BEFORE DEPARTMENT OF WATER RESOURCES

STATE OF IDAHO

IN THE MATTER OF THE MITIGATION PLAN OF THE NORTH SNAKE AND MAGIC VALLEY GROUND WATER DISTRICTS IMPLEMENTED BY APPLICATIONS FOR PERMIT NOS. 02-10405 AND 36-16645 AND APPLICATION FOR TRANSFER NO. 74904 TO PROVIDE REPLACEMENT WATER FOR CLEAR SPRINGS SNAKE RIVER FARM

(Water District Nos. 130 and 140)

DIRECT TESTIMONY OF
TERRY SCANLAN P.E., P.G.

SUBMITTED ON BEHALF OF:

NORTH SNAKE GROUND WATER DISTRICT AND
MAGIC VALLEY GROUND WATER DISTRICT

December 5, 2008

LIST OF SPONSORED EXHIBITS

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DIRECT TESTIMONY OF TERRY SCANLAN

I. INTRODUCTION

Q. STATE YOUR NAME, BUSINESS ADDRESS AND POSITION.

A. My name is Terry Scanlan. I am employed by SPF Water Engineering, LLC, 300 E. Mallard Street, Suite 350, Boise, ID 83706. I am a principal engineer and hydrogeologist and a manager of the firm.

Q. WHO ARE YOU TESTIFYING FOR?

A. I am testifying as an expert witness on behalf of North Snake and Magic Valley Ground Water Districts which will are at times collectively be referred to as the "Ground Water Districts." I began serving as a technical consultant and advisor to the Ground Water Districts on this project in July 2008.

Q. WHAT IS YOUR AREA OF EXPERTISE?

A. I hold Master and Bachelor of Science degrees in Geological Engineering from the University of Idaho. I am a licensed professional engineer in Idaho, a licensed professional geologist in Idaho, and a certified water rights examiner in Idaho. I also have expertise in hydrogeology, well engineering, and water-system engineering. I have over 22 years of experience in this field of work. My current resume is included at the end of my testimony as Exhibit 4304.

Q. HAVE YOU EVER TESTIFIED AS AN EXPERT WITNESS BEFORE?

A. Yes. I have given expert testimony in administrative hearings before the Idaho Department of Water Resources in numerous matters dealing with water right permit and transfer applications. I have testified in District Court related to irrigation ditch and drainage issues. I recently prepared expert reports and provided testimony before the Snake River Basin Adjudication (SRBA) District Court regarding water right 63-00123D, 63-00123F & 63-00123G (Lexington Hills, Inc). In the past, I prepared several expert reports in the SRBA related to spring water rights in the Hagerman area.

II. <u>DISCUSSION</u>

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is:

1. To describe the design and location of the well or wells that may be used by the Ground Water Districts to supplement the water supply to Snake River Farms (SRF). Target supplemental water supply is 2.67 cfs.

2. To describe the design of facilities that may be used to divert the Idaho Fish and Game (ID&G) Water Right No. 36-4076 for the purpose of supplementing the water supply to Snake River Farms.

3. To provide testimony and opinion on the hydrogeologic characteristics of the deep aquifer that will be the source of water for the well or wells that may be used to supplement the water supply to Snake River Farms.

4. To provide testimony and opinion on the hydraulic connection between the deep aquifer that is the source for the proposed wells and the shallow aquifer that is the source of the springs.

5. To provide testimony and opinion on the feasibility of developing additional flow from the shallow aquifer that is the source of the springs diverted by water right 36-4076.

Q. CAN YOU GENERALLY DESCRIBE THE INFORMATION YOU REVIEWED AND RELIED UPON IN PREPARING YOUR TESTIMONY?

A. Yes. The information includes:

- data from a Clear Springs Foods test well that was test pumped in May 2006,
- well driller reports for wells in the vicinity of Snake River Farms (which include geologic, water level, well yield, and water temperature data)
- water quality data for springs supplying Snake River Farms, and
- published geologic mapping for the spring vicinity, including Covington and Weaver (1991, Geologic Maps and Profiles of the North Wall of the Snake River Canyon, Thousand Springs and Niagara Springs Quadrangles, Idaho, USGS Miscellaneous Investigation Series I-1947-C) and Gillerman and others (2005, Geologic Map of the Thousand Springs Quadrangle, Gooding and Twin Falls Counties, Idaho, IGS Digital Map 49).

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. Based on my analysis, I have reached the following conclusions:

1. More than 1.1 cfs could potentially be developed from the aquifer supplying Idaho Department of Fish and Game (IDF&G) water right 36-4076 through improving the existing diversions by horizontal boring into the hillside in the vicinity of the spring. If successful, the horizontal boring or borings could produce flows in excess of 2.67 cfs. This could be a proper means to optimize use of the water supply available under water right 36-4076 which is senior in priority to the calling water right of Snake River Farms.

2. Alternatively, in my opinion, approximately three 400-foot deep wells, spaced across an area for approximately 1/4 mile to the east of Snake River

Farms, on property owned by the IDF&G, may be capable of producing up to the 2.67 cfs required for supplemental supply to Snake River Farms. Such wells are not anticipated to injure local water rights or have a direct depletion to the local spring water supply. The source of water for these wells will be a deep aquifer that is not in direct hydraulic connection with the shallow aquifer zone that is the source for the springs that supply Snake River Farms.

3. As a second alternative, if the wells do not provide sufficient supply, spring flow currently diverted under the IDF&G Water Right No. 36-4076 can be piped directly to the head of the Snake River Farms raceways. Although Water Right No. 36-4076 authorizes diversion of 3.59 cfs, under current conditions the springs that supply Water Right No. 36-4076 appear to provide approximately 1.1 cfs. The 1.1 cfs is the total of the discharge from at least four separate springs (including at least three springs on the IDF&G property and one spring on the east side of Snake River Farms). Therefore, capture of all of the available spring flow may provide slightly over 1 cfs. Note that the 1.1 cfs measured flow does not include any of the discharge from the westernmost point of diversion for water right 36-4076. The westernmost point of diversion is located in Lot 5 (SESENE) of Section 2, on the west side of Snake River Farms. Flow from this western spring likely exceeds 3.59 cfs, but is currently being diverted by Snake River Farms under junior-priority water rights.

4. The preferred source or sources of supplemental water supply, and the design of the facilities to supply the water, have not been determined. A final design of facilities, including determination of the source or sources of

supplemental supply (i.e., deep wells, existing IDF&G springs, horizontal wells at the springs, or other sources) will depend on approvals from the Idaho Department of Water Resources.

Q. WHAT ABOUT USE OF THE IDAHO FISH AND GAME WATER RIGHT NO. 36-4076?

A. Water Right No. 36-4076 could be delivered directly to Snake River Farms from four springs, consisting of one spring located near the northeast corner of the Snake River Farms property and three springs located on the IDF&G property. Conceptual details of a piping and pumping plan that could potentially convey this water are provided in the Exhibit 4303. In my opinion, a piping and pumping system such as described in Exhibit 4303 can be successfully constructed. The water diverted from the springs would need to be replaced with an alternate water source to maintain the wetland complex on the IDF&G property. The recommended source for such water is discharge from the Snake River Farms facility. The water could be pumped from the lower end of the Snake River Farms' raceway, and delivered into the ditch that conveys water from IDF&G Spring 1, located at the northeast corner of the Snake River Farms' facility. The ditch eventually discharges into the IDF&G wetland complex. The Snake River Farms' water source is similar in chemistry to the water that currently maintains the IDF&G wetlands.

Q. PLEASE EXPLAIN YOUR PROPOSAL FOR ADDITIONAL DEVELOPMENT OF WATER FROM THE AQUIFER SOURCE FOR THE SPRINGS THAT SUPPLY OF THE IDAHO FISH AND GAME WATER RIGHT NO. 36-4076?

A. Additional development of the IDF&G springs could be attempted through excavation or shallow drilling (i.e., less than 18 feet below ground surface). In my opinion, the potential to develop significant increases in spring flow using such methods is not high. The potential for development of water from shallow zones (i.e., less than 18 feet deep) can be evaluated during initial phases of deep aquifer test well drilling.

Horizontal drilling into the aquifer supplying the IDF&G springs could potentially develop flows of 2.67 cfs or more. The water from a horizontal well tapping the aquifer should be identical in quality to the water discharging from the springs. A horizontal well would likely begin with a nominal 10-inch or 12-inch casing sealed approximately 50 feet into the Sand Springs Basalt at approximate elevation 3050. The casing would be equipped with a flanged gate valve at the outlet for water control. After installation and sealing of the casing, an open horizontal bore would be extended for approximately 500 feet into the hillside in an effort to penetrate water-bearing fractures or interflows within the basalt. The horizontal boring would be terminated after sufficient water supply is developed for the intended purposes. A perforated liner pipe may be installed to stabilize the boring if needed. There are directional drilling and horizontal boring contractors in southern Idaho capable of doing this work.

Q. WHAT IS THE BASIS FOR YOUR OPINION THAT DRILLING ONE TO THREE WELLS WILL PROVIDE UP TO 2.67 CFS AND NOT CAUSE INTERERENCE WITH THE SPRINGS?

A. Existing wells in the vicinity of Snake River Farms and Clear Lakes penetrate aquifer zones found in sedimentary deposits below elevation 3000 feet. These interbedded sediment layers begin at a depth of approximately 50 feet below Snake River Farms and are described in driller's reports (Exhibit 4301) as primarily sand, clay, and sandstone. Based on geologic descriptions in Covington and Weaver (1991), the sediments are likely stream deposits of the lower part of the Banbury Basalt. The sediments are overlain at Snake River Farms by approximately 50 feet of basalt. This basalt is likely the upper part of the Banbury Basalt.

The springs that supply Snake River Farms and Clear Lake issue from a shallow aquifer found within the base of the Sand Springs Basalt. The Sand Springs Basalt appears to overly the upper part of the Banbury basalt. The upper part of the Banbury basalt apparently has low permeability, preventing water from moving downward from the shallow aquifer in the base of the Sand Springs Basalt into the underlying Banbury basalt. Instead, water is forced to move laterally and discharge from the base of the Sand Springs Basalt at the springs. According to Covington and Weaver (1991), "The top of the Banbury Basalt, relative to other more permeable rock units, defines the lower limit of spring emergence along the present canyon".

Review of well driller's reports suggest that static water level elevations in the wells tapping the deep aquifer zones in the sediments range from approximately

2900 to 2980 feet, whereas the springs discharge at elevations between 3030 and 3070. Water-table elevations in the shallow aquifer approximately ¼ mile up-gradient from the springs are approximately 100 feet higher than the springs. The 50-foot to more than 200-foot difference in water level elevations between the deep aquifer zones that will be tapped by the wells and the shallow aquifer zone that discharges to the springs demonstrates a degree hydraulic of discontinuity. This discontinuity is not surprising, as direct hydraulic connection should not be expected between the shallow and deep aquifer zones due to the low permeability clay and rock layers that separate these zones.

Water chemistry from the Clear Springs Test Well (tapping the deep aquifer) and the water chemistry from the springs differ. The water produced from the deep aquifer zones tapped by the Clear Springs Test Well has lower concentrations of nitrate, alkalinity, hardness, and chloride, and higher concentrations of arsenic and fluoride (Exhibit 4300). These differences in water chemistry further indicate that the deep aquifer zones are separated from the shallow aquifer that discharges to the springs.

Given the separation between the deep and shallow aquifers, it is not likely that pumping of the proposed wells will significantly interfere with the source of water from the springs. As an example, pumping of the Clear Springs Test Well produced no detectable change in spring discharge as measured at Kanaka Creek. This finding supports the static water level, water chemistry, and geologic data indicating no direct hydraulic connection between the aquifer zone that discharges to the springs and the deeper aquifer zone tapped by the test well. In the case of the Clear Springs Test Well, C.E. Brockway. Ph.D., P.E., (January 24, 2007 letter report "Re: New Well Operation") noted the following.

> "Several factors indicate that the well production zone is a separate system from the spring flow and will not produce any noticeable impact to annual spring flows. This opinion is primarily based on measurements of creek flow recorded throughout the drilling program and pump test in addition to comparison of water chemistry between spring water samples and samples taken from the well at the end of the pumping tested conducted in May, 2006." (Exhibit 4300)\

The potential yield from deep aquifer wells has been determined using data from the Clear Springs Test Well. The calculated deep aquifer transmissivity (using the residual-drawdown method, as described on page 256 of Groundwater and Wells (Driscoll, 1986)) from the Clear Spring Test Well recovery data is approximately 17,000 gpd/ft. No storage coefficient can be calculated from the Clear Springs Test Well data, but a storage coefficient of approximately 0.001 is typical for a confined to semi-confined aquifer (such as the sedimentary aquifer tapped by the Clear Springs Well). Based on these estimates of transmissivity and storage coefficient, potential well yields can be calculated using the Theis equation. In this instance, assuming that the transmissivity of the deep aquifer is relatively consistent at 17,000 gpd/ft throughout the local area, and that aquifer the storage coefficient is approximately 0.001, then a single, hydraulically-efficient well tapping the aquifer would produce a yield of approximately 700 gpm (1.56 cfs) with pumping drawdown of approximately 100 feet. Well drilling and testing are needed to confirm these projections. The ability of the aquifer to sustain long-term pumping at this rate or higher rates has not been tested.

Q. WHY DO YOU BELIEVE MORE THAN ONE WELL MAY BE NECESSARY TO SUPPLY 2.67 CFS?

A. Multiple wells can develop more water than a single well, but will need to be spaced to reduce interference drawdown. For example, two wells spaced ¼ mile (1,320 feet) apart could each produce approximately 525 gpm (2.34 cfs in combination) with approximately 100 feet of drawdown. Three wells, spaced over ¼ mile (i.e., 1/8 mile between each well), would each produce 400 gpm (2.67 cfs total in combination) with an average of 100 feet drawdown each. There are diminishing returns with each well added, but two wells provide a greater combined yield than one well, and three wells provide a greater combined yield than two wells. Given the anticipated variability in aquifer hydraulic characteristics and the lack of more detailed hydraulic data for the deep aquifer below Snake River Farms, actual well yields will likely be more or less than predicted above. Well construction and testing is required to better document aquifer characteristics.

Q. IS THE PROPOSED LOCATION OF THE WELLS SUFFICIENT TO ACCOMMODATE ONE OR MORE WELLS?

A. In my opinion, the best available location for the first well site is a bare flat lot, approximately 1000 feet east of Snake River Farms, in the SE NW Section 1, T9S, R14E, on property owned by the IDF&G. This site has plenty of room to work, and is not directly adjacent to the road, wetlands or spring areas. If a test well at that location is successful, and the Ground Water Districts propose to mitigate for spring flow depletions with deep aquifer groundwater, one or more additional wells could be located closer to (or at) Snake River Farms to develop additional water to potentially meet the 2.67 cfs target. Each of these wells could be equipped with a standard-construction submersible pump. Pump motors totaling approximately 100 horsepower would be required to supply 2.67 cfs. A nominal 8-inch and 10-inch diameter pipeline would be used to deliver the water from the wells to Snake River Farms. A back-up generator with automatic transfer switch can be provided to keep the wells operating during power failures.

Q. HOW WILL YOU VERIFY THAT THERE IS ENOUGH WATER IN THAT LOCATION?

A. A test well has been designed and would need to be constructed and tested. The test well specifications contemplate (1) identifying shallow supplies that might be available to improve the existing supplies by installing horizontal collectors, (2) installing and sealing 18-inch surface casing to exclude shallow groundwater associated with the springs, (3) drilling an exploratory borehole below the surface casing to 400 feet depth, (4) conducting a geophysical survey to identify potential aquifer zones, (5) conducting two or three zone pumping tests to document water temperature and chemistry, static water level, and potential productivity of each water-bearing interval, (6) reaming the exploration borehole to the desired depth based on zone test data, (7) completing the well with 12-inch casing, screen, and filter pack, and (8) conducting pumping tests. The well is sized to produce a maximum potential yield of about 1200 gpm (2.67 cfs). Based on the Clear Springs test well, 300 to 800 gpm is the anticipated yield from a single well. Bids for drilling, construction, and testing of the well have been received from three drilling contractors. Well specifications are provided as Exhibit 4302.

Following completion of the well, aquifer testing will consist of initial step-rate pumping to characterize well productivity. The step-rate test will be followed by a 24-hour constant-rate test at the maximum anticipated production rate for the well. During the constant-rate test, flow rate from adjacent springs on the IDF&G property will be monitored. Water levels in local wells (such as the Clear Springs Foods test well and the Snake River Farms well) might also be monitored.