Chapter 4

Water Supply and Service Areas of Water Suppliers

Historical Background

The Butte Creek Watershed is situated in an area generally considered to have sufficient water to supply both agriculture and domestic uses, as well as providing habitat for wildlife. The northern Sacramento Valley is actually considered by some to have a surplus of water, which prompeted the development of the State Water Project (Littleworth and Garner, 1995). The Oroville Dam on the Feather River was built and formed Lake Oroville, the main water supply source for the State Water Project. Water from Lake Oroville is passed down the Feather River to the Sacramento River, and continues down to the Delta. The water is then pulled through the Delta and pumped back out on the south side and passed through the California Aqueduct to serve areas of the San Joaquin Valley and Southern California. The moving of large amounts of water from Northern to Southern California has since been a major issue of concern. Most notably many persons in the agricultural community of Northern California feel that their water is being taken away while the Southern California urbanites desperately need a source of water to alleviate their deficiency. Water supply and demand issues for the state of California have been a concern for many years and will undoubtedly be a concern for many years to come as the population continues to grow. Although the entire state's needs have to be addressed, local needs are of great importance as well. The following text is a look into water supply issues for the Butte Creek Watershed.

The Butte Creek Watershed is considered by some to be an area with sufficient water supply to meet the local demand. Many resource managers however contend that there is not an adequate supply to meet the growing demands of agriculture, fisheries and future urban growth. Although the available water supply fluctuates from year to year, our watershed is dependent mostly on winter precipitation and ground water recharge. Years of drought will drop the amount of available surface water and put an increased strain on ground water use. Years of sufficient precipitation will provide plentiful surface water supplies and allow for recharge of ground water resources.

As the Butte Creek Watershed resources were being developed, beginning with the first settlers in the 1840's and 1850's, surface water from local creeks and streams were the first to be manipulated. Ground water, at this time, was used on a relatively small scale for domestic needs, and later for supplying livestock. Water supply was not a major issue for the early settlers of the area due to their small population and the abundance of water resources. Domestic use was small at this time and even the early forms of agriculture, animal husbandry and grain farming, used very little water. Even though large amounts of water began to be used in the 1850s for mining, it wasn't until the introduction of irrigation in the 1860's that water supply became a major issue of concern. In 1877 the Wright Act was passed which allowed individuals to form irrigation districts to bring water to land not directly bordering streams (McGee, 1980). This was followed in 1879 by the first well being dug, near Woodland, to utilize ground water for irrigation (DWR, 1978). These events laid precedence in the development of water supply issues that exist today.

Water Suppliers

In the first half of the 20th Century many irrigation and water districts were formed to serve agricultural needs as well as growing domestic uses in the Butte Creek Watershed. See Figure 4.1 for current boundaries of service for the water and irrigation districts in the valley section of the watershed. Boundaries not shown include California Water Service, which covers the Chico urban area. Del Oro Water District and Paradise Irrigation District boundaries are also not shown. These two districts cover from Stirling City to Lime Saddle (see Map Appendix - Watershed Base Map); Del Oro includes Paradise Pines District, Magalia District and Lime Saddle District.

A large percentage of the water supply for the water and irrigation districts in the Butte Creek Watershed actually comes from the Feather River. Feather River water is imported into Butte Creek via Hendricks (Toadtown) Canal above Lake DeSabla. Del Oro Water District has a small water right to Feather River water being passed through the Hendricks Canal. The rest of their water supply comes from Lake Oroville, and ground water from two wells in Magalia and five wells in the Paradise Pines area (Pers. com., Ofarreol, 1998). Paradise Irrigation District's water supply comes from Little Butte Creek by way of Paradise and Magalia Reservoirs, as well as one well in town in case of drought. Magalia Reservoir has a current capacity of 796 acre-feet, since the dam was lowered by 25 feet in early 1998 to comply with a Division of Safety of Dams safety requirement. Prior to the lowering of the dam the reservoir had a capacity of 2575 acre-feet. Paradise Reservoir has a current storage of 11,500 acre-feet. There are plans to eventually increase the storage to 16,000 acre-feet but presently the estimated cost of $10 million is beyond the financial resources of the community (Pers. com., Steve Felte, 1997). Of the imported Feather River water, Dayton Mutual Water Company has a right to 3.3 cfs, in addition they have a water right of 16 cfs of Butte Creek water via two pumping stations on Edgar Slough. Durham Mutual also diverts directly off of Butte Creek, utilizing a water right of 44.7 cfs (Hillaire, 1993).

The three major water suppliers for the Butte Basin area within the Butte Creek Watershed are Western Canal Water District (WCWD), Biggs-West Gridley Water District, and Richvale Irrigation District. All three of these districts receive their water from the Thermalito Afterbay. Western Canal and Richvale Canal outlets are combined into one structure. Biggs-West Gridley receives water through the Main Canal which is fed from the Sutter-Butte Canal outlet (see Map Appendix, Hydrology Map). Western Canal has a flow capacity of 1200 cfs and delivers an average of 226,500 acre-feet per year. Richvale Canal has a flow capacity of 500 cfs and deliveries an average of 80,700 acre-feet per year. Richvale Canal supplies water to the eastern portion of Richvale Irrigation District while the western side is served through the Main Canal via the Biggs Extension Canal, providing an average of 52,700 acre-feet per year. The Biggs-West Gridley Water District is supplied by the Main Canal via Belding Lateral, which brings an average of 133,000 acre-feet per year (DWR, 1994). WCWD also has a small water right to Butte Creek water. From April 1 to June 15 they have a right of 33 to 99 cfs, depending on the specific flow for a given year. Western has not diverted water off Butte Creek for the last year due to the fact their new siphon project is being installed. Starting next year they will receive their Butte Creek water through Gorrill Ranch's ditch. To keep things in perspective Butte Creek has an annual average discharge, measured at the Chico gauging station below Honeyrun Covered Bridge, of 289,700 acre-feet per year of which 111,200 acre-feet are used for irrigation (Hillaire, 1993). For the Butte Basin water supply flow diagram showing which canals deliver water from which sources to which water and irrigation districts see Figure 4.2.

Butte Creek is the water supply source for many other ranches and individuals and the information on those diversions and water rights can be found in the Department of Water Resources Butte and Sutter Basins Water Data Atlas. Also further information is available from Todd Hillaire's DWR report on Butte and Sutter Basins.

Table 4.1 shows the information available for the irrigation and water districts active today that influence the Butte Creek Watershed.

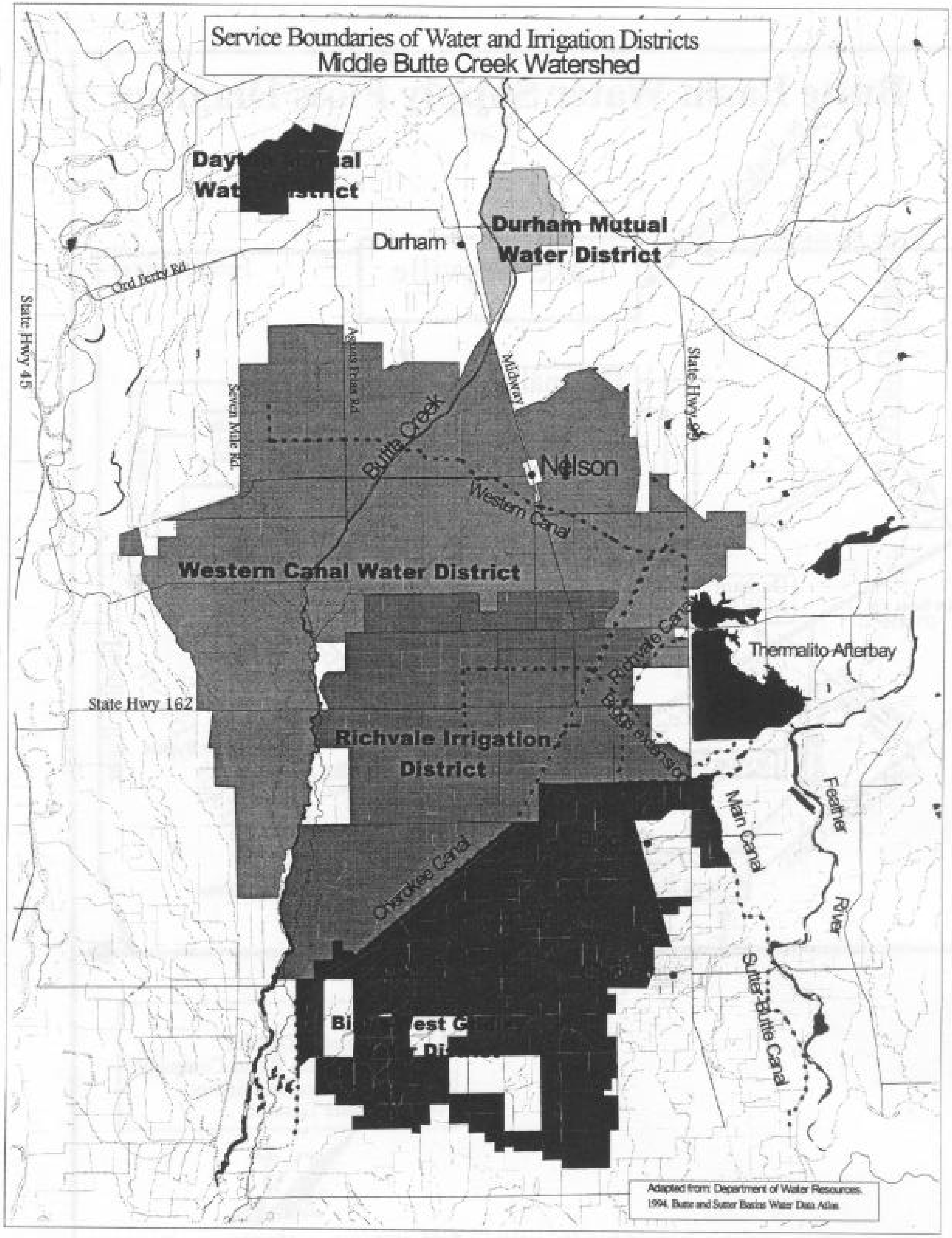
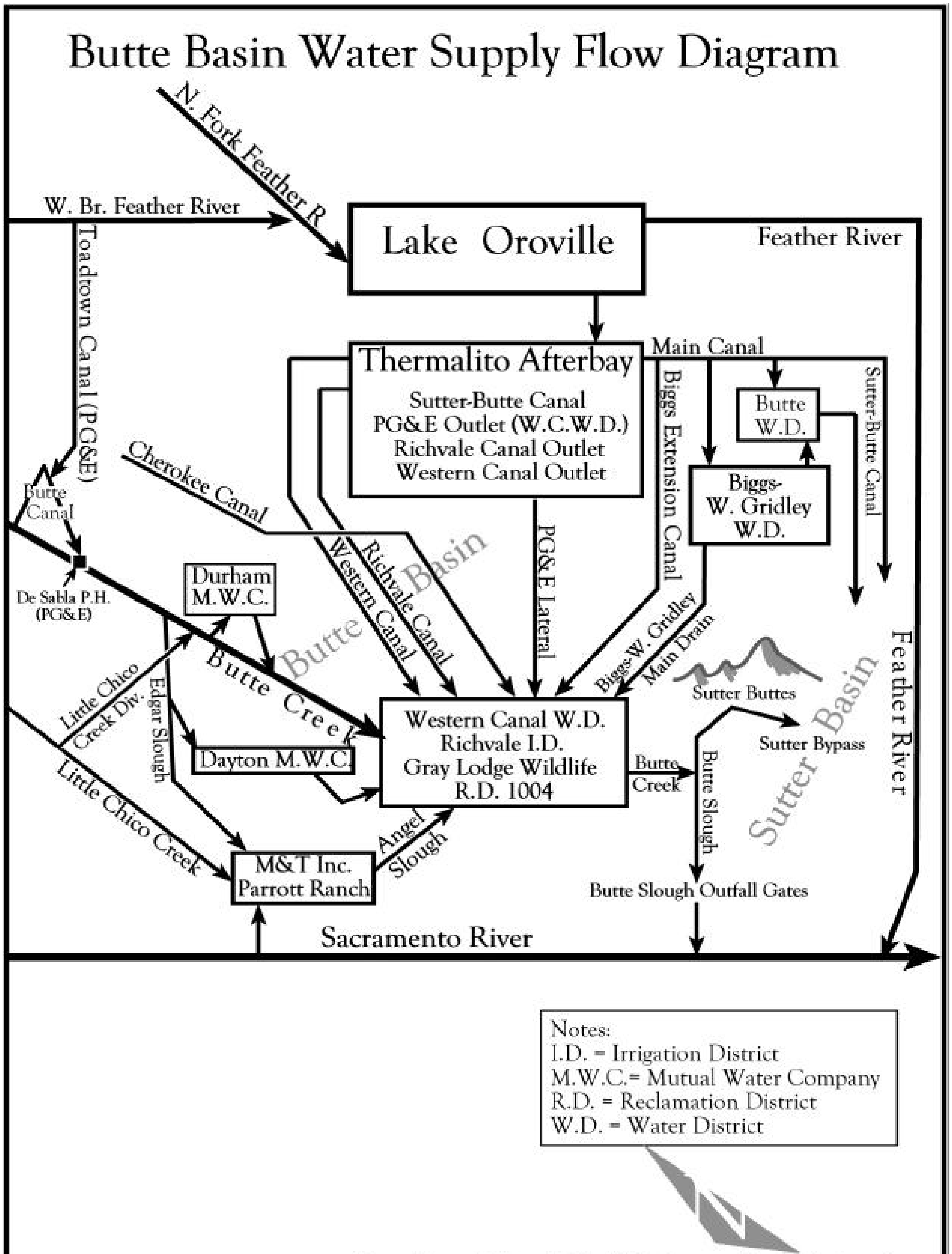

Service Boundaries of Water and Irrigation Districts
Middle Butte Creek Watershed
Durham
Durham Mutual
Water District
Ord Ferry Rd
State Hwy 45
Seven Mile Rd
Aguas Frias Rd
Midway
State Hwy
Butte Creek
Nelson
Western Canal
Western Canal Water District
Richvale Canal
Thermalito Afterbay
State Hwy 162
Richvale Irrigation
District
Biggs extension
Main Canal
Feather
River
Cherokee Canal
Sutter-Butte Canal
Adapted from: Department of Water Resources.
1994. Butte and Sutter Basins Water Data Atlas.

Figure 4.1



Adapted from: Hillaire, Todd. 1993. Butte and Sutter Basins: Departm of Water Resources Memorandum Report, Northern District.

Table 4.1
Available Information for Water and Irrigation Districts

Name	Year Formed	Water Supply Source	Area Irrigated	People Provided	Misc. Facts	Water Rights
Paradise Irrigation District	1916	Little Butte Creek/Magalia Reservoir and Paradise Reservoir	300 acres	26,000	One well in town in case of drought	
Western Canal Water District	Origins in 1915 under Great Western Power Company, became a water district in 1986	Lake Almanor/Feather River via Thermalito Afterbay and Butte Creek	60,000 acres		System purchased from PG&E in 1986 and became a water district	145,000 ac/ft per year off Lake Almanor 150,000 ac/ft off Feather River 33 to 99 cfs/yr off Butte Creek
Richvale Irrigation District	1930	Lake Oroville via Thermalito Afterbay	26-27,000 acres		Small water right to Cherokee Canal during drought	149,850 ac/ft per year
Biggs-West Gridley Water District	1942	Lake Oroville via Thermalito Afterbay	27-29,000 acres			160,000 ac/ft per year
Durham Mutual Water Company	1918	Butte Creek	2,400 acre boundary			44.7 cfs
Del Oro Water District	1968	Lake Oroville, Hendricks Canal, 2 wells in Magalia, 5 wells in Paradise Pines		6,000 service connections	Originally started to serve Paradise Pines, Currently serves from Stirling City to Lime Saddle excluding area served by Paradise Irrigation District	
Durham Irrigation District		Ground water via 3 wells and one other shared with Durham School District		1500	Only one meter for all wells, pulling approximately 350 ac/ft/yr	
Dayton Mutual Water District		Butte Creek via Edgar Slough			1990 second pump on Edgar Slough installed	19.3 cfs
California Water Service	1926	Ground water via 67 wells		20,000 service connections	Serves Chico urban area	

Groundwater

The groundwater systems for the Butte Creek Watershed can be divided into two primary sections, the upper watershed and the lower watershed, and into two analyses, the physical description of the aquifer, and an overview of groundwater quality. Groundwater management consists of various private and public entities. The County of Butte has groundwater regulations that are currently being implemented.

Geographical Perspective

The West Butte subbasin is bounded on the west and south by the Sacramento River, on the north by Big Chico Creek, on the northeast by the Chico Monocline, and on the east by Butte Creek. The East Butte subbasin is bounded on the west and northwest by Butte Creek, on the northeast by the Cascade Ranges, on the southeast by the Feather River, and on the south by Sutter Buttes.

Hydrogeologic Description

The West Butte aquifer system is comprised of deposits of Late Tertiary to Quaternary age. The West Butte Late Tertiary deposits consist of poorly sorted fluvial deposits of the Tehama Formation and volcanic deposits of the Tuscan Formation. The Tehama Formation consists of locally cememted silt, sand, gravel, and clay of fluviatile deposited from the coast ranges. The Tuscan Formation consists of volcanic gravel and tuff-breccia, fine to coarse-grained volcanic sandstone, conglomerate and tuff, tuffaceous silt and clay predominantly derived from andesitic and basaltic source rocks. Tertiary deposits begin at the surface along the east subbasin boundary and range to approximately 100 feet near the Sacramento River. Maximum thickness of Tertiary age deposits is about 2,500 feet near the western edge of the subbasin. Wells in this zone range from about 150 to 600 feet deep and draw groundwater from the multiple layers of moderate to high permeability. These Tertiary Deposits are the primary source of groundwater for most irrigation and municipal wells in the West Butte Basin.

The West Butte Quaternary deposits consist of the younger alluvium (alluvial fan, flood basin deposits, and recent stream gravel deposits), and older alluvium (Pleistocene alluvial fan and terrace deposits of the Riverbank and Modesto Formations). Quaternary deposits of the Modesto and Riverbank consist of poorly indurated, very coarse-grained gravel and cobbles, with medium to coarse-grained sand, and occasional silt deposited during the Pleistocene period. The Quaternary age deposits begin at ground surface and range in thickness from 0 to about 90 feet. Permeability of the flood basin deposits and finer grained older alluvium is generally low, while permeability of the alluvial fan and recent stream gravel deposits is moderate to high. These deposits are the primary water source for many domestic wells, which range in depth from about 50 to 200 feet.

The East Butte aquifer system is comprised of fluvial and volcanic continental deposits of the Late Tertiary to Quaternary age. The composition of the East Butte Basin subbasin Quaternary alluvial deposits are similar to those of the West Butte subbasin but range in thickness from ground surface to approximately 50 feet. Permeability of these units range from low (flood basin deposits and finer grained older alluvium) to high, with alluvial fan and recent stream gravel deposits yielding large quantities (200 to 3000 gal/min) of water from shallow wells. The East Butte subbasin characteristically has a perennial zone of shallow, or perched groundwater because of agricultural practices (rice farming and flood irrigation with imported surface water). This shallow groundwater zone consists of Quaternary deposits and is a source of water for many domestic wells ranging in depth from approximately 50 to 200 feet.

Late Tertiary deposits consist of the volcanic deposits of the Tuscan Formation and the interbedded alluvial sand, gravel, and silt deposits of the Laguna formation. Tertiary deposits begin at a depth ranging from the surface along the east subbasin boundary. Maximum thickness of the Tertiary age deposits is about 2,000 feet. Tuscan Formation consists of volcanic gravel, tuff breccia, fine to coarse-grained volcanic sandstone, conglomerate and tuff, tuffaceous silt and clay predominantly derived from andesitic and basaltic rocks. The Tuscan Formation is found interingered with the Tehama Formation along the Sacramento River to a thickness of 1,000 feet. Permeability of the Tuscan Formation ranges form moderate to high. The Laguna Formation consists of interbedded alluvial sand, gravel, and silt deposits which are moderately consolidated and poorly to well cemented. Permeability of the Laguna Formation is generally low, except in scattered gravels in the upper portion. Wells drawing from these Tertiary deposits range from about 150 to 700 feet deep and provide the primary source of groundwater for most irrigation and municipal wells in the East Butte subbasin.

Groundwater Levels

The Groundwater Monitoring Stations Map, shows the location of the monitoring wells in the Upper Butte Creek Basin (see Map Appendix). There are a total of 32 monitoring wells, three of which are monitored monthly and twenty-nine monitored semi-annually.

A table entitled *Groundwater Level Monitoring Wells in the Upper Butte Creek Watershed* (see Appendix H), provides information concerning the 32 wells within the basin. Each well can be located within a 40 acre tract as shown in the accompanying explanation of the numbering system (see also Appendix H). The wells are monitored monthly or semi-annually for groundwater levels. The semi-annual measurements were made in the spring and fall. Most of the water level measurements were begun in the late 1940s or early 1950s and continue to the present. Water levels were measured using an electric sounder or a steel tape. All water level measurements should be accurate to the nearest 1/10th of a foot. Long -term well hydrographs are shown on the Groundwater Monitoring Stations Map from the beginning of the measurement period through April of 1992 (DWR, 1993). More recent data can be obtained at the Red Bluff Office of the DWR or from the internet address: [http://well.water.ca.gov/exterra/DBQUERY.html]. Solid circles (dots) on the hydrographs depict actual measured values while a hollow circle enclosing a smaller dot indicates the measurement is questionable. Discontinuities or breaks in a hydrograph represent missing measurements.

The groundwater level monitoring table provides additional information for each well, describing what the well is used for, the type of groundwater body the well draws water from, the geologic units containing the ground water and the degree of certainty associated with the ground water body classification.

Groundwater levels tend to fluctuate annually responding to the amount of pumping, recharge from precipitation, stream percolation, infiltration of applied irrigation water, and subsurface inflow and outflow. Examination of the DWR hydrographs reveals spring to fall changes along with long terms changes resulting from climatic fluctuations or increased or decreased groundwater extraction over several seasons or years. Precipitation, applied water, local creeks, and the Thermalito Afterbay recharge groundwater in the Upper Butte Creek basin.

The 32 hydrographs within the Upper Butte Basin generally show:

- Most groundwater levels within the basin have not changed significantly since the 1950s.
- Three wells - 27, 28, and 30 - north and northwest of Durham show significant long-term water level declines.
- Groundwater levels declines in most wells were associated with the 1976-77 and 1986-92 droughts.
- Nearly all groundwater levels recovered from the 1976-77 drought to pre-drought levels during the wet years of the early 1980s.
- Seasonal fluctuations (spring to fall change) is about 10 to 20 feet in the northern portions of the basin and approximately 5 feet in the southerly portions of the basin.

Groundwater Management

The majority of the West Butte subbasin groundwater is managed by private wells and the users associated with the Butte Basin Water Users Association. There are various water agencies of public and private interests that include Buzztail Community service district, Durham ID, City of Chico, RD 1004, and Western Canal WD (public) with private management including Dayton Mutual Water Company, Del Oro Water Company, Durham Mutual Water Company and California Water Service. California Water Service has jurisdiction over 67 wells with 20,000 service connections to serve the Chico urban area (Pers. com., Bonastich, 1998). Durham Irrigation District also utilizes ground water via three wells and one which it shares with Durham School District (Pers. com., Morrison, 1998). In addition to these two users there are many private users of ground water for both domestic and irrigation use. Table 4.2 shows the number of irrigation and domestic wells, by township, in the Butte Basin section of the watershed.

TABLE 4.2
Well Density by Township

	R1W		R1E		R2E		R3E	
	Irrig.	Dom.	Irrig.	Dom.	Irrig.	Dom.	Irrig.	Dom.
T22N	------	------	274	1375	*19*	*279*	13	316
T21N	49	12	**361**	**574**	**190**	**564**	28	152
T20N	*18*	*2*	**92**	**37**	**104**	**51**	17	20
T19N	*129*	*61*	**30**	**13**	**40**	**76**	26	75
T18N	*94*	*48*	**30**	**13**	**66**	**201**	129	258
T17N	*56*	*20*	*15*	*3*	70	251	------	------

Legend:

Irrig.= Irrigation wells
Dom.= Domestic wells
Bold numbers = Townships area completely within watershed
Italicized numbers = Townships area at least 50% within watershed
Standard numbers = Townships area less than 50% within watershed

The maximum depth of irrigation wells ranged from 300 ft. to 845 ft.
The maximum depth of domestic wells ranged from 198 ft. to 860 ft.

The minimum depth of irrigation wells ranged from 35 ft. to 123 ft.
The minimum depth of domestic wells ranged from 18 ft. to 200 ft.

The mean depth of irrigation wells ranged from 129 ft. to 473 ft.
The mean depth of domestic wells ranged from 81 ft. to 269 ft.

Note: This data and a corresponding map are available on page 22 of the Butte and Sutter Basins Water Data Atlas.

East Butte subasin groundwater is managed similar to West Butte subbasin groundwater. The management entities include. Biggs West Gridley WD, Butte WD, Durham ID, City of Biggs, City of Gridley, Oroville Wyandotte ID, and Western Canal WD. Private management entities are North Burbank Public Utility District. Water projects in East Butte subbasin include Lake Oroville Reservoir, Thermalito Afterbay, Cherokee Canal, Western Canal, and Richvale Canal.

Regulatory Considerations and Measure G

Butte County's Measure G was voted in by the public in November 1996, adopted in December 1996 and codified in the Butte County Code as Chapter 33. The purpose of Measure G is based on findings that groundwater provides the people of Butte County water for agricultural, domestic, municipal and other purposes, and must be reasonably and beneficially used and conserved for the benefit of overlying land by avoiding extractions which harm the Butte Basin aquifer. Through measure G, the County of Butte seeks to foster prudent water management practices to avoid significant environmental, social, and economic impacts. Chapter 33 provides that a nine-member commission be appointed by the Butte County Board of Supervisors. The purpose of Chapter 33 of the Butte County Code is to protect the groundwater resources by requiring the commission and the public to review permit applications for groundwater extraction for use outside of the county. As of August 1, 1998 the County of Butte is working on modifications of measure G that would redefine some aspects of the ordinance and adding a subsection on the intent of the legislation. The modifications were not certified at the time this report was written.