Attachment 1

POLICY FOR DETERMINATION OF MAXIMUM NUMBER OF RESIDENCES ON SEPTIC SYSTEMS PER SQUARE MILE TO BE PERMITTED WITHOUT REQUIRING A GROUNDWATER STUDY TO DETERMINE IMPACT ON GROUNDWATER QUALITY

I. INTRODUCTION

The maximum number of residences on septic systems which will be permitted per square mile without a prior groundwater study has been determined for each of the 232 hydrographic areas in the State of Nevada. Results of this determination are available from the Bureau of Water Pollution Control. Once this predetermined residence number is projected to be exceeded in a given area, a groundwater study will be required before the Nevada Division of Environmental Protection will approve additional septic systems. The groundwater study will be used to determine the impact of proposed septic facilities on existing water quality; approvals may be issued or denied on that basis.

II. THE GOVERNING EQUATION DEFINED

The premise used in determining the number of residences which will trigger the requirement for a groundwater study is based on the following two—part governing equation:

- Total contamination equals contamination contributed to the total aquifer recharge plus contamination contributed to the groundwater in storage where:
- The total contamination is proportional to the total number of residences on a septic system,
- Groundwater in storage equals groundwater stored in upper 100’ of saturated alluvium,
- The volume available for assimilating (diluting) septage is the volume of the total aquifer recharge plus groundwater in storage, and
- The total number of septic systems equals the number of septic systems affecting recharge volume plus the number of septic systems affecting storage volume.

Based on the above premise and on the assumptions and calculations outlined in Parts III, IV, and V below, the governing equation is defined as follows:

$$\text{Number of septic systems} = \frac{(0.2)\,(\text{ppt recharge AF}) + (.02)\,(\text{storage AF})}{.392\ \text{AF/yr/residence}}$$

III. GENERAL ASSUMPTIONS AND DEFINITIONS

General assumptions and definitions inherent in the premise for the governing equation are listed below.

1. All contamination being considered is derived from septic systems; therefore, total contamination is related to the total number of residences on septic systems.

2. Total nitrogen has been selected as the constituent of primary concern with respect to impacts on groundwater quality from septic systems. This is based on known contaminants and groundwater studies done in Nevada to date.

3. An estimate of maximum residential flow is 350 gallon/s per day, which is equivalent to 0.392 acre—ft/year/residence.

4. Based on the EPA Design Manual for Onsite Wastewater Treatment and Disposal Systems, the concentration of total nitrogen which enters a leach field varies from 35 to 100 mg/l. As a conservative approach to groundwater protection, 100 mg/l total nitrogen was chosen as input to the leach field.

5. As a conservative estimate for use in the governing equation, the accepted limit of total nitrogen in groundwater used for drinking water is 10 mg/l.

6. All of the 100 mg/l of total nitrogen is available to be converted to nitrogen as nitrate. The drinking water standard for nitrate is 10 mg/l (Federal Safe Drinking Water Act).

7. The abbreviation for "precipitation" is defined as "ppt".

8. The abbreviation for "acre—feet per year" is defined as "AFY", and "acre—feet" is defined as "AF".

IV. ASSUMPTIONS AND CALCULATIONS RELATING TO THE NUMBER OF SEPTICS LIMITED BY RECHARGE CONSIDERATIONS (The First Factor in the Governing Equation)

A. Assumptions

1. A 50% decrease in concentration of septic effluent in the unsaturated zone was assumed (e.g., plant uptake, possible dilution, etc.). Therefore the possible concentration of the discharge from a septic system which could reach the groundwater was assumed to be 50 mg/l.

2. Precipitation recharge has a total nitrogen content of zero.

3. If precipitation recharge is assumed to have a nitrogen content of zero, then all nitrogen in recharge to groundwater must come from septic systems. If a septic system has an output of 50 mg/l, but 10 mg/l is the acceptable limit (IV.A.l), then the ratio of permissible septic recharge to precipitation recharge must be 1:5, or 0.20. Therefore, septic recharge equals (0.20) (precipitation recharge).

B. Calculations

In the determination of the first factor in the governing equation, which addresses the relationship of the total number of residences on septic systems to the contamination in the total recharge to the aquifer, the following relationships were employed:

Septic recharge = (number of septic systems) (output/septic)
= (number of septic systems) (0.392 AFY);

Septic recharge/precipitation recharge = 1/5 = 0.20; and,
Septic recharge = (0.20) (precipitation recharge).

Consequently,

$$\#\ \text{septics} = \frac{(0.20)\ (\text{ppt recharge AFY})}{0.392\ \text{AFY/residence}}$$

V. **ASSUMPTIONS AND CALCULATIONS RELATING TO THE NUMBER OF SEPTICS LIMITED BY AQUIFER STORAGE CONSIDERATIONS (The Second Factor in the Governing Equation)**

A. Assumptions

1. A Constant volume of aquifer storage is assumed, with negligible interbasin flow.

2. Groundwater in storage may have a background value of total nitrogen of 0-5 mg/l.

3. Because 10 mg/l is the “trigger” limit of nitrogen in groundwater used for drinking (111.5), and water in storage may have up to 5 mg/l background concentration
(V.A.2 above), the maximum concentration of nitrogen which could be added to water in storage is 5 mg/l. Therefore, some number less than 5 mg/l must be used in the calculations to provide an adequate means of pollution prevention. In this instance, 2 mg/l was chosen as a limit for nitrogen added to groundwater in storage.

4. When calculating the effect of nitrogen from septic systems on the ground water in aquifer storage, no decrease in concentration of septic effluent in an unsaturated zone was assumed.

5. If a septic system has an output of 100 mg/l (III.4), but 2 mg/l is the acceptable concentration to be added to ground water in storage (V.A.3 above), then the ratio of permissible septic nitrogen to aquifer storage nitrogen must be 2:100, or 0.02. Therefore, septic nitrogen contributed to groundwater in storage = (0.02) (groundwater in storage).

B. Calculations

In the determination of the second factor in the governing equation, which addresses the relationship of the total number of residences on septic systems to the contamination groundwater in storage in the aquifer, the following relationships were employed:

> Total nitrogen of groundwater in storage = nitrogen contributed from septic systems + background nitrogen of ground water in storage;
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> Concentrations of nitrogen from septic systems and background nitrogen concentrations are proportional to the respective associated fluid volumes;
>
> Nitrogen contributed from septic systems = (number of septic systems) (output from septic systems) = (number of septic systems) (.392 AF);
>
> Concentration of septic nitrogen/background concentration of groundwater in storage = 1/50 = 0.02; and,
>
> Septic nitrogen contributed to groundwater in storage = (.02) (groundwater in storage).

Consequently,

$$\text{The number of septics} = \frac{(0.02)\ (\text{AF storage})}{0.392\ \ \text{AF}}$$

VI. HIGH AND LOW END LIMITATIONS

The values obtained for the number of residences on septic systems per square mile which will trigger the requirement for a groundwater study prior to approval of additional septic systems have been limited by NDEP on both the high and low ends. Most of the residence numbers fell between 50 and 200; consequently, 50 and 200 were chosen as end—member values. Basins with residence numbers of less than 50 were raised to 50; basins with very high numbers were scaled down to a limit of 200 residences per square mile. This was judged by NDEP to be a fair balance between maximizing groundwater protection in areas of high population pressures, and minimizing the burden on growth in under populated areas.