MEMORANDUM

December 15, 2003

TO: Karl Dreher

FROM: Cindy Yenter

CC: Brian Patton, Jennifer Berkey, Tim Luke

RE: Water Right Review and Sufficiency of Measuring Devices, Rangen Aquaculture

Water Rights Review

Rangen, Inc. holds three water rights for fish propagation use at the hatchery and research facility on Billingsley Creek. They are as follows:

36-15501	7/01/1957	1.46 cfs
36-2551	7/13/1962	48.54 cfs (includes 0.1 cfs for domestic use)
36-7694	4/12/1977	26.00 cfs
Total authorized diversion		76.00 cfs

Additionally, Rangen, Inc. holds two earlier water rights for irrigation and domestic uses:

36-134B	10/09/1884	0.09 cfs	
36-135A	4/01/1908	0.05 cfs	
Total authorized diversion		0.14 cfs	7 acres

According to historical flow data which Rangen submitted, flows at the head of Billingsley Creek have not been available to fully satisfy the most junior fish propagation right, 36-7694, since October 1972[1], a period predating the priority of the right. In fact, it is unclear whether diversion and beneficial use have ever actually occurred under right no. 36-7694. Reported average monthly flows during the development period of the water right permit, April 1977 through 1979, never exceeded 50 cfs, the amount of the two earlier rights. The licensing examination from 1979 appears to base the recommendation for an additional 26 cfs diversion rate, on average estimated spring flows of 76 cfs which occurred in October 1972, *five years prior to the filing of the permit.* Even though there may have been some historical basis for the issuance of this license, there is no actual beneficial use documented.

The last year in which flows may have been available to satisfy right no. 36-2551 was during October 1987, when average available flows at the head of Billingsley Creek were estimated to

[1] See Rangen's table entitled "Head of Billingsley Creek at Curren Tunnel". Per Jennifer Berkey's 12-04-03 Memo, these figures reflect total available flows from the source, rather than actual hatchery diversions.

be above 50 cfs[2]. However, a breakdown of submitted data indicates that Rangen had only diverted a maximum of about 42 cfs to hatchery raceways during that same month[3]. It is not clear where the balance of the flows were used. A portion may have been diverted for late-season irrigation under the Musser and Candy rights (at the tunnel pipelines), although an average of 10 cfs was measured over the creek weir during that month. This may indicate a significant bypass of flows around the hatchery.

The largest beneficial-use diversion indicated in post-1981 data occurred during November 1983, when nearly 48 cfs was measured at the large raceways. Prior to 1981, submitted data cannot be parsed to individual measurements, but the estimated total flows in Billingsley Creek exceeded 50 cfs during November in every year from 1966 to 1976, indicating that flows were available at least part of those years, to satisfy right nos. 36-15501 and 36-2551.

Because of a lack of documentation to support historical use of right no. 36-7694, any indication of injury at Rangen should be limited to the documented reduction of available flows to satisfy right no. 36-2551.

Sufficiency of Measuring Devices

1. 6" PVC Pipeline from Curren Tunnel

This pipeline has no measuring device. It may be used to divert an unspecified portion of the Rangen fish propagation rights to the hatch house and research lab, and is the sole conveyance for domestic water to the lab, shop, office, and manager's house, as well as irrigation water for 3 to 5 acres of landscaping. Instantaneous flow through the hatch house incubation and rearing tanks may be estimated by determining the number of tanks in operation and applying pre-determined flows per unit, as shown on the attached worksheet. The unit flows were calculated by previous Rangen facility managers, using timed fill tests. All hatch house flows are returned to the Billingsley Creek channel, above the diversion to the lower raceways, and are measured again at the raceways.

Diversions for domestic and irrigation uses are not measured. The hatch house worksheet uses a constant 20 gpm for domestic (including irrigation) uses. This is likely on the high side for winter diversions, and too low for summer when irrigation is occuring. Authorized diversion rate for these uses is 0.14 cfs, from right nos. 36-134B and 36-135A, plus 0.1 cfs as a non-additive element of right no. 36-2551. This is a comparatively small portion of Rangen's total diversions, nevertheless, it is the only consumptive portion.

In July 2001, Tim Luke conducted a measurement certification on the 6" pipeline using a polysonic meter. Concurrently, the hatchery manager estimated flow through the pipeline using the worksheet. On that date, indicated pipeline flow was 18% higher than the standard meter.

In March 2002, I conducted the same test, again working with the hatchery manager. On that date, indicated pipeline flow was 9% lower than the standard meter.

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[2]See Rangen's table entitled "Head of Billingsley Creek at Curren Tunnel".

[3] See tables attached to Jennifer Berkey's 12-11-03 memo. Measurements taken in the Large Raceways are most representative of total hatchery diversions.

There seems to be a great deal of variability in pipeline estimations. Because the majority of the flow returns to the creek to be reused and re-measured, this is probably not of great concern. However, the magnitude of diversions to domestic and irrigation uses is still unknown.

2. Rangen Hatchery Raceways

Raceway flows are measured by Rangen personnel over dam boards in the two lowest blocks of raceways ("large" raceways and "CTR" raceways - see facility diagram submitted by Rangen). The CTR raceways are situated downstream from the large raceways. Each block of raceways contains three sets of check dams; heads are collected at the uppermost set of checks in each block. A measurement is also taken over a check dam in the Billingsley Creek channel.

At the time of our visit, Mr. Wayne Courtney (Rangen Inc) indicated that measurements are taken weekly in both the large and the CTR raceways, and the two results averaged for a final flow. Presently, all flows from the large raceways are being sent to the CTR raceways, so these measurements should cross-check.

On the day of our investigation, Brian Patton and I took measurements at both the large and CTR raceways. Width of the individual raceway openings, and thus crest length, varied slightly from raceway to raceway. Most checks were not entirely level. We took crest width measurements at each opening, and, using a standard hand-held 3-foot staff gage, took the average of three head readings across each check. Applying the Francis formula for rectangular suppressed weirs, Brian Patton calculated a flow of 18.49 cfs in the large raceways and 18.21 cfs in the CTR raceways. These measurements are representative of the total diverted flow through the facility. We also measured 0.48 cfs over the dam in the creek, using the same techniques. This measurement is representative of the unappropriated flows which bypass all or part of the facility.

Aside from Mr. Courtney, there were no hatchery workers present during our investigation to confirm either the measurement points or the measurement methods used by Rangen staff. I made a call to the hatchery on Friday, December 12, and spoke with Lonnie Tate, who confirmed that all measurements are made at the first set of checks in each block. Mr. Tate indicated that heads were read at the middle of the crest, with a 2" wide metal ruler rather than a standard staff gage. Measurements taken by hatchery personnel on November 24, the day before our visit, indicated flows of 16.6 cfs in the large raceways and 15.9 cfs in the CTR raceways. These flows are as related to me by Mr. Tate, and are not documented. They are 10% to 12% lower than the flows we measured the next day. The chances of actual inflows changing 2 cfs over a 24-hour period is possible but not probable. Mr. Tate confirmed that no operational changes were made within the hatchery during that period. Mr. Tate also confirms that Rangen is still using some form of averaging between the large and CTR raceways and the creek dam flow, to derive flows for reporting purposes.

Brian Patton applied the Francis formula individually to each set of data we collected, but Rangen uses weir discharge tables calculated with fixed 44 inch (for large raceway) or 58 inch (for CTR raceway) openings. In the large raceway measurement section, crest lengths ranged from 43.44 to 44.04 inches. In the CTR block, crest lengths ranged from 58.32 inches to 58.8 inches. To test the sufficiency of the fixed-length discharge tables, I applied our head measurements to the Rangen tables, and calculated total flows of at 18.55 cfs for the large raceways and 18.03 for CTR raceways, a difference of less than 1% in each case, from the flows derived from the sum of independant equations.

The 10% difference found in total flow measurements taken by Rangen and by DWR is not greater than the range of accuracy expected for open-channel measurements under these conditions, and therefore Rangen also passes the sufficiency test with respect to measurement methodology. My experience has been that measurements taken at flat-crested dam boards are generally less accurate than those taken at sharp-crested weirs, and that flat-crested dam measurements return indications of flow which are typically 5-10% lower than actual flow, when checked against other methods of measurement. Because I have not had the opportunity to check flows at this particular facility against a more standard method of measurement, I can only compare one set of measurements against the other.

The most likely cause of the discrepancy between the DWR measurement and the Rangen measurement is a data collection error due to the hatchery staff's use of a narrow metal ruler to measure head. The best measurement location for head readings is upstream from the crest, past the point of crest drawdown. When this is not possible, proper technique for using a hand-held staff gage directly on the crest is to turn the surface of the gage into the flow slightly, to overcome the drawdown and simulate a true head reading. Without actually observing the hatchery staff's measurement techniques, I suspect that the head readings taken by them are probably more indicative of crest drawdown rather than true head over the dam. This would result in a slightly lower head reading and a lower total flow.

It seems reasonable to conclude that, while Rangen's measuring techniques for the hatchery raceways may not be absolutely correct, they are fairly consistent, and are resulting in reported measurements which are no more than about 10% lower than actual flows. However, the reported measurements continue to be measurements of available flow, which usually includes at least some bypass flow, and not actual diverted flow.

Attachment A
Rangen Worksheet for Estimating Hatch House Use

IDWR record		Hatchery/Lab water use		
Date Location	# possible	# in use	GPM/unit	Total GPM
Hatchery 1-6	6	0		
Hatchery 7-12	6	6	22	132
Greenhouse A-D	4	4	9.56	38.2
Greenhouse 1-20	20	20	9.56	191.2
Greenhouse 1H-3H	3		19.96	
Barrels 1-36	36		2.00	
Greenhouse E,F	2		9.56	
Swamp Cooler	1		2.00	
Cleanroom 1-34	34		0.50	
Isolation tanks 1-18	18		2.00	
Domestic	1	10	20.00	20
Total GPM				381.4
CFS				.85

6 (calibrated by timed fill by previous mgr)

hatchery tanks w/ calibrated inlets & standpipes, hd. table & variable flows

hatchery barrels w/ flow restrictors, always run full open, calibrated volumetrically (timed fill) by Caroline

esf.

timed fill calibration?

esf.

to- Cindy [illegible] / Dept. Water Resources

From - Lonny - Rangen Hatchery

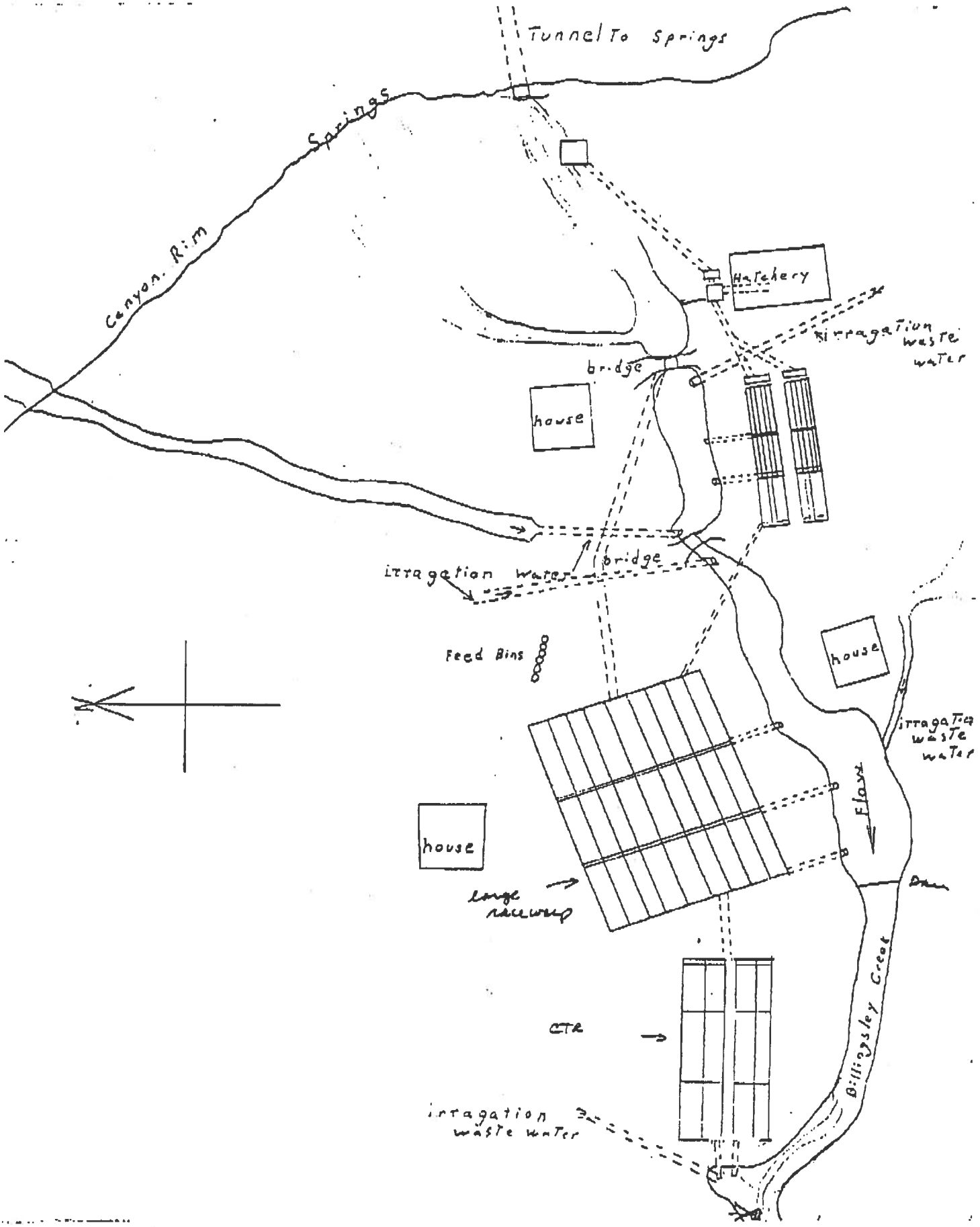
736-3067

INCHES		LG RW	CTR	SM	DAM
1	0	0.25	0.33	0.23	0.28
1	1/8	0.30	0.40	0.27	0.33
1	1/4	0.35	0.47	0.31	0.39
1	3/8	0.41	0.54	0.36	0.45
1	1/2	0.47	0.61	0.41	0.51
1	5/8	0.52	0.69	0.47	0.57
1	3/4	0.59	0.77	0.52	0.64
1	7/8	0.65	0.86	0.58	0.71
2	0	0.72	0.95	0.64	0.78
2	1/8	0.79	1.04	0.70	0.86
2	1/4	0.93	1.22	0.82	1.01
2	3/8	1.00	1.32	0.89	1.09
2	1/2	1.08	1.42	0.96	1.18
2	5/8	1.16	1.53	1.03	1.26
2	3/4	1.24	1.63	1.10	1.35
2	7/8	1.32	1.74	1.17	1.44
3	0	1.40	1.85	1.24	1.53
3	1/8	1.48	1.96	1.32	1.62
3	1/4	1.57	2.07	1.40	1.72
3	3/8	1.66	2.19	1.47	1.81
3	1/2	1.75	2.31	1.55	1.91
3	5/8	1.84	2.43	1.63	2.01
3	3/4	1.93	2.55	1.72	2.11
3	7/8	2.12	2.80	1.89	2.32
4	0	2.22	2.93	1.97	2.43
4	1/8	2.32	3.06	2.06	2.53
4	1/4	2.42	3.19	2.15	2.64
4	3/8	2.52	3.33	2.24	2.75
4	1/2	2.62	3.46	2.33	2.87
4	5/8	2.73	3.60	2.42	2.98
4	3/4	2.83	3.74	2.52	3.10
4	7/8	2.94	3.88	2.61	3.21
5	0	3.05	4.02	2.71	3.33
5	1/8	3.16	4.17	2.80	3.45
5	1/4	3.27	4.31	2.90	3.57
5	3/8	3.38	4.46	3.00	3.69
5	1/2	3.49	4.61	3.10	3.82
5	5/8	3.61	4.76	3.20	3.94
5	3/4	3.72	4.92	3.31	4.07
5	7/8	3.84	5.07	3.41	4.20
6	0	3.96	5.23	3.52	4.33
6	1/8	4.08	5.38	3.62	4.46
6	1/4	4.20	5.54	3.73	4.59
6	3/8	4.32	5.70	3.84	4.72
6	1/2	4.44	5.86	3.95	4.86
6	5/8	4.57	6.03	4.06	4.99
6	3/4	4.69	6.19	4.17	5.13
6	7/8	4.82	6.36	4.28	5.27

** table adjusted for measurement over 2" boards

		LG RW	CTR	DAM
7	0	4.95	6.53	5.41
7	1/8	5.08	6.70	5.55
7	1/4	5.21	6.87	5.69
7	3/8	5.34	7.04	5.83
7	1/2	5.47	7.22	5.98
7	5/8	5.60	7.39	6.12
7	3/4	5.73	7.57	6.27
7	7/8	5.87	7.75	6.41
8	0	6.01	7.92	6.56
8	1/8	6.14	8.11	6.71
8	1/4	6.28	8.29	6.86
8	3/8	6.42	8.47	7.02
8	1/2	6.56	8.66	7.17
8	5/8	6.70	8.84	7.32
8	3/4	6.84	9.03	7.48
8	7/8	6.99	9.22	7.63
9	0	7.13	9.41	7.79
9	1/8	7.27	9.60	7.95
9	1/4	7.42	9.79	8.11
9	3/8	7.57	9.99	8.27
9	1/2	7.72	10.18	8.43
9	5/8	7.86	10.38	8.59
9	3/4	8.01	10.58	8.76
9	7/8	8.16	10.77	8.92
10	0	8.32	10.97	9.09
10	1/8	8.47	11.18	9.26
10	1/4	8.62	11.38	9.42
10	3/8	8.78	11.58	9.59
10	1/2	8.93	11.79	9.76
10	5/8	9.09	11.99	9.93
10	3/4	9.25	12.20	10.10
10	7/8	9.40	12.41	10.28
11	0	9.56	12.62	10.45
11	1/8	9.72	12.83	10.63
11	1/4	9.88	13.04	10.80
11	3/8	10.04	13.26	10.98
11	1/2	10.21	13.47	11.16
11	5/8	10.37	13.69	11.33
11	3/4	10.53	13.90	11.51
11	7/8	10.70	14.12	11.69
12	0	10.87	14.34	11.87

Rangens Research Hatchery
Hagerman Ida.



11-25-03 Cindy Yenter Brian Patton J Dee May
Wayne Courtney Frank Erwin
(Doug Ramsey – hatchery lead)

- Config of diversion works
- Sufficiency of mgas devices
- Amount of water diverted now
- any undiverted flows? How much
- alternate sources

11-25-03 Ranger Tour

- Irr pipes L to R Candy - Musser - Morris
- White pipes from Rt Box → Middle box (Crandell mine)
- White pipes from middle box → ~~lower~~ upper raceways + spill to creek
- Div @ bridge → lower raceways + outflow from upper
- numerous seeps, all captured.
- How much irrigation use on hatchery grounds?
- everything below bridge not retrievable?
  - minor seep @ headgate 1 gpm
  - 40-50 gpm over checks
  - 2 anti-freeze pipes from dom. systems (house & shop) 1-2 gpm

- Upper raceways 2 of 8
- lower " 4 of 10 A Block
  2 of 4 B Block
  (1 used as settling pond) – pond is pumped, does not spill
  all discharges to creek channel.

11-25-03 Rangen (cont)

- Uncaptured flows in ck mtgs @ check next to Lower Block B (CTR)

May sent a packet to Karl containing a system diagram and historical diversion data.

I asked that discharge tables being used for dam board measurements be sent to Brian for review

Need to assess how much irrigation, and what right it is authorized under.

At Rangen's measuring point in upper bank in lower raceways

Large Raceway

2nd Raceway from right

	W (ft)	H (ft)	Q (cfs)
Right	3.65	0.34	2.41
Right Middle	3.65	0.34	2.41
Left Middle	3.62	0.3	1.98
Left	3.67	0.34	2.42

3rd Raceway from right

	W (ft)	H (ft)	Q (cfs)
Right	3.67	0.3	2.01
Right Middle	3.66	0.36	2.63
Left Middle	3.66	0.34	2.42
Left	3.66	0.32	2.21
		TOTAL	**18.49**

Q (cfs) from Rangen tables
2.42
2.42
2.01
2.42

2.01 (avg width = 43.86")
2.64
2.42
2.21
18.55 < 1%

At d/s end of upper bank in Lower raceways

2nd Raceway from right

	W (ft)	H (ft)	Q (cfs)
Right	3.66	0.3	2.00
Right Middle	3.65	0.32	2.20
Left Middle	3.63	0.28	1.79
Left	3.71	0.28	1.83

3rd Raceway from right

	W (ft)	H (ft)	Q (cfs)
Right	3.65	0.28	1.80
Right Middle	3.66	0.3	2.00
Left Middle	3.68	0.3	2.01
Left	3.55	0.36	2.55
		TOTAL	**16.19**

At lower bank of lower raceways

CTR Raceway

2nd Raceway from right

	W (ft)	H (ft)	Q (cfs)
Right	4.9	0.34	3.23
Middle	4.87	0.36	3.50
Left	4.86	0.32	2.93

3rd Raceway from right

	W (ft)	H (ft)	Q (cfs)
Right	4.88	0.32	2.94
Middle	4.89	0.3	2.68
Left	4.86	0.32	2.93
		TOTAL	**18.21**

Q from Range table
3.19
3.47
2.91

avg width = 58.52"
2.91
2.64
2.91
18.03 < 1%

At wier in stream near d/s of facility

W (ft)	H (ft)	Q (cfs)
3.5	0.12	0.48

12-11-03 phone call

Lonnie - Don measures

@ 1st check in Log

@ 1st check in CTR (capacity ~ 30 cfs)

@ creek weir

Meas on 24th 16.6 Log

15.9 CTR

1.62 creek

form sw-1
3/95

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

RECEIVED
JAN 23 1996
Department of Water Resources

WATER MEASUREMENT REPORT FORM FOR OPEN CHANNEL MEASUREMENT

1995 Reporting Form

Year end data must be submitted to Idaho Department of Water Resources, 1301 N. Orchard, Boise Idaho 83706, on or before January 15, 1996.

NOTE: Please submit a separate reporting form for each diversion from a public water source. Refer to page 4 for detailed instructions.

This report form may be used for the following diversion:

Diversion Name or Facility: RANGEN HATCHERY/BILLINGSLEY CK HE
Water Source: SPRINGS/Billingsley CK
Water Right(s) Owner or Contact: RANGEN INC.
(owner name(s) may be omitted if there are multiple owners on same diversion) DIESHER, BOB

Div # 410529

SECTION 1. Water Right Holder/Operator Information
Name and Address of Water Right Holder
(If there are multiple water right holders on a common ditch or conveyance system, please designate the contact person below)

Current Owner
Name Rangen Inc. (Last, First, MI)
Phone 208-543-6421
Address P.O. Box 706
Fax 208-543-4698
City Buhl
State & Zip ID 83316

Original Owner (if sold within last year)
Name _____ (Last, First, MI)
Phone _____
Address _____
Fax _____
City _____
State & Zip _____

Operator or Contact Person
Name Reitzschmidt, Caroline (Last, First, MI)
Phone 208-837-6191
Address 2928 B South 1175 East
Fax 208-837-4505
City Hagerman, ID
State & Zip ID 83332

SECTION 3. Measuring Device Information

A. Type & Description of Measuring Device(s): standard suppressed Rectangular Weir

B. Attach copies of all measuring device rating tables to this report.

SECTION 4. Certification

I hereby certify that the information reported is correct to the best of my knowledge and that I recognize that willful submittal of false or inaccurate data is a violation of law subject to the penalty provisions of Sections 42-311, 42-350 and 42-351, Idaho Code.

Signature: Charlie Peterschmidt Title: Hatchery Mgr Date: 15 Jan 1996

Note: Each reporting form shall be accompanied by a report processing fee in the amount of twenty dollars ($20) per diversion made payable to the Idaho Department of Water Resources. (Section 42-701(6), Idaho Code). All domestic uses, as defined in Section 42-111, Idaho Code, and all stockwatering uses, as defined in Section 42-1401A(12), Idaho Code, are exempt from measurement and reporting requirements.

For Department Use Only

Received by _____ Date _____ Time _____

Fee amount submitted 20.00 Correct? yes _____ no _____

Receipted by JW Receipt No. C034635

Data Entry by _____ Date 1-23-96

Total Annual Flow (CFS) _____

Total Annual Volume (Acre-Feet) _____

CTRS

DISCHARGE OF STANDARD SUPPRESSED RECTANGULAR WEIR
Where weir crest length (L) = 58 inches

Head in Feet (H)	Head in Inches	Discharge (Q) CFS	Head in Feet (H)	Head in Inches	Discharge CFS
0.04	1/2	0.13	0.50	6	5.69
0.05	5/8	0.18	0.51	6-1/8	5.86
0.06	3/4	0.24	0.52	6-1/4	6.03
0.07	7/8	0.30	0.53	6-3/8	6.21
0.08	1	0.36	0.54	6-1/2	6.38
0.09	1-1/16	0.43	0.55	6-5/8	6.56
0.10	1-3/16	0.51	0.56	6-3/4	6.74
0.11	1-5/16	0.59	0.57	6-13/16	6.92
0.12	1-7/16	0.67	0.58	6-15/16	7.10
0.13	1-9/16	0.75	0.59	7-1/16	7.29
0.14	1-11/16	0.84	0.60	7-3/16	7.48
0.15	1-13/16	0.93	0.61	7-5/16	7.66
0.16	1-15/16	1.03	0.62	7-7/16	7.85
0.17	2-1/16	1.13	0.63	7-9/16	8.04
0.18	2-3/16	1.23	0.64	7-11/16	8.23
0.19	2-1/4	1.33	0.65	7-13/16	8.43
0.20	2-3/8	1.44	0.66	7-15/16	8.62
0.21	2-1/2	1.55	0.67	8-1/16	8.82
0.22	2-5/8	1.66	0.68	8-3/16	9.02
0.23	2-3/4	1.77	0.69	8-1/4	9.22
0.24	2-7/8	1.89	0.70	8-3/8	9.42
0.25	3	2.01	0.71	8-1/2	9.62
0.26	3-1/8	2.13	0.72	8-5/8	9.83
0.27	3-1/4	2.26	0.73	8-3/4	10.03
0.28	3-3/8	2.38	0.74	8-7/8	10.24
0.29	3-1/2	2.51	0.75	9	10.45
0.30	3-5/8	2.64	0.76	9-1/8	10.66
0.31	3-3/4	2.78	0.77	9-1/4	10.87
0.32	3-13/16	2.91	0.78	9-3/8	11.08
0.33	3-15/16	3.05	0.79	9-1/2	11.29
0.34	4-1/16	3.19	0.80	9-5/8	11.51
0.35	4-3/16	3.33	0.81	9-3/4	11.73
0.36	4-5/16	3.47	0.82	9-13/16	11.94
0.37	4-7/16	3.62	0.83	9-15/16	12.16
0.38	4-9/16	3.77	0.84	10-1/16	12.38
0.39	4-11/16	3.92	0.85	10-3/16	12.60
0.40	4-13/16	4.07	0.86	10-5/16	12.83
0.41	4-15/16	4.22	0.87	10-7/16	13.05
0.42	5-1/16	4.38	0.88	10-9/16	13.28
0.43	5-3/16	4.54	0.89	10-11/16	13.50
0.44	5-1/4	4.69	0.90	10-13/16	13.73
0.45	5-3/8	4.86	0.91	10-15/16	13.96
0.46	5-1/2	5.02	0.92	11-1/16	14.19
0.47	5-5/8	5.18	0.93	11-3/16	14.42
0.48	5-3/4	5.35	0.94	11-1/4	14.66
0.49	5-7/8	5.52	0.95	11-3/8	14.89

Computed from the formula $Q = 3.33LH^{3/2}$

LARGE RACE

DISCHARGE OF STANDARD SUPPRESSED RECTANGULAR WEIR
Where weir crest length (L) = 44 inches

Head in Feet (H)	Head in Inches	Discharge (Q) CFS	Head in Feet (H)	Head in Inches	Discharge CFS
0.04	1/2	0.10	0.50	6	4.32
0.05	5/8	0.14	0.51	6-1/8	4.45
0.06	3/4	0.18	0.52	6-1/4	4.58
0.07	7/8	0.23	0.53	6-3/8	4.72
0.08	1	0.28	0.54	6-1/2	4.85
0.09	1-1/16	0.33	0.55	6-5/8	4.98
0.10	1-3/16	0.39	0.56	6-3/4	5.12
0.11	1-5/16	0.45	0.57	6-13/16	5.26
0.12	1-7/16	0.51	0.58	6-15/16	5.40
0.13	1-9/16	0.57	0.59	7-1/16	5.54
0.14	1-11/16	0.64	0.60	7-3/16	5.68
0.15	1-13/16	0.71	0.61	7-5/16	5.82
0.16	1-15/16	0.78	0.62	7-7/16	5.97
0.17	2-1/16	0.86	0.63	7-9/16	6.11
0.18	2-3/16	0.93	0.64	7-11/16	6.26
0.19	2-1/4	1.01	0.65	7-13/16	6.40
0.20	2-3/8	1.09	0.66	7-15/16	6.55
0.21	2-1/2	1.18	0.67	8-1/16	6.70
0.22	2-5/8	1.26	0.68	8-3/16	6.85
0.23	2-3/4	1.35	0.69	8-1/4	7.00
0.24	2-7/8	1.44	0.70	8-3/8	7.16
0.25	3	1.53	0.71	8-1/2	7.31
0.26	3-1/8	1.62	0.72	8-5/8	7.47
0.27	3-1/4	1.71	0.73	8-3/4	7.62
0.28	3-3/8	1.81	0.74	8-7/8	7.78
0.29	3-1/2	1.91	0.75	9	7.94
0.30	3-5/8	2.01	0.76	9-1/8	8.10
0.31	3-3/4	2.11	0.77	9-1/4	8.26
0.32	3-13/16	2.21	0.78	9-3/8	8.42
0.33	3-15/16	2.32	0.79	9-1/2	8.58
0.34	4-1/16	2.42	0.80	9-5/8	8.74
0.35	4-3/16	2.53	0.81	9-3/4	8.91
0.36	4-5/16	2.64	0.82	9-13/16	9.07
0.37	4-7/16	2.75	0.83	9-15/16	9.24
0.38	4-9/16	2.86	0.84	10-1/16	9.41
0.39	4-11/16	2.98	0.85	10-3/16	9.58
0.40	4-13/16	3.09	0.86	10-5/16	9.75
0.41	4-15/16	3.21	0.87	10-7/16	9.92
0.42	5-1/16	3.33	0.88	10-9/16	10.09
0.43	5-3/16	3.45	0.89	10-11/16	10.26
0.44	5-1/4	3.57	0.90	10-13/16	10.43
0.45	5-3/8	3.69	0.91	10-15/16	10.61
0.46	5-1/2	3.81	0.92	11-1/16	10.78
0.47	5-5/8	3.94	0.93	11-3/16	10.96
0.48	5-3/4	4.06	0.94	11-1/4	11.14
0.49	5-7/8	4.19	0.95	11-3/8	11.32

Computed from the formula $Q = 3.33LH^{3/2}$

	Rangen Research Hatchery, total flow measurements												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
CTR + Dam measurements, average for the month													
1966	52.2	48.2	44.9	38.5	34.2	45.4	51.3	53.2	62.4	69.9	58.4	49.2	50.7
1967	43.9	39.3	33.4	36.6	37.6	47.4	49.0	52.9	58.9	69.4	67.4	64.3	50.0
1968	52.8	45.8	41.2	36.0	36.8	45.0	50.5	58.9	68.2	68.2	65.5	63.1	52.7
1969	50.8	43.4	38.2	33.4	34.3	45.5	49.6	58.5	65.9	66.9	64.7	57.2	50.7
1970	49.8	42.7	42.0	34.7	34.5	42.5	50.3	59.4	66.0	69.3	63.3	60.0	51.2
1971	50.2	41.2	39.1	37.2	40.5	43.4	51.0	60.5	64.8	73.7	70.2	63.4	52.9
1972	55.1	48.1	43.0	40.6	45.9	58.1	61.0	67.3	73.9	76.1	68.2	66.7	58.7
1973	57.9	49.1	46.2	37.6	39.6	42.1	53.1	55.1	57.8	65.6	61.6	55.3	51.8
1974	44.1	46.5	41.1	35.8	34.4	43.4	47.1	55.0	59.2	69.6	62.8	57.9	49.7
1975	43.0	39.9	32.8	33.5	37.3	39.5	43.2	51.9	55.6	57.9	56.2	58.3	45.8
1976	50.0	44.3	41.1	33.1	35.9	38.0	39.5	47.2	56.4	61.6	58.7	53.0	46.6
1977	47.1	39.5	37.7	35.2	32.6	37.0	34.9	33.9	37.9	38.9	42.4	37.6	37.9
1978	33.3	29.4	30.1	28.3	27.6	27.3	27.9	33.6	49.9	42.8	40.3	36.5	33.9
1979	34.4	30.3	29.3	24.5	20.3	25.4	27.1	36.1	47.8	47.7	42.2	38.3	33.6
1980	34.6	31.7	27.5	25.8	22.7	30.9	32.7	34.5	37.8	47.4	41.1	34.9	33.5
1981	31.1	26.7	22.4	23.7	20.0	21.5	27.5	33.3	37.0	39.1	41.0	34.1	29.8
1982	30.6	30.1	29.7	24.7	24.1	23.0	29.0	33.1	42.8	46.7	47.6	41.9	33.6
1983	37.0	33.1	32.3	28.2	30.3	29.0	35.1	43.1	47.5	51.9	48.6	46.7	38.6
1984	41.0	40.1	37.4	33.6	31.5	35.0	37.9	42.1	42.9	47.6	45.8	44.1	39.9
1985	40.2	38.3	36.1	34.5	31.7	31.0	32.9	45.3	48.9	52.0	49.1	42.5	40.2
1986	37.8	36.5	34.8	32.4	34.3	34.2	38.2	49.6	52.6	55.6	51.5	48.9	42.2
1987	43.3	38.2	36.1	30.7	30.1	35.5	37.2	45.2	45.6	52.3	47.4	45.3	40.6
1988	37.6	33.9	30.8	27.6	27.7	30.1	29.9	35.8	39.7	47.5	43.1	37.9	35.1
1989	34.4	31.3	28.7	22.2	23.2	25.0	27.5	35.3	34.9	42.9	38.7	36.7	31.7

	Rangen Research Hatchery, total flow measurements												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	34.3	31.7	28.8	20.9	22.3	24.9	26.5	30.4	35.2	41.9	35.6	32.1	30.4
1991	28.6	27.2	27.3	17.8	18.9	19.9	20.8	27.5	34.8	35.6	32.8	32.3	27.0
1992	27.4	22.9	21.8	16.4	15.7	15.5	18.1	18.8	21.3	24.8	20.4	18.9	20.2
1993	16.8	17.0	15.4	16.4	13.9	15.2	15.8	21.0	27.3	36.2	31.2	27.5	21.1
1994	24.3	22.3	19.8	17.1	18.9	16.9	19.4	22.3	27.6	33.4	28.8	25.8	23.1
1995	22.5	20.7	19.7	19.1	18.1	19.2	16.5	19.5	25.3	30.9	31.9	28.5	22.7
1996	25.4	23.3	22.4	22.2	20.3	18.9	19.4	22.8	30.2	34.8	34.2	32.6	25.5
1997	31.6	29.9	30.0	26.2	24.0	26.1	25.4	27.8	35.2	43.2	43.3	37.5	31.7
1998	36.1	33.6	30.9	29.9	30.1	32.9	26.1	26.6	33.6	41.3	41.9	39.5	33.5
1999	36.5	32.6	30.8	25.7	24.8	24.3	19.8	21.8	27.9	36.1	38.3	32.2	29.2
2000	31.7	29.3	28.5	22.7	20.3	18.7	16.0	21.7	27.7	33.9	34.0	29.5	26.2
2001	27.0	24.2	23.1	21.3	16.9	12.8	13.2	14.8	18.3	23.6	24.0	21.8	20.1
2002	20.1	18.4	17.3	14.9	12.5	11.7	10.8	11.0	15.2	21.0	21.1	19.9	16.2
2003	16.5	15.1	13.9	12.9	12.9	12.7	11.6	12.0	14.9				
Average	37.1	33.6	31.2	27.7	27.3	30.1		37.3	42.9	48.6	45.8	41.9	36.7
							32.2						
avg 66-75	50.0	44.4	40.2	36.4	37.5	45.2		57.3	63.3	68.7	63.8	59.5	51.5
avg 76-85	37.9	34.4	32.4	29.2	27.7	29.8	50.6	38.2	44.9	47.6	45.7	41.0	38.3
avg 86-95	30.7	28.2	26.3	22.1	22.3	23.6	32.5	30.5	34.4	40.1	36.1	33.4	30.0
avg 96-02	29.8	27.3	26.1	23.3	21.3	20.8	25.0	20.9	26.9	33.4	33.8	30.4	26.6

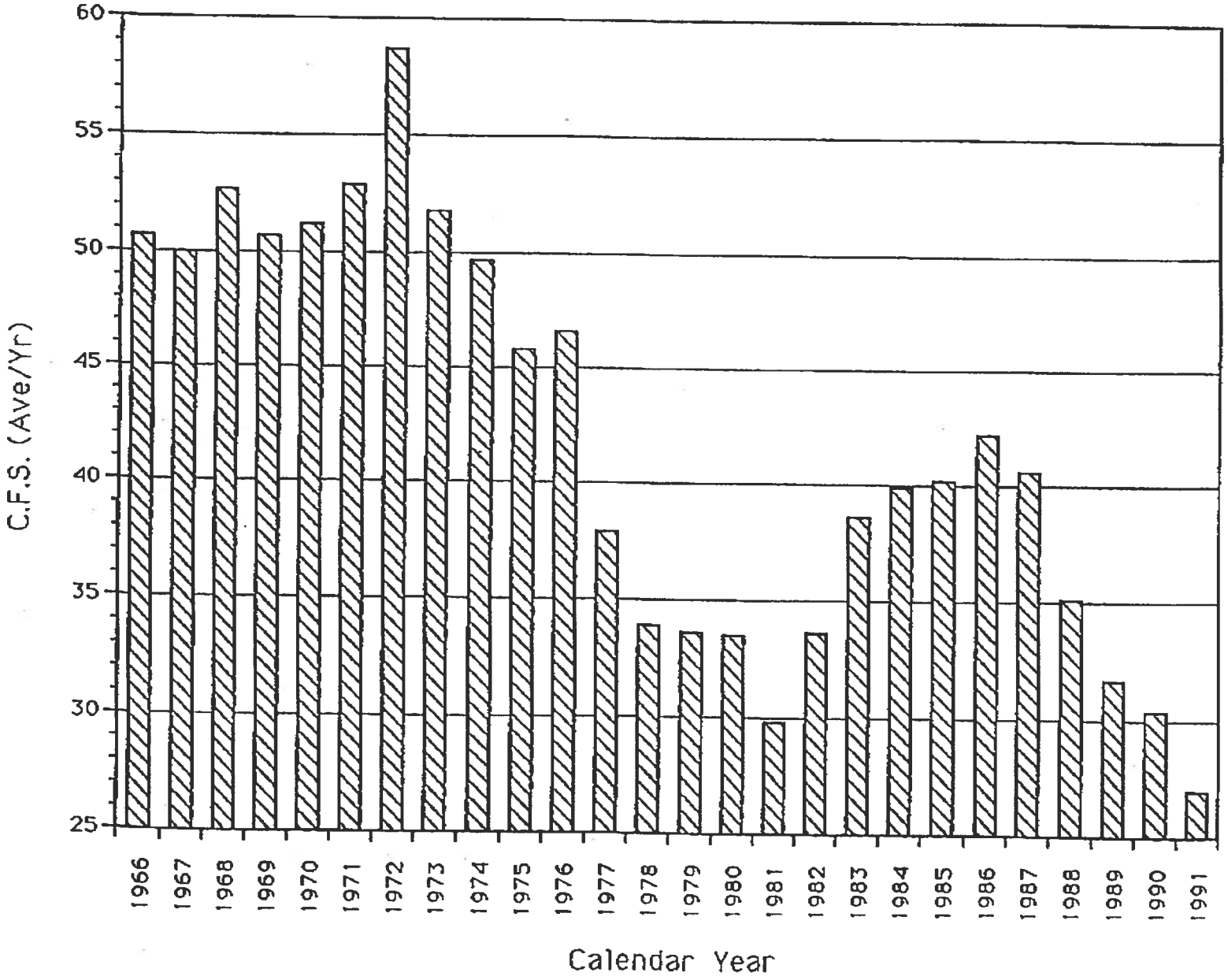
C.F.S.

Head of Billingsley Creek at Curran Tunnel

Month	January	February	March	April	May	June	July	August	September	October	November	December	Total Ave/Year
1966	52.2	48.2	44.9	38.5	34.2	45.4	51.3	53.2	62.4	69.9	58.4	49.2	50.7
1967	43.9	39.3	33.4	36.6	37.6	47.4	49.0	52.9	58.9	69.4	67.4	64.3	50.0
1968	52.8	45.8	41.2	36.0	36.8	45.0	50.5	58.9	68.2	68.2	65.5	63.1	52.7
1969	50.8	43.4	38.2	33.4	34.3	45.5	49.6	58.5	65.9	66.9	64.7	57.2	50.7
1970	49.8	42.7	42.0	34.7	34.5	42.5	50.3	59.4	66.0	69.3	63.3	60.0	51.2
1971	50.2	41.2	39.1	37.2	40.5	43.4	51.0	60.5	64.8	73.7	70.2	63.4	52.9
1972	55.1	48.1	43.0	40.6	45.9	58.1	61.0	67.3	73.9	76.1	68.2	66.7	58.7
1973	57.9	49.1	46.2	37.6	39.6	42.1	53.1	55.1	57.8	65.8	61.6	55.3	51.8
1974	44.1	46.5	41.1	35.8	34.4	43.4	47.1	55.0	59.2	69.6	62.8	57.9	49.7
1975	43.0	39.9	32.8	33.5	37.3	39.5	43.2	51.9	55.6	57.9	56.2	58.3	45.8
1976	50.0	44.3	41.1	33.1	35.9	38.0	39.5	47.2	56.4	61.6	58.7	53.0	46.6
1977	47.1	39.5	37.7	35.2	32.6	37.0	34.9	33.9	37.9	38.9	42.4	37.6	37.9
1978	33.3	29.4	30.1	28.3	27.6	27.3	27.9	33.6	49.9	42.8	40.3	36.5	33.9
1979	34.4	30.3	29.3	24.5	20.3	25.4	27.1	36.1	47.8	47.7	42.2	38.3	33.6
1980	34.6	31.7	27.5	25.8	22.7	30.9	32.7	34.5	37.8	47.4	41.1	34.9	33.5
1981	31.1	26.7	22.4	23.7	20.0	21.5	27.5	33.3	37.0	39.1	41.0	34.1	29.8
1982	30.6	30.1	29.7	24.7	24.1	23.0	29.0	33.1	42.8	46.7	47.6	41.9	33.6
1983	37.0	33.1	32.3	28.2	30.3	29.0	35.1	43.1	47.5	51.9	48.6	46.7	38.6
1984	41.0	40.1	37.4	33.6	31.5	35.0	37.9	42.1	42.9	47.6	45.8	44.1	39.9
1985	40.2	38.3	36.1	34.5	31.7	31.0	32.9	45.3	48.9	52.0	49.1	42.5	40.2
1986	37.8	36.5	34.8	32.4	34.3	34.2	38.2	49.6	52.6	55.6	51.5	48.9	42.2
1987	43.3	38.2	36.1	30.7	30.1	35.5	37.2	45.2	45.6	52.3	47.4	45.3	40.6
1988	37.6	33.9	30.8	27.6	27.7	30.1	29.9	35.8	39.7	47.5	43.1	37.9	35.1
1989	34.4	31.3	28.7	22.2	23.2	25.0	27.5	35.3	34.9	42.9	38.7	36.7	31.7
1990	34.3	31.7	28.8	20.9	22.3	24.9	26.5	30.4	35.2	41.9	35.6	32.1	30.4
1991	28.6	27.2	27.3	17.8	18.9	19.9	20.8	27.5	34.8	35.6	32.8	32.3	27.0
Diverted	0.0	0.0	0.0	2.1	6.9	6.7	7.4	8.6	4.8	3.0	0.0	0.0	0.0

Water Flow Measurements

Head of Billingsley Creek



[illegible]
January 19, 1967

[illegible]
1[illegible]7 [illegible]
[illegible] 83[illegible]

Dear Mr. W[illegible]: [illegible] Jan 17, '67.

[illegible] measurements I have made [illegible] [illegible] as follows

Dec 11, 1965.

22 [illegible] average — 64.60 cfs

[illegible] measurements

Jan. 9, 1966 – 22 [illegible] 52.15 "

Feb. 11, 1966 [illegible] 48.23 "

March 11, 1966 " 44.94 "

April and May was not made [illegible] [illegible] [illegible]. I bought a [illegible]

	Canon Creek	3 pipes	creek
June 22, 1966	45.41 cfs	8.10	37.31
July 27, 1966	51.30	8.45	42.85
Sept. 21, "	62.42	3.22	59.20
Oct. 21, "	69.89	0.82	69.07
Nov. 21, "	59.38		
Dec. 27, "	47.23	0.40	[illegible]

[illegible] all the water in the creek [illegible] [illegible] facilities.

[illegible] [illegible]

YEAR	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1966				38.47	34.20			53.26				
1967							59.00					
1968												63.12
1969												
1970										67.27	63.32	60.00
1971	50.21	41.19	39.06				51.01					
1972										76.12		
1973						42.07		55.07				55.27
1974			41.07			43.44			54.16		62.76	57.96
1975	42.97	39.87	32.76	33.47					55.56		56.20	
1976		44.27		33.11		38.02		47.24			56.74	
1977												
1978												
1979												

measurements by George Lammons (Watermaster)

Gary: Hope this will help you. The circled figures are estimates and not actual measurements

Lyn

To: Tim Luke

Cc: Cindy Yenter, Brian Patton

From: Jennifer Berkey

Date: December 4, 2003

Re: Review of Rangen Hatchery data

As you requested, I have reviewed the data submitted for the Rangen Research Hatchery (Rangen) by May, Sudweeks & Browning, LLP (May), via correspondence dated November 21, 2003. The submittal includes the following:

1. A table of monthly average flow measurements from 1966 to 2003, which is titled "Rangen Research Hatchery, total flow measurements"
2. A chart of yearly average flow from 1966 to 1991, titled "Water Flow Measurements, Head of Billingsley Creek"
3. A table of monthly average flow from 1966 to 1991, titled "Head of Billingsley Creek at Curran Tunnel"
4. Copies of handwritten records of weekly flow measurements recorded between 1966 and 2003
5. A sketch of the hatchery facilities

Rangen has also reported weekly diversion data to IDWR on an annual basis for the years of 1995 through 2002. These data have been entered into the IDWR database SW36DATA.mdb. Data are reported for two diversions, which are denoted as 410089 "Rangen Hatchery/Billingsley Ck Head", and 410041 "Rangen Pipe from Curren Tunnel". As part of this review I have compared these data to the recent submittal.

The handwritten weekly flow records indicate that Rangen measures flow at the following three locations, which are shown on the sketch included in the submittal. Measurement methods are not documented.

A. Large raceways
B. CTR raceways
C. Dam on Billingsley Creek

Based on the sketch and discussions with Cindy Yenter and Brian Patton, who recently conducted a detailed site visit, the measurements collected at the dam on Billingsley Creek could potentially include bypass flows not diverted by Rangen, spring inflow downstream of Rangen's lower diversion, irrigation return flows, and discharge from the raceways when they are drained for maintenance. According to Brian Patton, most of the flow at the dam in Billingsley Creek during the November 25, 2003 site visit was the result of spring inflow downstream of Rangen's lower diversion. Leakage around the check structure at Rangen's lower diversion and leakage from the raceway drainage pipes contributed a very small amount to the flow in the creek.

Comparison of the handwritten records with the data in SWDATA.mdb, indicates that the diversion data submitted by Rangen for diversion 410089 is the sum of the CTR raceway

measurement and the measurement at the dam on Billingsley Creek. Therefore, these data appear to include water that was not diverted or put to beneficial use by Rangen.

Diversion 410041 is not addressed in the recent submittal. Based on discussion with Cindy Yenter, diversion 410041 includes water measured in the pipeline at the laboratory and an estimate of Rangen's irrigation water, which is diverted through the same pipeline, but rediverted before the point of measurement. Rangen's water rights authorized irrigation of 7 acres. Rangen has not included the data reported for 410041 in the monthly averages reported in the recent submittal because some of the water (the water used in the laboratory) flows into the lower raceways and is measured again at the large and CTR raceways. It should be noted that water used by Rangen for irrigation or domestic purposes is not included in the data recently submitted by May.

The table titled "Rangen Research Hatchery, total flow measurements" has a descriptive note indicating that the monthly average flows are also the sum of the CTR raceway measurement and the dam measurement. Review of the handwritten records indicates that this is true for the 1997 and 1999 through 2003 data. The data presented in this table for other years were calculated using other measurements, and include an estimate of water diverted from Curren Tunnel by irrigators. Documentation of the method used to estimate the irrigation diversions was not provided. Note that the data presented for 1966 through 1991 are identical to Rangen's total spring flow data presented in the table titled "Head of Billingsley Creek at Curren Tunnel. The following table summarizes my findings regarding the methods used to calculate the monthly average flows.

Year	Calculation of reported flow	Reported flow represents
1997 and 1999-2003	CTR + dam	Raceway use plus undiverted bypass flow in creek
1998	CTR + dam + "estimated farmers"	Estimate of total spring flow
11/1993-12/1996	(Large raceway + CTR + dam)/2 + "estimated farmers"	Estimate of total spring flow minus half of the undiverted bypass flow in creek
1/1992-12/1993	(Large raceway + CTR)/2 + "estimated farmers"	Estimate of total spring flow minus undiverted bypass flow in creek
1984-1991	(Large raceway + CTR)/2 + dam + "estimated farmers"	Estimate of total spring flow
1981-1983	(Large raceway + CTR)/2 + "fishout/creek" + "estimated farmers"	Estimate of total spring flow
1966-1980	Documentation is not sufficient to determine where measurements were made. Estimated irrigation use was added to the monthly average measurements.	Estimate of total spring flow

Comparison of the 1997 and 1999 through 2003 monthly average flow data with the monthly average flow data generated by SW36DATA.mdb shows that, although the same weekly flow measurements were used, the monthly averages are different. This is because Rangen calculated the monthly flow measurements by giving equal weight to

each measurement collected during that month, while each measurement was assigned to a seven day period in SW36DATA.mdb.

Because the data reported in the table "Rangen Research Hatchery, total flow measurements" do not represent the same parameters each years, this table cannot be used to evaluate Rangen's historical water use. Using the handwritten weekly records, it would be possible to derive a table of average monthly raceway flows that would more closely represent Rangen's historical use between 1981 and 2003. Some data gaps and errors would likely occur in this analysis because some of the handwritten records are not legible. The data sheets for years prior to 1981 are not sufficient to derive monthly raceway data.

Recommendations:

1. The monthly average data submitted in the table "Rangen Research Hatchery, total flow measurements" do not represent Rangen's diversion and beneficial use of water and are not consistent in the parameters they represent.

2. If average monthly raceways flows and/or average monthly creek bypass flows would be useful in the evaluation of Rangen's call, we can derive them for 1981 to 2003 from the weekly handwritten records. This will involve a large amount of data entry or hand calculation, so I would like feedback on whether or not these data would be useful before proceeding.

3. The data Rangen has submitted for annual reporting (diversion 410089) appears to include undiverted bypass flow in Billingsley Creek, in addition to their diversions to the raceways. We should consider revising the data in SW36DATA.mdb using the weekly raceway measurements (with a note that this data overlaps with some of the water diverted at 410041). We should also consider giving Rangen more specific guidelines for measurement and reporting.

State of Idaho
DEPARTMENT OF WATER RESOURCES
P.O. Box 83720 Boise, Idaho 83720-0098
1301 North Orchard Street, Boise, Idaho 83706
Phone: (208) 327-7900 FAX: (208) 327-7866

DIRK KEMPTHORNE
GOVERNOR

KARL J. DREHER
DIRECTOR

FAX COVER SHEET

Date: 12/9/2003

To: Cindy Yenter

From: Jennifer Berkey

Document description: Data you requested from Rangen file. Please contact me if this isn't what you were looking for.

Cover sheet + ~~8~~ 6 **pages**

Please contact 327-7871 **if there is a problem with the transmittal.**

WMP2 8-6-1998

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
Water Measurement Program

1998 WATER MEASURING DEVICE CERTIFICATION

District [redacted] Inventory Date [redacted] Inventory Examiner [redacted] PCC ok? Yes / no

Date of test [redacted] Person performing test [redacted] Exam complete? (Yes) / no

Name: Rangen Inc

Water Right No:

Legal Description: T____ R____ Sec.____ ____ ¼ ____ ¼ ____ ¼

Site Tag No: A0001509

Diversion Name: Rangen Pipe

Current Owner

Name_____ Phone _____
Last, First, MI

Address_____ City _____ State ____ Zip_____

Operator (if leased or operated by someone else)

Name Peterschmidt Caroline Phone 8376191
Last, First, MI

SECTION I WELL SITE IDENTIFICATION

Global Positioning System Data:

Data Collection Filename [redacted] Offset [redacted]

IDWR Site Tag Identification No. [redacted]

Site Tag location description: [redacted]

PLS/USGS Locator _____

Diversion Name: [redacted]

For Department/District Use Only

Received by _____ Date _____

Reviewed by _____ Date _____

Data Entry by _____ Date _____

SECTION II INSTALLED METER INFORMATION

METER AND MOUNTING PIPE INFORMATION			
Motor HP		Volume Units	Acre-Feet Gallons Other(specify)
Meter Install Date		Volume Multiplier	
Manufacturer		Installation location	Excl Good Fair Poor
Meter Type		Pipe material	
Meter Model		Outside Diameter	6.68"
Serial Number		Wall Thickness	.28"
Size (nominal)		Inside Diameter	
Measure Flow Rate?	(circle one) Yes No	Dist. of straight pipe upstream from meter	+10D
Measurement Units	(circle one) CFS GPM Other(specify)	Dist. of Straight pipe downstream from meter	+10D
Flow rate Multiplier		Std Meter Type	Sonic Evg Cplins Rail Anub Dye/chem Other
Measure Cumulative Volume?	(circle one) Yes No	Std; Meter Confidence	Ex. Good Fair Poor 2% 5% 10% >10% X

Are **multiple flowmeters** used to measure diversions from this well? Yes / No
If so, how many?_____ (Attach separate form for each meter checked and/or calibrated)

If this meter measures diversions from **multiple wells**, names and locations of other wells:

SECTION III CERTIFICATION FOR CALIBRATION OF A WATER MEASUREMENT METER

See back page for instructions.

Measurement No. 1 (M_1) is the measured rate of flow from the permanently installed flow meter.

Measurement No. 2 (M_2) is the measured rate of flow from the measuring device being used to check the flow for the calibration. This method or device must be accurate to within ± 5% error. **Describe below the method and equipment used to perform this measurement.**

_____

Percent Difference = $(M_1 - M_2) \div M_2 \times 100 = \pm$ % (Acceptable is within ± 10%) (equation 1)

Calibration Multiplier = $M_2 \div M_1$ (equation 2)

Is flowmeter installed according to manufacturer's specifications? Yes / No / Unsure
Describe any apparent problems with installation or operation _____
_____
_____

Flowmeter accuracy prior to any adjustments:_____. Totalizer reading _____

Flowmeter accuracy after final adjustment:_____. Totalizer reading_____

Flowmeter calibration multiplier:

Water Level Data

Does the well have **access** to measure water levels? Yes / No

Is this well part of USGS, IDWR, or another **network** of water level monitoring wells? Yes / No

Static Water Level _____ ft **Pumping Water Level** _____ ft (at condition_____)

Date _____ **Date** _____

FLOWMETER ACCURACY CALIBRATION TABLE

Owners meter (totalizer reading)	Time	Total Gallons	Ave. Flow Rate - GPM (M_1)	Standard total gallons	Average flow rate (M_2)	Percent diff. (±)	Comments and adjustments
			381.4	4206	420.6	-9.3%	for totalizer
					419.2	-9.0%	data logger

Notes, Comments or Calculations: Signal = 5 bars quality = 4790
100.35%
Use Sch 40 PVC table for wall thickness
Attached sheet used by hatchery to estimate flows w/ lek

Sketch and or photograph of installation:

I certify that the above information is true and correct to the best of my knowledge and ability and the measurements taken and recorded are in accordance with the standards and specifications of the equipment used.

Signature C Wynter Date 3-12-02
(person performing measurements)

Rangen Pipe from Curren Tunnel
A0001509
Measured by: C. Yenter, 3-12-02

LOG NAME:RANGEN PIPE
START :03-12 15:42
END :03-12 15:52
INTERVAL:00:01:00

3/12/2002 15:42
+4.600E+0 ft/s
+4.218E+2 gal/m
+TOTAL 0000000 gal
NORMAL

3/12/2002 15:43
+4.595E+0 ft/s
+4.213E+2 gal/m
+TOTAL 0000416 gal
NORMAL

3/12/2002 15:44
+4.572E+0 ft/s
+4.192E+2 gal/m
+TOTAL 0000836 gal
NORMAL

3/12/2002 15:45
+4.602E+0 ft/s
+4.219E+2 gal/m
+TOTAL 0001256 gal
NORMAL

3/12/2002 15:46
+4.580E+0 ft/s
+4.199E+2 gal/m
+TOTAL 0001675 gal
NORMAL

3/12/2002 15:47
+4.603E+0 ft/s
+4.220E+2 gal/m
+TOTAL 0002096 gal
NORMAL

3/12/2002 15:48
+4.602E+0 ft/s
+4.219E+2 gal/m
+TOTAL 0002516 gal
NORMAL

3/12/2002 15:49
+4.552E+0 ft/s
+4.173E+2 gal/m
+TOTAL 0002935 gal
NORMAL

3/12/2002 15:50
+4.548E+0 ft/s
+4.169E+2 gal/m
+TOTAL 0003354 gal
NORMAL

3/12/2002 15:51
+4.572E+0 ft/s
+4.192E+2 gal/m
+TOTAL 0003773 gal
NORMAL

3/12/2002 15:52
+4.552E+0 ft/s
+4.173E+2 gal/m
+TOTAL 0004192 gal
NORMAL

AVG FLOW **419.2 gpm**

Rangen Pipe from Curren Tunnel
Measured by T. Luke, S. Burrell
Meter: Fuji Electronics Time Flyte

LD03
No.03
LOG NAME:R3
START :07-25 16:26
END :07-25 16:36
INTERVAL:00:01:00

7/25/2001 16:26
+3.583E+0 ft/s
+2.672E+2 gal/m
+TOTAL 0000000 gal
NORMAL

7/25/2001 16:27
+3.614E+0 ft/s
+2.695E+2 gal/m
+TOTAL 0000264 gal
NORMAL

7/25/2001 16:28
+3.608E+0 ft/s
+2.691E+2 gal/m
+TOTAL 0000533 gal
NORMAL

7/25/2001 16:29
+3.631E+0 ft/s
+2.709E+2 gal/m
+TOTAL 0000802 gal
NORMAL

7/25/2001 16:30
+3.645E+0 ft/s
+2.719E+2 gal/m
+TOTAL 0001072 gal
NORMAL

7/25/2001 16:31
+3.652E+0 ft/s
+2.724E+2 gal/m
+TOTAL 0001343 gal
NORMAL

7/25/2001 16:32
+3.644E+0 ft/s
+2.718E+2 gal/m
+TOTAL 0001617 gal
NORMAL

7/25/2001 16:33
+3.650E+0 ft/s
+2.722E+2 gal/m
+TOTAL 0001889 gal
NORMAL

7/25/2001 16:34
+3.686E+0 ft/s
+2.749E+2 gal/m
+TOTAL 0002163 gal
NORMAL

7/25/2001 16:35
+3.638E+0 ft/s
+2.714E+2 gal/m
+TOTAL 0002436 gal
NORMAL

7/25/2001 16:36
+3.655E+0 ft/s
+2.726E+2 gal/m
+TOTAL 0002709 gal
NORMAL

2709 gal/10 min = 271 gpm

Note: As per Rangens 'calibrated' lab measurements, pipe flow was about 320 to 340 gpm (they assume a 20 gpm constant domestic use but we observed little or no domestic use at the time, so their flow was about 320 gpm). T.J.

+18%

IDWR record		Hatchery/Lab water use		
Date				
Location	# possible	# in use	GPM/unit	Total GPM
Hatchery 1-6	6	0		
Hatchery 7-12	6	6	22	132
Greenhouse A-D	4	4	9.56	38.2
Greenhouse 1-20	20	20	9.56	191.2
Greenhouse 1H-3H	3		19.96	
Barrels 1-36	36		2.00	
Greenhouse E,F	2		9.56	
Swamp Cooler	1		2.00	
Cleanroom 1-34	34		0.50	
Isolation tanks 1-18	18		2.00	
Domestic	1	20	20.00	20
Total GPM				381.4
CFS				.85

(calibrated by timed fill by previous mgr)

hatchery tanks w/ calibrated inlets & standpipes, hd. table & variable flows

hatchery barrels w/ flow restrictors, always run full open, calibrated volumetrically (timed fill) by Caroline

est.

timed fill calibration?. ~~Not used~~

est.