



5.0 HYDROLOGICAL CONDITIONS

5.1 SURFACE HYDROLOGY

The drainage patterns of the Paradise area reflect the uniqueness of its location on a gently sloping ridge surface. The Paradise area is dominated by a somewhat continuous overland runoff flow which is organized into local rills or depressions as the runoff is collected. There is localized erosion and siltation in these depressions or swales due to slope and the topography. However, the bulk of the runoff is shunted downslope to become runoff in lower stream systems.

The Paradise area is divided into fairly distinct drainage basins. These basins are mapped in the *Master Storm Drainage Study and Facilities Plan, Paradise, California* (McCain Associates, 1980). The drainage basins serve to collect the upslope surface runoff and direct it downslope. However, in these local drainage swales the flow is intermittent and only lasts briefly following rainfall. Due to the lack of a continuous flow, the characteristics of a system of active stream erosion have not developed atop the ridge surface.

The drainage basins' bottom configuration depth of incisement is very shallow, usually less than one meter. Thus, these drainage swales lack adequate capacity to convey runoff waters from lengthy storm activity during the winter months. Since the drainage basins are long and narrow, averaging one-fourth to one-half mile wide and four to five miles long, localized flooding may occur at various points. Downslope, these drainage systems have become incised into the basement volcanic rocks and have developed steeper sides and more clearly defined channels. Many of these channels carry a perennial runoff flow.

The drainage systems often coincide with groundwater seeps and springs which serve to increase the moisture availability beyond the intermittent flows directly related to storm runoff. Consequently, the drainage depressions and their downslope channels are often thickly vegetated.

As these areas are developed, the undergrowth and grass cover is often removed and channels are randomly excavated to suit the individual owner's or developer's interest. Often when this takes place, either through lack of knowledge, lack of funds or indifference, the resulting channel is inadequate in capacity and poses a real possibility of promoting damage. While the soils and subsoils of the Paradise area do not markedly aggravate the runoff situation, they also do not prove to be highly permeable. This often results in localized flooding which can be exacerbated by such land use activities as grading operations, vegetation clearance, inattention to storm runoff from construction sites during the peak winter rainfall period, large-scale paving and the lack of a collection system for storm waters. Storm runoff arrives at the principal drainage channels through overland flow for most of the Paradise area. Very few collector systems have been constructed and the primary form of collection has been through roadside ditches.

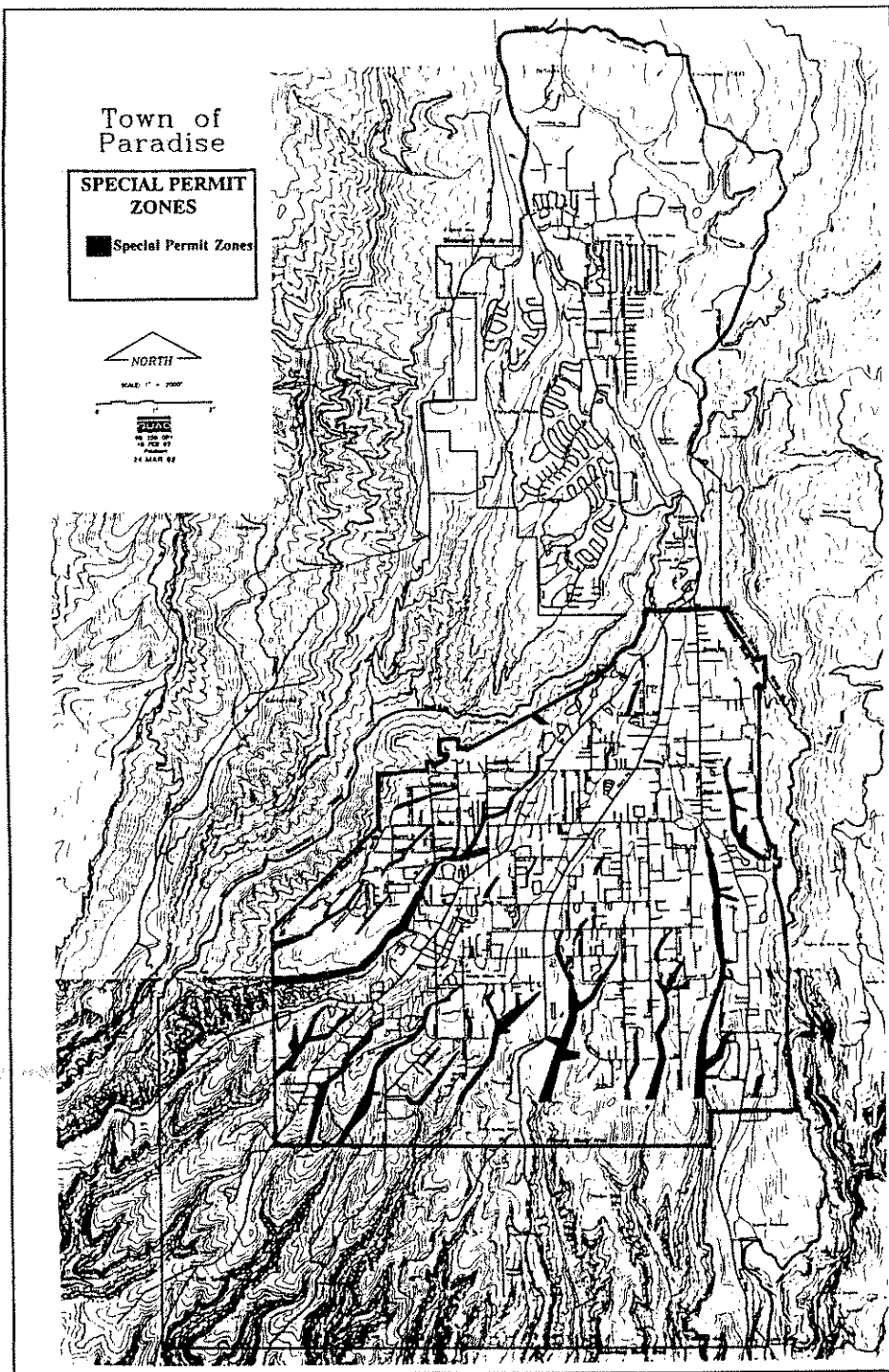


The major public roads running north and south are situated along ridges between basins and carry runoff south until intercepted by east-west roads. The roadside ditches along these roadways tend to get quite deep and create maintenance problems for town road crews and a somewhat unsightly and dangerous condition for motorists and pedestrians.

According to the *Master Storm Drainage Study*, the area studied is situated in such a manner that it is not subject to flooding from outside sources. Unlike many towns on the valley floor, no large streams or rivers pass sufficiently close to provide any threat. Primary overland flow from storm runoff, the inefficiency of local drainage depressions and roadside ditches to carry the intermediate flow and the aggravation of runoff efficiency by human activities has created a somewhat difficult situation for the management of present storm runoff. This situation also has implications for future development projects which could create further flooding difficulties.

The *Master Storm Drainage Study* considered the possibility of recommending flood zoning of the natural drainage channels. In order to properly describe and locate the boundaries of such a zone, detailed hydrologic and hydraulic studies must be made in order to determine the actual flood stage. The study concluded that this approach is more applicable to towns adjoining major streams and rivers. It requires that extensive topographic information and hydraulic calculations be made in order to determine the actual bounds of the design flood. According to the study, the nature of the topography, and lack of major streams and stream flow data, preclude this level of detail and make flood zoning impractical.

As an alternative, the study recommended the establishment of general areas where special clearance should be required prior to construction of improvements. This approach, called "special permit zones," requires the developer or property owner to verify that adequate provisions are provided for design flows. The special permit zones are depicted in Figure 5-1. The study includes recommended design criteria within the special permit zones. The study cautions that the special permit zones do not indicate limits of flooding.



SPECIAL PERMIT ZONES

FIGURE 5-1



5.2 WATER QUALITY

It has been reported (*Town of Paradise Wastewater Management Study, Supplementary Phase 1 Report, 1984*) that there has been contamination of small streams in or emanating from the Paradise area associated with surfacing septic tank effluent.

The layered geology beneath Paradise has led to the formation of several aquifer zones. Depending on local conditions of permeability, weathering and fracturing, the aquifers may have some hydraulic continuity. Beneath Paradise, groundwater movement is generally in a north-to-south direction, although some flow does occur toward Butte Creek and West Branch Feather River Canyons. It is estimated that there are approximately 300 privately owned wells in Paradise which supply water for irrigation and domestic uses. Most wells penetrate into the Tuscan Formation and generally are less than 200 feet in depth.

The most shallow groundwater body consists of perched water lying atop the Tuscan Formation. Influenced by seasonal precipitation and local recharge from onsite wastewater disposal systems, this perched, unconfined groundwater does not produce dependable yields of usable quantity. The underlying Tuscan Formation, however, does have weathered and permeable zones which yield significant quantities of groundwater. Based on a review of well logs for the Paradise area, the Tuscan Formation typically yields usable water at depths of less than 200 feet. Much of the water is under pressure indicating at least partial confinement of some of the water-bearing zones. The upper portions of the Tuscan Formation may hold unconfined water which receives recharge from the Paradise area and could be subject to contamination by septic systems.

Beneath the Tuscan Formation lie the auriferous channel aquifers, which contain large quantities of high-quality water. Since the auriferous, or gold-bearing, channels occur at substantial depths and underlie only limited portions of Paradise, they remain relatively untapped. Due to their depth and apparent confinement, the auriferous channels do not appear to receive significant recharge from surface water or septic systems in Paradise.

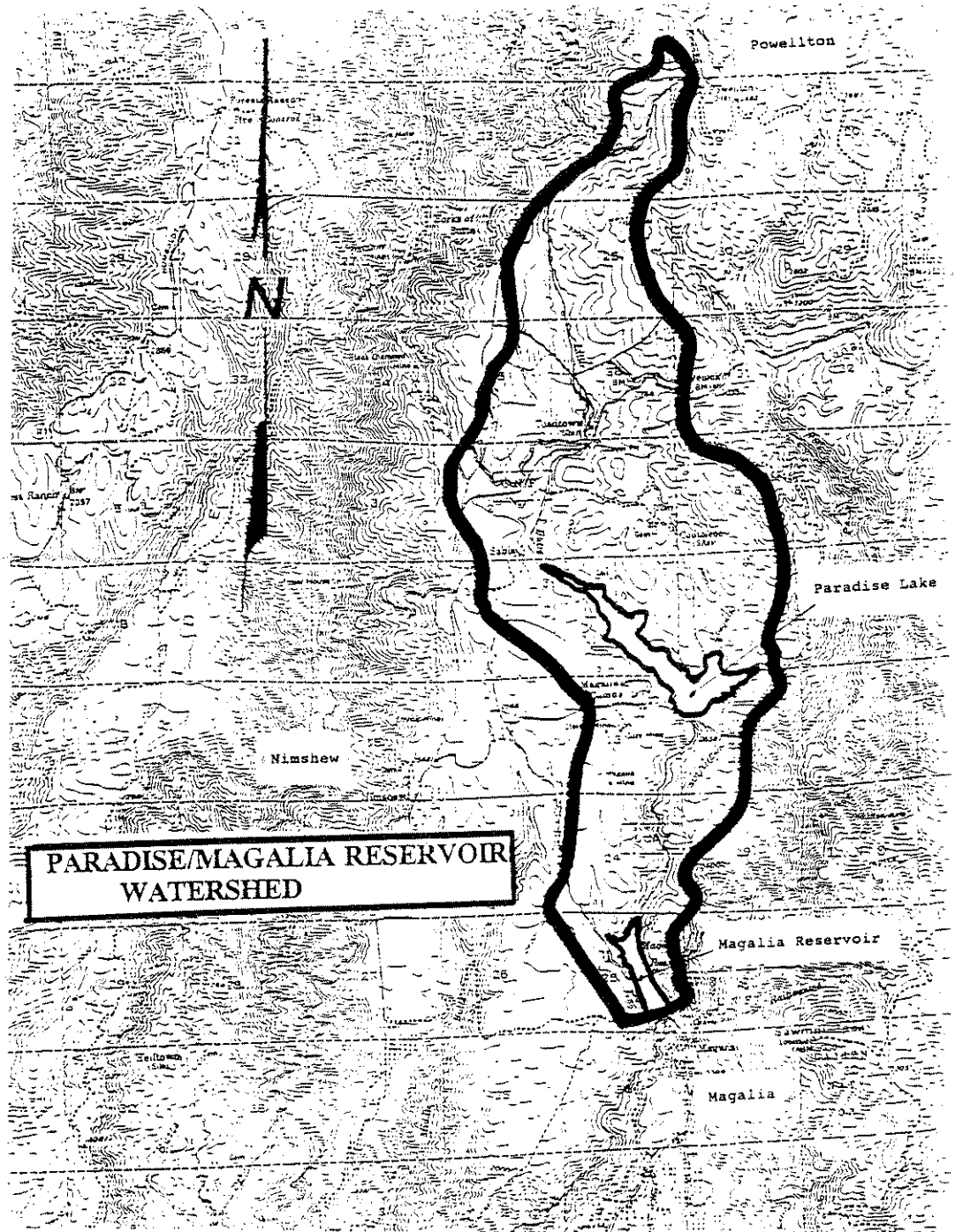
The Metamorphic Basement Complex is well consolidated with few weathered or fractured zones and thus is not expected to yield large quantities of water. Only the deepest wells in Paradise appear to penetrate this formation. Like the auriferous channels, the basement complex lies well beneath septic systems and should not be subject to contamination from on-site wastewater disposal.

Septic tank/leach line failures in Paradise do not affect water supplies distributed by the Paradise Irrigation District since its sources are outside the urban area. Local shallow wells which were dug long ago and which may still have limited use may be affected.



Factors that may affect the domestic water quality and supply for the Town of Paradise:

- a. Surface water protection from siltation, contamination and other pollutants.
- b. Logging operations within the Little Butte Creek watershed.
- c. Development within the Little Butte Creek watershed.
- d. Unauthorized land use activities within the Magalia/Paradise watershed protection zone.
- e. Legal issues related to appropriation of water and associated water rights.
- f. Regulations concerning treatment requirements of surface water.
- g. Long-term precipitation averages (e.g. drought conditions).
- h. Storage capacity of Paradise Lake and Magalia Reservoir.
- i. Potable water treatment, storage and distribution system capacities and conditions.
- j. Water reclamation and reuse regulations and practices.
- k. Seepage and loss of water supply from reservoirs and delivery system network.
- l. Funding sources for required system maintenance, upgrades and necessary facilities expansion to meet existing or future demand.



PARADISE/MAGALIA RESERVOIR WATERSHED

FIGURE 5-2



5.3 TOWN AND DISTRICT RESPONSIBILITIES

The Town of Paradise exercises, through the Town Engineer and the Community Development Department, regulatory responsibility for the provision of adequate drainage facilities for new developments. The town also provides maintenance for drainage facilities within public rights-of-way.

North of and adjacent to the town, County Service Area No. 4 provides periodic maintenance of drainage facilities in county rights-of-way for the community of Paradise Pines. The county requires drainage improvements as a condition of development.

The recommendations of the above-referenced *Master Storm Drainage Study and Facilities Plan* (1980) with respect to detention basins, channel improvements, and culvert upgrading are implemented to the extent that funding and regulatory authority with respect to new development permits.