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**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

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1 irrigation ditch and drainage issues. I recently prepared expert reports and
2 provided testimony before the Snake River Basin Adjudication (SRBA) District
3 Court regarding water right 63-00123D, 63-00123F & 63-00123G (Lexington
4 Hills, Inc). In the past, I prepared several expert reports in the SRBA related to
5 spring water rights in the Hagerman area.

6 **II. DISCUSSION**

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

9
10 A. The purpose of my testimony is:

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

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

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

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

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

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

3
4 A. Yes. The information includes:

- 5 • data from a Clear Springs Foods test well that was test pumped in May 2006,
- 6 • well driller reports for wells in the vicinity of Snake River Farms (which
7 include geologic, water level, well yield, and water temperature data)
- 8 • water quality data for springs supplying Snake River Farms, and
- 9 • published geologic mapping for the spring vicinity, including Covington and
10 Weaver (1991, Geologic Maps and Profiles of the North Wall of the Snake
11 River Canyon, Thousand Springs and Niagara Springs Quadrangles, Idaho,
12 USGS Miscellaneous Investigation Series I-1947-C) and Gillerman and others
13 (2005, Geologic Map of the Thousand Springs Quadrangle, Gooding and
14 Twin Falls Counties, Idaho, IGS Digital Map 49).

15 **Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.**

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

- 17 1. More than 1.1 cfs could potentially be developed from the aquifer
18 supplying Idaho Department of Fish and Game (IDF&G) water right 36-4076
19 through improving the existing diversions by horizontal boring into the hillside in
20 the vicinity of the spring. If successful, the horizontal boring or borings could
21 produce flows in excess of 2.67 cfs. This could be a proper means to optimize use
22 of the water supply available under water right 36-4076 which is senior in priority
23 to the calling water right of Snake River Farms.
- 24 2. Alternatively, in my opinion, approximately three 400-foot deep wells,
25 spaced across an area for approximately 1/4 mile to the east of Snake River

1 Farms, on property owned by the IDF&G, may be capable of producing up to the
2 2.67 cfs required for supplemental supply to Snake River Farms. Such wells are
3 not anticipated to injure local water rights or have a direct depletion to the local
4 spring water supply. The source of water for these wells will be a deep aquifer
5 that is not in direct hydraulic connection with the shallow aquifer zone that is the
6 source for the springs that supply Snake River Farms.

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

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

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

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

6
7 A. Water Right No. 36-4076 could be delivered directly to Snake River Farms from
8 four springs, consisting of one spring located near the northeast corner of the
9 Snake River Farms property and three springs located on the IDF&G property.
10 Conceptual details of a piping and pumping plan that could potentially convey
11 this water are provided in the Exhibit 4303. In my opinion, a piping and pumping
12 system such as described in Exhibit 4303 can be successfully constructed. The
13 water diverted from the springs would need to be replaced with an alternate water
14 source to maintain the wetland complex on the IDF&G property. The
15 recommended source for such water is discharge from the Snake River Farms
16 facility. The water could be pumped from the lower end of the Snake River
17 Farms' raceway, and delivered into the ditch that conveys water from IDF&G
18 Spring 1, located at the northeast corner of the Snake River Farms' facility. The
19 ditch eventually discharges into the IDF&G wetland complex. The Snake River
20 Farms' water source is similar in chemistry to the water that currently maintains
21 the IDF&G wetlands.

1 **Q. PLEASE EXPLAIN YOUR PROPOSAL FOR ADDITIONAL**
2 **DEVELOPMENT OF WATER FROM THE AQUIFER SOURCE FOR**
3 **THE SPRINGS THAT SUPPLY OF THE IDAHO FISH AND GAME**
4 **WATER RIGHT NO. 36-4076?**
5

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

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

1 **Q. WHAT IS THE BASIS FOR YOUR OPINION THAT DRILLING ONE TO**
2 **THREE WELLS WILL PROVIDE UP TO 2.67 CFS AND NOT CAUSE**
3 **INTERERENCE WITH THE SPRINGS?**
4

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

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

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

1 2900 to 2980 feet, whereas the springs discharge at elevations between 3030 and
2 3070. Water-table elevations in the shallow aquifer approximately ¼ mile up-
3 gradient from the springs are approximately 100 feet higher than the springs.
4 The 50-foot to more than 200-foot difference in water level elevations between
5 the deep aquifer zones that will be tapped by the wells and the shallow aquifer
6 zone that discharges to the springs demonstrates a degree hydraulic of
7 discontinuity. This discontinuity is not surprising, as direct hydraulic connection
8 should not be expected between the shallow and deep aquifer zones due to the low
9 permeability clay and rock layers that separate these zones.

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

17 Given the separation between the deep and shallow aquifers, it is not likely that
18 pumping of the proposed wells will significantly interfere with the source of water
19 from the springs. As an example, pumping of the Clear Springs Test Well
20 produced no detectable change in spring discharge as measured at Kanaka Creek.
21 This finding supports the static water level, water chemistry, and geologic data
22 indicating no direct hydraulic connection between the aquifer zone that discharges
23 to the springs and the deeper aquifer zone tapped by the test well. In the case of

1 the Clear Springs Test Well, C.E. Brockway, Ph.D., P.E., (January 24, 2007 letter
2 report "Re: New Well Operation") noted the following.

3 "Several factors indicate that the well production zone is a separate system
4 from the spring flow and will not produce any noticeable impact to annual
5 spring flows. This opinion is primarily based on measurements of creek
6 flow recorded throughout the drilling program and pump test in addition to
7 comparison of water chemistry between spring water samples and samples
8 taken from the well at the end of the pumping tested conducted in May,
9 2006." (Exhibit 4300)\

10
11 The potential yield from deep aquifer wells has been determined using data from
12 the Clear Springs Test Well. The calculated deep aquifer transmissivity (using the
13 residual-drawdown method, as described on page 256 of Groundwater and Wells
14 (Driscoll, 1986)) from the Clear Spring Test Well recovery data is approximately
15 17,000 gpd/ft. No storage coefficient can be calculated from the Clear Springs
16 Test Well data, but a storage coefficient of approximately 0.001 is typical for a
17 confined to semi-confined aquifer (such as the sedimentary aquifer tapped by the
18 Clear Springs Well). Based on these estimates of transmissivity and storage
19 coefficient, potential well yields can be calculated using the Theis equation. In
20 this instance, assuming that the transmissivity of the deep aquifer is relatively
21 consistent at 17,000 gpd/ft throughout the local area, and that aquifer the storage
22 coefficient is approximately 0.001, then a single, hydraulically-efficient well
23 tapping the aquifer would produce a yield of approximately 700 gpm (1.56 cfs)
24 with pumping drawdown of approximately 100 feet. Well drilling and testing are
25 needed to confirm these projections. The ability of the aquifer to sustain long-
26 term pumping at this rate or higher rates has not been tested.

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

3
4 A. Multiple wells can develop more water than a single well, but will need to be
5 spaced to reduce interference drawdown. For example, two wells spaced ¼ mile
6 (1,320 feet) apart could each produce approximately 525 gpm (2.34 cfs in
7 combination) with approximately 100 feet of drawdown. Three wells, spaced
8 over ¼ mile (i.e., 1/8 mile between each well), would each produce 400 gpm (2.67
9 cfs total in combination) with an average of 100 feet drawdown each. There are
10 diminishing returns with each well added, but two wells provide a greater
11 combined yield than one well, and three wells provide a greater combined yield
12 than two wells. Given the anticipated variability in aquifer hydraulic
13 characteristics and the lack of more detailed hydraulic data for the deep aquifer
14 below Snake River Farms, actual well yields will likely be more or less than
15 predicted above. Well construction and testing is required to better document
16 aquifer characteristics.

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

19
20 A. In my opinion, the best available location for the first well site is a bare flat lot,
21 approximately 1000 feet east of Snake River Farms, in the SE NW Section 1, T9S,
22 R14E, on property owned by the IDF&G. This site has plenty of room to work,
23 and is not directly adjacent to the road, wetlands or spring areas. If a test well at
24 that location is successful, and the Ground Water Districts propose to mitigate for
25 spring flow depletions with deep aquifer groundwater, one or more additional
26 wells could be located closer to (or at) Snake River Farms to develop additional

1 water to potentially meet the 2.67 cfs target. Each of these wells could be
2 equipped with a standard-construction submersible pump. Pump motors totaling
3 approximately 100 horsepower would be required to supply 2.67 cfs. A nominal
4 8-inch and 10-inch diameter pipeline would be used to deliver the water from the
5 wells to Snake River Farms. A back-up generator with automatic transfer switch
6 can be provided to keep the wells operating during power failures.

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

9
10 A. A test well has been designed and would need to be constructed and tested. The
11 test well specifications contemplate (1) identifying shallow supplies that might be
12 available to improve the existing supplies by installing horizontal collectors, (2)
13 installing and sealing 18-inch surface casing to exclude shallow groundwater
14 associated with the springs, (3) drilling an exploratory borehole below the surface
15 casing to 400 feet depth, (4) conducting a geophysical survey to identify potential
16 aquifer zones, (5) conducting two or three zone pumping tests to document water
17 temperature and chemistry, static water level, and potential productivity of each
18 water-bearing interval, (6) reaming the exploration borehole to the desired depth
19 based on zone test data, (7) completing the well with 12-inch casing, screen, and
20 filter pack, and (8) conducting pumping tests. The well is sized to produce a
21 maximum potential yield of about 1200 gpm (2.67 cfs). Based on the Clear
22 Springs test well, 300 to 800 gpm is the anticipated yield from a single well. Bids
23 for drilling, construction, and testing of the well have been received from three
24 drilling contractors. Well specifications are provided as Exhibit 4302.

1 Following completion of the well, aquifer testing will consist of initial step-rate
2 pumping to characterize well productivity. The step-rate test will be followed by
3 a 24-hour constant-rate test at the maximum anticipated production rate for the
4 well. During the constant-rate test, flow rate from adjacent springs on the
5 IDF&G property will be monitored. Water levels in local wells (such as the
6 Clear Springs Foods test well and the Snake River Farms well) might also be
7 monitored.
8