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SPF Water Engineering, LLC
water resource consultants
600 E. River Park Lane, Ste. 105
Boise, ID 83706

TO:

Mr. Wayne Courtney
Rangen, Inc.
P.O. Box 706
Buhl, ID 83316

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SPF Water Engineering, LLC
water resource consultants

Christian Petrich, Ph.D., P.E.
Principal Engineer/Hydrologist
600 E. River Park Lane, Ste. 105
Boise, ID 83706
208.383.4140 x202
fax 208.383.4156
e-mail cpetrich@spfwater.com
www.spfwater.com

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SPF Water Engineering, LLC
water resource consultants

Memorandum (DRAFT)

RECEIVED
MAY 22 2004
RANGEN, INC.

DATE: May 20, 2004

TO: Rangen, Inc. (c/o Justin May)

FROM: Christian Petrich

RE: Rangen Application

Flows from the Curren Tunnel to the Rangen, Inc., aquaculture facility have decreased substantially over the last several decades. The Eastern Snake Plain Aquifer Mitigation, Recovery, and Restoration Agreement for 2004 established a $500,000 fund within the Idaho Department of Commerce and Labor to provide grant money to spring users experiencing decreased flows. The goal of the grant money is to implement improvements that address spring water supply problems. The purpose of this memo is to outline potential components of a grant application by Rangen, Inc., under the 2004 agreement.

The memo is divided into four parts. The first is a description of background information used in this initial evaluation. The second part is a brief review of hydrologic characteristics in the vicinity of the Rangen Spring. The third part presents a discussion of potential options for enhancing water flow at the Rangen facility. The final part lists general components to be considered for a financial assistance application to the Idaho Department of Commerce.

BACKGROUND INFORMATION

The following data and information were compiled and used in the preparation of these potential grant alternatives:

1. Flow data from measurements in the Curren Tunnel (IDWR);
2. Discharge data from the Rangen Aquaculture Facility (Rangen, Inc.);
3. Hydrographs from wells in the vicinity of the Curren Tunnel (IDWR);
4. List of water rights in the vicinity of the Curren Tunnel (IDWR);
5. Drillers' reports from the vicinity of the Curren Tunnel
6. A map of water rights and approximate well locations in the vicinity of the Rangen Aquaculture Facility;

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6. A map of water rights and approximate well locations in the vicinity of the Rangen Aquaculture Facility;
7. Several geologic cross-sections based on drillers' reports;
8. Digital elevation data with 10-foot contour spacing (USGS);
9. Geologic Map and Profiles of the North Wall of the Snake River Canyon, Bliss, Hagerman, and Tuttle Quadrangles, Idaho (Covington and Weaver, 1989);
10. Summary of Ground Water Conditions at the Curren Tunnel near Hagerman, Idaho (Draft) (Bendixsen, 1995);
11. Relationships between Spring Discharge and Aquifer Water Levels in the Thousand Springs Region, Idaho (Janszak, 2001);
12. Response of well-water elevations and spring discharge to changes in barometric pressure, Eastern Snake River plain Aquifer, Hagerman, Idaho (Rush and Johnson, 2002); and
13. Spring discharge along the Milner to King Hill Reach of the Snake River (Johnson et al., 2002).

CHARACTERISTICS OF SPRING DISCHARGE INTO THE CURREN TUNNEL

The Curren Tunnel draws water from a pillow lava facies of the Malad Basalt (Johnson et al., 2002). A geologic cross section from the vicinity of the Curren Tunnel (Covington and Weaver, 1989) suggests that discharge is controlled, in part, by clay zones associated with the Yahoo Clay (Figure 1).

Average annual diversion rates to the Rangen facility from the Curren Tunnel were over 50 cfs during the 1960s and early 1970s, but have decreased to less than 15 cfs in recent years (Figure 2). Decreases in discharge from the Curren Tunnel have been greater than in some other springs, presumably because of the relatively high elevation of the Curren Tunnel.

Discharge records for the Curren Tunnel show a much greater variation in annual and seasonal flows than other nearby springs (Johnson et al., 2002). The variations may be the result of a more direct level of hydraulic connection between subsurface fracture flow in the vicinity of the Curren Tunnel and (1) overlying surface water (e.g., canal leakage, infiltration from irrigation) and (2) ground water withdrawals.

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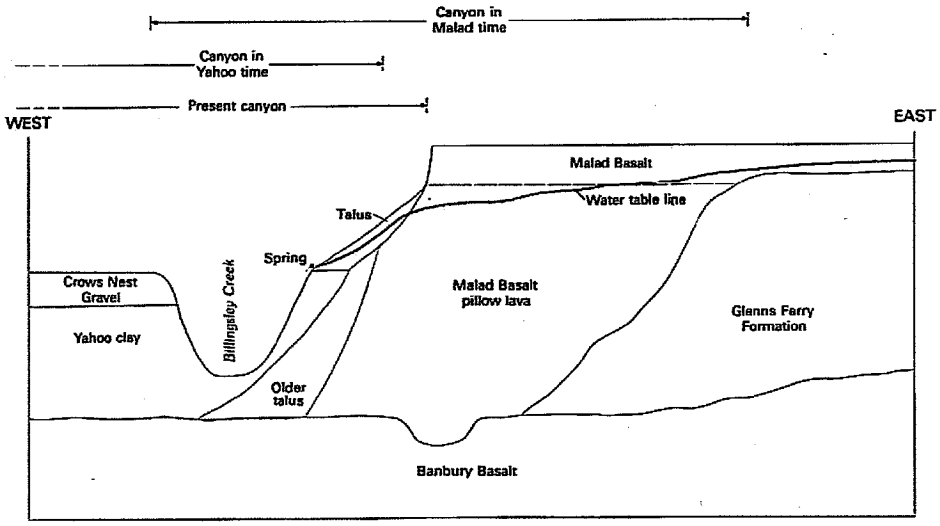

Figure 3. Schematic section of the canyon wall near profile-control location 179–1 east of Hagerman. Section shows the interpretative relation of the confining units of Yahoo Clay and Glenns Ferry sediments to the Malad Basalt canyon filling deposits.

Figure 1: Schematic section of the canyon wall near the Three-Springs and Weatherby Spring (Covington and Weaver, 1989).

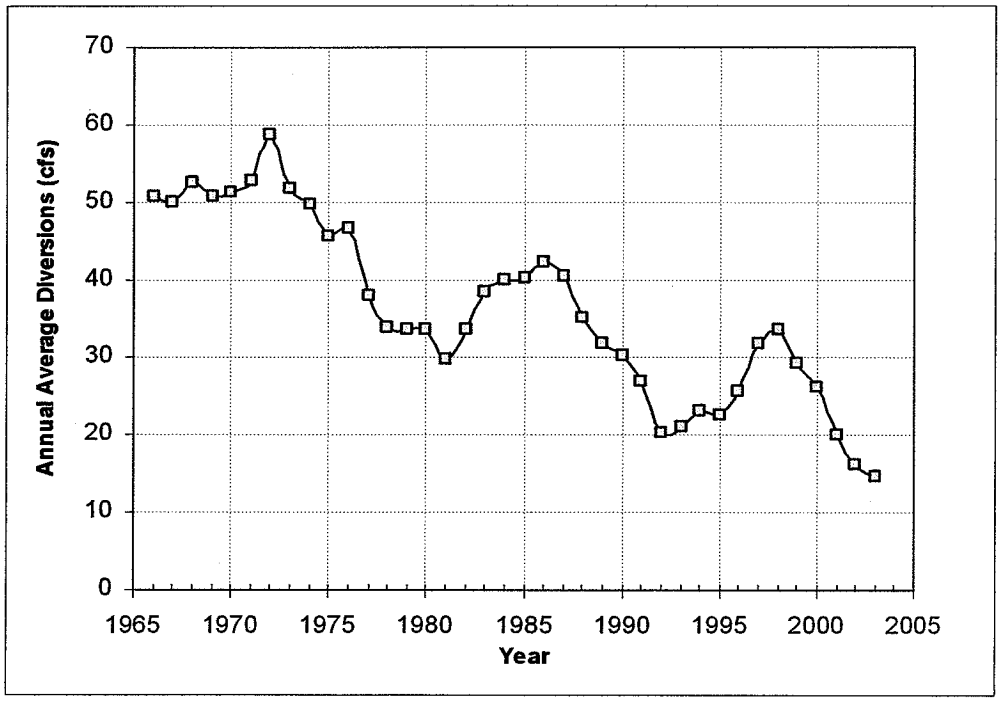

Figure 2: Annual average diversions to the Rangen aquaculture facility.

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OPTIONS FOR AUGMENTING WATER SUPPLIES AT THE RANGEN FACILITY

Potential options for increasing flows to the Rangen facility (which are discussed in greater detail below) include the following:

1. Augmentation using water from Weatherby Springs/Hoagland Tunnel;
2. Divert Curren-Tunnel water currently used for agricultural irrigation to the Rangen facility prior to re-use as irrigation.
3. Withdraw water from a vertical well (or wells) located at the Rangen facility;
4. Construct a horizontal well (or wells) near the Curren Tunnel and at an elevation below the Curren Tunnel;
5. Reduce, if present, downward vertical flow through existing wells in the area upgradient of the Curren Tunnel;
6. Treatment and re-use of water from the Rangen aquaculture facility.

1. Augmentation with water originating in the Weatherby Springs/Hoagland Tunnel

Water from the Hoagland Tunnel/Weatherby Springs is diverted for a variety uses (see attached map). Much of this water flows through the Jones aquaculture facility. Two water rights (36-119 and 36-120) are used to irrigate approximately 15 acres in the NENE and NWNE portions of Section 31 just west of the Rangen facility. The diversion rate of these two rights is 0.7 cfs, although this amount would need to be field-verified. The ditch at its closest location to the Rangen facility lies at an elevation of approximately 3,130 feet (above mean sea level – msl), and is located approximately 800 feet horizontally from the top of the upper Rangen raceway. The upper Rangen raceway lies at an elevation of approximately 3,080 feet.

The quality and temperature of water is more important for aquaculture uses than irrigation uses. One alternative to augment water at the Rangen facility would be to transfer water from irrigation uses under rights 36-119 and 36-120 to the Rangen facility. Mitigation for this change of use could consist of the following:

1. Pump water at the Rangen raceway discharge point back to the current places of use for rights 36-119 and 36-120. This would require a lift of approximately 80 feet.

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2. Install a well for ground water withdrawals to replace water under rights 36-119 and 36-120. The use of well water may require mitigation to downgradient users.

Advantages of this alternative are that potential augmentation water is relatively close to the Rangen facility and is of a quality and temperature consistent with aquaculture operations (because of the spring source). The disadvantage is that the amount of water potentially available is relatively small (less than 1 cfs). There is a chance that there may be additional irrigation water available by transfer from either the Hoagland Tunnel/Weatherby Springs or Three-Springs. If available by transfer, it may be possible to convey this water through the same pipe/ditch currently being used for rights 36-119 and 36-120.

2. Transfers of irrigation water rights from Curren Tunnel to aquaculture facility

There currently are several diversions (initial review suggests an amount of approximately 10 cfs) from the Curren Tunnel being used for irrigation. It may be possible to use some of this water in the Rangen aquaculture raceways if it were possible to replace the irrigation water with (a) raceway discharge or (b) well water. Use of well water may require some form of mitigation to downgradient users. The elevation difference between the lower Rangen raceway discharge point and the Curren Tunnel is approximately 115 feet over approximately 2,500 feet horizontal distance. The elevation gain to a lower point on the diversion from the Curren tunnel (i.e., minimum elevation required for gravity flow to the next place of use) would be approximately 50 to 75 feet.

3. A vertical well (or wells) located at the Rangen facility

One alternative would be to pump water from a vertical well located near the upstream end of the Rangen raceways. This may, however, require a lift of more than 100 feet.

The existing Rangen well was drilled to a depth of 278 feet (based on the driller's report). Substantial clay was encountered to a depth of approximately 220 feet (presumably the "Yahoo Clay") prior to encountering basalt (presumably "Banbury Basalt"). The static depth to water was listed as 112 feet, with a discharge through a 6-inch casing of 33 gpm over 3 hours.

Rangen has expressed two concerns with this alternative. One concern is the pumping costs associated with lifting a substantial amount of water from the

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well to the raceways. The second concern is that of dependence on ground water may require redundant wells and pump systems for operational confidence.

Also, an additional well may be considered to be a new use that would have a current priority date. Mitigation for new well withdrawals may be required.

4. Horizontal well (or wells) near the Curren Tunnel

IDWR has suggested that a horizontal well in the vicinity of the Curren Tunnel could be considered a "well deepening" of the current Curren Tunnel discharge point. Thus, a fourth potential option is to drill a horizontal well near the Curren Tunnel.

Most of the natural springs in the vicinity of the Curren Tunnel discharge from a similar elevation, suggesting that a common feature is controlling the discharge elevation (e.g., Yahoo Clay or Glenns Ferry sediments?). Drilling a horizontal well as the same elevation as the Curren Tunnel risks going into the same formation in which water levels have already declined. Installing a horizontal well below this point risks missing the fractured basalt zone that supplies water to the Rangen Tunnel.

Conceptually, a horizontal well drilled from the Rangen site would penetrate a talus slope, possibly clays associated with the Yahoo Clay formation, and then into the pillow basalt associated with the Malad Basalt (see Figure 1). The target aquifer would be the Malad Basalt. The distance from the canyon wall to Malad basalt is unknown.

One approach to better define characteristics that might be encountered in a horizontal well would be to construct one or more vertical test wells above the canyon rim, but close to the Curren Tunnel. A test well (or wells) could be used to define subsurface lithology, water levels, vertical hydraulic gradients, and aquifer characteristics at some distance from the canyon rim. Vertical test wells would be much less expensive than a horizontal test well.

A successful horizontal well could result in a substantial increase in flow to the Rangen facility. However, this flow will likely decrease current discharge to the Curren Tunnel, to other springs in the vicinity of the Curren Tunnel, and possibly to wells located on the rim above the Curren Tunnel.

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5. Reducing, if present, downward vertical flow through existing wells

Wells that are completed over large intervals (i.e., screened or open uncased over a large vertical distance) may enable vertical movement of ground water. This could have the effect of lowering the aquifer levels upgradient of the Curren Tunnel. It may be worthwhile to conduct a more thorough evaluation of wells above the canyon rim to determine the likelihood of vertical movement. This would include a more detailed well-log review and possibly in-well flow measurements during static conditions.

6. Treatment and re-use of water from the Rangen aquaculture facility.

The final option for enhancing the water supply at the Rangen facility would be to evaluate the treatment and re-use of water. Apparently an analysis was conducted several years ago by Brockway Engineering to determine the feasibility and cost of treatment and re-use. Changing hydrologic conditions might merit reconsideration of this option.

RECOMMENDATIONS FOR GRANT APPLICATION

None of the options listed above appear to stand out as ideal alternatives for restoring flows at the Rangen facility to 1960 levels. Based on our initial review of these alternatives, it is our opinion that a horizontal well near the Curren Tunnel has the greatest potential for providing substantially enhanced flows to the Rangen facility. Two or more vertical test wells may be required to help define a target elevation and length for a horizontal borehole. Several other alternatives also merit additional investigation. We would therefore recommend the following:

1. Construction of at least 2 vertical test wells above the Curren Tunnel to evaluate possible targets for a horizontal well.
2. Attempt to augment the Rangen facility with water from the Hoagland Tunnel.
3. Divert Curren-Tunnel water currently used for agricultural irrigation to the Rangen facility prior to re-use as irrigation. Pump a corresponding amount of discharge from the Rangen facility to replace the irrigation water.
4. Evaluate whether some wells located upgradient of the Curren Tunnel may be contributing to vertical downward ground water flow.

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5. Construct a vertical test well at the aquaculture facility as close to the canyon sides as possible to confirm stratigraphy and water levels in this area.
6. Reconsider water treatment and re-use within the Rangen facility.

REFERENCES

Bendixsen, S., 1995. Summary of Ground Water Conditions at the Curren Tunnel near Hagerman, Idaho (Draft), Idaho Department of Water Resources.

Covington, H.R. and Weaver, J.N., 1989. Geologic Map and Profiles of the North Wall of the Snake River Canyon, Bliss, Hagerman, and Tuttle Quadrangles, Idaho. U.S. Geological Survey, Miscellaneous Investigations Series, Regional Aquifer System Analysis Program.

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Rush, J.D. and Johnson, G.S., 2002. Response of well-water elevations and spring discharge to changes in barometric pressure, Eastern Snake River plain Aquifer, Hagerman, Idaho, Idaho Water Resources Research Institute.

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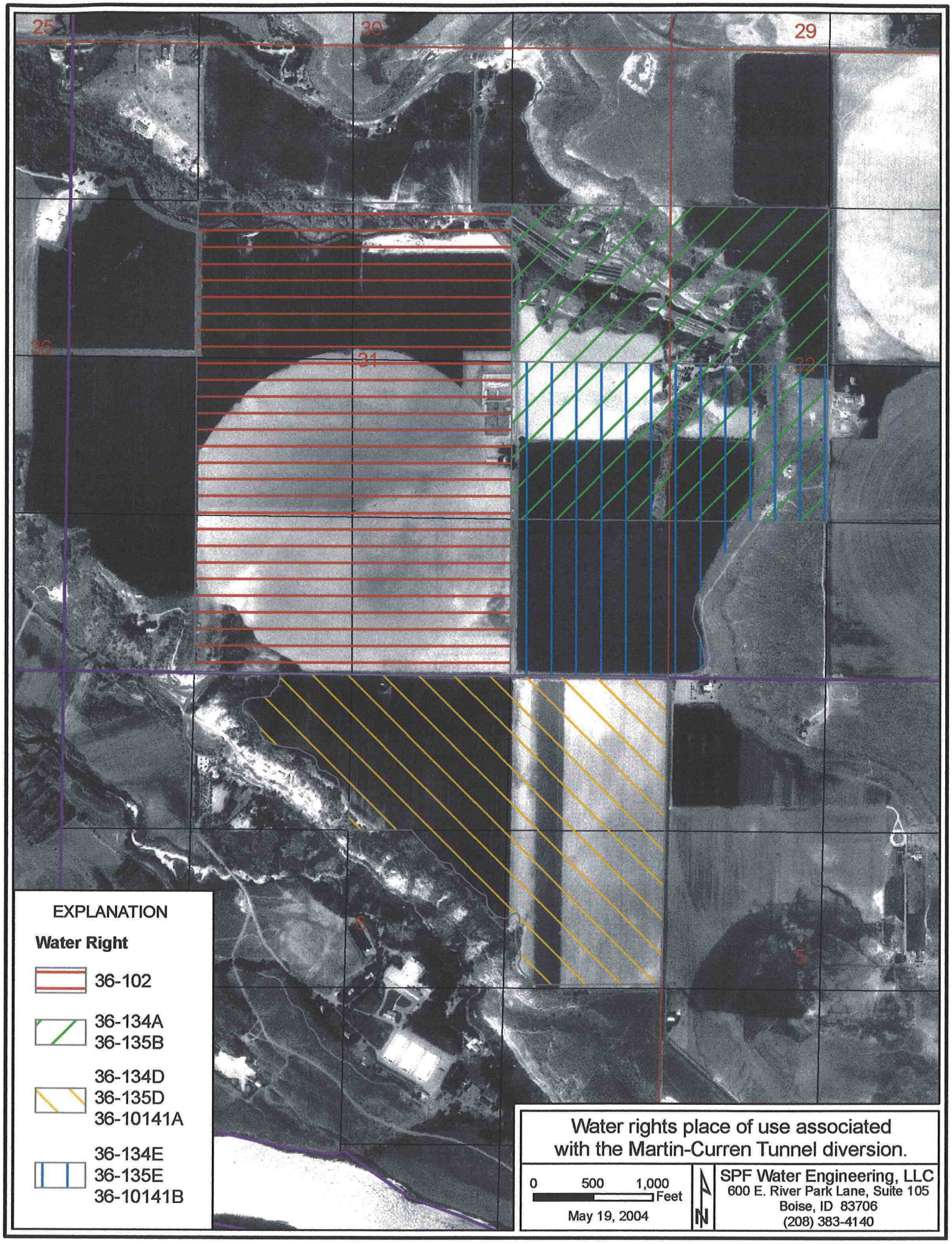

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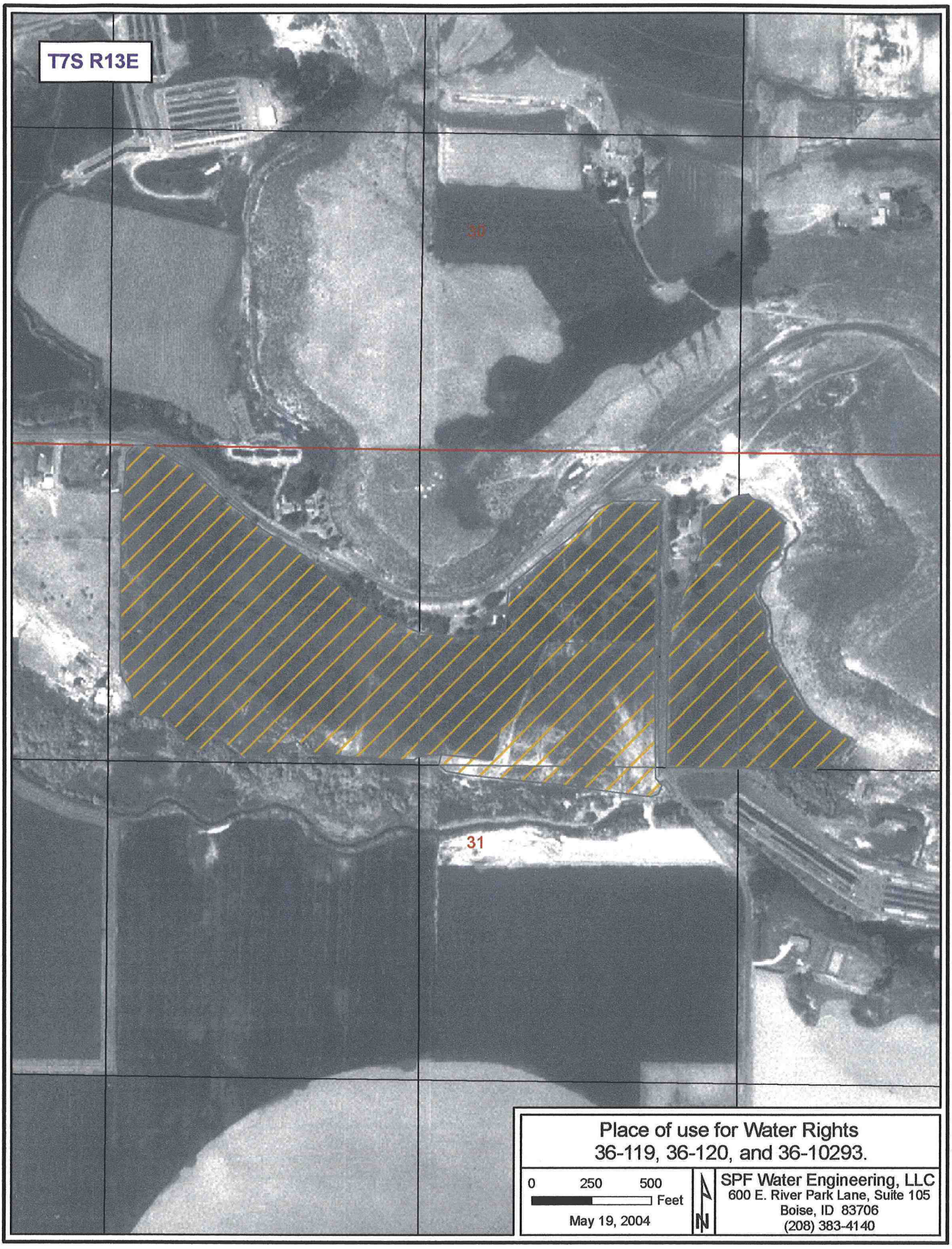

Place of use for Water Rights
36-119, 36-120, and 36-10293.

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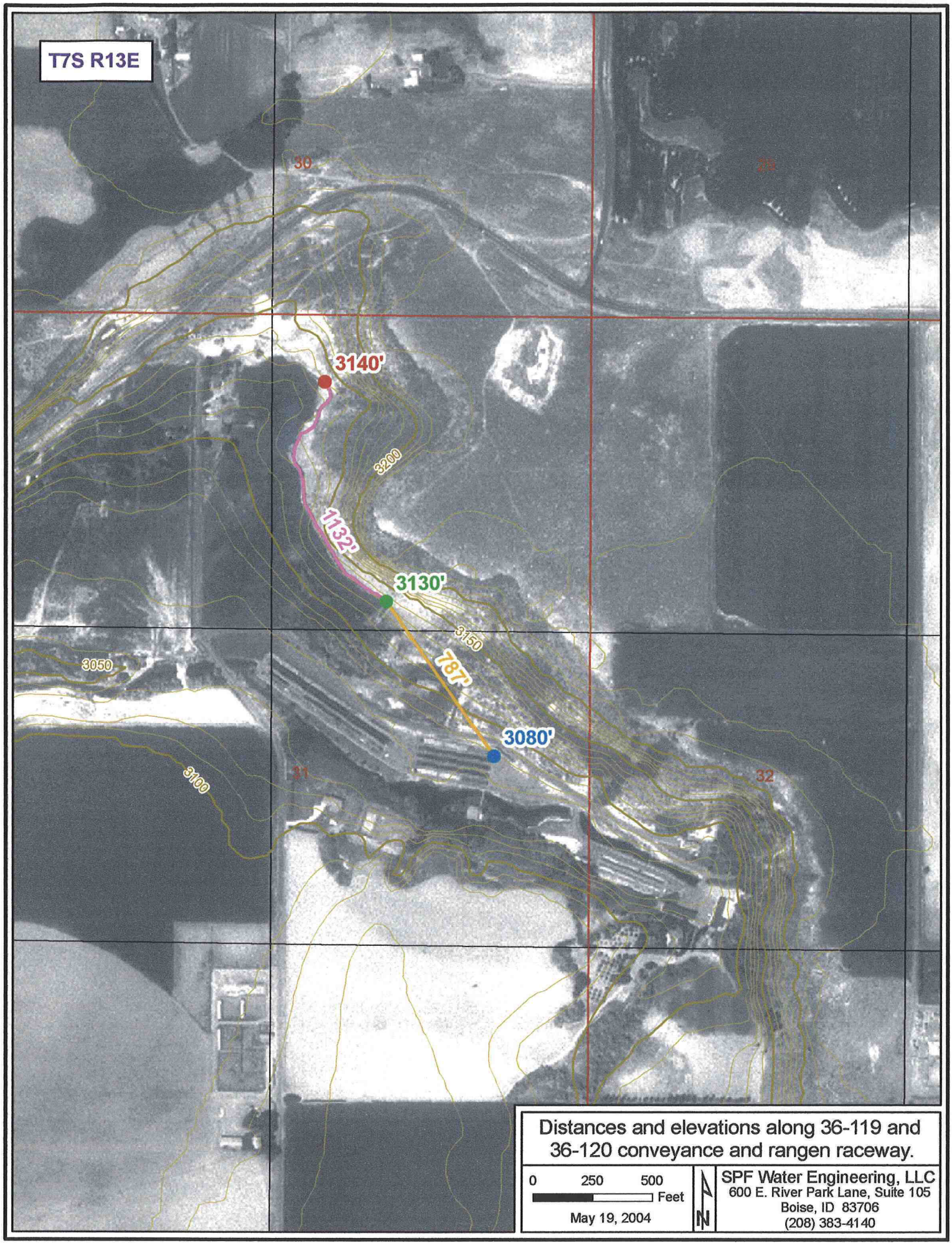

Distances and elevations along 36-119 and 36-120 conveyance and rangen raceway.

0 250 500 Feet

May 19, 2004

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SPF Water Engineering, LLC
600 E. River Park Lane, Suite 105
Boise, ID 83706
(208) 383-4140

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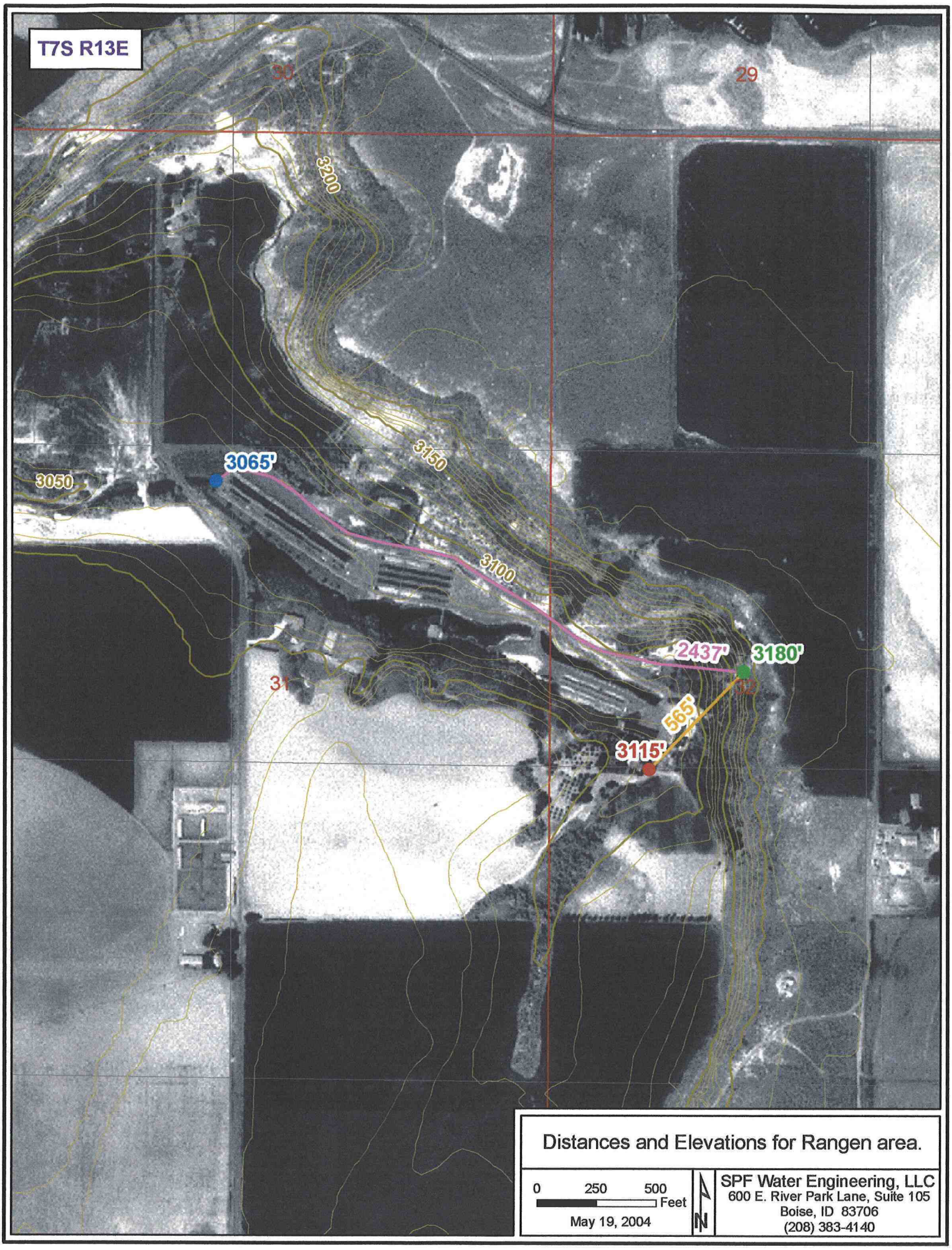

Distances and Elevations for Rangen area.

0 250 500 Feet

May 19, 2004

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SPF Water Engineering, LLC
600 E. River Park Lane, Suite 105
Boise, ID 83706
(208) 383-4140

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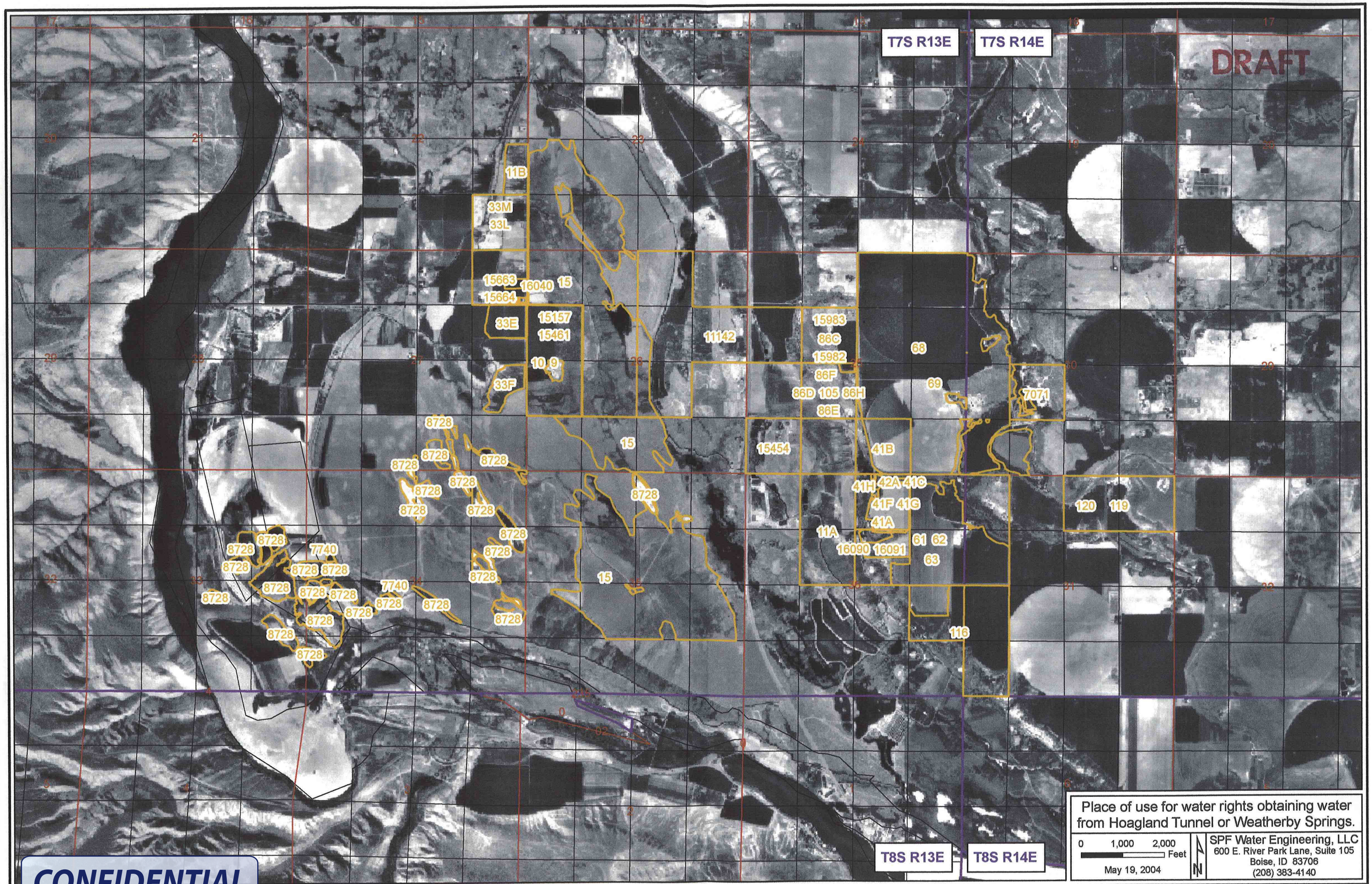

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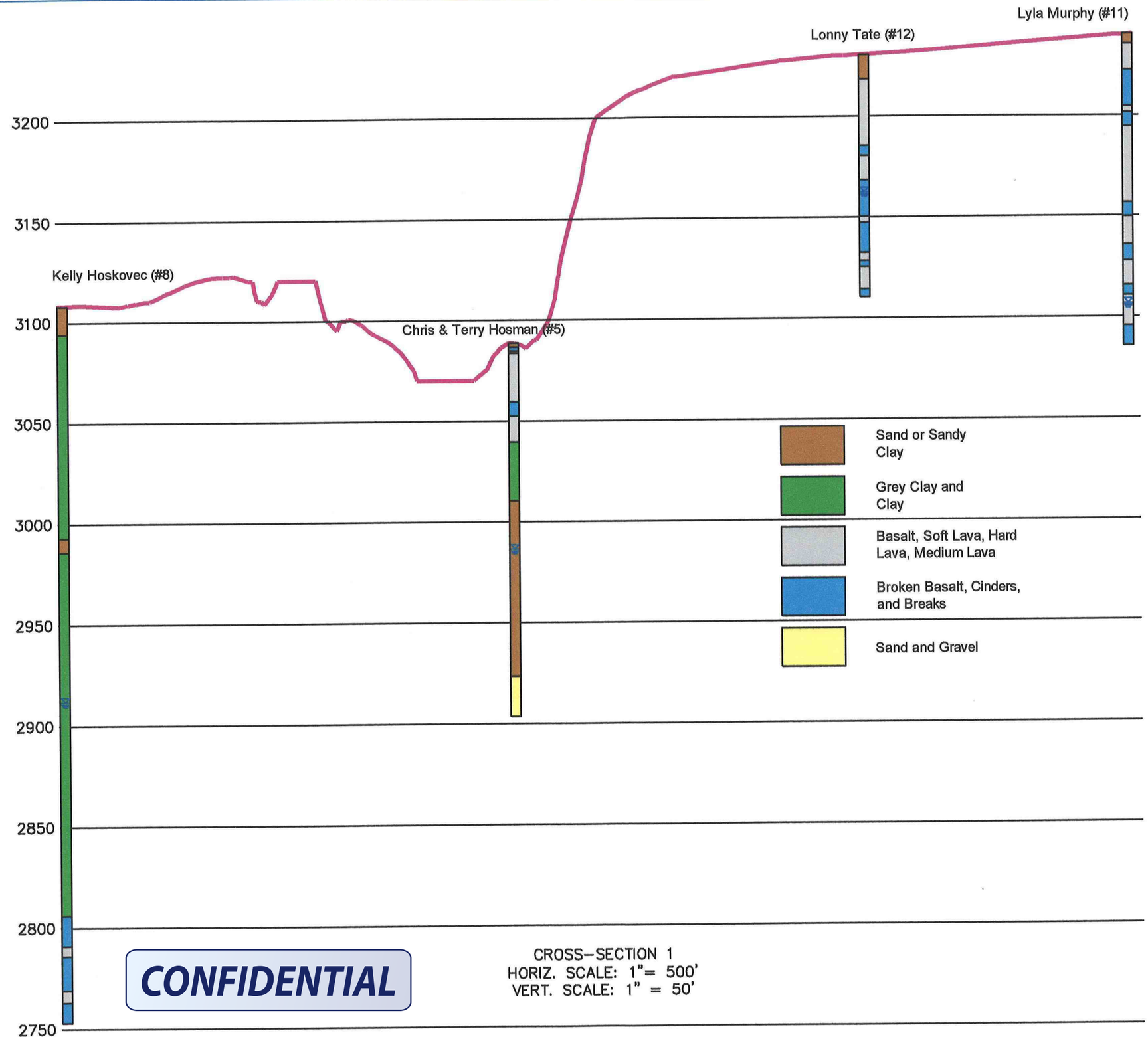

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CROSS–SECTION 1
HORIZ. SCALE: 1"= 500'
VERT. SCALE: 1" = 50'

SPF Water Engineering, LLC
water resource consultants
600 East River Park Lane, Suite 105, Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GROUND WATER INVESTIGATION FOR RANGEN, INC.
WATER RIGHTS AND WELLS IN VICINITY OF CURREN TUNNEL

AREA AFFECTED IN SECTIONS 29, 30, 31, & 32 OF TOWNSHIP 7 SOUTH, RANGE 14 EAST;
SECTION 36 OF TOWNSHIP 7 SOUTH, RANGE 13 EAST; SECTION 1 OF TOWNSHIP 8 SOUTH,
RANGE 13 EAST; SECTIONS 5 & 6 OF TOWNSHIP 8 SOUTH, RANGE 14 EAST, BOISE MERIDIAN

ENGINEER
CHRISTIAN PETRICK
600 EAST RIVER PARK LANE, SUITE 105
BOISE, IDAHO 83706
PHONE: 208–383–4140

OWNER/DEVELOPER
RANGEN, INC.

DRAWN BY:	S. CRANE
CHECKED BY:	C. PETRICK
SCALE:	AS NOTED
PLOT SCALE:	1 =1

DRAWING DIRECTORY
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MAY 19, 2002

REVISIONS	
DESCRIPTION	DATE
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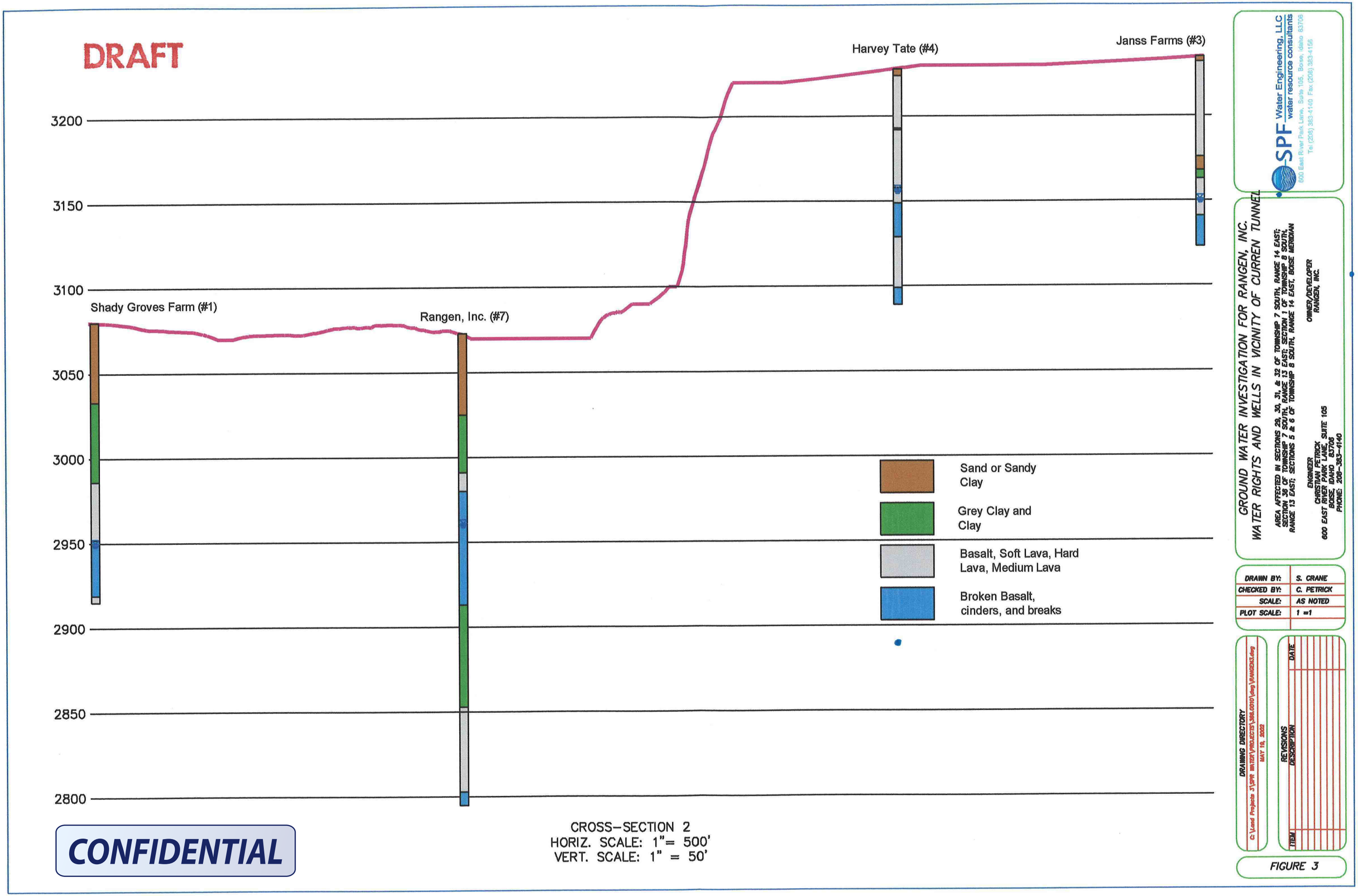
FIGURE 4


DRAFT
Shady Groves Farm (#1)
Rangen, Inc. (#7)
Harvey Tate (#4)
Janss Farms (#3)
3200
3150
3100
3050
3000
2950
2900
2850
2800
Sand or Sandy Clay
Grey Clay and Clay
Basalt, Soft Lava, Hard Lava, Medium Lava
Broken Basalt, cinders, and breaks
CROSS-SECTION 2
HORIZ. SCALE: 1"= 500'
VERT. SCALE: 1" = 50'
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SPF Water Engineering, LLC
water resource consultants
600 East River Park Lane, Suite 105, Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156
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ENGINEER
CHRISTIAN PETRICK
600 EAST RIVER PARK LANE, SUITE 105
BOISE, IDAHO 83706
PHONE: 208-383-4140
OWNER/DEVELOPER
RANGEN, INC.
DRAWN BY: S. CRANE
CHECKED BY: C. PETRICK
SCALE: AS NOTED
PLOT SCALE: 1 =1
DRAWING DIRECTORY
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MAY 19, 2022
REVISIONS
ITEM
DESCRIPTION
DATE
FIGURE 3