Eastern Snake Plain Aquifer Mitigation Program

APPLICATION FOR FINANCIAL ASSISTANCE TO EVALUATE THE FEASIBILITY OF A HORIZONTAL WELL IN THE VICINITY OF THE CURREN TUNNEL

Submitted to:

The Idaho Department of Commerce and Labor
Division of Economic Development
P.O. Box 83720
Boise, ID 83720-0093

Submitted by:

Rangen, Inc.
P.O. Box 706
Buhl, ID 83316

May 31, 2004

Table of Contents

List of Figures

List of Tables

ESPAM ASSISTANCE GRANT APPLICATION

Applicant: Rangen, Inc. Phone: 208-543-6421

Address: P.O. Box 706, Buhl, ID 83316

Application Prepared By: SPF Water Engineering, LLC Phone: (208) 383-4140

Address: 600 East River Park Lane, Suite 105, Boise, ID 83706

Technical Service Provider: SPF Water Engineering, LLC Phone: (208) 383-4140

Address: 600 East River Park Lane, Suite 105, Boise, ID 83706

Water Right Number(s): 36-15501, 36-02551, 36-07694

Amount of Water Supply Reduction: Approximately 80%

PROJECT FINANCING OVERVIEW:

ESPAM:	$ 132,928
Private:	$
Federal:	$
Other:	$
TOTAL:	$ 132,928

DESCRIBE PRIVATE/FEDERAL/OTHER MATCHING FUNDS:

BRIEF PROJECT DESCRIPTION: Feasibility evaluation of a horizontal well in vicinity of Curren Tunnel; primary task consists of installation of three test wells on canyon rim above Curren Tunnel

APPLICATION CERTIFICATION: The data in this application is true and correct. The undersigned has the authority to submit this application on behalf of the Applicant and will comply with all required certifications, laws, and regulations if the application is approved and selected for funding.

Name: (typed) J. Wayne Courtney Title: Executive Vice President

Signature: Date: 6/1/2007

Name: (typed) May, Sudweeks & Browning Title: Attorneys for Rangen, Inc.

Signature: Date:

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ESPAM:	$ 132,925
Private:	$
Federal:	$
Other:	$
TOTAL:	$ 132,925

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Signature: _____ Date: _____

ATTACHMENT A - BUDGET

Grantee: Rangen, Inc. Project No.:

Project: Feasibility Evaluation of a horizontal Well in Vicinity of Curren Tunnel

LINE ITEMS	AMOUNTS				
	ESPAM Grant	Private	Federal	Other	Total
Construction and Project Improvement (includes equipment)	67,000				$67,000
Professional/Engineering Fees	43,773				$43,773
Contingency	22,155				$22,155
Total Costs (includes contingency)	$132,928	$	$	$	$132,928

1) Project Description

a) Background

Rangen, Inc. ("Rangen") is one of the largest suppliers of high-yield, low waste feeds for the aquaculture industry. Rangen conducts on-going nutrition research to improve aquaculture feeds and husbandry practices. Rangen feeds are then tested in its aquaculture facility near Hagerman, Idaho to measure performance under practical conditions.

The Rangen aquaculture facility (Figure 1) is located in Gooding County approximately 3 miles from Hagerman, Idaho. The primary water source for the Rangen facility (Table 1) is spring discharge from the Curren Tunnel[1]. This is one of many springs in the Milner to King Hill reach of the Snake River (Figure 2) that collectively form a primary discharge area for the Eastern Snake River Plain (ESRP) aquifer.

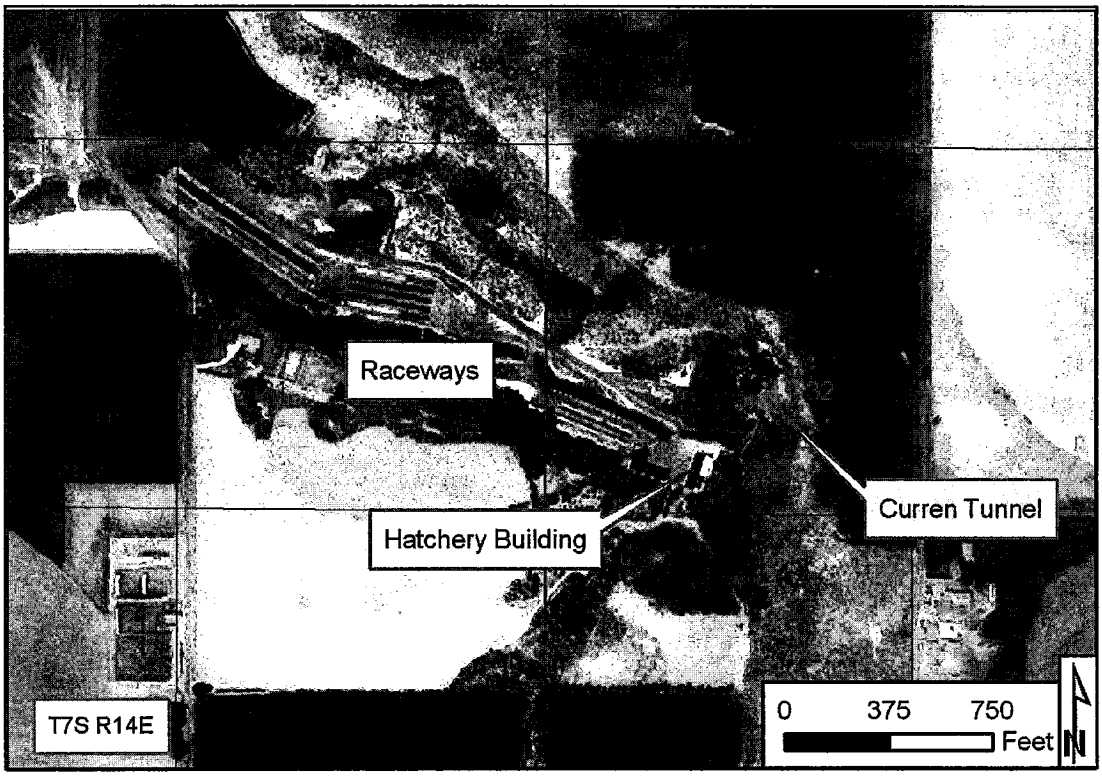

Figure 1: Rangen aquaculture facility.

[1] Also known as the Martin-Curren Tunnel.

Number	Priority Date	Decreed Date	Source	Maximum Diversion Rate	Maximum Diversion Volume
36-135A	Apr 1 1908	Aug 27 2001	Martin-Curren Tunnel	0.050	0.000
36-15501	Jul 1 1957	Dec 29 1997	Springs	1.460	0.000
36-2551	Jul 13 1962	Dec 29 1997	Martin-Curren Tunnel	48.540	0.000
36-10269	Aug 5 1976	Nov 22 1996	Ground Water	0.040	0.000
36-7694	Apr 12 1977	Dec 29 1997	Springs	26.000	0.000
36-8048	Dec 21 1981	Aug 27 2001	Ground Water	0.410	80.800
36-134B	Oct 9 1884	Aug 27 2001	Martin-Curren Tunnel	0.090	0.000

Table 1: Rangen water rights.

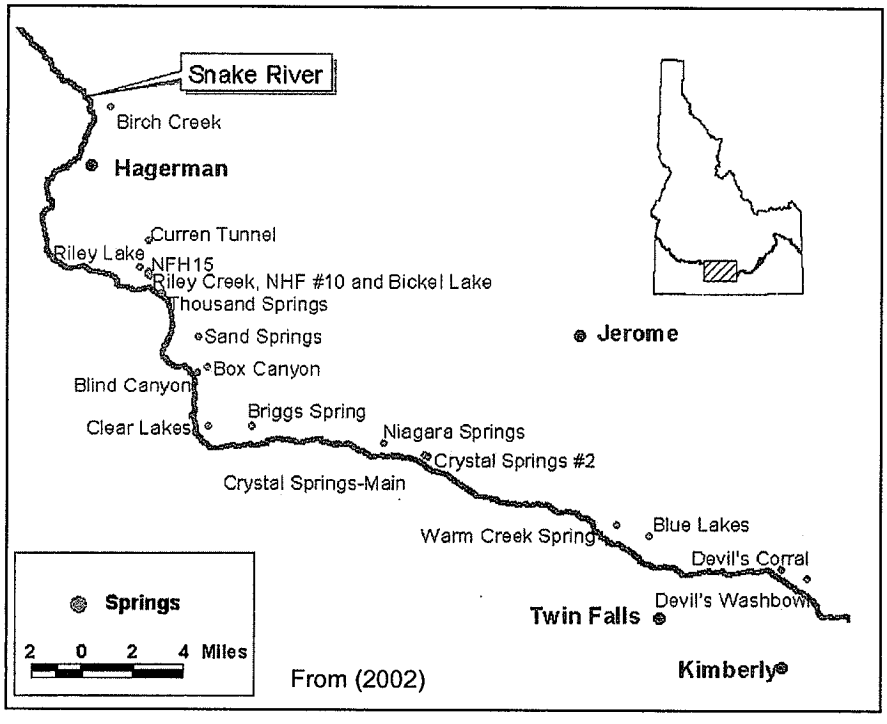

Figure 2: Major springs in the Milner to King Hill reach of the Snake River.

Numerous springs in the Milner – King Hill reach have experienced decreased flows in recent years (Bendixsen, 1995; Johnson et al., 2002). Average annual diversion rates (based on average monthly diversions) 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 3).

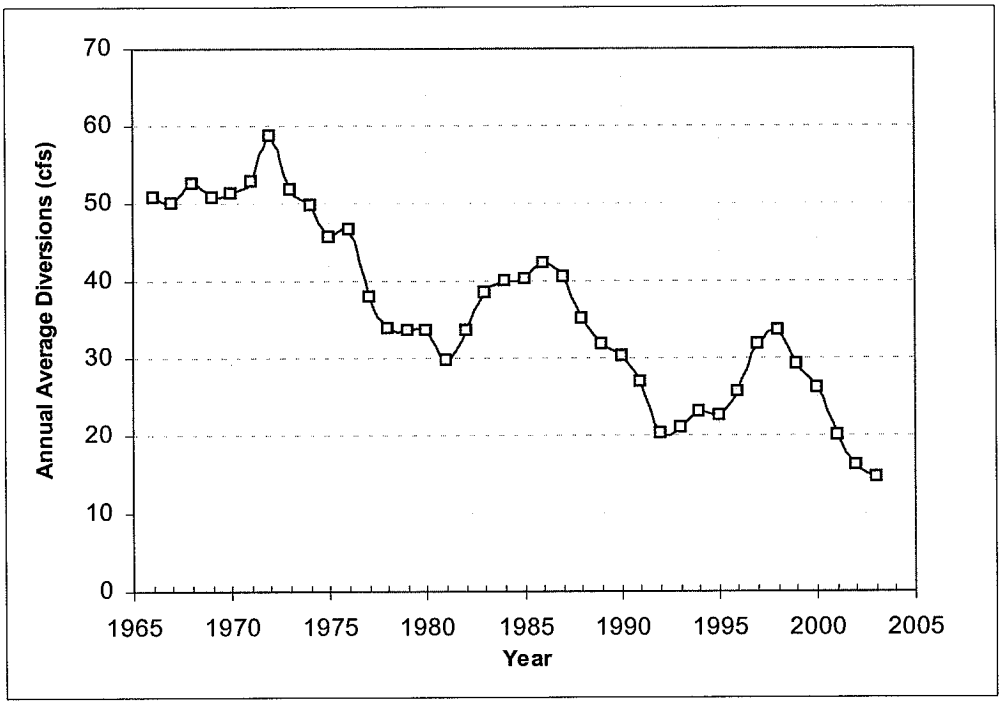

Figure 3: Average annual discharge rates from the Rangen, Inc., Aquaculture Facility.

The Curren Tunnel draws water from a pillow lava facies of the Malad Basalt (Johnson et al., 2002). Review of a geologic cross section (Figure 5) of the vicinity of the Curren Tunnel (Figure 4) compiled by Covington and Weaver (1989) suggests that discharge at the Current Tunnel may be controlled, in part, by clay zones associated with the Yahoo Clay or varying permeability characteristics of the Malad Basalt.

Declines in Curren Tunnel flows are attributed to a decline in ground water levels in the vicinity the tunnel. Possible reasons for these declines include increases in ground water withdrawals and decreases in recharge (associated with decreasing diversions resulting from increased surface water irrigation efficiency) in the ESRP.

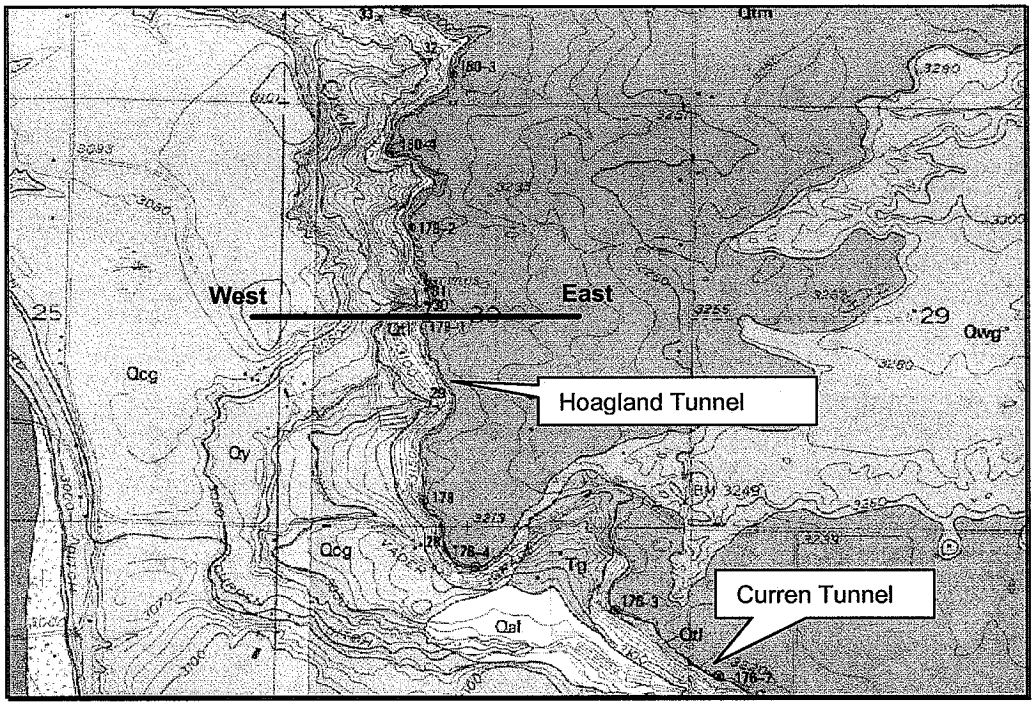

Figure 4: Approximate location of cross section shown in Figure 5 (from Covington and Weaver, 1989).

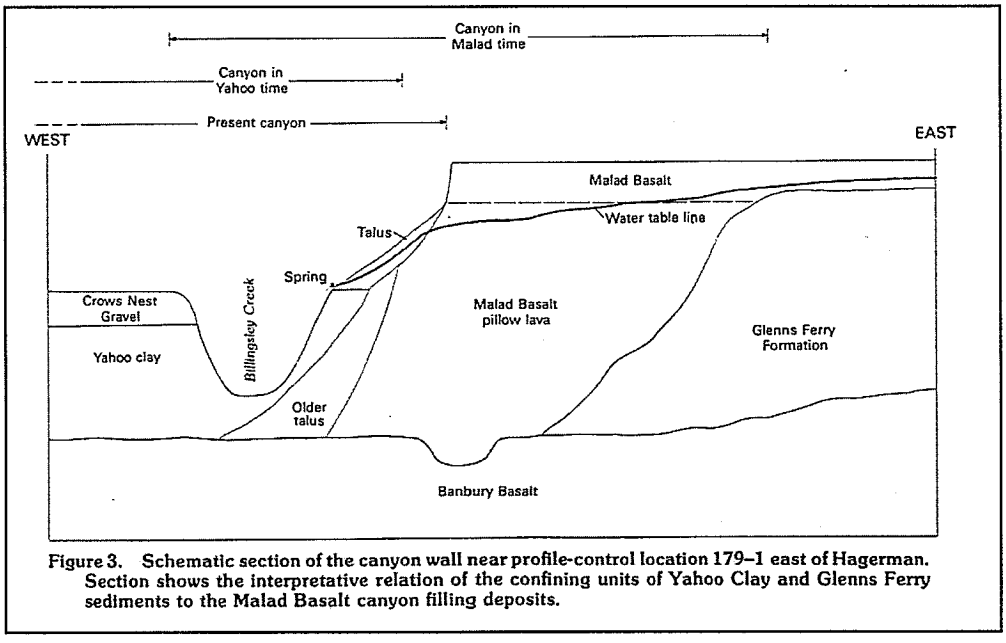

Figure 3. Schematic section of the canyon wall near profile-control location 179–1 east of Hagerman. Section shows the interpretative relation of the confining units of Yahoo Clay and Glenns Ferry sediments to the Malad Basalt canyon filling deposits.

Figure 5: Schematic cross section just north of Hoagland Tunnel/Weatherby Spring (from Covington and Weaver, 1989).

b) Project Description

One alternative for increasing spring flows to the Rangen facility would be to construct a horizontal well in the vicinity of, but at an elevation below, the Curren Tunnel. The purpose of the horizontal well would be to tap ground water in the vicinity of the Curren Tunnel, but doing so in the context of decreased local ground water levels. Such a horizontal well in the vicinity of the Curren Tunnel could be considered a "well deepening" of the current Curren Tunnel discharge point.

The major benefit of a horizontal well is this: if successful, a horizontal well could provide substantial increase in flow to the Rangen facility without requiring new water rights, mitigation for potential new withdrawals from vertical wells located at the Rangen facility, or ongoing operational costs and water quality concerns associated with various pump back strategies.

A major question associated with the construction of a horizontal well would be the availability of water at a point lower than the Curren Tunnel. Most of the natural springs in the vicinity of the Curren Tunnel discharge from a similar elevation, suggesting that a common geologic feature is controlling the discharge elevation. Such controls might include the presence of Yahoo Clay, Glenns Ferry sediments, other interflow sediments, or a less permeable portion of the Malad Basalt. Installing a horizontal well below the elevation of the Curren Tunnel risks missing the permeable zone that currently supplies water to the Curren Tunnel.

Drilling of a horizontal well can be expensive, costing approximately $500 per linear foot (Jack Seburn, North American Construction). A 300-foot long horizontal bore (24" diameter) with drilling and associated costs could cost more than $250,000. One approach to better define horizontal-well target zones would be to construct one or more vertical test wells. Test wells located above the canyon rim, but close to the Curren Tunnel, could be used to define subsurface lithology, water levels, vertical hydraulic gradients, and aquifer characteristics. Multiple vertical test wells would be less expensive than a horizontal test well, and would better enable evaluation of the feasibility of horizontal well to provide water to the Rangen facility.

2) Purpose and Objectives

The purpose of this proposed project is to increase natural flows to the Rangen aquaculture facility. The general objective is to evaluate the feasibility of a horizontal well located in the vicinity of the Curren Tunnel to supply natural flow to the Rangen facility. Specific objectives include the following:

a. Review local hydrogeologic conditions based on existing information.
b. Drill three vertical test wells on the canyon rim in the vicinity of the Curren Tunnel; evaluate subsurface lithology and hydrogeologic characteristics in the vicinity of the test wells based on of drill

cuttings, drilling resistance, test pumping, water level measurements, etc.

c. Evaluate the feasibility of a horizontal well based on test-drilling results.
d. If a horizontal well appears feasible, develop a construction plan and cost estimate for a horizontal production well near the Rangen facility.

3) Project Tasks

a) Evaluate Hydrogeologic Conditions

The first task will consist of a detailed review of hydrologic and geologic information in the vicinity of the Curren Tunnel. The task will include refinement of several cross-sections (including field-verification of well locations) for insight into characteristics of the Malad Basalt in this area. The task will include obtaining and plotting the timing of surface water flow and ground water extraction patterns with respect to Curren Tunnel Hoagland Tunnel, local well hydrographs, and other available spring-flow data. These and other data will be used to identify test well locations.

b) Well Construction and testing

Well construction and testing will include the following subtasks:

- Selection of drilling location
- Preparation of well design documents
- Solicitation of drilling bids
- Drilling supervision
- Geophysical logging
- Hydraulic gradient testing
- Aquifer testing

Three test wells are envisioned on the canyon rim above the Rangen facility, within approximately 400 feet of the canyon rim (Figure 6). The drilling location probably will be limited to property owned by Rangen, Inc. These wells will be used to evaluate hydrogeologic conditions (e.g., aquifer materials, relative permeability, etc.) to the maximum depth that would be considered for a horizontal test well. Two of the test wells will be between 150 and 175 feet deep. The third test well may extend to a depth of approximately 300 feet. The latter well will provide similar information as the first two wells, but will also provide subsurface information (geology, gradients, etc) for zones underlying the elevation of a possible horizontal well.

Eight-inch diameter test wells will be constructed using air-rotary drilling. Once below the water table, test pumping and water level checks will generally be conducted with every additional 20 feet of depth (coinciding with drill-stem lengths). Each test-pumping cycle may require removing the drill stem and lowering a test pump capable of pumping between 100 and 300 gallons per minute. Water levels will be monitored prior to and during pumping.

Camera surveys, geophysics, and/or borehole flow measurements will be conducted in each well prior to well completion. This information will be used to complete these wells as monitoring wells. The wells will be completed with seals, if necessary, to avoid substantial vertical flows within the boreholes. Completed as monitoring wells, the test wells will provide long-term, dedicated water level information for the vicinity of the Curren Tunnel.

A geologist will be on-site during drilling to monitor drill cuttings, fluid levels, and aquifer testing. Test well locations will be estimated using a global positioning system device; relative elevations will be surveyed following well completion.

A summary report will completed following test well construction and testing. The report will include a drilling description, detailed well logs, lithologic descriptions, camera survey and/or geophysical interpretations, and other data.

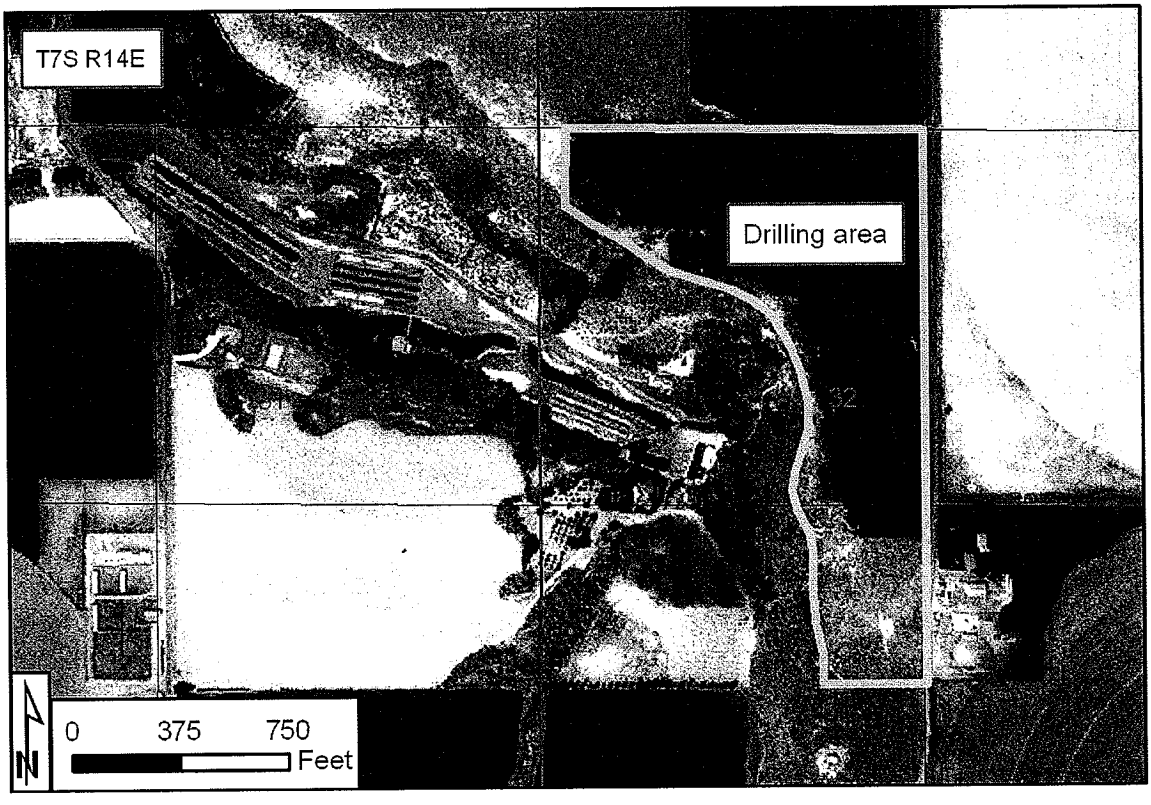

Figure 6: Rangen, Inc. property. Likely drilling area is shown in yellow.

c) Evaluate Feasibility of Horizontal Well

An evaluation of horizontal well feasibility will be prepared based on the test drilling results. This evaluation will have three components. The first component will consist of an evaluation of horizontal well feasibility based on test-well drilling, vertical and

horizontal hydraulic gradient analysis, and aquifer testing results, and on discussions with horizontal drilling contractors.

The second component will be an evaluation of potential effects on other water users. As of 2003, most of the water required by Curren Tunnel water-right holders (Table 2) users is being delivered through a recently-installed pipeline that transports irrigation water from the Northside Canal Company and rental pool water. This water is delivered in lieu of water from the Curren Tunnel. However, the rights to withdraw water from the Curren Tunnel have been maintained. If water deliveries in the pipeline are not possible (e.g., if rental water is unavailable) these users are still entitled to draw water from the Curren Tunnel (Jeff Martin, North Snake Ground Water District, *personal communication*, 5/24/04). If a new, successful horizontal well is installed below the elevation of the Curren Tunnel, there may be insufficient head for gravity feed from the horizontal well to the places of use, requiring mechanical lift. Furthermore, a successful horizontal well may produce more water than is currently flowing from the Curren Tunnel. Some of the additional water (up to the full allotment based on priority dates) might be claimed by the other Curren Tunnel users. An agreement resolving these issues might be required before the construction of a horizontal borehole in the vicinity of the Curren Tunnel commences.

Water Right	Priority Date	Owner	Maximum diversion rate (cfs)			
			Irrigation	Stockwater	Domestic	acres
134A	10/9/1884	Walter and Margaret Candy	0.49	0.04	-	36
135B	4/1/1908	Walter and Margaret Candy	0.51	-	-	36
134D	10/9/1884	Howard and Rhonda Morris	1.58	0.06	-	143
135D	4/1/1908	Howard and Rhonda Morris	1.58	0.06	-	143
10141A	12/1/1908	Howard and Rhonda Morris	0.82	0.03	-	143
134E	10/9/1884	Howard and Rhonda Morris	0.82	0.04	-	75
135E	4/1/1908	Howard and Rhonda Morris	0.82	0.02	-	75
10141B	12/1/1908	Howard and Rhonda Morris	0.43	0.02	-	75
102	4/1/1892	J Alvin Musser	4.1	0.07	0.04	205
Total			**11.15**	**0.34**	**0.04**	**931**

Table 2: Water rights to flow from the Curren Tunnel, excluding those held by Rangen, Inc.

In addition, it is possible that lower horizontal well near the Curren Tunnel may lead to decreases in local ground water levels outside of the immediate Curren Tunnel area. An analysis of responses in surface water applications, ground water withdrawals, and spring flows in the Curren Tunnel and Hoagland Tunnel (to the extent that data are available) may give insight into this question (Task 3a). These factors will be considered in analyzing the feasibility of a horizontal well.

The third component – a construction plan for a horizontal test well – will be prepared if it is determined that a horizontal well would represent a feasible solution to supplying

additional water to the Rangen facility. The plan would contain drilling specifications, estimated costs, and other information required to proceed with construction of a horizontal well.

4) Project Schedule

A tentative project schedule is shown in Table 3. The schedule assumes a start time of August 2004.

	Tentative Schedule						
Task	**Aug 2004**	**Sep 2004**	**Oct 2004**	**Nov 2004**	**Dec 2004**	**Jan 2005**	**Feb 2005**
a) Evaluate Hydrogeologic Conditions	x						
b) Obtain drilling bids, construct test wells, evaluate hydrogeologic characteristics		x	x	x	x		
c) Evaluate Feasibility of Horizontal Well; develop horizontal well construction plan				x	x	x	
Submit Final Report							x

Table 3: Tentative project schedule.

5) Cost Details

Preliminary costs for this project are shown in Table 4. These costs are greater than general well-drilling costs because of frequent water level measurements and test pumping during drilling, the presence of an on-site engineer/geologist during drilling and testing, and pre- and post-drilling analyses.

Task	SubTasks	Engineering	Construction and indirect	Total
a) Evaluate Hydrogeologic Conditions				
	Review of driller reports	944		944
	Field verify well locations	1,216		1,216
	Draw several x-sections in vicinity of Curren Tunnel based on field-verified well locations	1,288		1,288
	Obtain any available ground water extraction estimates for vicinity of Curren Tunnel	200		200
	Obtain Northside canal flows and timing in vicinity of Curren Tunnel	200		200
	Plot canal timing and ground water extraction timing on Curren Tunnel, Hoagland Tunnel, and other hydrographs	1,488		1,488
	Summarize results in brief report	2364		2364
	Subtotal	7,700		7,700
b) Well Construction				
	Prepare well design specifications	1,920		1,920
	Obtain, review bids	1,920		1,920
	Drilling supervision	10,930		10,930
	Geophysical logging	1,180		1,180
	Lithologic descriptions	1,480		1,480
	Geophysical interpretation	960		960
	Summary report	4,248		4,248
	Travel Expenses		1875	1,875
	Subtotal	22,638	1875	24,513
Estimated Contractor Costs				
	Drilling subcontractor (assume 2 wells at 200 ft each and 1 well at 300 ft each for a total of 700 ft. Assume $85/ft to account for frequent water level measurements and tripping out for test pumping every 20 feet).		59,500	59,500
	Geophysics and/or camera subcontractor; assume $2,500 per well		7,500	7,500
	Subtotal		67,000	67,000
c) Evaluate Feasibility of Horizontal Well				
	Analysis	2,904		2,904
	Horizontal drilling plan	4,368		4,368
	Presentation with client, discussion with Interim Committee	1,600		1,600
	Summary Report	2,688		2,688
	Subtotal	11,560		11,560
Subtotal				$110,773
Contingency (20%)				22,155
Total				**$132,928**

Table 4: Budget details

6) Potential Benefits and Risks

a) Potential Benefits

A successful horizontal well could result in a substantial increase in flow to the Rangen facility. If accepted by IDWR as a "well deepening," the horizontal well would not require mitigation measures that might be required with other vertical well solutions. If constructed at an elevation greater than the Rangen aquaculture facility, the horizontal well would not require operating costs to lift water.

b) Potential Risks

There are several potential risks associated with this project. The first is that test drilling does not reveal a promising zone into which to drill a horizontal well. The second risk is that a promising zone is identified, but the horizontal well, if constructed, is unable to produce a sufficient amount of water. A third risk associated with a successful horizontal well in the vicinity of the Curren Tunnel would lower local hydraulic heads in the vicinity of the Curren Tunnel. This would likely lead to decreased flows in the Curren Tunnel and possibly other springs in the vicinity of the Curren Tunnel. Some analysis of response characteristics between Curren Tunnel, other springs (e.g., Hoagland Tunnel) and fluxes above the canyon rim (e.g., spring canal filling, summer ground water withdrawals, etc.) may give insight into this question (Task 3a). Provisions would need to be considered to shield other Curren Tunnel users with rights more senior to that of Rangen from the effects of reduced flow. Options for doing so would be done as part of Task 3c.

7) Summary Discussion

This proposed project consists of constructing a series of vertical test wells to determine feasibility of a horizontal well in the vicinity of the Curren Tunnel. A successful horizontal well to replace decreased flows to the Rangen aquaculture facility may provide a long-term solution to diminished flows that are constraining the Rangen aquaculture operation. Increasing flows to the Rangen facility would provide a major benefit to other water users that may be affected by decreased flows to the Rangen facility.

The success of a horizontal well design based on the proposed test wells is not guaranteed. Test drilling may not indicate productive targets for a horizontal well. Potential targets based on test drilling may or may not result in a successful horizontal well. A successful horizontal well may have adverse impacts on flows to the Curren Tunnel and surrounding water levels.

8) References

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

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.

Johnson, G.S. et al., 2002. Spring discharge along the Milner to King Hill Reach of the Snake River, Idaho Water Resources Research Institute.