the requirements of CEQA.

2. Adopt the updated plan and the 1997 Turlock Groundwater Basin Groundwater Management Plan is superseded.

PASSED AND ADOPTED at a regular meeting of the City Council of the City of Turlock this 26th day of February, 2008, by the following vote:

AYES:	Councilmembers Hatcher, Howze, Spycher, Vander Weide and Mayor Lazar
NOES:	None
ABSTAIN:	None
NOT PARTICIPATING:	None
ABSENT:	None

ATTEST:

[signature]
Rhonda Greenlee, CMC
City Clerk, City of Turlock, County of Stanislaus, State of California

The foregoing is a correct copy of the original on file in this office which has not been revoked and is now in full force and effect.

[signature]
RHONDA GREENLEE, City Clerk of the City of Turlock, County of Stanislaus, State of California

CITY OF Turlock INC. 1908

RESOLUTION NO. 2008-8

RESOLUTION ADOPTING THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN TO AMEND AND SUPERSEDE THE EXISTING PLAN, FINDING THAT THE PLAN IS EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT, AND AUTHORIZING FILING OF NOTICE OF EXEMPTION

WHEREAS, the Board of Directors of the Turlock Irrigation District (District) on October 14, 1997 adopted the Turlock Groundwater Basin Groundwater Management Plan ("Plan") for lands within the District's irrigation service area pursuant to Water Code Sections 10750 et seq.; and

WHEREAS, the Plan was designed to be a living document that needs to be updated occasionally to best reflect the current conditions within the basin; and

WHEREAS, the Turlock Groundwater Basin Association, of which the Turlock Irrigation District is a member, has developed an update of the Plan pursuant to Water Code Sections 10750 et seq., and staff participated in the development of the Plan; and

WHEREAS, staff recommends that this Board adopt the Plan; and

WHEREAS, the California Environmental Quality Act ("CEQA") exempts certain projects from the environmental review process; and

WHEREAS, staff has conducted a review of the Plan and CEQA and has presented that review to the Board;

NOW, THEREFORE, be it resolved, as follows:

1. The findings and evidence set forth in Attachment A are hereby adopted.

2. The Board finds that the project is exempt from CEQA and the Secretary of the Board is authorized and directed to sign and file a notice of exemption for the project pursuant to the requirements of CEQA.

3. The Plan is hereby adopted and the 1997 Turlock Groundwater Basin Groundwater Management Plan is superseded.

Moved by Director Santos, seconded by Director Short, that the foregoing resolution be adopted.

Upon roll call the following vote was had:

Ayes:	Directors Short, Berryhill, Santos, Fernandes
Noes:	Directors None
Absent:	Director Fiorini

The President declared the resolution adopted.

I, Tami Wallenburg, Deputy Secretary of the Board of Directors of the TURLOCK IRRIGATION DISTRICT, do hereby CERTIFY that the foregoing is a full, true and correct copy of a resolution duly adopted at a regular meeting of the said Board of Directors held the 18th day of March, 2008.

Deputy Secretary of the Board of
Directors of the Turlock Irrigation District

HILMAR COUNTY WATER DISTRICT
RESOLUTION NO. 431

RESOLUTION ADOPTING THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN TO AMEND AND SUPERSEDE THE EXISTING PLAN, FINDING THAT THE PLAN IS EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT, AND AUTHORIZING FILING OF NOTICE OF EXEMPTION

The Board of Directors of the Hilmar County Water District, Merced County, California, hereby finds:

WHEREAS, the Board of Directors of the Hilmar County Water District adopted the Turlock Groundwater Basin Groundwater Management Plan ("Plan") on December 2, 1997, and adopted an updated version of the Turlock Groundwater Basin Groundwater Management Plan on November 4, 2003, for those lands within the Hilmar County Water District's service area, pursuant to Part 2.75 (commencing with Section 10750) of Division 6 of the Water Code; and

WHEREAS, the Plan was designed to be a living document that needs to be updated occasionally to best reflect the current conditions within the basin; and

WHEREAS, the Turlock Groundwater Basin Association, of which the Hilmar County Water District is a member, has developed an update of the Plan pursuant to the Water Code Sections 10750 et seq., and staff participated in the development of the Plan; and

WHEREAS, the staff at the Hilmar County Water District recommends that the Board of Directors of the Hilmar County Water District adopt the Plan; and

WHEREAS, the California Environmental Quality Act ("CEQA") exempts certain project from the environmental review process; and

WHEREAS, the Board of Directors of the Hilmar County Water District has conducted a public hearing on the adoption of the Plan which public hearing was properly noticed and was held at 7:30 p.m., on April 1, 2008, which public hearing was properly noticed as evidence by the Certificate of District Secretary which is attached to this Resolution; and

WHEREAS, no protest forms were filed with the District prior to the conclusion of said public hearing; and

WHEREAS, the Hilmar County Water District staff has conducted a review of the Plan and CEQA and has presented that review to the Hilmar County Water District Board of Directors.

NOW, THEREFORE, be it resolved, as follows:

1. The Hilmar County Water District Board of Directors finds that the project is exempt from CEQA and the Manager of the District is authorized and directed to sign and file a Notice of Exemption for the project pursuant to the requirements of CEQA.

2. The Plan is hereby adopted and the 1997 Turlock Groundwater Baisn Groundwater Management Plan is superseded.

PASSED AND ADOPTED by the Board of Directors of the Hilmar County Water District on this 1st day of April, 2008, by the following vote:

AYES AND IN FAVOR: Director(s): JOE SEQUEIRA, JIM GERDES

NOES: Director(s):

ABSENT: Director(s): ROGER AVILLA, JOSEPH GOMES

ABSTENTIONS: Director(s):

DATED: April 1, 2008.

DAVID A. ANDERSON, President
of the Board of Directors of
Hilmar County Water District

ATTEST:

DALE O. WICKSTROM, Secretary
of the Board of Directors of
Hilmar County Water District

MODESTO CITY COUNCIL
RESOLUTION NO. 2008-206

A RESOLUTION ADOPTING THE TURLOCK GROUNDWATER BASIN ASSOCIATION'S GROUNDWATER MANAGEMENT PLAN FOR THE TURLOCK SUB-BASIN

WHEREAS, a portion of the City of Modesto overlies a part of the Turlock Groundwater Sub-basin and receives some of its annual water supply from wells located within the Sub-basin, and

WHEREAS, in 1992 and 2002, the California Legislature passed Assembly Bill (AB) 3030 and Senate Bill (SB) 1938 respectively, which provided local public agencies increased management authority over their groundwater resources and encouraged them to work cooperatively together in the adoption of a Groundwater Management Plan (GMP), and

WHEREAS, on October 9, 2001, the City Council approved Resolution No. 2001-514 adopting a Memorandum of Understanding with other local water supply agencies to re-form the Turlock Groundwater Basin Association (TGBA) within the Turlock Sub-Basin to coordinate water resource planning efforts and develop a GMP, and

WHEREAS, a Public Hearing was held on April 1, 2008, at 5:30 p.m. in the Tenth Street Place Chambers located in the basement at 1010 Tenth Street, Modesto, California, for public comments regarding the adoption of the GMP,

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Modesto that it hereby adopts the Turlock Groundwater Basin Association's Groundwater Management Plan for the Turlock Sub-basin.

The foregoing resolution was introduced at a regular meeting of the Council of the City of Modesto held on the 1st day of April, 2008, by Councilmember Hawn, who moved its adoption, which motion being duly seconded by Councilmember O'Bryant, was upon roll call carried and the resolution adopted by the following vote:

AYES:	Councilmembers:	Hawn, Keating, Marsh, O'Bryant, Olsen, Mayor Ridenour
NOES:	Councilmembers:	None
ABSENT:	Councilmembers:	Lopez

ATTEST: ______________________
STEPHANIE LOPEZ, Acting City Clerk

(SEAL)

APPROVED AS TO FORM:

By______________________
SUSANA ALCALA WOOD, City Attorney

DELHI COUNTY WATER DISTRICT
RESOLUTION NO. 476
RESOLUTION ADOPTING OF THE TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN WHICH WOULD AMEND AND SUPERSEDE THE EXISTING TURLOCK GROUNDWATER BASIN GROUNDWATER MANAGEMENT PLAN, FINDING THE PLAN IS EXEMPT FROM CEQA, AND AUTHORIZING THE FILING OF A NOTICE OF EXEMPTION

RESOLVED, by the Board of Directors of the DELHI COUNTY WATER DISTRICT, Merced County, California, as follows:

WHEREAS, the Board of Directors of the Delhi County Water District adopted the Turlock Groundwater Basin Groundwater Management Plan on October 1, 1997 for those lands within the District's service area, pursuant to Part 2.75 (commencing with Section 10750) of Division 6 of the California Water Code; and

WHEREAS, the Turlock Groundwater Basin Association , with which the District has cooperated and provided information, has been meeting on a regular basis to coordinate groundwater management activities within the basin, and the District has from time to time attended such meetings; and

WHEREAS, the groundwater management plan was designed to be a living document that needs to be updated occasionally to best reflect the current condition of the basin; and

WHEREAS, a public hearing to receive public input on the Draft Turlock Groundwater Basin Groundwater Management Plan was held on April 2, 2008; and

WHEREAS, the Delhi County Water District considered public input in developing the update of the Groundwater Management Plan; and.

WHEREAS, a public hearing to determine whether to adopt the updated Groundwater Management Plan was held on May 7, 2008: and

WHEREAS, the California Environmental Quality Act (CEQA) exempts certain projects from CEQA review, of which this project qualifies: and

WHEREAS, he Board determines that it is in the best interest of the District to adopt the Turlock Groundwater Management Plan; that it is exempt from CEQA review and that a Notice of Exemptions should be filed with the State of California.

NOW THEREFORE, IT IS HEREBY FOUND, DETERMINED AND RESOLVED THAT: The Board of Directors of the Delhi County Water District adopts the Turlock Groundwater Basin Groundwater Management Plan as updated in 2008, superseding the original plan of 1997, and finds that the project is exempt from CEQA review.

IT IS HEREBY FURTHER RESOLVED that the Secretary of the Board is authorized to file a Notice of Exemption for the project pursuant to the requirements of CEQA.

PASSED AND ADOPTED by the Board of Directors of the DELHI COUNTY WATER DISTRICT this 7th day of May, 2008 at the regular meeting of the DELHI COUNTY WATER DISTRICT by the following vote:

AYES AND IN FAVOR THEREOF: Myers, Davis, Isley, Nightengale and Morris

NOES: ______

ABSENT: ______

ABSTENTIONS: ______

Kenneth J. Myers, President of the Board of Directors of the Delhi County Water District

ATTEST:

Stephany Perry, Secretary of the Board of Directors of the Delhi County Water District

Appendix H

GROUNDWATER MANAGEMENT RELATED CALIFORNIA WATER CODE SECTIONS

PART 2.75. GROUNDWATER MANAGEMENT (CALIFORNIA WATER CODE SECTION 10750 ET SEQ.)

Chapter 1. General Provisions

10750.
(a) The Legislature finds and declares that groundwater is a valuable natural resource in California, and should be managed to ensure both its safe production and its quality. It is the intent of the Legislature to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdictions.

(b) The Legislature also finds and declares that additional study of groundwater resources is necessary to better understand how to manage groundwater effectively to ensure the safe production, quality, and proper storage of groundwater in this state.

10750.2.
(a) Subject to subdivision (b), this part applies to all groundwater basins in the state.

(b) This part does not apply to any portion of a groundwater basin that is subject to groundwater management by a local agency or a watermaster pursuant to other provisions of law or a court order, judgment, or decree, unless the local agency or watermaster agrees to the application of this part.

10750.4.
Nothing in this part requires a local agency overlying a groundwater basin to adopt or implement a groundwater management plan or groundwater management program pursuant to this part.

10750.6.
Nothing in this part affects the authority of a local agency or a watermaster to manage groundwater pursuant to other provisions of law or a court order, judgment, or decree.

10750.7.
(a) A local agency may not manage groundwater pursuant to this part within the service area of another local agency, a water corporation regulated by the Public Utilities Commission, or a mutual water company without the agreement of that other entity.

(b) This section applies only to groundwater basins that are not critically overdrafted.

10750.8.
(a) A local agency may not manage groundwater pursuant to this part within the service area of another local agency without the agreement of that other entity.

(b) This section applies only to groundwater basins that are critically overdrafted.

10750.9.
(a) A local agency that commences procedures, prior to January 1, 1993, to adopt an ordinance or resolution to establish a program for the management of groundwater pursuant to Part 2.75 (commencing with Section 10750), as added by Chapter 903 of the Statutes of 1991, may proceed to adopt the ordinance or resolution pursuant to Part 2.75, and the completion of those procedures is deemed to meet the requirements of this part.

(b) A local agency that has adopted an ordinance or resolution pursuant to Part 2.75 (commencing with Section 10750), as added by Chapter 903 of the Statutes of 1991, may amend its groundwater management program by ordinance or resolution of the governing body of the local agency to include any of the plan components set forth in Section 10753.7.

10750.10.
This part is in addition to, and not a limitation on, the authority granted to a local agency pursuant to other provisions of law.

Chapter 2. Definitions

10752.
Unless the context otherwise requires, the following definitions govern the construction of this part:

(a) "Groundwater" means all water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water, but does not include water which flows in known and definite channels.

(b) "Groundwater basin" means any basin identified in the department's Bulletin No. 118, dated September 1975, and any amendments to that bulletin, but does not include a basin in which the average well yield, excluding domestic wells that supply water to a single-unit dwelling, is less than 100 gallons per minute.

(c) "Groundwater extraction facility" means any device or method for the extraction of groundwater within a groundwater basin.

(d) "Groundwater management plan" or "plan" means a document that describes the activities intended to be included in a groundwater management program.

(e) "Groundwater management program" or "program" means a coordinated and ongoing activity undertaken for the benefit of a groundwater basin, or a portion of a groundwater basin, pursuant to a groundwater management plan adopted pursuant to this part.

(f) "Groundwater recharge" means the augmentation of groundwater, by natural or artificial means, with surface water or recycled water.

(g) "Local agency" means any local public agency that provides water service to all or a portion of its service area, and includes a joint powers authority formed by local public agencies that provide water service.

(h) "Recharge area" means the area that supplies water to an aquifer in a groundwater basin and includes multiple wellhead protection areas.

(i) "Watermaster" means a watermaster appointed by a court or pursuant to other provisions of law.

(j) "Wellhead protection area" means the surface and subsurface area surrounding a water well or well field that supplies a public water system through which contaminants are reasonably likely to migrate toward the water well or well field.

Chapter 3. Groundwater Management Plans

10753.
(a) Any local agency, whose service area includes a groundwater basin, or a portion of a groundwater basin, that is not subject to groundwater management pursuant to other provisions of law or a court order, judgment, or decree, may, by ordinance, or by resolution if the local agency is not authorized to act by ordinance, adopt and implement a groundwater management plan pursuant to this part within all or a portion of its service area.

(b) Notwithstanding subdivision (a), a local public agency, other than an agency defined in subdivision (g) of Section 10752, that provides flood control, groundwater management, or groundwater replenishment, or a local agency formed pursuant to this code for the principal purpose of providing water service that has not yet provided that service, may exercise the authority of this part within a groundwater basin that is located within its boundaries within areas that are either of the following:

(1) Not served by a local agency.

(2) Served by a local agency whose governing body, by a majority vote, declines to exercise the authority of this part and enters into an agreement with the local public agency pursuant to Section 10750.7 or 10750.8.

10753.1.
Nothing in this part, or in any groundwater management plan adopted pursuant to this part, affects surface water rights or the procedures under common law or local groundwater authority, or any provision of law other than this part that determines or grants surface water rights.

10753.2.
(a) Prior to adopting a resolution of intention to draft a groundwater management plan, a local agency shall hold a hearing, after publication of notice pursuant to Section 6066 of the Government Code, on whether or not to adopt a resolution of intention to draft a groundwater management plan pursuant to this part for the purposes of implementing the plan and establishing a groundwater management program.

(b) At the conclusion of the hearing, the local agency may draft a resolution of intention to adopt a groundwater management plan pursuant to this part for the purposes of implementing the plan and establishing a groundwater management program.

10753.3.
(a) After the conclusion of the hearing, and if the local agency adopts a resolution of intention, the local agency shall publish the resolution of intention in the same manner that notice for the hearing held under Section 10753.2 was published.

(b) Upon written request, the local agency shall provide any interested person with a copy of the resolution of intention.

10753.4.
(a) The local agency shall prepare a groundwater management plan within two years of the date of the adoption of the resolution of intention. If the plan is not adopted within two years, the resolution of intention expires, and no plan may be adopted except pursuant to a new resolution of intention adopted in accordance with this chapter.

(b) For the purposes of carrying out this part, the local agency shall make available to the public a written statement describing the manner in which interested parties may participate in developing the groundwater management plan. The local agency may appoint, and consult with, a technical advisory committee consisting of interested parties for the purposes of carrying out this part.

10753.5.
(a) After a groundwater management plan is prepared, the local agency shall hold a second hearing to determine whether to adopt the plan. Notice of the hearing shall be given pursuant to Section 6066 of the Government Code. The notice shall include a summary of the plan and shall state that copies of the plan may be obtained for the cost of reproduction at the office of the local agency.

(b) At the second hearing, the local agency shall consider protests to the adoption of the plan. At any time prior to the conclusion of the second hearing, any landowner within the local agency may file a written protest or withdraw a protest previously filed.

10753.6.
(a) A written protest filed by a landowner shall include the landowner's signature and a description of the land owned sufficient to identify the land. A public agency owning land is deemed to be a landowner for the purpose of making a written protest.

(b) The secretary of the local agency shall compare the names and property descriptions on the protest against the property ownership records of the county assessors.

(c) (1) A majority protest shall be determined to exist if the governing board of the local agency finds that the protests filed and not withdrawn prior to the conclusion of the second hearing represent more than 50 percent of the assessed value of the land within the local agency subject to groundwater management pursuant to this part.
(2) If the local agency determines that a majority protest exists, the groundwater plan may not be adopted and the local agency shall not consider adopting a plan for the area proposed to be included within the program for a period of one year after the date of the second hearing.
(3) If a majority protest has not been filed, the local agency, within 35 days after the conclusion of the second hearing, may adopt the groundwater management plan.

10753.7.
(a) For the purposes of qualifying as a groundwater management plan under this section, a plan shall contain the components that are set forth in this section. In addition to the requirements of a specific funding program, any local agency seeking state funds administered by the department for the construction of groundwater projects or groundwater quality projects, excluding programs that are funded under Part 2.78 (commencing with Section 10795), shall do all of the following:
(1) Prepare and implement a groundwater management plan that includes basin management objectives for the groundwater basin that is subject to the plan. The plan shall include components relating to the monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.
(2) For the purposes of carrying out paragraph (1), the local agency shall prepare a plan to involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin.
(3) For the purposes of carrying out paragraph (1), the local agency shall prepare a map that details the area of the groundwater basin, as defined in the department's Bulletin No. 118, and the area of the local agency, that will be subject to the plan, as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan.

(4) The local agency shall adopt monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management.
(5) Local agencies that are located in areas outside the groundwater basins delineated on the latest edition of the department's groundwater basin and subbasin map shall prepare groundwater management plans incorporating the components in this subdivision, and shall use geologic and hydrologic principles appropriate to those areas.

(b) (1)

(A) A local agency may receive state funds administered by the department for the construction of groundwater projects or for other projects that directly affect groundwater levels or quality if it prepares and implements, participates in, or consents to be subject to, a groundwater management plan, a basinwide management plan, or other integrated regional water management program or plan that meets, or is in the process of meeting, the requirements of subdivision (a). A local agency with an existing groundwater management plan that meets the requirements of subdivision (a), or a local agency that completes an upgrade of its plan to meet the requirements of subdivision (a) within one year of applying for funds, shall be given priority consideration for state funds administered by the department over local agencies that are in the process of developing a groundwater management plan. The department shall withhold funds from the project until the upgrade of the groundwater management plan is complete.

(B) Notwithstanding subparagraph (A), a local agency that manages groundwater under any other provision of existing law that meets the requirements of subdivision (a), or that completes an upgrade of its plan to meet the requirements of subdivision (a) within one year of applying for funding, shall be eligible for funding administered by the department. The department shall withhold funds from a project until the upgrade of the groundwater management plan is complete.

(C) Notwithstanding subparagraph (A), a local agency that conforms to the requirements of an adjudication of water rights in the groundwater basin is in compliance with subdivision (a). For purposes of this section, an "adjudication" includes an adjudication under Section 2101, an administrative adjudication, and an adjudication in state or federal court.

(D) Subparagraphs (A) and (B) do not apply to proposals for funding under Part 2.78 (commencing with Section 10795), or to funds authorized or appropriated prior to September 1, 2002.

(2) Upon the adoption of a groundwater management plan in accordance with this part, the local agency shall submit a copy of the plan to the department, in an electronic

format, if practicable, approved by the department. The department shall make available to the public copies of the plan received pursuant to this part.

10753.8.
A groundwater management plan may include components relating to all of the following:

(a) The control of saline water intrusion.
(b) Identification and management of wellhead protection areas and recharge areas.
(c) Regulation of the migration of contaminated groundwater.
(d) The administration of a well abandonment and well destruction program.
(e) Mitigation of conditions of overdraft.
(f) Replenishment of groundwater extracted by water producers.
(g) Monitoring of groundwater levels and storage.
(h) Facilitating conjunctive use operations.
(i) Identification of well construction policies.
(j) The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
(k) The development of relationships with state and federal regulatory agencies.
(l) The review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination.

10753.9.

(a) A local agency shall adopt rules and regulations to implement and enforce a groundwater management plan adopted pursuant to this part.
(b) Nothing in this part shall be construed as authorizing the local agency to make a binding determination of the water rights of any person or entity.
(c) Nothing in this part shall be construed as authorizing the local agency to limit or suspend extractions unless the local agency has determined through study and investigation that groundwater replenishment programs or other alternative sources of water supply have proved insufficient or infeasible to lessen the demand for groundwater.

10753.10.
In adopting rules and regulations pursuant to Section 10753.9, the local agency shall consider the potential impact of those rules and regulations on business activities, including agricultural operations, and to the extent practicable and consistent with the protection of the groundwater resources, minimize any adverse impacts on those business activities.

Chapter 4. Finances

10754.
For purposes of groundwater management, a local agency that adopts a groundwater management plan pursuant to this part has the authority of a water replenishment district pursuant to Part 4 (commencing with Section 60220) of Division 18 and may fix and collect fees

and assessments for groundwater management in accordance with Part 6 (commencing with Section 60300) of Division 18.

10754.2.

(a) Subject to Section 10754.3, except as specified in subdivision (b), a local agency that adopts a groundwater management plan pursuant to this part, may impose equitable annual fees and assessments for groundwater management based on the amount of groundwater extracted from the groundwater basin within the area included in the groundwater management plan to pay for costs incurred by the local agency for groundwater management, including, but not limited to, the costs associated with the acquisition of replenishment water, administrative and operating costs, and costs of construction of capital facilities necessary to implement the groundwater management plan.

(b) The local agency may not impose fees or assessments on the extraction and replacement of groundwater pursuant to a groundwater remediation program required by other provisions of law or a groundwater storage contract with the local agency.

10754.3.

Before a local agency may levy a water management assessment pursuant to Section 10754.2 or otherwise fix and collect fees for the replenishment or extraction of groundwater pursuant to this part, the local agency shall hold an election on the proposition of whether or not the local agency shall be authorized to levy a groundwater management assessment or fix and collect fees for the replenishment or extraction of groundwater. The local agency shall be so authorized if a majority of the votes cast at the election is in favor of the proposition. The election shall be conducted in the manner prescribed by the laws applicable to the local agency or, if there are no laws so applicable, then as prescribed by laws relating to local elections. The election shall be conducted only within the portion of the jurisdiction of the local agency subject to groundwater management pursuant to this part.

Chapter 5. Miscellaneous

10755.

(a) If a local agency annexes land subject to a groundwater management plan adopted pursuant to this part, the local agency annexing the land shall comply with the groundwater management plan for the annexed property.

(b) If a local agency subject to a groundwater management plan adopted pursuant to this part annexes land not subject to a groundwater management plan adopted pursuant to this part at the time of annexation, the annexed territory shall be subject to the groundwater management plan of the local agency annexing the land.

10755.2.

(a) It is the intent of the Legislature to encourage local agencies, within the same groundwater basin, that are authorized to adopt groundwater management plans pursuant to this part, to adopt and implement a coordinated groundwater management plan.
(b) For the purpose of adopting and implementing a coordinated groundwater management program pursuant to this part, a local agency may enter into a joint powers agreement pursuant to Chapter 5 (commencing with Section 6500) of Division 7 of Title 1 of the Government Code with public agencies, or a memorandum of understanding with public or private entities providing water service.
(c) A local agency may enter into agreements with public entities or private parties for the purpose of implementing a coordinated groundwater management plan.

10755.3.

Local agencies within the same groundwater basin that conduct groundwater management programs within that basin pursuant to this part, and cities and counties that either manage groundwater pursuant to this part or have ordinances relating to groundwater within that basin, shall, at least annually, meet to coordinate those programs.

10755.4.

Except in those groundwater basins that are subject to critical conditions of groundwater overdraft, as identified in the department's Bulletin 118-80, revised on December 24, 1982, the requirements of a groundwater management plan that is implemented pursuant to this part do not apply to the extraction of groundwater by means of a groundwater extraction facility that is used to provide water for domestic purposes to a single-unit residence and, if applicable, any dwelling unit authorized to be constructed pursuant to Section 65852.1 or 65852.2 of the Government Code.