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Allen Robertson, Deputy Chief
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P.O. Box 944246
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Northern Region Headquarters
California Department of Forestry
135 Ridgeway Avenue
Santa Rosa, CA 95401

Subject: Evaluation of Potential Hydrologic Effects
THP No. 1-04-059 SON and Proposed Mitigated Negative Declaration TCP No.04-531
Sleepy Hollow (Martin) THP/Conversion, Annapolis, California

Dear Mr. Robertson:

I am a hydrologist with over seventeen years of technical and consulting experience in the fields of geology and hydrology. I have a Master's of Science degree in Geology received from Miami University (Oxford, Ohio) in 1989 and am a California Registered Geologist and Certified Hydrogeologist. I have been providing professional hydrology services in California since 1991 and routinely manage projects in the areas of surface- and groundwater hydrology, water supply, water quality assessments, water resources management, and geomorphology. Most of my work is located in the Coast Range watersheds of Northern and Central California. I have been working professionally in the Gualala River watershed for over three years, most recently completing hydrologic investigations in support of a resource management plan for the lower Gualala River and estuary on behalf of the Sotoyome RCD and State Coastal Conservancy. My areas of expertise include: characterizing and modeling watershed-scale hydrologic and geomorphic processes; evaluating surface- and ground-water resources/quality and their interaction; assessing hydrologic, geomorphic, and water quality responses to land-use changes in watersheds and causes of stream channel instability; and designing and implementing field investigations characterizing surface and subsurface hydrologic and water quality conditions. I also teach an annual course on hydrology and geomorphology through the University of California Extension (Berkeley) and provide technical talks to community and non-profit groups. I co-own and manage a hydrology and engineering consulting firm in San Rafael, California (established in 1997).

The purpose of this letter is to present my comments and opinions regarding likely project induced environmental impacts in the Little Creek and Grasshopper Creek watersheds associated with the Sleepy Hollow (Martin) Timber Harvest Plan and (Vineyard) Conversion (THP Number 1-04-059 SON and TCP No. 04-531). My conclusions are based on reviewing the following project planning documents:

- The Sleepy Hollow THP/Conversion, THP No. 01-04-059 SON, prepared by Randy Jacobszoon on behalf of Emily Martin and received by the CDF (Coast Area Office, Resource Management) on March 26, 2004;

- Initial Study and Proposed Mitigated Negative Declaration for Sleepy Hollow Timberland Conversion, Timberland Conversion Permit No. 04-531, prepared by Randy Jacobszoon, (RPF#2498) for California Department of Forestry and Fire Protection, Environmental Protection, Sacramento, California (dated March 2004) and received by CDF on March 26, 2004;

- Erosion Control and Mitigation Plan, Sleepy Hollow Vineyard, 40445 Sleepy Hollow Road, Annapolis, CA 95412, prepared by Erickson Engineering, Inc., October 21, 2003 (hereafter referred to as 2003 Erickson report);

- Preharvest Inspection report for THP 1-04-059 SON, prepared by Scott A. Gergus, Engineering Geologist with California Regional Water Quality Control Board, North Coast Region (RWQCB), dated June 10, 2004 and received by CDF on June 14, 2004;

- Preharvest inspection recommendations for THP 1-04-059, prepared by Stephen Smith and Kenneth Margiott (CDF), dated April 20, 2004; and

- Internal CDF preharvest inspection memorandum from Department of Forestry and Fire Protection, Sonoma-Lake-Napa Ranger Unit, to Wayne Mitchell, Acting Region Chief, dated April 20, 2004.

Many of the data, assumptions, site characteristics, and conclusions regarding potential impacts to local and watershed hydrologic conditions are incorrect and/or misleading in the THP and TCP reports (especially the 2003 Erickson report). Contrary to the conclusions presented in these reports, the THP/Conversion project may have significant negative impact on the environment and surrounding property owners. Because these documents do not accurately evaluate the potential impacts to hydrologic conditions, the project should be required to prepare an Environmental Impact Report (EIR) in order to correct these deficiencies. The rational for these statements are presented below.

Potentially Inaccurate Watershed Runoff Estimates

The quantification of project-induced changes in storm water runoff is an important first-step in determining if a project will exacerbate erosion and sediment supply to downstream reaches, a leading cause of impaired water quality in the Gualala River watershed. No analyses or defensible data are presented to substantiate the claim that “runoff should not be appreciably changed as a result of project implementation” (2003 Erickson report, page 4). This claim is based solely on the assumption that, “soil type and condition will remain the same after project implementation” and “a permanent grass cover crop will be substituted for second growth timber and brush, with similar infiltration rates” (2003 Erickson report, pg. 4). The processes that control storm water runoff (rainfall interception by trees and brush, infiltration, vegetation density, evapotranspiration, soil properties, etc.) differ significantly between a vineyard with grass cover and forest.

Based on review of available watershed data, the 50-percent runoff factor presented in the 2003 Erickson report underestimates storm and annual runoff totals. Long-term annual runoff totals at a U.S. Geological Survey (USGS) stream gage on the South Fork Gualala River indicate that 63-percent of annual rainfall exits the watershed as runoff[1]. Thus, storm and annual runoff totals, and associated erosion potential, estimated for the THP project site may be 20-percent lower than those actually measured in the project watershed.

From a water supply perspective, the runoff discrepancy may translate into significantly reduced water availability for groundwater recharge (i.e. instead of 50-percent of annual rainfall being available for

[1] Rantz, S.E., 1974, Mean annual runoff in the San Francisco Bay Region, California, 1931-70. United States Geological Survey, Water Resources Division Miscellaneous Field Studies Map (MF-613).

infiltration and "contributing to low-flow based flows in the lower reaches of Little Creek" (2003 Erickson report, page 4), only 37-percent will be available for infiltration. Another problem is that these figures only reflect existing watershed conditions. In order to properly quantify the impacts of the project on hydrologic conditions, one needs to develop a detailed water budget comparing the perceived gains in available soil moisture as a result of logging against the retained vegetation water demands (evapotranspiration) and infiltration potential from the altered substrate. The relationships between groundcover type and infiltration potential are well understood as exemplified in the attached Figures. In general, these figures[2] demonstrate:

- Increased organic cover leads to increased infiltration rates;
- Areas covered in vegetation have higher infiltration rates than cultivated areas; and
- Forested areas commonly have higher infiltration rates than grasslands.

The last of these bullets is in direct opposition to the claim in the 2003 Erickson report that states the vineyard will have an infiltration rate similar to forested conditions.

Potentially Inaccurate Water Budget Parameters

Review of available rainfall data for the project area suggests that the 2003 Erickson report is overestimating the average annual precipitation total for the site. In turn, overestimating the rainfall total overestimates the magnitude of both the runoff and infiltration variables (both expressed as percentage of total average annual rainfall), used to evaluate available project water supply. The 2003 Erickson report estimates potential runoff and infiltration based on 70-inches of annual precipitation. A 1971 USGS[3] isohyet (lines of equal average annual rainfall) map indicates a mean annual rainfall total of 44-inches for the project site. The 1974 USGS runoff report (see citation under footnote 1) reports a "mean annual basin wide" rainfall total of 51-inches for the South Fork Gualala River gage near Annapolis. The California Department of Water Resources Bulletin 118 reports an average annual rainfall total for the Annapolis area ranging from 36- to 49-inches[4]. The long-term (1976-2003) average annual rainfall total for Annapolis as determined from data obtained from the local news paper called the Independent Coast Observer is 58.2-inches. And finally, rainfall data (1959 - 2000) collected by Fred Radtkey at the Hedgepeth Ranch, located approximately 9 miles Southeast of Annapolis, yields an annual average rainfall total of 57.2-inches. Although some values are somewhat dated, the magnitude of discrepancy is not attributable solely to differing periods of record and a more in-depth analysis of a representative value is warranted.

The 2003 Erickson report also indicates that the long-term vineyard irrigation water demand is based on 20-gallons per vine per irrigation season (page 5). However, in the following report section, Erickson indicates that the minimum vineyard evapotranspiration rate translates to 85-gallons per vine per 4-month irrigation season. Evapotranspiration (ET) is the sum of evaporation from soil and plant surfaces and transpiration, which is the evaporation that takes place within the plant leaves and the vapor that diffuses into the air through pores (stomata) on the leaf surfaces. The amount of ET that takes place any given day depends on weather (esp., solar radiation, air temperature and wind speed), crop age, crop size and

[2] All figures from, ASCE, 1996, Hydrology Handbook. ASCE manuals and reports on engineering practice No. 28, 784p.

[3] Rantz, S.E., 1971, Mean annual precipitation depth-duration-frequency data for the San Francisco Bay Region, California. United States Geological Survey, Water Resources Division open-file report, prepared in cooperation with the U.S. Department of Housing and Urban Development, 23p.

[4] California Department of Water Resources, 2003, California's Groundwater. DWR Bulletin 118, updated 2003.

roughness. It is unclear to me how a viable vineyard can be sustained throughout a 4-month summer growing season under a state of water deficit, year-in and year-out. Vineyard water budgets I have reviewed and developed in the past have always have always assumed that water application over the growing season would satisfy the existing water demand based on estimated or calculated vineyard evapotranspiration rates. If, over time, it is determined that similar project water demands exist, the project will need to increase groundwater pumping by as much as a factor of 425-percent. As discussed below, satisfying this demand through increased groundwater extraction may not be feasible, let alone the potential environmental impacts associated with groundwater pumping.

Inaccurate Description of Groundwater-Surface Water Interaction
Erickson characterizes site surface water-groundwater conditions as, "two independent and unrelated sources of water" and that, "there is no scientifically valid way to directly correlate well water levels or yields in any area with local rainfall patterns or with surface runoff patterns." It is my experience and professional understanding that nothing could be further from the truth, and that surface water and groundwater resources are closely interrelated in the Gualala River watershed. The following narrative describes the geologic setting, history, and conditions within the project vicinity and the dominant processes controlling groundwater recharge and discharge to and from local aquifer system.

The project site is underlain by the Ohlson Ranch Formation, which, in turn, lies above Franciscan Complex bedrock. The main water bearing formation in the area is the Ohlson Ranch Formation (DWR, 2003; see footnote 4). This Formation consists of sandstone, siltstone, and conglomerate. The underlying Franciscan Complex consists of complexly folded and faulted metasedimentary (cemented), volcanic, and intrusive igneous rocks. The Franciscan Complex is considered non-water bearing relative to the Ohlson Ranch Formation, although it can yield enough water to wells for domestic uses (DWR, 2003). Evaluation of local geologic maps and reports along with regional geologic cross-sections indicate that the contact between the Ohlson Ranch and Franciscan Complex is essentially a horizontal to slightly eastward dipping plane, resulting in the thickest portions of the Ohlson Ranch Formation being located beneath the higher elevations of area ridges[5, 6, 7, 8]. The lateral extent and thickness of the Ohlson Ranch Formation deposits are the primary control over groundwater storage capacity within these aquifers. Thus, in essence, the "Annapolis Ohlson Ranch Formation Highlands Groundwater Basin" described and named by DWR (2003), is actually an assemblage of independent and disconnected aquifers occupying the ridge tops, the extent to which can be determined from outcrop and geologic maps.

The sequence of geologic events that lead to this configuration is as follows. After emplacement, the Franciscan Complex, it was eroded to a relatively flat plain along the coast. About five million years ago, this surface was covered by silts, sands, and gravels of the Ohlson Ranch Formation in what was likely a broad shallow marine embayment covering most of Sonoma County (Blake et al., 1971; Rice and Strand,

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[5] Blake, M.C., Jr., Smith, J.T., Wentworth, C.M., and Wright, R.H., 1971, Preliminary Geologic Map of Western Sonoma County and Northernmost Marin County, California. U.S. Geological Survey and U.S. Department of Housing and Urban Development, San Francisco Bay Region Environment and Resources Planning Study Map (scale unknown; partial copy).

[6] California Department of Water Resources, 1975, Evaluation of groundwater resources: Sonoma County, Volume 1. Geologic and hydrologic data, Bulletin 118(4), prepared in cooperation with Sonoma County, 177p.

[7] Travis, R.B., 1952, Geology of the Sebastopol quadrangle, California. California Department of Natural Resources, Division of Mines Bulletin 162, 33p.

[8] Huffman, M.E., and Armstrong, C.F., 1980, Geology for planning in Sonoma County. California Division of Mines and Geology, Special Report 120, 31p.

1971[9]). Following deposition of approximately 500 feet of deposits, the combined effects of a net fall in sea level and uplift of the coastal mountains led to erosion and down cutting into the Ohlson Ranch Formation. Today, the Ohlson Ranch Formation ranges in thickness from about 20 to 160 feet and caps area ridge tops (DWR, 2003).

Reported yields from this formation range from 2 to 36 gallons per minute (gpm). It is reported that some wells in this formation go dry in the fall months (DWR, 2003). This phenomenon is due to dewatering of the aquifer by natural outflow at springs and seeps, and human-induced well pumping. Thus, the water table in the Ohlson Ranch Formation aquifers display a seasonal cycle of rise and fall in concert with infiltration and recharge during winter rains and declining levels during the summer dry season. The rate of summer decline in water levels and aquifer storage is controlled by the rate of natural and human-induced withdrawals. Similarly, the rate and total amount of wet-season recharge is dictated by available infiltration of rainfall.

Field observations and geologic mapping indicate that most area springs occur at the Ohlson Ranch-Franciscan Complex contact, where relatively coarser and higher permeability sands of the basal Ohlson Ranch Formation lie on top of relatively impervious Franciscan bedrock. In fact, once this association was understood, the location of seeps, springs, and wetlands become a useful aid in identifying and mapping the location of the Ohlson Ranch-Franciscan Complex contact. Because there is a finite amount of storage associated with each Ohlson Ranch Formation aquifer, most spring/seep flow rates fall off throughout the dry season, similar to seasonal declines in well water levels.

Typically, in a water supply evaluation, it is assumed that there are no impact to groundwater resources if long-term natural groundwater recharge at a site is equal to or greater than the estimated consumptive use rate. Unfortunately, the THP/TCP analyses assume that project groundwater extraction for irrigation is the only consumptive use of groundwater beneath the site worth quantifying. Other potential consumptive uses at the site such as seasonal/perennial supplies to seeps, springs, and creeks that maintain aquatic and riparian habitats are not addressed. In addition, the cumulative or off-site effects from project groundwater pumping on existing consumptive uses are not addressed. Potential existing adjacent off-site consumptive uses include domestic, agricultural pumping as well as recharge to headwater wetlands, creeks and valley-bottom rivers that maintain water supply and beneficial water quality to aquatic organisms and riparian vegetation.

No Evaluation of Groundwater Safe Yield and Potential Pumping Impacts

Based on: 1) my experience in conducting hydrologic investigations at sites and watersheds containing Ohlson Ranch and similar formations, 2) the lack of meaningful subsurface and aquifer (pump) test information presented in the THP, and 3) the conceptual model of the groundwater conditions presented above, it is my opinion that the subsurface conditions and water bearing capacity have not been sufficiently characterized at the project site to make any definitive statements as to whether the project will or will not adversely impact surrounding wells, seeps, springs, or other consumptive users.

Information that is most commonly used to delineate and quantify aquifer size beneath a site includes driller boring-logs for wells. These logs provide descriptions of the characteristics of materials encountered during drilling including rock type and moisture content. Along with a knowledge of surface outcrop locations, descriptions from borings assist in extrapolating individual stratigraphic units between sites.

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[9] Rice, S.J., Smith, T.C., and Strand, R.G., 1976, Geology for Planning, Central and Southeastern Marin County, California. California Division of Mines and Geology Open File Report 76-2 (includes numerous plates).

Once an aquifer is identified in the Ohlson Ranch Formation, a well pump test is necessary in order to evaluate its water bearing properties. If performed correctly, a well pump test can quantify the maximum pumping rate from the aquifer as well as a storage estimate for the aquifer. These parameters that are needed to determine the safe yield from an aquifer. However, in order to begin evaluating pump test results, one needs to know where the well is screened (i.e. from what layer or unit is it drawing water), and if surrounding monitoring wells are screened in the same hydraulically connected unit. Without detailed information regarding the subsurface lithologies encountered during drilling and production well construction details (i.e., depth, screened interval, sand pack interval, etc.), no defensible evaluation of the interconnectedness between on-site and off-site water bearing units can be made. This type of information is not presented or discussed in the 2003 Erickson, or any other, report therefore making it impossible to determine whether the effects of pumping from one well could affect another nearby well. Therefore, it is my opinion that there is not enough information presented in the THP/TCP, to adequately evaluate the results of the aquifer pump test mentioned the 2003 Erickson report. The results presented in the THP/TCP do not provide enough information to evaluate and/or quantify aquifer properties in a standard fashion. Typically, information that is collected and reported as part of standard aquifer (pump) test of an irrigation well includes:

- Continuous water levels in the pumping wells for a 24- to 72-hour pumping period;
- Water level recordings collected over an equal length of time after pumping has stopped to monitor the rate and extent of water level recovery;
- The pumping rate that produces an equilibrated (i.e. non-varying) water level condition after a reasonable duration of pumping; and
- Impacts on surrounding wells, springs/seeps, and creeks.

Such an evaluation is necessary to make any defensible conclusion regarding potential impacts to groundwater resources as a result of pumping from the project irrigation well(s), or any other proposed well.

Lack of Cumulative Effects Impact Assessment
the hydrology and water development reports submitted as part of the THP/Conversion contain a number of misleading and inaccurate conclusions. They focus solely on how perceived changes in discrete variables will impact the overall water balance. This is a flawed approach, as it does not consider the cumulative/net effects of additive or competing processes and variables. A proper evaluation should also account for and integrate surface water (e.g., runoff, infiltration, etc.) and groundwater (e.g., withdrawals) conditions and processes. These hydrologic processes are intrinsically linked at the project site and conclusions suggesting there will be no change in runoff patterns or there is no link between surface water and groundwater resources are inaccurate without characterizing and simultaneously evaluating the other dominant processes at play (e.g., increased runoff, reduced infiltration, groundwater withdrawals, etc.).

If you have any questions or wish to discuss any opinions in this letter, please call me.

Sincerely,

Greg Kamman
Principal Hydrologist

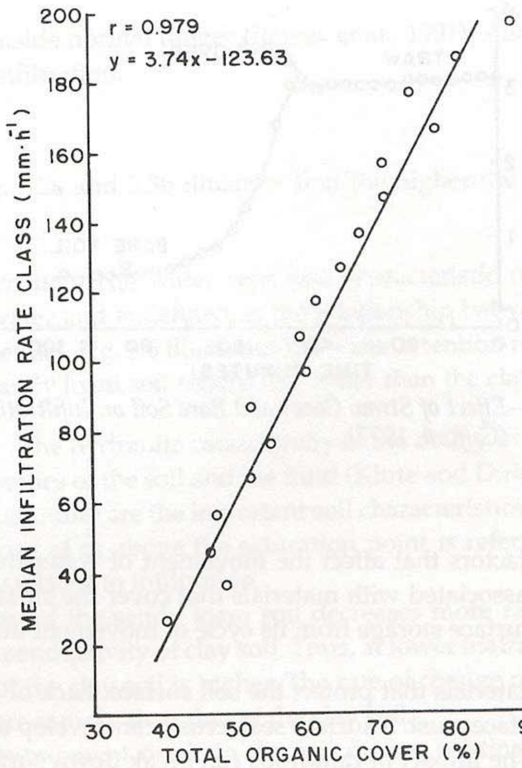

Figure 3.8.—Relationship of Median Infiltration Rate Classes with Total Organic Cover (%), Edwards Plateau, TX (Thurow, 1985).

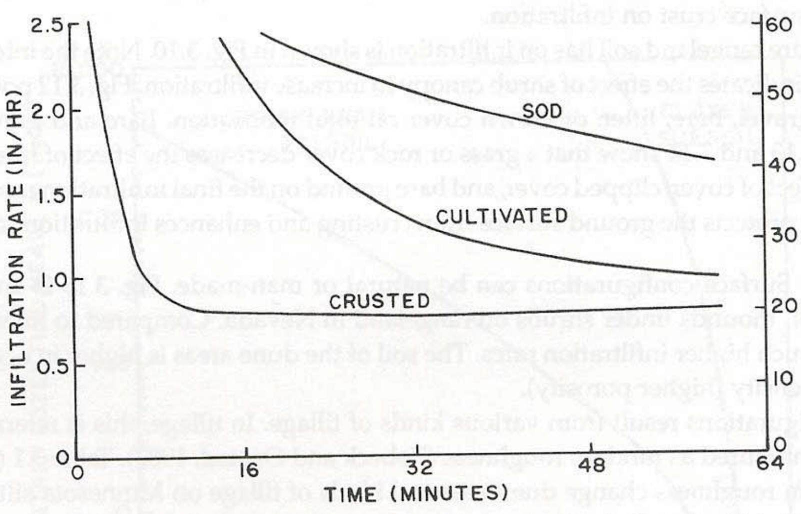

Figure 3.9.—Effect of Surface Sealing and Crusting on Infiltration Rate for a Zanesville Silt Loam (Skaggs and Khaleel, 1982).

Source: ASCE, 1996 (see Footnote 2)

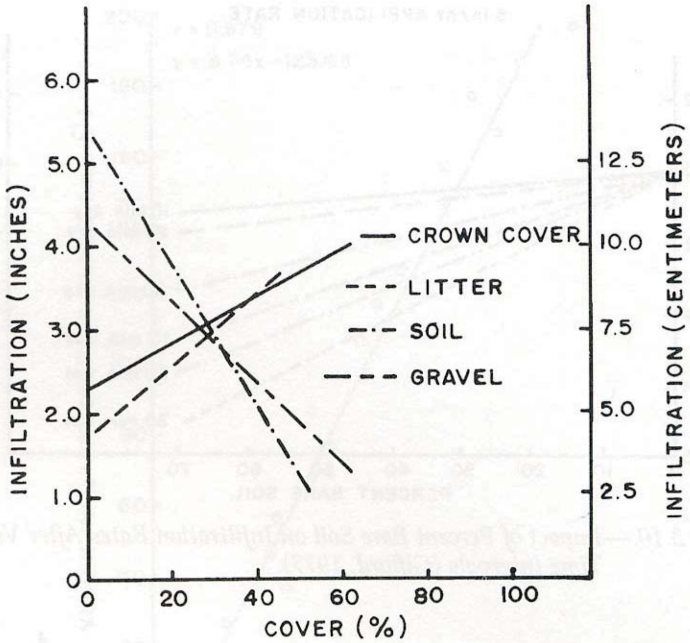

Figure 3.12.—Relationship of Various Covers to Infiltration Rates (Gifford, 1977).

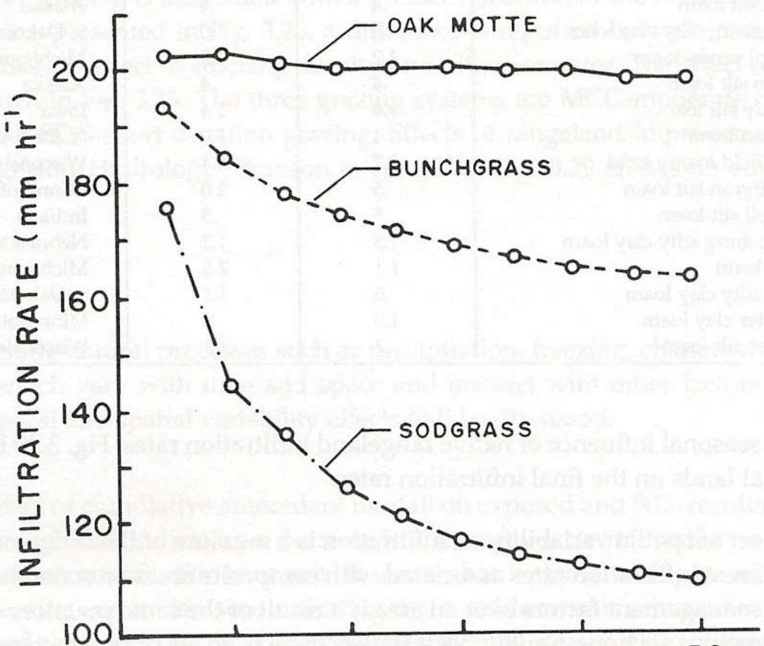

Figure 3.22.—Mean Infiltration Rates for Three Vegetation Types, Edwards Plateau, TX (Thurow et al., 1986).

Source: ASCE, 1996 (see Footnote 2)

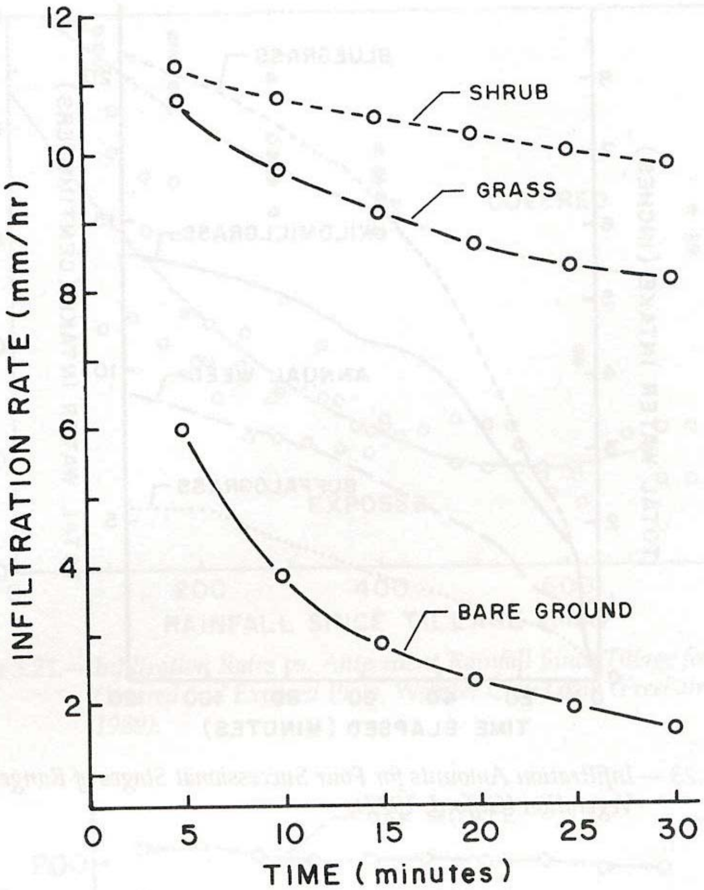

Figure 3.24.—Mean Infiltration Rates for Shrub (GRBI), Grass (CHRO), and Bare Ground (BAGR) (Mbakaya, 1985).

Source: ASCE, 1996 (see Footnote 2)