Butte County Water Inventory and Analysis

Evaluating the County's Water Supply and Demand

Project Description **March 2016**

Department of Water & Resource Conservation

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Our Mission

"To manage and conserve water and other resources for the citizens of Butte County"

Project Advisory Committee

Water Commission
- George Barber
- David Skinner

Technical Advisory Committee
- Pete Bonacich
- Joe Connell
- Richard Price

Development Services
- Dan Breedon

Water Resource Inventory & Analysis Project

The Department of Water and Resource Conservation with the assistance of Davids Engineering is updating the Butte County *Water Inventory and Analysis Report* also known as a "water budget". Like a financial budget that estimates income and spending for a set period of time, a water budget reflects and quantifies the input and output of water through a region over a specified time period. Determining current and future water demands is fundamental to managing water resources and to protecting area of origin water rights. Without accurate information on local availability of and demand on water resources, focused planning and protection cannot occur. The updated *Water Inventory and Analysis Report* will be completed in the Summer of 2016.

The *Water Inventory and Analysis Report* builds upon previous reports that accounted for baseline water demand, water supply availability, and related analyses. The first report, the *Water Inventory and Analysis Report* was produced in 2001 and was partially updated in 2008 to capture changes since its original publication. Other reports were subsequently produced to complement the *Water Inventory and Analysis Report.* Additionally, over the past 20 years, a mathematical groundwater model of the Butte Basin has been developed. The Butte Basin Groundwater Model (BBGM) is a tool that can be used to explore aspects of the groundwater system in the County and the Butte Basin as a whole and to estimate water budgets for each subregion. This model currently simulates historical conditions (precipitation, streamflow, land use, water deliveries and pumping, groundwater levels, and stream-groundwater interaction) for 1970-1999. The BBGM provides a framework for organizing available data to quantify and estimate each component of the water cycle and management activities. It will be used to update the *Water Inventory and Analysis Report* which will provide estimates of current water supply and demand (through 2014) and evaluate possible changes in demand.

The updated *Water Inventory and Analysis Report* will integrate elements from the other key documents and will:

1.Identify how water demands have changed over the past decade and in specific areas.

2.Develop water budgets for each sub-region to inform the local conversation regarding resource use and sustainability.

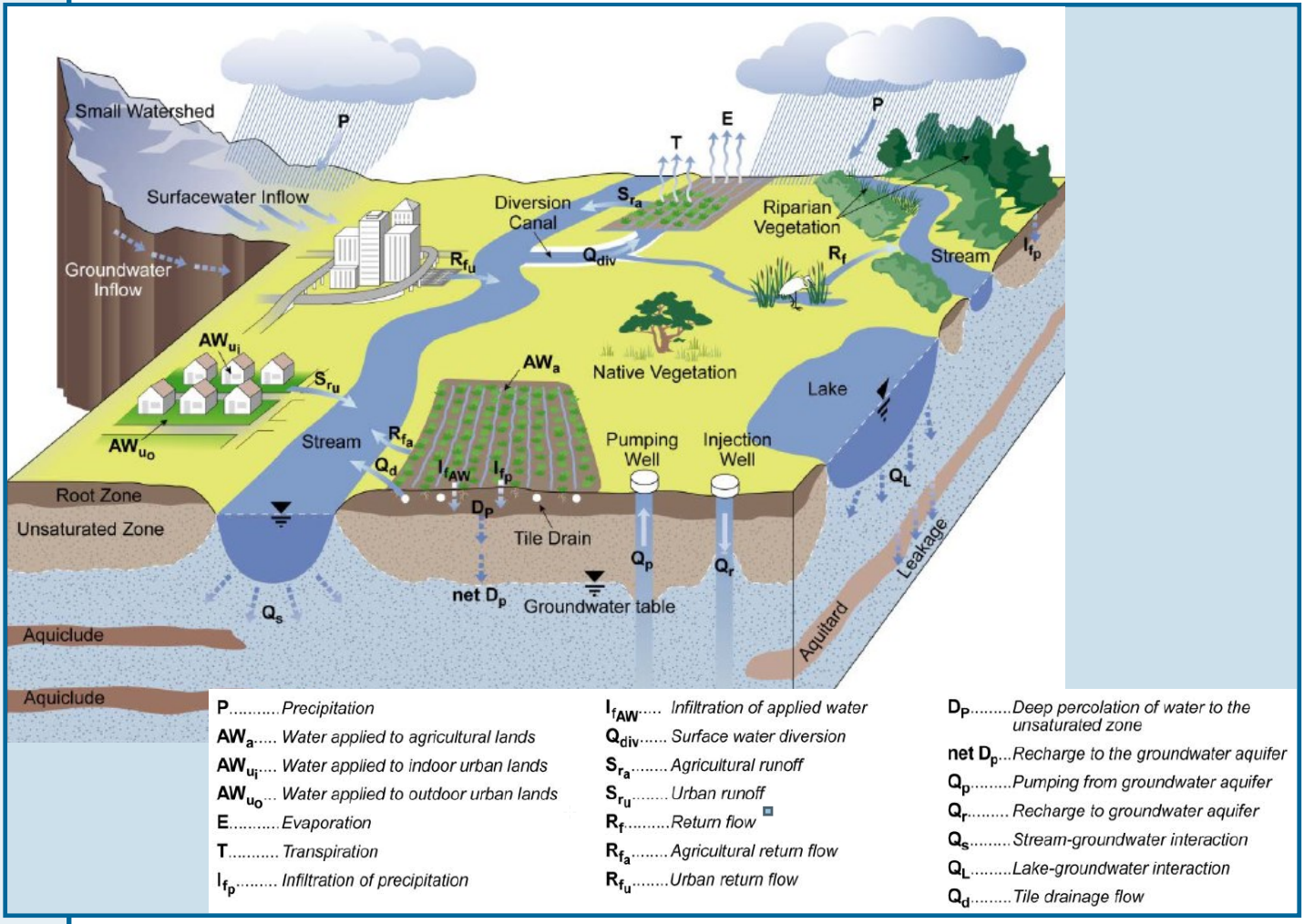
3.Evaluate what the future may hold and how best to prepare by developing alternative urban and agricultural water demand scenarios. Develop climate change hydrology scenarios for future groundwater model runs and associated analysis.

4.Increase familiarity with the Butte Basin Groundwater Model to maintain it as a useful and productive tool.

5. Provide the ability to produce water budgets required by the Sustainable Groundwater Management Act

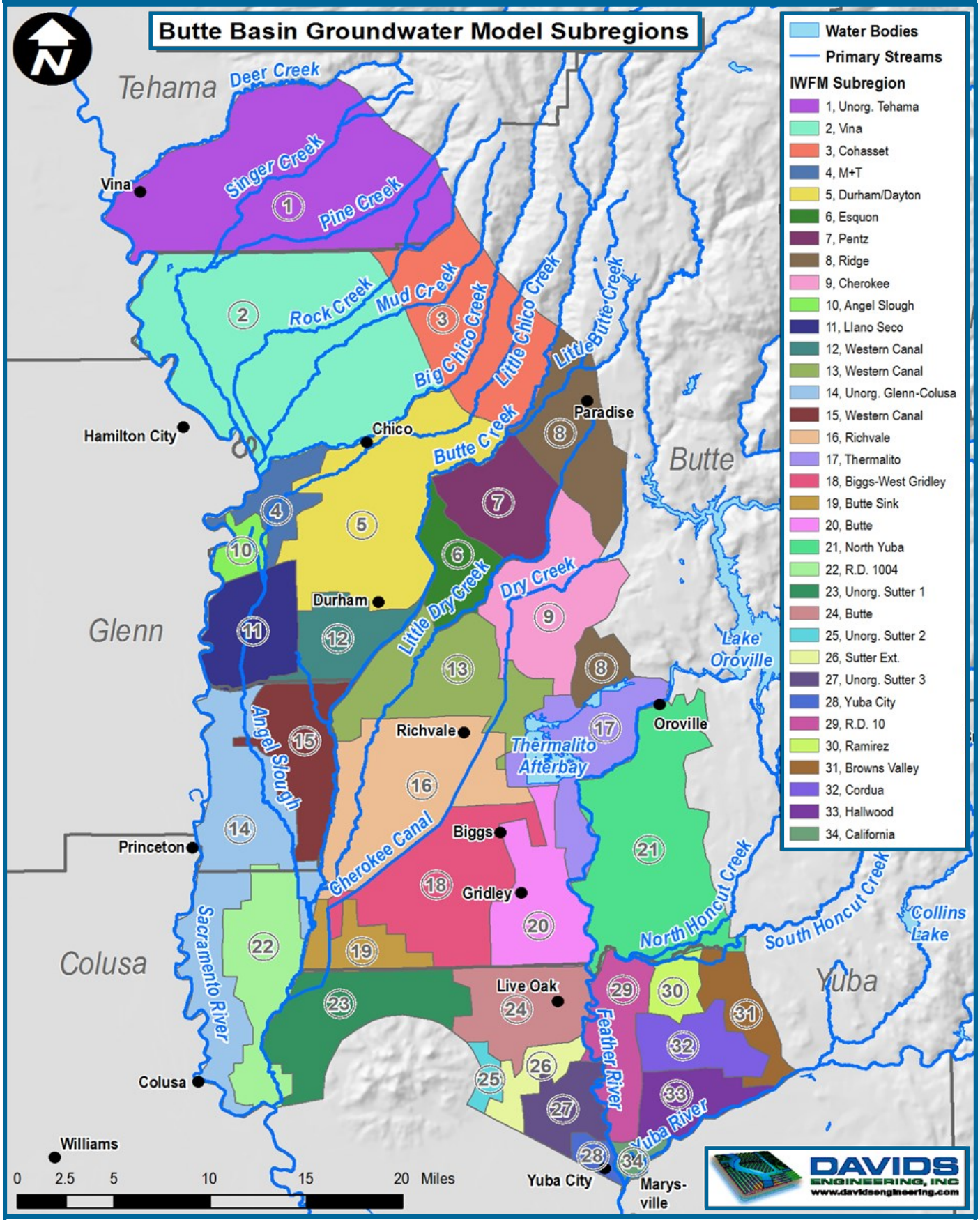
The *Water Inventory and Analysis Report* will reflect Butte County's water portfolio under current conditions and alternative scenarios such as changes in demand (i.e., land use changes, conservation, urban growth).

Creating a Water Inventory



The image above shows the common ways water moves into, through, and out of a hydrologic system and the processes that can be modeled by the groundwater model. Overall, just like a checking account, the inflows minus the outflows must add up to the total change in storage of water within the defined region. Water budgets can be defined for different subsets of the system. For example, for the groundwater system, inflows include deep percolation from precipitation and from applied water (for irrigation), seepage from canals, and flow from streams to the groundwater. Outflows include pumping and flows from groundwater to streams. With an annual water budget, we can see how each of these components changes over time as demand and availability change.

To develop a water budget, not only do you need an understanding of how the system works, but also datasets for each of the system's components. Most components are not constant and change seasonally, annually, and over a long period of time. Some of the changes are temporary (e.g. drought years), but others may be permanent (e.g. land use). We have direct measurements for many of the datasets, but for some datasets we must rely on estimated values. For example, groundwater pumping for agricultural water use is not metered or directly measured. As a result, one of the most common ways pumping is estimated is by estimating required agricultural water demands to irrigate a particular crop. Some of the demand may be met by delivered or recovered surface water, but if there is any remaining water requirement, groundwater pumping is assumed to be the supply source. The Butte Basin Groundwater Model includes in its mathematics an irrigation demand calculator that is used to estimate water demand and associated groundwater pumping. This provides a means of constructing a complete water budget. As a groundwater model, it also simulates changing groundwater conditions (groundwater levels and stream-aquifer interaction).



Butte Basin Groundwater Model area with subregions and primary streams. The model area extends into parts of Tehama, Glenn, Colusa, Sutter and Yuba Counties. However, the Butte County portion will be the focus for reporting out water supply and demand results.

Update of Butte County Water Inventory and Analysis

For more information about this project visit us at:
www.buttecounty.net/waterresourceconservation/WaterInventoryandAnalysis.aspx

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Technical Approach

The *Water Inventory and Analysis Report* will be updated based on water budget results produced using the Butte Basin Groundwater Model. The first step is the creation of time series inputs for the model updated through 2014. In the fall of 2013, the Inventory and Analysis Advisory Committee made recommendations to the Department on the methodologies. A Technical Memorandum was prepared that described the methodology for the following datasets supporting the model update and water budget analysis:

Precipitation
Reference Evapotranspiration (ET)
Crop Coefficients
Land Use and Future Cropping
Irrigation Efficiency
Stream inflows and Diversions
Urban Pumping
Climate Change Hydrology

Based on the methodology, the model will be used to produce estimates of water supplies and demands throughout the model domain over the full simulation period (1970 through 2014). Certain years or series of years will be selected from the simulation period to represent "normal" and "drought" hydrologic periods, and the results for those periods will be analyzed and presented in the *Water Inventory and Analysis* report.

The model provides a framework for organizing available data to quantify and estimate each component of the water cycle and management activities

Alternative Demand Scenarios

Using the Butte Basin Groundwater Model as a foundation for the *Water Inventory and Analysis* allows for adjusting variables to estimate potential future conditions in the basin. Although predicting the future is an exercise subject to substantial uncertainty, we can make reasonable assumptions about potential future conditions for planning purposes and to better understand how the system may respond to potential changes. For example, land use plans have set targets for development for the next couple of decades. As a result, we can base future water demand on these plans. Changes in cropping patterns and associated irrigation practices can have a huge effect on total water demands, as well as the portion of demand met by surface water versus groundwater. Estimating potential shifts in cropping patterns allows for the evaluation of resultant water demands. Another important future consideration is the impact of short and long term drought periods on available water supplies. Lastly, climate change may alter groundwater recharge and water supply reliability. The *Water Inventory and Analysis* project will account for these and other considerations to support development of alternative agricultural and urban water demands and identification of associated water management challenges.

Project Timeline

June 1, 2016	Final Report presented to Water Commission
June 2016 (TBD)	Public Workshop

Butte County Department of Water & Resource Conservation

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