Review of Nestle Waters North America Inc. Water Bottling Project Draft Environmental Impact Report / Environmental Assessment

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Presented to:

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Executive Summary

The McCloud River watershed drains the east and southeast slopes of Mt. Shasta. Heavy winter snowpack and glaciers provide much of the watershed's water storage. Much of the snowmelt infiltrates into the streambeds below the glaciers and recharges the aquifers. The recharge water flows through extremely porous and conductive aquifers, primarily of volcanic origin, and discharges from springs along the base and in the foothills of Mt. Shasta. Big Springs, which discharges into the McCloud River upstream from the Lake McCloud, is by far the largest of these springs.

Nestle proposes to withdraw water directly from springs and streams and develop wells in the region's aquifers. Nestle will use the water in various bottling ventures. The project includes the purchase of spring water currently being diverted from Intake (Squaw Creek), Upper Elk, and Lower Elk Springs by the McCloud Community Services District, the potential installation of boreholes to intercept spring flow before it is captured by and diverted from the existing springhouses, and the potential purchase of groundwater from the McCloud Community Services District from water supply wells installed at the mill site.

If implemented, the project will have two major impacts. First, diverting spring discharge directly from the springs will decrease the surface flows below the spring and below the point where overflow currently returns to the streams. Second, Nestle's groundwater development will pull water directly from aquifers which supply flow to downgradient springs and existing wells.

The DEIR/EA does not describe the project sufficiently to adequately predict the project impacts. The problems include uncertainty over the relative amount of the water that will be drawn from the springs and how much will be pumped from a to-be-determined number of wells to be dug near the bottling plant (mill site). There are also significant questions about Nestle's agreement to use only up to 1600 af/y because the contract it has with the McCloud Community Service District (MCSD) has no such limitation; the record of decision must include a limitation that prevents the pumpage of more water and if Nestle desires to increase its pumpage it must do additional CEQA/NEPA analysis.

The surface water flow estimates provided in the DEIR/EA are incorrect because they rely on runoff coefficients not appropriate for the spring flow dominated streams. The streamflow estimates are also inappropriate for this analysis because they are annual averages that do not reflect seasonal variability. If Nestle removes the proposed amount of water from Mud Creek, for example, the flow during low flow periods will be decreased by about 45 percent.

The proposal for developing spring water will decrease the amount of water in Squaw Valley and Mud Creeks by an amount equal to that which is no longer returned as an overflow. Currently, this return flow supports flow below the point of return; the DEIR/EA does not adequately map the point of return flow. The DEIR/EA also does not consider the effect of this return flow on downstream water rights.

The DEIR/EA indicates that Nestle could develop wells at the plant site. USGS studies of the McCloud area aquifer show substantial seasonal water level changes and the wells have mostly been considered "low yield" probably due to low storativity. The DEIR/EA provides almost no assessment of the hydrogeology of the aquifer; it does not even reference the USGS studies. The DEIR/EA conceptualizes the recharge/discharge regime of the aquifer correctly by describing that recharge occurs through the mountain block and streambottoms and discharge is primarily to springs. But it does not discuss the magnitude of flows or the amount of groundwater storage in the aquifer; without a water balance assessment there is no opportunity to assess the effect of pumping or diverting the amount of water proposed herein. There is no basis for the claim the DEIR/EA makes that a well-designed production well should be able to yield much higher amounts of water than the nearby domestic wells. However, the DEIR/EA does not analyze the potential effect of these wells other than to note that there could be a significant impact to water levels.

Based on the USGS studies, developing one or more production wells near McCloud could have very detrimental effects on nearby domestic wells. Because of the unique hydrogeology of the McCloud area aquifer, pumping a large amount of water from within the shallow zone of the aquifer or from a deeper high yield zone could lower the water table significantly near the area's domestic wells. This would occur even if the production well screen is hundreds of feet below the domestic wells because of the likely hydraulic connection. The amount of drawdown cannot be assessed without detailed hydrogeologic assessment of the aquifers near the plant site.

Both the surface water and groundwater aspect of this project should have additional research completed and included in the environmental impact report. The inclusion of this additional research would allow the environmental document to fulfill the legal requirements of CEQA which is to analyze, disclose, and effectively mitigate potentially significant environmental impacts. In addition to a much improved project description and ironclad limits on the amount of pumpage which will occur, additional data and analyses should be collected and completed as follows:

- Nestle should install gaging stations on Squaw Valley and Mud Creeks at the point the springs would naturally discharge into the streams and the point where overflow reaches the stream. Surface flows should be collected for at least two years to determine accurate loss rates. On Mud Creek, a downstream point should be chosen which would allow an assessment of flow loss rates.

- The surface water data should also be compared with existing nearby long-term gages to estimate annual runoff averages and seasonal fluctuations. Comparison with nearby gages using regression or other area proportion analyses could be acceptable.

- In lieu of gaging stations, this data could be collected with weekly spot measurements.

- The groundwater assessment should include exploration of the hydrogeology near the mill site. It should include an assessment of the stratigraphy and a pump test.

- The pump test requires a deep pumping well and at least two deep observation wells. The wells should be at least as deep as the potential production wells. The well should have the capability of pumping at multiple levels to test the hydrogeologic parameters at differing levels. The observation wells should also be multi-port or otherwise have the capability of monitoring groundwater levels at multiple levels simultaneously.

- Using the well logs from these deep wells, there should be a detailed description of the stratigraphy beneath the site.

- The wells should be used for a multi-week pump test; the response of groundwater levels would allow the agencies to determine whether it is possible to develop large quantities of water at this site without drying shallow wells. The test would help to determine the hydraulic connection among aquifer levels.

- At least one of the monitoring wells should be retained as such for long-term project monitoring.

- There should be a reportable and an enforceable mitigation plan based on the monitoring water levels that will provide for pumping decreases or cessation when necessary.

NEPA and CEQA require that an agency collect data that is reasonably available. Both the surface water and groundwater data is reasonably obtainable, and in the case of the groundwater, the wells may be used during production. The agencies should not, and may not legally be able to, approve a project without knowledge of the basic information these tests can provide. The DEIR/EA should be withdrawn and new data should be collected and analyzed. Then, the DEIR/EA should be released in draft form for adequate review.

The impacts analysis is based on very poor data collection and analysis, as outlined throughout this review. Impacts concerning groundwater depletion, water quality, surface water flow, and effects on a public water supply are likely significant; there is at least not sufficient data or analysis to claim the impacts are not significant. None of the potential impacts has any real mitigation proposed to offset the impact.

Introduction

The McCloud River watershed drains the east and southeast slopes of Mt. Shasta. Heavy winter snowpack and glaciers provide much of the watershed's water storage. Much of the snowmelt infiltrates into the streambeds below the glaciers and recharges the aquifers. The recharge water flows through extremely porous and conductive aquifers, primarily of volcanic origin, and discharges from springs along the base and in the foothills of Mt. Shasta. Big Springs, which discharges into the McCloud River upstream from the Lake McCloud, is by far the largest of these springs.

Nestle proposes to withdraw water directly from springs and streams and to develop wells in the region's aquifers. Nestle will use the water in various bottling ventures. Vestra (2005) lists the components as:

- Purchase spring water currently being diverted from Intake (Squaw Creek), Upper Elk, and Lower Elk Springs from the McCloud Community Services District,
- Potential installation of boreholes to intercept spring flow before it is captured by and diverted from the existing springhouses,
- Potential purchase of groundwater from the McCloud Community Services District from water supply wells installed at the mill site,
- Re-establish an existing water right to divert water from the McCloud River at Lakin Dam.

Vestra states the later has been removed from the project. If implemented, the project will have two major impacts. First, diverting spring discharge directly from the springs will decrease the surface flows below the spring and below the point where overflow currently returns to the streams. Second, Nestle's groundwater development will pull water directly from aquifers which supply flow to downgradient springs and existing wells.

Water balance is the most important hydrologic concept on the McCloud River watershed. In a watershed at steady state, inflow equals outflow. The question is how this development project affects that water balance. Developing a well adds a new discharge to the aquifers that eventually takes water from the other discharges. It is not a question of if there is an impact but only one of the time until the impact is observed. The length of time between the development of the well and decreased discharges elsewhere depends on the aquifer groundwater storage compared to the recharge. Flow to natural discharge points, springs and streams, depends on the groundwater level in the aquifer; the groundwater level depends on the groundwater storage in the aquifer. New pumping initially removes water from storage which eventually lowers the water level and reduces the natural discharges.

Based on seasonal groundwater level and spring discharge measurements, reported in two US Geological Survey and one California DWR reports, the watershed has very little year-to-year groundwater storage, at least compared to watersheds that have a large alluvial aquifer storing the water. Observed seasonal groundwater level changes reflect the rapid responses expected in aquifers with little storage; the aquifer outflow depends mostly on recent inflow, or recharge. Adding stresses to the aquifer in the form of substantial pumping will likely reduce the storage quickly and cause a rapid change in the discharge from the watershed.

This report reviews the water resources and hydrologic issues of the draft environmental impact report and environmental assessment (DEIR/EA) completed for Siskiyou County and the Forest Service, respectively. It also reviews the relevant appendices and references other previously completed reports.

The first, procedural, comment, is that the FS treats this as an environmental assessment. Clearly, the potential effects of this project on the hydrology and other aspects of McCloud are significant. The FS should withdraw this document and complete it as a draft environmental impact statement after it better defines the proposed project and completes the analyses indicated in this report.

Proposed Project

The DEIR/EA indicates that the diversion from the springs will be for up to 1600 af/y at a maximum rate of 1250 gpm (DEIR/EA, page 2.0-4). It also indicates that wells drilled at the site of the bottling plant, which is several miles from the spring houses, will pump at a volume "included in the 1,600 acre-feet per year volume limitation" (DEIR/EA, page 2.0-5). The introduction also expresses this limit: "As described in **Section 2.0, Project Description** of this EIR/EA, at full buildout, the water bottling facility would be approximately one million square feet in size and use up to 1,600 acre feet of spring water per year." (DEIR/EA, page 1.0-3).

The contract allows Nestle to request that MCSD design and construct at the bottling facility additional wells for non-spring water uses. "At Purchaser's request, District shall design, construct and install one or more ground water production wells on the Bottling Facility site for Purchaser's use as a supply for non-spring water purposes … The amount of water Purchaser uses from the ground water wells pursuant to this Section 6.4 shall not be included, in any event, in the calculation of the Maximum Take" (Appendix S.1-2, Contractual Agreement, page 16). The contract does not limit the amount of water these additional wells could pump. The contractual agreement also provides for MCSD to provide additional water to Nestle beyond the 1600 af/y maximum take (Appendix S.1-2, Contractual Agreement, page 7); this appears to be an additional amount from the springs and would be limited only by the flow rate of the springs and the capacity of the conveyance structures (the pipeline). This same contract section provides for MCSD to increase the conveyance capacity. Additionally, water provided to Nestle for domestic use at the site is also not subject to the maximum take.

This limitation appears to not be included in the agreement between MSCD and Nestle, therefore, if this DEIR/EA is approved, the approval must be contingent on the maximum volume used being limited to 1600 af/y. Otherwise, approval of the DEIR/EA will allow Nestle to build a plant and acquire wells that under California water law will have no limitation to the potential groundwater pumping.

Without the agreement, the project could include the removal of 1600 af/y from Intake and Upper and Lower Elk Springs. "The proposed project includes construction of three pipelines to transport water **owned** by the MCSD from the springs to the bottling facility …" (DEIR/EA, page 1.0-5). Therefore the spring diversion appears to be likely. None of this water will return to the groundwater or surface flow system in the McCloud area. The project will also include construction of production wells, the number not specified, near the millsite which will become Nestle's new bottling plant. State water law will not limit the amount of water that could be pumped from these wells irregardless of the statements in the DEIR/EA.

Hydrogeology

Conceptual Model of Flow in the McCloud Watershed

A proper conceptual model of the flow in the system being developed is critical prior to assessing the impacts of that development (Bredehoeft 2003). The DEIR/EA provides a description which could be described as a conceptual model of the groundwater flow systems near Mt. Shasta as follows:

> The lower flanks of Mount Shasta consist mostly of a broad fan of pyroclastic, mudflow, and fluvial deposits. Precipitation infiltrates into these deposits, and water moves through the underlying volcanic rock via fractures, volcanic pipes, tuff beds, and rubble zones. This groundwater discharges to the surface at numerous springs surrounding Mount Shasta. In the McCloud area the springs, including Intake, Upper Elk and Lower Elk Springs, typically experience peak discharge flows during the spring and summer months based on spring rain and the continual snowmelt associated with the Konwakiton Glacier ice melt. Both

> spring flows and water demands are at their highest values during the summer months throughout the McCloud area. (DEIR/EA, page 3.9-6)

This description is correct, but the DEIR/EA does not take the next, necessary, step of determining the water budget for the basin. A water budget is an accounting of the inflow, outflow, and change in storage for the basin. If change in storage is close to nil, as it probably is now in this relatively undeveloped watershed, the system is at steady state and inflow equals outflow. A water budget should be completed for both the watershed and the aquifer portion of the watershed. The water budget for each may be summarized as follows.

Inflow = Outflow

$$P + GW_{in} = ET + Q_{out} + GW_{out}$$ **Watershed water balance**

$$R + GW_{in} = GWet + Q_{sp} + GW_{out}$$ **Groundwater balance**

In these relations, P is precipitation, GW_{in} is groundwater inflow to the watershed, ET is evapotranspiration from the watershed, which includes transpiration from soil water, Q_{out} is river and stream outflow (and diversions from a developed watershed), GW_{out} is outflow through groundwater connections with surrounding aquifers, R is recharge, the amount of precipitation that is excess to replenishment of soil moisture and basinwide ET GWet is evapotranspiration from phreatophytes and other plants with roots drawing moisture from the groundwater, and Q_{sp} is discharge to springs and seeps, which includes discharge to rivers in gaining river reaches. If the components are determined independently and the equations do not balance, it is possible that the basin is not in balance.

It is essential to identify the components of these equations to determine the effects of adding an outflow. In this case the new outflow is both the additional consumptive use from diverting the streams into bottles or the additional pumping caused by new wells, pumping within, or not within, the 1600 af/y limit, developed at the bottling plant site. In a basin at steady state, developing a new outflow, a well or diversion, takes flow away from an existing outflow – this is necessary to maintain water balance – no new water enters the system on the left hand side of the equations.

Initially upon the development of a groundwater well, there is a new outflow but the remaining outflows have not yet adjusted. The new discharge continues while the other discharges decrease. During the adjustment period, the pumping removes groundwater storage, an amount often called transitional storage for water removed during the transition to a new equilibrium state, to lower the water table which is necessary to decrease the flow to springs, Q_{sp}, wetlands, GWet, or from the basin, GW_{out}.

The point of this water balance discussion is to show that it is impossible to determine the impacts of a groundwater development without knowing the water balance fluxes. But this DEIR/EA has not estimated any of these components much less attempted to assess the transition to new equilibrium caused by developing a new discharge. The following questions must be answered in a new DEIR/EA:

- How much water recharges the aquifers?
- How much groundwater discharges to springs within the watershed (not just the project springs)? For the groundwater system, spring discharge and seepage to rivers appears to be the primary outflow.
- How much discharges to groundwater evapotranspiration? The watershed does not have extensive areas of wetlands, but riparian zones near rivers likely discharge groundwater.
- What is the residence time for flow through the system? Residence time is not a water budget component, but it is necessary to know this to assess how long from the commencement of stress will be required until impacts begin to be felt.

The DEIR/EA fails to even mention or reference two Geological Survey studies completed on the watersheds of the south side of Mt. Shasta: Poeschel et al (1986) and Blodgett et al (1988). These reports discuss the conceptual flow through the basin, including spring discharge throughout the area, including Intake and Upper and Lower Elk springs, and recharge to the aquifers which appears to primarily be from the stream bottoms.

Recharge and Spring Discharge

Recharge in the McCloud and/or Mud Creek and Squaw Valley watersheds occurs in two ways. First, snowmelt recharges into the mountain block where it melts, but the volume of this appears to be limited by unfractured lava. Blodgett et al (1988) mention high elevation springs that appear to issue from thin soil layers suggesting that substantial perching of high mountain recharge occurs. Discharge from these perched springs combines with direct snowmelt and glacier runoff to form streams. These springs are intermittent and not part of a larger regional aquifer system. The streams concentrate the runoff and tend to occur near fractured lava into which the streamflow recharges. Blodgett et al (1988) estimate that 0.4 cfs/mile infiltrates from the bottom of several streams into highly permeable pyroclastic and fluvial debris. An observation in Mud Creek taken in May 1981 indicates a 0.9 cfs/mile infiltration rate.

The total recharge to a basin is substantial. If the average flow in the McCloud River below Big Springs is 2.82 cfs/mi^2 and the drainage area is 322 mi^2, as indicated by Blodgett et al (1988), the runoff is 3.18 feet or 38.2 inches, over the entire basin. They indicate also that average discharge is 909 cfs and that the average discharge from Big Springs is about 600 cfs. The proportion of McCloud watershed area that contributes to the flow at Big Springs is not known, but it likely drains most of the southeast and east slopes of Shasta. It is a discharge point from the McCloud area groundwater basin as described by the California Groundwater Bulletin 118 (Figure 1). The bulletin indicates that the aquifer is also just 21,320 acres. Clearly, the flow reaching Big Springs emanates from areas beyond the area of the aquifer; it would require over 20 feet of recharge over the entire aquifer to support Big Springs while Bulletin 118 reports 49 to 55 inches per year of precipitation.

Much of the water discharging from Big Springs could recharge the aquifer from streams crossing the aquifer or from groundwater discharge from colluvium bounding the aquifer, primarily on the Mt. Shasta side. Squaw Valley and Mud Creek both cross substantial colluvium before crossing the aquifer; these could be two of many sources of recharge to the aquifer.

The McCloud area aquifer therefore appears to have a substantial inflow and outflow. Recharge is primarily from stream runoff, mountain block and groundwater inflow processes. Discharge is to springs, primarily Big Springs but also Lower Elk Springs. Discharge from the other two springs included in the project, Intake and Upper Elk springs, likely contributes to direct recharge to the aquifer as evidenced by the variable discharge rates.

Big Springs is about 1000 feet lower than Intake and Elk Springs and about 6 miles south and east. The huge flow rate indicates that it may emanate from a very substantial fracture zone and/or solution conduit. How all of the fractures and conduits merge and combine water draining east from Mt. Shasta into one major discharge point is unknown.

The Thimbleberry ridge just west of McCloud likely represents a bedrock divide which separates the flow system east and west. Blodgett et al (1988) report on numerous springs on Mt. Shasta west of this ridge; east of the ridge there is Big Springs and the springs to be developed in this project. Topographic maps do not show any more springs on the east side. This supports the conceptual model of the McCloud area aquifer transporting much of the recharged runoff from the east side of Mt. Shasta to the McCloud River.

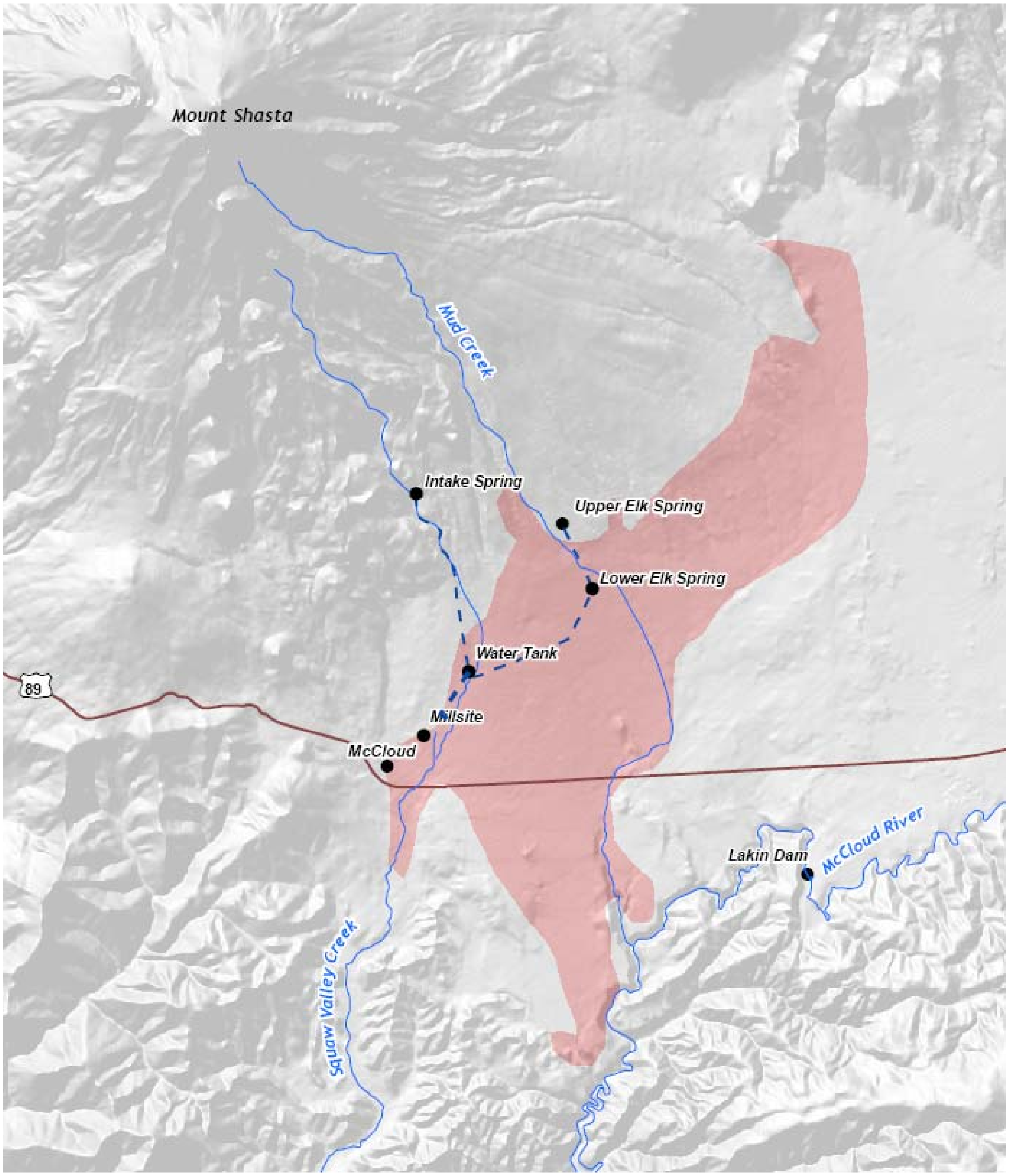

Figure 1: McCloud Area Groundwater Basin, from Vestra, 2005.

Water Level Fluctuation

There are not many water level measurements in the area. Blodget et al (1988) provide two hydrographs of wells in the Mt. Shasta area. Well 40N/2W-25L1 shows a 25 foot increase level rise from December to April, 1982 (Blodgett et al, 1988, figure 7). Well 41N/5W-26L1 shows an 8 foot annual fluctuation. This shows a strong seasonal influence. Blodgett et al (1988, page 29) note that shallow wells in the McCloud area have "larger than average fluctuations" noted to be about 18 feet. For an area with little development, as noted in the next section, these seasonal changes show an aquifer in dynamic equilibrium with the seasonal recharge. Blodgett et al (1988) suggest the fluctuations are caused by low storage coefficients.

Aquifer Groundwater Development

There are no good surveys of water well use in the aquifer; the communities use spring flow (which is of course groundwater which has discharged to the surface). Bulletin 118 reports:

> The estimate of groundwater extraction for the McCloud Area Basin is based on a 1991 survey conducted by the California Department of Water Resources. The survey included land use and sources of water. Groundwater extraction for agricultural use is estimated to be 3 acre-feet. Groundwater extraction for municipal and industrial uses is estimated to be 420 acre-feet. Deep percolation of applied water is estimated to be 280 acre feet.

The bulletin is not specific, but it seems reasonable to assume that the deep percolation would be from all sources of water use including the developed springs**.**

Appendix 3.9-7 discusses the number of domestic wells existing near the Elk Springs (Vestra 2005, page 5). The wells are reportedly shallow, less than 300 feet, and have a fairly low yield. This suggests that none of these domestic wells connects to any of the fracture zones which could yield substantial amounts of water. This suggests there is a substantially different aquifer system feeding each.

Project Spring Measurements

Spring flow measurements presented in DEIR/EA Tables 3.9-4 and 3.9-5 are for the diversion to MCSD, not the actual flow in the spring. MCSD collected on average in 2005 5605 gpm from the springs and conveyed it to the MCSD storage tank. The community uses approximately 1000 gpm and the remainder returns to Squaw Valley Creek; of the diversion, approximately 17 percent is used by the community (DEIR/EA, page 3.9-6). There is no information provided about the consumptive use within the community or the return flow to the stream and groundwater from the 1000 gpm used by the community.

MCSD does not manage to collect all of the spring discharge; some overflows the spring houses. There is an attempt to add this overflow to the diversions to predict the actual flow from the springs in Table 3.9-5. The following passage describes the adjustment.

> Overflow occurs from the Upper Elk and Lower Elk Springs springhouses. This overflow was measured during a peak flow period in July 2004. [See **Appendix 3.9-4**] when total flow from Upper Elk Spring was 1,566 gpm with 615 gpm of

> overflow. Total flow from Lower Elk Spring was 1,235 gpm with 18 gpm of overflow. Based on these very limited measurements, flow from Upper Elk Spring accounts for approximately 56 percent of the water delivered to the storage tank through the combined Upper and Lower Elk Springs pipeline. Flow from the Lower Elk Spring accounts for 44 percent. Assuming that the overflow was measured during the peak month, and that the overflow can be prorated throughout the year using the normalized monthly distribution for Intake Spring, average overflow from Upper Elk Springs is approximately 230 gpm, and average overflow from Lower Elk Springs is less than 10 gpm. Based on this information, spring capacities are estimated in **Table 3.9-5.** (DEIR/EA, page 3.9-7)

The assumption is that the 615 gpm of overflow occurred during a "peak flow period" but that the "**overflow** can be prorated**"** according to the distribution for Intake Spring for which the measurement is the entire spring. Thus, the diversion from the Upper Elk spring is fairly constant and the overflow varies from 0 in March to almost 600 gpm in July. It is not explained in the DEIR/EA or in Appendix 3.9-4 just how an overflow of 0 at Upper Elk spring in March corresponds with a flow at the Intake Springs equal to 1965 gpm or how an overflow of 615 gpm in July corresponds with a flow at Intake Springs equal to 4396 gpm. The flow rates in Table 3.9-5 should not be treated as measured or actual flow because they include a great deal of subjectivity.

Even so, the values shown in Table 3.9-5 probably are of the correct order of magnitude. Blodget et al (1988) report that the total flow from the three springs is about 15 cfs (6732 gpm). It is interesting that Intake Spring varies by almost 50 percent from high to low flow while Upper Elk Spring varies about 33 percent and Lower Elk Spring varies very little. Neither Intake nor Upper Elk Spring apparently discharge from the McCloud area aquifer either (Figure 1). Spring flow is substantially more variable at higher elevations. This may reflect the increasing groundwater storage from the McCloud area aquifer contributing to the lower spring. Storage would even out natural seasonal or drought-induced fluctuations.

Water Rights

The DEIR/EA does not provide proof of water rights. Appendix 3.9-6 shows a transfer of title of the water rights to MCSD, but it does not quantify them or provide proof that they were applied to beneficial use. Appendix S.1-4 shows an internal Forest Service memorandum expressing one specialist's opinion that the water rights are good, but also does not quantify them or express what was actually reviewed to arrive at that opinion.

The rights to spring water differ from groundwater rights (although emanating from the same source) in that they are subject to the prior appropriation doctrine. As discussed above, MCSD only uses 17 percent of the diverted water; the remainder is return flow to the streams. Some of that return flow likely percolates and supports shallow aquifer uses as discussed above.

But, it is very likely that some of the return flow remains in the stream and supports downstream surface water rights on the McCloud River. It is possible that Nestle can only use the water that MCSD had consumptively used prior to this project.

The FS and County should ascertain this as part of this DEIR/EA because the effects of the project depend on it.

Impact Project on Groundwater Levels and Flows

The DEIR/EA ignores the potential effect of pumping groundwater from wells to potentially be developed at the bottling plant. Contrary to the contract between MCSD and Nestle, the DEIR/EA assumes that a maximum 1600 af will be developed from the springs and wells together. If this project is approved, it must be with a strict limitation on the amount of water that can be developed.

The DEIR/EA also ignores the decrease in recharge to the local aquifer that could be caused by eliminating some of the return flow from the overflow of the springs as would occur if Nestle collects most of the water.

The DEIR/EA indicates that wells could be built at the plant site and that the yield from a properly designed and built well could be much higher than for domestic wells. Nestle's production wells could be much deeper than the domestic wells. There is little information about the connection between deep fractured aquifers and shallower, less-porous aquifers. Pumpage of substantial amounts of water from deep aquifers, which are more porous than shallow aquifers, could substantially lower water levels in the shallow aquifer.

As noted above, the storage coefficient in the shallow aquifers near McCloud is low. If Nestle develops wells and pumps continuously at the proposed rate, the pumping will affect water levels in the shallow aquifers depended on by the residents of McCloud. The overlap could occur in two ways.

- If the high yield productions wells overlap the aquifer drawn on by the local wells, the larger well will cause a drawdown cone that encompasses the local wells.

- Much more likely, the production well will draw water from a deeper level. There is no evidence of an aquitard between levels, therefore drawing water from a deeper aquifer could cause a gradient between levels which will decrease water levels in the shallow aquifer. In other words, deep pumping could suck the near-surface aquifers dry.

The project can also affect local groundwater by eliminating local recharge of water in Squaw Valley and Mud Creek. Nestle proposes to divert up to 1600 af/y of water from the springs. Currently, of the water diverted from the springs, as much as 83 percent returns to the streams (see the section on spring flow above). Nestle will not return this "overflow", as the DEIR/EA describes, to the stream. Currently, much of this water infiltrates the stream bottoms and percolates to the shallow aquifer. This direct recharge supports the shallow aquifer which supports the domestic wells in the McCloud area. The amount of water returned to the stream is of the same order of magnitude of the current groundwater usage reported above. As noted by the large seasonal water level changes and low storage coefficients of the aquifers, the effects of this large change in recharge on the local, shallow aquifer may be extensive.

Impact of Project on Surface Flows

The DEIR/EA assumes for impact analysis that 1600 af/y or 1000 gpm will be the consumptive use caused by this project. As discussed elsewhere, the limit discussed in the DEIR/EA ignores the contract which allows Nestle to develop essentially unlimited water from potential wells at the proposed bottling plant. Because the streams appear to recharge the groundwater, for the purpose of surface water impact analysis, considering the effect of removing 1600 af/y on the surface flows in Mud and Squaw Valley Creeks is sufficient. It is not sufficient however if considering the effects on the McCloud River or Big Springs because the groundwater withdrawn would be from the aquifer that discharges at Big Springs.

The impacts on flow in Mud Creek and Squaw Valley Creek result from the lack of return flow, mentioned above, and the improved diversion from the springs which will allow less flow in the channel below the springs.

The DEIR/EA assessment of the flow is also wrong because it uses runoff factors to estimate flows rather than considering that spring discharge at discrete locations control the flow rates. The DEIR/EA estimates flow in Squaw Valley Creek and Mud Creek by assuming the runoff factor for the entire McCloud River watershed applies for the two sub-basins. These estimates are not sufficient for detailed impacts analysis because the runoff factor varies according to the exact point of interest in the watershed, primarily the location of the nearest spring. The DEIR/EA, as shown in Table 3.9-10 uses a runoff factor of 0.7, meaning that 0.7 feet for every foot of precipitation above that point is discharge at the point, determined for the McCloud River above Lake McCloud; the average flow rate in the McCloud river watershed was 2.63 cfs/mi^2. Because of higher precipitation, the DEIR/EA determines that the average flow rate in Squaw Valley Creek (above Hwy 89) and Mud Creek (above Elk Springs) is 3.08 and 3.14 cfs/mi^2 or 42 and 46 cfs (18,800 and 20,400 gpm), respectively. Compared to the total consumptive use of the project, there appears to be sufficient water. **But this is wrong because stream flows are grossly overestimated**.

Based on the flows at Mud Creek near McCloud (Figure 2), the average monthly flow is 10.8 cfs and average monthly flows range from 2.5 to 28.3 cfs (Table 1), not 46 cfs. The DEIR/EA is wrong it its claim that there is no flow data on Mud Creek as shown by the existence of this gage (DEIR/EA, page 3.9-24). Diverting a substantial portion of Elk Springs could take a substantial amount of flow from Mud Creek[1]. If half of the total

[1] The McCloud gage is downstream of Elk Springs where the spring diversion would occur and it is possible that the stream loses flow between the sites. However, the loss rate per mile of stream to drop the average flow from 46 to 10.8 cfs would far exceed any of the rates measured by the U.S. Geological Survey

1000 gpm of diversion, or 1.1 cfs, comes from Elk Springs, about 10 percent of the average and 45 percent of the lowest monthly flow could be lost from Mud Creek at the former gaging station. Because of the loss rate on the stream, additional stream reaches will go dry during low flow periods.

A similar argument applies for Squaw Valley Creek. However, the diversion of these springs will likely not have a significant effect on the McCloud River because of the large spring flow at Big Springs. It is possible that seepage into the streambed in Mud Creek below Elk Springs contributes to Big Springs, therefore diverting the streamflow will affect Big Springs, but the proportion is very small

Table 1: Descriptive statistics for monthly flows at the Mud Creek near McCloud gage. Period of record from 1927 to 1932.

Mean	10.83
Standard Error	0.82
Median	8.18
Mode	13.90
Standard Deviation	6.21
Sample Variance	38.61
Kurtosis	1.02
Skewness	1.18
Range	25.83
Minimum	2.47
Maximum	28.30
Sum	617.52
Count	57.00
Largest(1)	28.30
Smallest(1)	2.47
Confidence Level(95.0%)	1.65

(Blodgett et al 1988). It is not known how much of the USGS flow data was discharge from the combined Elk Springs, but it was likely a high proportion of the flow.

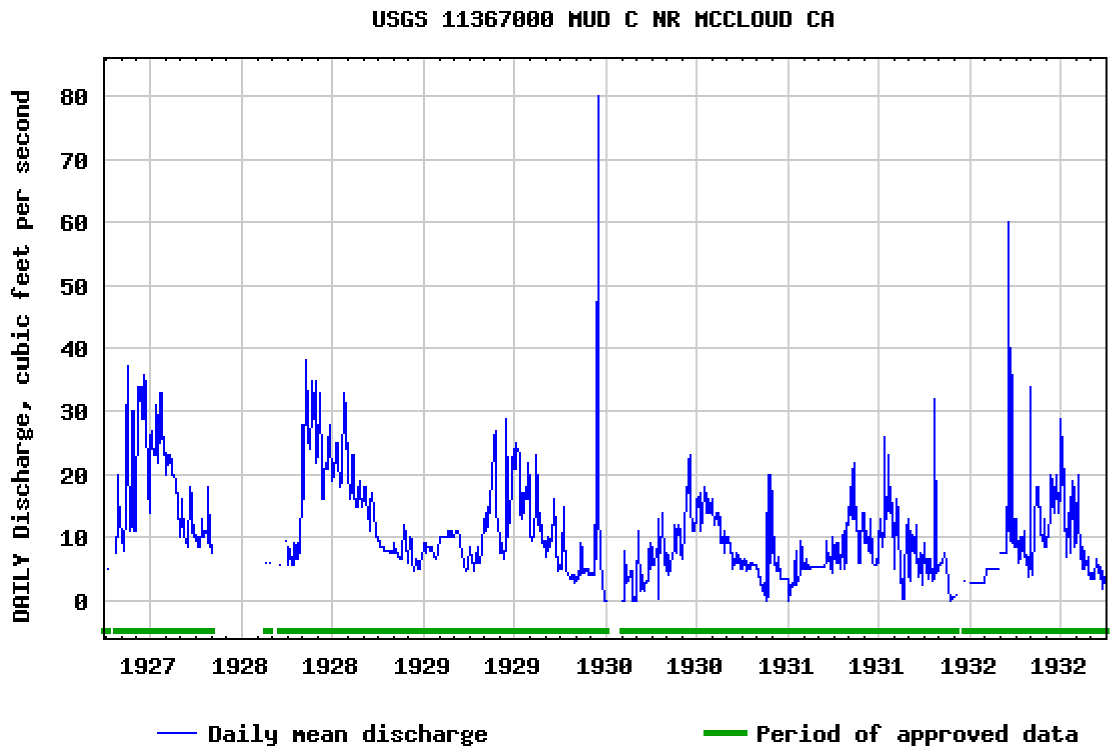

Figure 2: Hydrograph of flows on Mud Creek. Downloaded from USGS water data website on 8/3/06. The USGS maintained the gage only from 1927 through 1932.

Mitigation Plan

The DEIR/EA analyzes 9 items regarding hydrology that could have impacts and discusses potential mitigation if it determines those impacts could be significant. This section reviews that impact and mitigation analysis.

Impacts 3.9.3 through 3.9.7 concern storm runoff and flooding. These issues are relatively common and are accommodated here through general stormwater permits, floodplain mapping, detention basins (indicated here), and sedimentation. Specifics of these are not reviewed here.

The first impact, 3.9.1, is that water quality could be affected but it determines the potential for this is less than significant (DEIR/EA page 3.9-25). This is wrong because it relies on a wetland disposal system and onsite discharge to dispose of its lubrication, washing, sanitizing, and spring water spillage water. The DEIR/EA does not even mention the types of waste that could be included in this; it seems apparent that cleansers and hydrocarbon based fluids could be part of the waste stream. Without a design of the wetland system, it is not possible to assess its efficacy; merely stating that it will comply with a standard is not appropriate and does not meet the standards required by CEQA or NEPA. The full build-out discharge rate of 50 gpm is substantial. Onsite discharge means that it either evaporates or infiltrates; there is insufficient ET most of the year, therefore it will likely be infiltrated. This is large amount of waste to leach into the groundwater under the site and may cause a substantial contamination problem. The DEIR/EA must complete a hydrologic analysis of this discharge and include a monitoring well to determine if the discharge causes groundwater to violate standards.

Impact 3.9.2 indicates the project "could substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volumes or a lowering of the local groundwater table level" (DEIR/EA, page 3.9-28). It also states this impact is potentially significant and proposes mitigation. The document does not adequately propose mitigation however for the significant impacts or even identify all of the significant aspects

- The project will cause about 47 acres of ground surface to become imperious, more than 24 acres of building and 23 acres of parking lot. Recharge that previously occurred on this site will no longer occur. The document should determine the actual decrease in recharge. The DEIR/EA indicates that that the discharge of waste and recharge of runoff will offset this impact. Without any analysis, it is not possible to make this claim.

- The DEIR/EA proposes using boreholes to intercept the water before it actually reaches the Elk Springs. It basically takes an approach that there will be no problem with this if the borehole does not enter the volcanic rock beneath the springs. The DEIR/EA indicates that test boreholes will be drilled; this should have been done prior to this document. The primary effect is that the spring will likely go dry. The springs could be damaged permanently by the boreholes disrupting the flow path. The mitigation should be that boreholes are not allowed at any of the springs.

- The DEIR/EA does not analyze the effect of pumping at the mill site and proposes no mitigation. The only specified activity is that the yield will be determined by testing before construction. As discussed elsewhere in the report, much additional analysis of the hydrogeology at proposed well sites must be completed as part of this report.

Impact 3.9.8 concerns the decrease in surface water flows. The previous section of this review considered this in detail. The predicted flows discussed in the section concerning impacts depend on flow data which is poorly estimated in the DEIR/EA; see the previous section. The project proponent should collect substantial baseline data and analyze it before re-releasing this document. The mitigation which calls for the MCSD to commence monitoring is too little too late; it should have been completed prior to this DEIR/EA as discussed in the previous section.

Impact 3.9.9 claims the project will not cause a significant impact on a public water supply. Partly, the document bases the claim on the fact that the project installs new conveyance from the springs to the bottling plant. Without analyzing the potential new wells and the amount of water that may be pumped, it is not possible to determine whether the impact is significant or what mitigation may be needed.

Conclusion and Recommendation

The description of the project in the DEIR/EA is not sufficient to adequately predict the impacts of the project. The problems include uncertainty over the relative amount of the water that would be drawn from the springs and how much would be pumped from a to-be-determined number of wells to be dug near the bottling plant (mill site). There are also significant questions about Nestle's agreement to use only up to 1600 af/y because the contract it has with the MCSD has no such limitation; the record of decision must include a limitation that prevents the pumpage of more water and if Nestle desires to increase its pumpage it must do additional CEQA/NEPA analysis.

The surface water flow estimates provided in the DEIR/EA are incorrect because they rely on runoff coefficients not appropriate for the spring flow dominated streams. The streamflow estimates are also inappropriate for this analysis because they are annual averages that do not reflect seasonal variability. If Nestle removes the proposed amount of water from Mud Creek, for example, the flow during low flow periods will be decreased by about 45 percent.

The proposal for developing spring water will decrease the amount of water in Squaw Valley and Mud Creeks by an amount equal to that which is no longer returned as an overflow. Currently, this return flow supports flow below the point of return flow; the DEIR/EA does not adequately map the point of return flow. The DEIR/EA also does not consider the effect of this return flow on downstream water rights.

The DEIR/EA also indicates that Nestle could develop wells at the plant site. USGS studies of the McCloud area aquifer shows substantial seasonal water level changes and the wells have mostly been considered "low yield" probably due to low storativity. The DEIR/EA provides almost no assessment of the hydrogeology of the aquifer; it does not even reference the USGS studies. The DEIR/EA conceptualizes the recharge/discharge regime of the aquifer correctly, in that recharge occurs through the mountain block and streambottoms and discharge is primarily to springs. But it does not discuss the magnitude of flows; without a water balance assessment there is no opportunity to assess the effect of pumping or diverting the amount of water proposed herein. There is no basis for the claim the DEIR/EA makes that a well-designed production well should be able to yield much higher amounts of water than the nearby domestic wells. However, the DEIR/EA does not analyze the potential effect of these wells other than to note that there could be a significant impact to water levels.

Based on the USGS studies, developing one or more production wells near McCloud could have very detrimental effects on nearby domestic wells. Because of the unique hydrogeology of the McCloud area aquifer, pumping a large amount of water from within the shallow zone of the aquifer or from a deeper high yield zone could lower the water table significantly near the area's domestic wells. This would occur even if the production well screen is hundreds of feet below the domestic wells because of the likely hydraulic connection. **The amount of drawdown cannot be assessed without detailed hydrogeologic assessment of the aquifers near the plant site.**

Both the surface water and groundwater aspect of this project should have additional research completed. In addition to a much improved project description and ironclad limits on the amount of pumpage which will occur, additional data and analyses should be collected and completed as follows:

Nestle should install gaging stations on Squaw Valley and Mud Creeks at the point the springs would naturally discharge into the streams and the point where overflow reaches the stream. On Mud Creek, a downstream point should be chosen which would allow an assessment of flow loss rates. The gaging station records should also be used with existing nearby long-term gages to estimate annual runoff averages and seasonal fluctuations. In lieu of a gaging station, this data could be collected with weekly spot measurements. Comparison with nearby gages using regression or other area proportion analyses could be acceptable.

The groundwater assessment should include exploration of the hydrogeology near the mill site. Nestle should install a deep pumping well and at least two deep observation wells. The pumping well would initially be used for testing the aquifer; after testing, if the hydrogeology is acceptable the well could be converted to a production well. The well should have the capability of pumping at multiple levels to test the hydrogeologic parameters at differing levels. The observation wells should also be multi-port or otherwise have the capability of monitoring groundwater levels at multiple levels simultaneously. During a multi-week pump test, the response of groundwater levels would allow the agencies to determine whether it is possible to develop large quantities of water at this site without drying shallow wells. The test would help to determine the hydraulic connection among aquifer levels. The test would also help Nestle determine whether it has a viable project. The monitoring wells could be converted to pumping wells, if desired; however, at least one of the monitoring wells should be retained as such so that long-term project monitoring can occur.

NEPA requires that an agency collect data that is reasonably available. Both the surface water and groundwater data is reasonably obtainable, and in the case of the groundwater, the wells may be used during production. The agencies should not, and may not legally be able to, approve a project without knowledge of the basic information these tests can provide. The DEIR/EA should be withdrawn and new data should be collected and analyzed prior to another release with the project in the form of a full environmental impact statement.

The impacts analysis is based on very poor data collection and analysis, as outlined throughout this review. Impacts concerning groundwater depletion, water quality, surface water flow, and effects on a public water supply are likely significant; there is at least not sufficient data or analysis to claim the impacts are not significant. None of the potential impacts has any real mitigation proposed to offset the impacts.

References

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