

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 74-7337

Exam Date: 5/22/2012

1. Current Owner: STATE OF IDAHO
DEPT OF FISH & GAME
PO BOX 25
BOISE ID 83707
(208)287-2714
2. Accompanied by: Larry Weeks
Phone No: (208) 756-6022
Address: Region 7, PO Box 1336, Salmon, ID 83647
Relationship to Permit Holder: Easement Specialist
3. SOURCE TRIBUTARY
LEMHI RIVER SALMON RIVER

B. OVERLAP REVIEW

1. Other water rights with the same place of use: None
2. Other water rights with the same point of diversion: 74-695

C. DIVERSION AND DELIVERY SYSTEM**1. LOCATION OF POINT(S) OF DIVERSION:**

LEMHI RIVER SE1/4SE1/4 Sec. 10, Twp 21N, Rge 22E, B.M.
LEMHI County

Method of Determination: Visual Inspection and Existing Spatial Data information

2.

PLACE OF USE: FISH PROPAGATION

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	
21N	22E	10													X				

Method of Determination: Visual Inspection and GIS

3. YES Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
YES Aerial Photo Attached (required for irrigation of 10+ acres).
YES Photo of Diversion and System Attached

4.

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
Site Tag # A0011417	NONE				Open Ditch

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date

2. Measurements: The system was set up with a standard orifice that is used on all of the fish screens in the Salmon River and Lemhi River area. This orifice has been checked for accuracy and found to be reliable. Please see Cory Skinner's memo dated 8/24/2011.

E. FLOW CALCULATIONS X Additional Computation Sheets Attached

Measured Method:

Measurement = 0.77 cfs
 Permit allowed = 0.80 cfs

License recommend for 0.77 cfs.

F. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) =$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 =$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} =$$

2. Volume Calculations for Other Uses:

0.77 cfs X 246 days in irrigation season X 1.9835 = 357.7 af of use per year.

G. NARRATIVE/REMARKS/COMMENTS

Water from Ditch is diverted from Lemhi River through a ditch that travels approximately 260 feet northwest to the fish screen. At the fish screen the majority of the water continues down the ditch to supply water to the other water rights using this diversion. A maximum of 0.77 cfs is diverted through a 10 inch pipe back to the creek to prevent fish kills in the creek. The water going back to the creek is run through a 4 inch orifice for measurement purposes.

The only other water right diverted through this ditch is 74-695. The fish screen was actually located in the NESE instead of the SESE as listed on the permit. A licensing amendment has been sought to correct this error.

Have conditions of permit approval been met? X Yes No

H. RECOMMENDATIONS**1. Recommended Amounts**

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>DIVERSION RATE</u>	<u>ANNUAL VOLUME</u>
FISH PROPAGATION	03/15 to 11/15	0.770 CFS	375.70 AF
<u>Totals:</u>		0.770 CFS	375.70 AF

2. Recommended Amendments

Change P.D. as reflected above Add P.D. as reflected above None

Change P.U. as reflected above Add P.U. as reflected above Other

I. AUTHENTICATION Daniel A. Nelson – Staff Hydrologist

Field Examiner's Name Daniel A. Nelson Date 10-17-2012

Reviewer _____ Date _____

State of Idaho
Department of Water Resources

Attachment To Water Right License

74-7337

This map depicts the FISH PROPAGATION place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.

R22E



Fish Screen

Ditch

Lemhi River

**System Diagram for Water Right 74-7337 By
Dan Nelson**

Water from Ditch is diverted from Lemhi River through a ditch that travels approximately 260 feet northwest to the fish screen. At the fish screen the majority of the water continues down the ditch to supply water to the other water rights using this diversion. A maximum of 0.77 cfs is diverted through a 10 inch pipe back to the creek to prevent fish kills in the creek. The water going back to the creek is run through a 4 inch orifice for measurement purposes.

NESE

NWSW

SESE

SWSW

NENE

NWNW

Field Exam Flow Rate Calculation Sheet for Fish Screen Orifices

Water Right Number: 74-7337
Field Examiner: Daniel Nelson
Date of Exam: 5/21/2012

Discharge from a tank through an orifice (see attached memo from water right 72-16754 by Corey Skinner for a formula and orifice coefficient.

Formula = $C_d A_o (2gh)^{1/2}$

Where C_d = coefficient of discharge
 A_o = Area of orifice opening in Square feet
 $g=32.2$ feet per second²

h = Measured head above center of orifice opening in feet

Orifice Diameter in inches =	4
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$A_o = (\pi r^2) / 144 = \text{Square Feet}$

$A_o = 0.087$

Head above center of orifice in Inches =	32.5
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 (Measured to High Water Mark)

$h = 2.708$

Coefficient of Discharge for Orifice* =	0.67
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Total Diversion Rate = 0.77

* Per Cory Skinner's memo for Basin 71 and 72 IDF&G Fish Bypass Permit Files dated August 24, 2011, the Coefficient for round edge orifice should be 0.67.

	Gradual, $\phi < 22^\circ$	Sudden, $\phi > 22^\circ$	
Enlargement	$2.6(\sin \phi)(1 - \beta^2)^2$	$(1 - \beta^2)^2$	3.81
Contraction	$0.8(\sin \phi)(1 - \beta^2)$	$\frac{1}{2}(1 - \beta^2)\sqrt{\sin \phi}$	3.82

4 HEAD ADDITIONS/EXTRACTIONS

A pump adds head (energy) to the fluid stream. A turbine extracts head from the fluid stream. The amount of head added or extracted can be found by evaluating Bernoulli's equation (equation 3.55) on both sides of the device.

$$h_A = H_2 - H_1 \quad (\text{pumps}) \quad 3.83$$

$$h_E = H_1 - H_2 \quad (\text{turbines}) \quad 3.84$$

The head increase from a pump is given by equation 3.85.

$$h_A = \frac{(550)(\text{pump input horsepower})\eta_{\text{pump}}}{\dot{m}} \left(\frac{g_c}{g} \right) \quad 3.85$$

Bernoulli's equation also can be used to calculate the power available to a turbine in a fluid stream by multiplying the total energy by the mass flow rate. This is called the *water horsepower*.

$$P = \dot{m}H \left(\frac{g}{g_c} \right) = \dot{m} \left(\frac{p}{\gamma} + \frac{v^2}{2g} + z \right) \left(\frac{g}{g_c} \right) \quad 3.86$$

$$\dot{m} = \rho A v \quad 3.87$$

$$\text{whp} = \frac{P}{550} \quad 3.88$$

Pumps and turbines are covered in greater detail in chapter 4.

5 DISCHARGE FROM TANKS

Flow from a tank discharging liquid to the atmosphere through an opening in the tank wall (figure 3.14) is affected by both the area and the shape of the opening. At the orifice, the total head of the fluid is converted into kinetic energy according to equation 3.89.⁶

$$v_o = C_v \sqrt{2gh} \quad 3.89$$

⁶ Although the term g_c appears in the equation for velocity head (equation 3.53), here it is the local gravity, g , which appears in equation 3.89. An analysis of equation 3.197 will show you why this is so.

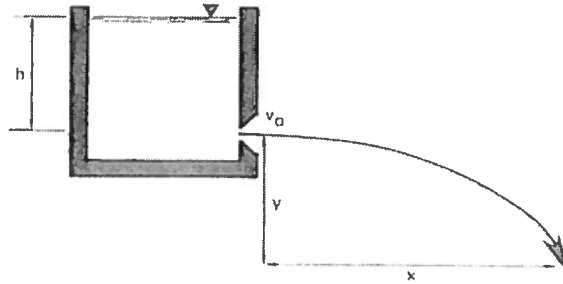


Figure 3.14 Discharge From a Tank

C_v is the *coefficient of velocity* which can be calculated from the *coefficients of discharge and contraction*. Typical values of C_v , C_d , and C_c are given in table 3.10.

$$C_v = \frac{C_d}{C_c} \quad 3.90$$

The discharge from the orifice is

$$\begin{aligned} \dot{V} &= (C_c A_o) v_o = C_c A_o C_v \sqrt{2gh} \\ &= C_d A_o \sqrt{2gh} \end{aligned} \quad 3.91$$

The head loss due to turbulence at the orifice is

$$h_f = \left(\frac{1}{C_v^2} - 1 \right) \frac{v_o^2}{2g} \quad 3.92$$

The discharge stream coordinates (see figure 3.14) are

$$x = v_o t = v_o \sqrt{\frac{2y}{g}} = 2C_v \sqrt{hy} \quad 3.93$$

$$y = \frac{gt^2}{2} = \frac{g}{2} \left(\frac{x}{v_o} \right)^2 \quad 3.94$$

The fluid velocity at a point downstream of the orifice is

$$v_x = v_o \quad 3.95$$

$$v_y = gt \quad 3.96$$

If the liquid in a tank is not being replenished constantly, the static head forcing discharge through the orifice will decrease. For a tank with a constant cross-sectional area, the time required to lower the fluid level from level h_1 to h_2 is calculated from equation 3.97.

$$t = \frac{2A_t(\sqrt{h_1} - \sqrt{h_2})}{C_d A_o \sqrt{2g}} \quad 3.97$$

If the tank has a varying cross section, the following basic relationship holds.

$$Q dt = -A_t dh \quad 3.98$$

Table 3.10
Orifice Coefficients for Water
(fully turbulent)

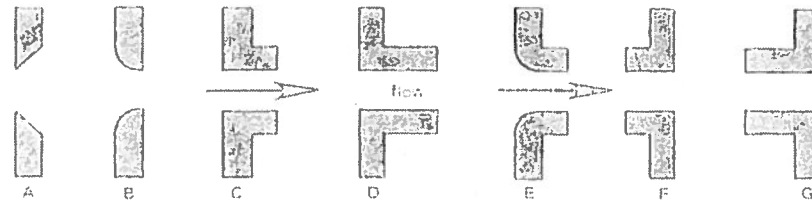
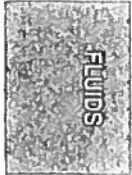


illustration	description	C_d	C_c	C_v
A	sharp-edged	0.62	0.62	0.98
B	round-edged	0.98	1.00	0.98
C	short tube (fluid separates from walls)	0.61	1.00	0.61
D	short tube (no separation)	0.82	1.00	0.82
E	short tube with rounded entrance	0.97	0.99	0.98
F	reentrant tube, length less than one-half of pipe diameter	0.54	0.55	0.99
G	reentrant tube, length 2 to 3 pipe diameters	0.72	1.00	0.72
not shown	smooth, well-tapered nozzle	0.98	0.99	0.99



An expression for the tank area, A_t , as a function of h , must be determined. Then, the time to empty the tank from height h_1 to lower height h_2 is

$$t = \int_{h_1}^{h_2} \frac{A_t dh}{C_d A_o \sqrt{2gh}} \quad 3.99$$

For a tank being fed at a rate, $\dot{V}_{in}$, which is less than the discharge through the orifice, the time to empty expression is

$$t = \int_{h_1}^{h_2} \frac{A_t dh}{(C_d A_o \sqrt{2gh}) - \dot{V}_{in}} \quad 3.100$$

When a tank is being fed at a rate greater than the discharge, equation 3.100 will become positive, indicating a rising head. t then will be the time it takes to raise the fluid level from h_1 to h_2 .

The preceding discussion has assumed that the tank has been open or vented to the atmosphere. If the fluid is discharging from a pressurized tank, the total head will be increased by the gage pressure converted to head of fluid by means of equation 3.52.

Example 3.22

A 15' diameter tank discharges 150°F water through a sharp edged 1" diameter orifice. If the original water depth is 12' and the tank is continually pressurized to 50 psig, find the time to empty the tank.

At 150°F, $\rho = 61.20 \text{ lbm/ft}^3$

For the orifice,

$$A_t = 0.00545 \text{ ft}^2, \quad C_c = 0.62$$

$$h_1 = 12 + \frac{(50)(144)}{61.2} = 129.65 \text{ ft}$$

$$h_2 = \frac{(50)(144)}{61.20} = 117.65 \text{ ft}$$

From equation 3.97,

$$t = \frac{2[\pi(7.5)^2](\sqrt{129.65} - \sqrt{117.65})}{(0.62)(0.00545)\sqrt{(2)(32.2)}} = 7037 \text{ seconds}$$

6 CULVERTS AND SIPHONS

A culvert is a water path used to drain runoff from a obstructing geographical feature. Most culvert design are empirical. However, if the entrance and exit of the culvert both are submerged, the discharge will be independent of the barrel slope. (Chapter 5 treats the subject in greater detail.) In that case, equation 3.1C can be used to evaluate the discharge. h is the difference in surface levels of the headwater and tailwater.

$$\dot{V} = C_d A \sqrt{2gh} \quad 3.11$$



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PHOTOGRAPHER AND DATE OF PHOTOS DANIEL A NELSON 5/21/2012

FILE NUMBER 74-7337



This is a photo of the fish screen for this water right. The orifice is attached to the handle at the bottom right hand side of the picture.



State of Idaho

DEPARTMENT OF WATER RESOURCES

322 East Front Street • P.O. Box 83720 • Boise, Idaho 83720-0098

Phone: (208) 287-4800 • Fax: (208) 287-6700 • Web Site: www.idwr.idaho.gov

C.L. "BUTCH" OTTER

Governor

GARY SPACKMAN

Director

10/17/2012

Idaho Department of Fish and Game
Region 7
Attn: Larry Weeks
PO Box 1336
Salmon, ID 83647

COPY

RE: Water Right Permit No. 74-07337

Dear Permit Holder(s):

The Department of Water Resources is reviewing the permit referenced above prior to issuing a water right license. By issuing a license, the Department confirms the extent of development that has been established in compliance with the terms of the permit. The examiner who verified your water use reported that certain elements of the permit have been developed differently than described on your permit. Changes that do not increase the authorized use of water under the permit can be requested and approved in accordance with Section 42-211, Idaho Code. Before a license can be issued, your permit must be amended to depict your water use as it was actually developed.

Based on the examiner's report, the following elements were developed differently than described on your permit:

The Place of Use (Fish Screen) was located in the NESE of Section 14, Township 17 North, Range 23 East, instead of the SESE of Section 14, Township 17 North, Range 23 East as listed on the permit. Please See Attached Map.

The enclosed Application for Amendment form depicts the elements of the water right as they will appear on the license when it is issued. Please review the amendment form carefully. If you concur with the information presented, please sign the form and return it with the \$50.00 filing fee within 14 days.

If you have any questions, please call me at (208) 287-4856.

Sincerely,

Daniel A. Nelson
Staff Hydrologist

Enclosure(s)