DATA GAPS

The following section identifies data gaps. We have selected the data and information gaps that would be the most useful to fill to inform the next phase of integrated watershed management planning.

LAND-USE

Updated General Plans for each County in the Watershed

Updated general plans for each county in the watershed will provide updated population growth projections and will present the preferred alternatives for growth and development. As a result of the plans and policies presented in the next generation of county general plans, portions of the Colusa Basin Watershed will experience some land conversion, which will both affect and be affected by issues related to stormwater management, groundwater use, flood control, habitat protection, and agricultural protection. Many of these issues are also central stakeholder concerns for this Watershed Assessment and presumably for future watershed planning. Therefore, there will be opportunities to integrate future watershed management planning with each county's comprehensive land-use planning actions.

This data gap should be filled by the proposed work of the counties within the watershed, provided they each update and adopt their renewed general plans according to schedule. The current Yolo County general plan dates to 1983, with a revised version due out in 2008 (Yolo County Community Development Agency 1983). The Colusa County general plan was adopted in 1989 with a horizon of 20 yrs (to 2010), but its housing element was updated in 2003. The remainder of this plan will be due for a revision to cover the 2010-2030 time period. The latest version of the Glenn County general plan was completed in 1993 and it was conceived as a 20 yr plan to be renewed in 2012 (QUAD Consultants 1993). It is also currently under revision.

GEOMORPHOLOGY

Fluvial Geomorphology for Stream Restoration and Bank Stabilization Design

Digital High-resolution Color Ortho Photos and Digital Topographic Contour Elevation Map (Air Photo DEM). The most useful database to acquire for fluvial geomorphic assessment and inventory work along the foothill streams and the Colusa Basin Drain would be a set of digital color orthophotos overlain by 1-ft interval topographic contours. These have multiple potential uses from hydraulic modeling and floodplain mapping for flood control alternatives, to riparian corridor mapping, restoration, management, and monitoring (discussed below). These would also document a baseline condition of the geomorphology of watershed lands. With its generally sparse tree cover, the Colusa Basin Watershed is well suited to digital topographic mapping using high-resolution aerial photos. For example, accurate stream cross-section and longitudinal bed profiles could be extracted directly from the DEM using Auto-Cad or ArcViewGIS. The DEM could be overlain with property boundary data so that site topographic maps could be quickly viewed and extracted for conceptual project design purposes, facilitating the preparation of grant applications to obtain funding for project design and construction.

Stream Bank Condition Inventory and Restoration Project Prioritization. No inventories have been made of the channelized, armored, and still intact sections of the foothill streams. Inspection of the 1:24,000 scale 1993-1999 air photos underlying the Colusa Basin Soil Survey maps reveal numerous locations where the riparian corridor appears relatively intact and the active channel and streambanks are presumably in a relatively natural condition. These features would be more accurately identified and screened using the Air Photo DEM described above. Using such an Air photo DEM as a field base map, these features could be mapped and evaluated using RTK GPS field inventory survey of the foothill stream corridors. Such a detailed survey overlay could be designed to have multiple objectives and resource management benefits. Topographic data collected under the stream canopy and along the toes of steep banks could be input into the surface model comprising the DEM so that topographic contours could be refined as necessary along the stream corridors. Mapped intact stream sections could be used as analogs for future stream restoration project design. Flood high water marks and debris lines could be mapped as input data for hydraulic models and proxy design discharge data for stream restoration projects. Bank erosion could be inventoried and correlated with the exposure of variously consolidated alluvial deposits (geologic units) exposed in the stream banks, and the effects of channelization and revetments.

Priority stream bank stabilization and stream and floodplain restoration projects could be identified and catalogued by the survey for future refinement and prioritization. Vegetation features could be mapped in detail and these polygons and point data could be viewed in their geomorphic context.

Landowner willingness to allow such a survey might be encouraged by landowner site interviews during the process of the survey work; there is much value in the cumulative landowner experience with channel modifications and maintenance work. Landowner experience should be considered as part of any future efforts to restore sections of the foothill streams.

Historical Geomorphic Analysis. The best repository of historical stream condition are the early air photos of the basin combined with field observations of geomorphic processes. Examining the earliest high quality set of 9" x 9" orthopair black and white air photos is recommended first to determine what information is available about the fluvial geomorphology of the foothill streams prior to much of the channelization and other riparian corridor modification that have taken place after 1850. For example, such an analysis combined with follow up field assessments could provide the best available information for documenting the timing and rate of channel bed incision. 1927 photos covering the watershed lands might be held at the Shields Library at UC Davis.

HYDROLOGY

Mean Daily Flow Data

Compared to other regions and large watersheds in California, the Colusa Basin watershed has very few historical streamflow data. Beginning now to collect mean daily flow data for some of the foothill streams would prove helpful anywhere stream restoration and riparian vegetation establishment work will occur in the future. It may make most sense to collect these data nearer the downstream ends of the foothill streams where riparian corridor restoration efforts generally

might be more successful both because the groundwater table is naturally nearer to the streambed elevation and seepage from applied irrigation water may be helping to sustain baseflows or wet conditions through the summer. Such data would represent baseline stream-groundwater conditions for evaluating success of any future groundwater recharge projects. It would be sensible to locate pressure-transducer type stage gages on bridge abutments at existing road crossings because stream banks are generally subject to frequent erosion and modification by landowners.

In the absence of new stream gage data, hydrologic conditions affecting stream bank and riparian corridor restoration project design and success can be indirectly assessed using groundwater monitoring wells to the extent that stream-groundwater interactions are understood (discussed below).

Peak Flow Data

The watershed also has very few historical annual peak flow data. Presently peak flow data are collected at only one gage: South Fork Willow Creek near Fruto under operations resumed by DWR after the 1998 flood. New peak flow data on foothill streams would be very helpful for stream restoration design, but landowner accounts might substitute for this purpose. New data may be more useful for refining the evaluations of potential flood management projects for mitigating crop damage incurred by summer and winter flooding along the Colusa Basin Drain. DWR (1990) recommended a list of first priority and second priority new gaging stations that is a good starting point for discussion.

Water Budget

The most recently compiled irrigation season water budget may be that of DWR (1990). A more recent water budget would be helpful for water supply planning purposes. It may not be feasible to prepare a reliable winter season or total annual water budget because there is presently only one gage collecting peak flow data.

DWR published semi-annual groundwater monitoring well data for about 98 wells in the Colusa Basin Watershed. These data are available for analysis. It may be helpful to prepare current Spring and Fall groundwater contour elevation maps for comparison to the 1975 and 1988 maps in DWR (1990) to understand groundwater elevation trends for planning groundwater management actions. This work is presumably being accomplished by the groundwater management plan efforts in each of the counties.

Flood Management

DWR (1962, 1964, 1990), CBDD, and USBR (Navigant Consulting, Inc. 2000; CH2MHill 2003), and many other miscellaneous engineering reports have compiled a lot of information over time in preparing and evaluating various combinations of potential flood protection measures in the watershed. Not all of the available information was obtained and reviewed in preparing this assessment.

Future flood management efforts would undoubtedly benefit greatly from generating the Air Photo DEM data described above. These data could be used to update the topography of historically inundated areas along the Colusa Basin Drain. The Air Photo DEM would probably also reveal the presence and configuration of new levees and other features affecting drainage. Bathymetry of the Colusa Basin Drain could be acquired using traditional surveying methods or possibly more efficiently using a boat-mounted depth sounding device and a boat-mounted RTK-GPS transceiver, and these data could be input into the surface model of the Air Photo DEM to improve its accuracy for the purposes of monitoring the need for and effects of channel dredging, and refining hydraulic models of the channel capacity.

The Air Photo DEM would also provide baseline channel condition data, located upstream and downstream from proposed or constructed foothill stormwater detention reservoirs. These data would facilitate monitoring and evaluation of potential geomorphic effects downstream from the dams.

The DEM data could be used as direct input data into hydraulic models of the foothill streams and could be used to measure channel conveyance capacity along their lengths and map floodplain surfaces. These channel capacities could be compared to calculated conveyance capacity at road and railroad crossings to identify and prioritize crossings needing enlargement.Water Quality

- Obtain more extensive groundwater quality data throughout the Colusa Basin to gain a better understand of where areas of lower quality water are located.
- Continue monitoring groundwater for nitrate.
- Monitor effectiveness of TMDLs as limits are implemented.
- Track pesticide use in the Colusa Basin to see if there are correlations or relationships with detections in water. Also look for relationships with changes in Best Management Practices.
- Increase water quality monitoring of Sacramento River tributaries in the watershed. Existing data is limited.

BIOLOGY

Vegetation

- Survey and map the extent of the following invasive plant species within riparian habitats and drainage canals: salt cedar, giant reed, and Ludwigia to provide further information for Weed Management Area coordinators.
- Identify locations of sensitive habitats (e.g., wetlands, riparian, sycamore alluvial woodland, oak woodland) that are currently not protected within NWR System or other conservation lands. Conduct a rapid assessment to characterize the functions and values of these sensitive habitat areas.

  Such survey work could be utilized not only to inform management planning, but also to identify reference sites for habitat restoration projects; sites which have been less

impacted by human activities and could potentially serve as models for restoration project design. Characterization of such reference sites could help to determine target ecosystem goals for ecological restoration projects (e.g., target topography, soils, hydrology, and plant community composition). For example, during this assessment we observed potential riparian habitat reference sites for foothill streams along Brush Creek (upstream of Boles Road), along the North Fork of Elk Creek, and along Elk Creek (upstream of the Hillgate Road crossing).

- Conduct a study to determine where riparian corridor improvements would be most efficiently supported by targeted groundwater recharge. The net effect of groundwater pumping and irrigation imports has likely been to raise the natural groundwater table nearer to or above the bed elevation of the foothill streams in the lower elevation reaches, near the valley flat. This effect could benefit riparian corridor restoration projects by providing shallow groundwater conditions conducive to the establishment of obligate, riparian vegetation. Future groundwater recharge projects could be designed to help restore riparian habitat by targeting recharge in foothill stream reaches lying immediately upstream from sufficiently wetted reaches.

Wildlife

Knowing the exact location of special-status wildlife species would enable proper assessments of potential project impacts. These assessments could be used for planning project locations, schedules and mitigation measures that would reduce these potential project impacts. It would also provide reference sites for future habitat restoration designs and enable coordinated planning to help maximize conservation benefits to special-status species.

Analyze and Summarize Existing Special-status Species Data for the Watershed. Much information and location data for many special-status species, excluding data in the California Natural Diversity Database, are not readily available and have not been summarized for the Colusa Basin Watershed and as such, signify a data gap. Many of these data exist as subsets of larger data sets and have not been summarized by the data-gathering institutions/agencies for the Colusa Basin Watershed. Other data have not yet been made available to the public. The task of identifying, collating and summarizing all of the potential data is a daunting task that may take many weeks to accomplish, provided that these data were readily available to the watershed assessment team.

The following are examples of existing data that could be collated and summarized for the watershed. There are data on the relative abundance of bird species in the national wildlife refuges in the Colusa Basin. Waterfowl counts are conducted each year along with nongame and upland gamebird surveys. Biologists from the Sacramento National Wildlife Refuge system have conducted a limited amount of surveys for Yellow-billed Cuckoos. There is also a dataset from point counts of birds from Point Reyes Bird Observatory that may include a few riparian locations within the Colusa Basin Watershed. Data from a recent Black Tern survey by PRBO should be incorporated. Additionally, recent statewide surveys for nesting Swainson's Hawks, Burrowing Owls and Tricolored Blackbirds and wintering Long-billed Curlews have been conducted and data for the watershed should be available once these survey reports are published. However, these surveys were not comprehensive and may have missed many areas

within the watershed. There may be additional data on giant garter snakes occurrences in the watershed that have not been uploaded into the CNDDB yet, and these would need to be included.

Collect New Data on Special-status Wildlife Species Habitat and Population Distributions. There does not appear to be much recent data on the relative abundance of special-status wildlife in the watershed outside of the national wildlife refuges and the Dunnigan Hills area and the following are representative of the types of basic locational data gaps thus far:

- locations of California Tiger Salamanders and their potential habitat outside of the Dunnigan area;
- locations of other vernal pool species such as vernal pool fairy shrimp, vernal pool tadpole shrimp, and western spadefoot toad;
- locations of areas with large stands of elderberry shrubs that provide important habitat for the valley elderberry longhorn beetle.
- locations where western pond turtles are successfully reproducing;
- locations and sizes of current Bank Swallow breeding colonies;
- nesting locations of special-status raptors outside of the national wildlife refuges;
- important Greater and Lesser Sandhill Crane wintering areas outside of the national wildlife refuges;
- locations and relative abundance of Grasshopper Sparrow;
- locations of riparian habitat patches that are occupied by or suitable for Yellow-billed Cuckoo, Purple Martin, Yellow-breasted Chat and California Yellow Warbler.