MEMORANDUM

TO: Water Right File 13-7996

FROM: Daniel Nelson – Analyst 3

DATE: August 24, 2020

SUBJECT: Licensing Review of Water Right 13-7996

The field exam for this right was performed by Certified Water Right Examiner Patrick Naylor of Rocky Mountain Environmental.

On April 1, 2020, Mr. Naylor submitted a field report that was subsequently rejected, because it did not meet the requirements of the Idaho Administrative Code Beneficial Use Examination Rules.

On August 11, 2020, Mr. Naylor submitted a second field examination that was considered complete. In the second field report, Mr. Naylor recommended a diversion rate of 1.00 cfs, but did not recommend any volume. However, he did calculate the volume at 724 af. I am assuming he simply neglected to enter the volume in the proper location for a recommended volume.

History and Overlap:

The ponds associated with this permit were developed in conjunction with Idaho Fish and Game (IDFG) to enhance the Bonneville Cutthroat Trout (BCT) population. Water right exchange 81756 was filed to change 2.8 af of water right 13-963 to fish propagation storage for the two ponds associated with this permit. The portion of water right 13-963 split off to fish propagation storage is water right number 13-7998. Although water right 13-7998 shows the Bear River as the source, the exchange authorized the diversion from the same unnamed spring as permit 13-7996.

It was discovered during the second field report that the Upper Pond has a volume of 2.35 af and the lower pond has a volume of 2.13 af. These volumes are well above the 2.8 af of storage authorized by water right 13-7998. Mr. Naylor then calculated the volume of the evaporation losses of the two ponds at 1.4 af. Therefore, the actual pond storage for these ponds is approximately 4.5 af for a total storage volume of 5.9 af when the evaporation losses are included.

In the analysis for water right exchange 81756, the reviewer considered that that the storage retired from 13-963 would have the same evaporation element as the two new ponds. Using this protocol, we cannot consider that this permit could cover the remaining storage component, because this permit is a totally non-consumptive water right. Using the same protocol, we would consider the water right 13-7998 only provided approximately 0.7 af of evaporation losses (1.4 af evaporation losses / 5.9 af total volume) X 2.8 = 0.664 af]. Therefore, the permit holder must come up with an additional 0.7 af of evaporation losses or consumptive use. Eastern Region staff are pursuing this water right exchange with the permit holder.

Point of Diversion Place of Use:

I don't have any issues with the points of diversion and places of use recommended by Mr. Naylor. I was able to replicate the ponds and I determined that the upper pond was at 0.428 acres and the lower pond at 0.432 af. Whereas the ponds were so close to what the field examiner calculated, I am going to go with the field examiner's calculations.

Diversion Rate:

Mr. Naylor calculated a diversion rate of 0.51 cfs being diverted into each of the 2 ponds for a total of 1.02 cfs. Mr. Naylor recommended the permitted rate of 1.00 cfs. Mr. Naylor used a formula for calculating the diversion rate that I haven't seen. Mr. Naylor referenced the 1997 revision of the Bureau of Reclamation Measurement Manual. I only have the 1984 revised reprint edition and the 2001 revised third edition reprint edition, but I didn't have the 1997 third edition. However, I was able to view an online PDF version of the 1997 edition.

In my review of all 3 editions of the measurement manual, I was not able to find the formula used by Mr. Naylor. I used the standard we use at the Department set forth in the 1951 Mechanical Engineers' Handbook, Fifth Edition, where you exchange the 3.33 coefficient for the standard sharp crested weir formula with 2.64. Using this formula, I was able to match Mr. Naylor's calculations exactly. I contact Mr. Naylor, and he provided me with proper reference points, so the formula he used did make sense after the email.

Even though the formula used by Mr. Naylor was new to me, it did match the standard used by the Department. Therefore, I feel the recommendation of 1.00 cfs made by Mr. Naylor is reasonable.

Diversion Volume:

Mr. Naylor calculated the volume of the water being diverted from the springs, but didn't make a recommendation in the field report. A portion of the springs are diverted year round, so the total volume calculated by Mr. Naylor of 724 af is reasonable. In order to assign a volume to this permit, we need to take into account the 5.9 af of volume used to fill the ponds and lost to evaporation. Therefore, the total volume we can consider for this permit is 718 af (724 af of capacity – 5.9 af for ponds = 718.1 af for flow through).

Beneficial Use Analysis:

In order to license a water right, the field agent must show that beneficial use of water occurred, and that the water being used is not excessive. Normal fish propagation reviews are performed on facilities with cement raceways, so there is a reasonable standard for calculating the amount of water needed for those types of fish rearing facilities. These ponds are used to raise wild BCT for breeding purposes for IDFG. The criteria needed for these ponds are much different than the requirements for fish hatcheries with cement raceways.

Administrative Processing Memorandum #15 states the following:

> Commercial producer often use earthen ponds or small lakes to rear trout. In this case trout density should not exceed ½ pound per cubic foot of water. Greater densities will lead to diseases that are difficult to handle in earthen ponds.

Mr. Naylor stated that the ponds currently hold between 173 to 341 fish averaging approximately 0.64 lbs per fish. This equates to 0.0008 lbs/ft^3. It seems from this information, that the ponds appear to be oversized. However, Mr. Naylor also states that the fish are wild stock, and are not fed as is the normal practice for commercial facilities. Therefore, it is reasonable to have a less density of fish than is normal to allow food species to adequately multiply to provide nourishment for the fish.

A draft Adjudication memo composed by Marci Sterling dated April 1, 1993, suggests that for cold water species, the IDFG recommends stocking between 50 and 200 fish per acre surface area. The field report states that each pond has a surface are of approximately 0.425 acres for a total of 0.85 acres. Using Ms. Sterling's suggestion, these ponds are smaller than what is recommended for 173 to 341 fish being planted into the ponds.

Ms. Sterling's 1993 memo also suggests that earthen ponds should have a turnover rate of one exchange every one to two days in a cold water fish pond. The field examiner states that the water in the pond exchanges approximately every 54.5 hours or 2.3 days. The exchanges seem reasonable for this system.

As described above, these ponds were developed to allow the IDFG the ability to capture BCT and raise them in the ponds to spawning size/age. The fish will then be transported to an IDFG fish hatchery where the eggs will be extracted and fertilized. The eggs will be raised and reintroduced back into the Bear River. Based on the information available, I believe that the water use developed, water being used, and the size of the facility seems to be reasonable for a fish propagation use.

Conditions:

All of the conditions on the permit need to be carried forward to licensing. Typically, we don't carry forward condition 004 if the point of diversion and place of use are all within the same tax parcel. However, the pipeline from the spring does cross over property owned by the Bureau of Land Management, so this condition needs to be carried forward to licensing.

Mechanical Engineers' Handbook

EDITED BY

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nozzle. In case of such a nozzle the coefficient 0.91 means that 17.2 percent of the head is "lost," *i.e.*, used up in overcoming friction.

Venturi Meter. This device was invented by Clemens Herschel in 1887, and named after Venturi, who observed the principle in 1791. The general formula of this useful flow meter is discussed on p. 238. Referring to Fig. 8, the practical formula connecting the measured difference of pressure heads, $H_1 - H_2 = h$, with the mean velocity of flow in the throat is the same as the nozzle formula on p. 243. For coefficients, see p. 2081.

The nominal size of a Venturi meter is that of the pipe line in which it is to be placed. The throat diameter usually is made some size between 0.25 and 0.75 of the upstream diameter, depending on the rate of flow to be expected and on the pressure in the line. The throat velocity with the low rates of flow should be great enough so that the difference of pressure heads (often called **the Venturi difference**) will cause a measurable indication on the register or gage, but should not be so great as to cause the throat pressure to drop below atmospheric, lest there be trouble with air leaking into the gage and register connections. The upstream convergence angle of a Venturi meter may be from 25 to 30 deg, but the downstream divergence angle should not be greater than $7\frac{1}{2}$ deg. The pressure connections usually are made to **ring piezometers,** consisting of circumferential passageways communicating to the interior of the meter by four or more small holes equally spaced around the pipe. The object is to assure the obtaining of the average pressure by avoiding dependence on a single piezometer hole subject to possible local disturbances. The ring piezometers are cast as part of the meter tube. The meters are usually made of cast iron and in several sections, bolted together. The throat is bronze-lined, very accurately bored to size and very smoothly finished. Venturi meters have been made of concrete and wood staves, the throats being lathe-finished bronze castings.

For the loss of head caused by the presence of a Venturi meter in a pipe line, see p. 2081.

Flow over Dams and Weirs

Weirs. A weir is a bulkhead or dam over which water flows, or a notch in the top of such a structure through which water flows. An orifice becomes a weir if the water surface upstream falls below its top edge. The velocity of approach is sometimes considerable, as for a low dam in a river at floodtime, or it may be practically negligible, as for a small notch in the side of a large tank.

The theoretical discharge over a weir of width l is $Q = \frac{2}{3}C_c lh\sqrt{2gh}$. This is two-thirds of the theoretical discharge through a rectangular orifice l ft long and h ft high under a head h. The actual discharge is $Q = 3.33lh^{3/2}$, as determined for sharp-crested weirs by **Francis,** who found an experimental discharge coefficient of 0.62. Multiplying this by $\frac{2}{3}\sqrt{2g}$ yields the value 3.33. This numerical constant contains g in ft-sec units, and Q is therefore in cu ft per sec and l and h are in ft.

By a sharp crest is meant one with a sharp upstream corner, so that full contraction is developed. The crest itself may have considerable thickness (but see under broad flat crests p. 246) and is frequently made of a steel plate or angle planed off and sometimes beveled on the downstream side to give a top flat portion from $\frac{1}{16}$ to $\frac{1}{8}$ in. wide.

Accuracy of Francis Formula. This formula is very widely used by engineers. It is reliable within from 1 to 3 percent for heads above 0.3 ft, provided (1) the weir bulkhead has a vertical upstream face and occupies the full width of the channel, (2) the crest is level, (3) the channel of approach is deep (*i.e.*, the weir bulkhead is high, so that the velocity of approach is small—see below for corrections), (4) there is free access of the air to the space below the falling sheet of water (*i.e.*, between it and the downstream face of the weir), (5) the head is measured a distance upstream from the weir of at least four times the head, (6) the side walls extend downstream from the weir (above the crest level) to prevent a lateral spreading as the water passes over the crest, and (7) due precautions in measuring are taken.

For very low heads, Francis formula results for discharge must be increased 1(3) percent when $h = 0.2$ ft, and 4(7) percent when $h = 0.1$ ft, the low values for a strictly sharp crest piece with extremely smooth upstream face, the high values for ordinary iron plate with machine-planed top but somewhat corroded.

Effects of Errors or Uncertainties. A small percentage error in head causes $1\frac{1}{2}$ times that error in discharge. Conversely, the allowable percentage error in head is two-thirds that in discharge. Considerable errors in the measured head may be made by careless methods of referencing the crest level to the head gage scale, and by assuming that a non-level crest is level without knowing the average level. The mean level of the water surface must be measured, not the crests of the small waves or surges existing in all flowing water. Rounding the upstream corner of the crest increases the discharge especially at low heads. Roughness of the upstream vertical face of the weir has the same effect.

For a **rectangular notch** with vertical sharp-edged ends, contraction occurs at the ends as well as at the crest, and the discharge is reduced approximately as though the length of the weir were decreased by $0.1h$ for each end contraction. Hence, the Francis formula for a sharp-crested weir with two end contractions is

$$Q = 3.33(l - 0.2h)h^{3/2}$$

This formula must not be used unless l is at least $2 \times h$.

See Cone, Flow through Weir Notches (rectangular, triangular, Cipolletti, circular) with Thin Edges and Full Contractions, *Jour. Agr. Research*, U.S. Dept. Agriculture, 5, No. 23, 1916; and a variety of weir-notch data by Pardoe in his discussion of Precise Weir Measurements, *Trans. ASCE*, 93, 1929.

Cipolletti Trapezoidal Weir. Cipolletti found that a trapezoidal notch with end slopes 1 horizontal to 4 vertical (Fig. 15) just compensated for the reduction due to

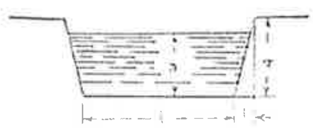

Fig. 15. Cipolletti weir.

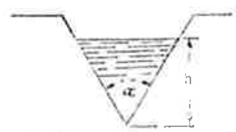

Fig. 16. Triangular-notch weir.

end contraction in a rectangular notch of the same crest length, and, accordingly, the simple Francis formula, $Q = 3.33lh^{3/2}$, may be used for such a trapezoidal notch. The crest length l must be at least $2 \times h$, and the crest should be 2 or $3 \times h$ above the bottom of the channel of approach to avoid a velocity-of-approach correction. The Cipolletti weir has become popular in the Western states for measuring irrigation water.

Triangular Notch. There are certain advantages in the triangular notch for measuring discharges that vary from a moderate maximum to a very small minimum, *e.g.*, 1 gpm, and where about the same degree of precision is desired whether the discharge is high or low. The formula for a sharp-edged notch (Fig. 16) is $Q = C \frac{8}{15} \tan (\alpha/2) h^2 \sqrt{2gh}$, where α is the notch angle and h is the head above the vertex. The discharge coefficient C has a value from 0.58 to 0.59, based on experiments at Cornell University, with heads up to 3 ft and vertex angles of 28, 60, 90, and 120 deg. The average coefficient 0.58 was found for the 60 and 90 deg weirs, and 0.59 for the 28 and 120 deg weirs. These results are close to those of Cone (*loc. cit.*). Prof. Thomson found for 90 deg, 0.60, and for 127 deg, 0.62, with heads 0.2 to 0.8 ft.

The inverted notch, with discharge proportional to head, allows very simple regulating and recording devices to be used with it. It is constructed with curved sides such that the width of notch above the straight level crest decreases just enough to keep the discharge proportional to the head. The rate of flow is given by the formula, $Q = C \times 1.57 \sqrt{2g}\, l \sqrt{h}\, h$, where Q is in cu ft per sec, l and h are notch width and head, respectively, in ft. With $C = 0.60$, this becomes $Q = 7.55\, l \sqrt{h}\, h$. The product $l \sqrt{h}$ is constant, and this gives the relation for the curves of the sides. Starting with some desired or convenient head for a value of the discharge, say near the probable maximum to be expected, the value of the notch width at that height above the crest is calculated from the above formula for Q. These values of width and head give the constant value $l\sqrt{h}$. It is not necessary to continue the side curves of the notch closer to the crest than about $\frac{1}{32}$ to $\frac{1}{8}$ in. (depending on the range of heads); they may terminate in short verticals to the crest. The ratio of the discharge shut off by reason of such an abrupt termination of the curves to the full opening discharge (if it could be secured) is $0.64\sqrt{h_1/h}$, where h_1 is the height of the end verticals and h is the head of water. For values of $h/h_1 = 400$, 100, 25, and 10, respectively, the percentage reductions in discharge are 3, 6, 13, and 20. Unless the notch curves are accurately constructed, large errors in estimated discharge are to be expected. For results of tests see *Eng. News*, Nov. 25, 1915.

Velocity-of-approach effects, causing a greater discharge than from a deep quiet pool with the same head, have been variously expressed in the formulas adopted by different engineers. The Bazin and Rehbock formulas avoid the direct use of $v^2/2g$, where v is the mean velocity through the cross section of the channel of approach upstream from the weir, where the head is measured. They provide for the changes in the discharge coefficient by expressions involving both the head and height of weir, but on the assumption that the distribution of velocities in the channel of approach is fairly uniform. The Fteley and Stearns and the Hamilton Smith formulas add $a(v^2/2g)$ to the observed (static) head, each using a constant value for a (1.5 and $1\frac{1}{3}$, respectively, for weirs without end contractions), thus also assuming fixed natural velocity distribution, yet recognizing that the flow-assisting velocities near the surface of the channel of approach are usually greater than those near the bottom.

Recent experimental evidence favors the **Rehbock formula** as probably the best of the rigid type of weir formulas for normal, or fairly uniform, velocity distribution in the upstream channel. This is for sharp-crested weirs without end contraction:

$$Q = \left(0.605 + \frac{1}{320h - 3} + \frac{0.08h}{d_0}\right) \tfrac{2}{3} Lh\sqrt{2gh} \qquad \text{(ft-sec units)}$$
$$= \left(3.234 + \frac{5.347}{320h - 3} + 0.428\frac{h}{d_0}\right) Lh^{3/2}$$

where d_0 is the height of weir or the depth of water at zero head. (See Precise Weir Measurements and discussions, *Trans. ASCE*, **93**, 1929.) Although this is not strictly correct dimensionally, it gives values agreeing within less than 1 percent with experiments on weirs from 0.2 to 4 ft in height with heads from 0.1 to 2 ft subject to the ratio h/d_0 not exceeding 4. For any particular weir and head, the discharge by this formula may be found readily by multiplying the discharge by the ratio of the parenthesis value to the 0.623 corresponding to the Francis formula (p. 244). Thus for a head of 1.605 ft on a weir 3 ft high the parenthesis value is $0.605 + 0.0020 + 0.0428 = 0.650$. This is 4.3 percent greater than 0.623, and the 6.77 cfs per ft for the head 1.605 ft is to be increased by this percentage, making it 7.06 cfs per ft of weir crest.

Flow of water over dams varies from about 20 percent less to 20 percent more than for a sharp crest of the same length and with the same head. **For broad flat-crested dams,** the flat top wider than the head, the coefficient 2.64, instead of Francis's 3.33, applies, or, with sufficient accuracy, the discharge is 80 percent of that given by the Francis formula. If the upstream corner is rounded, the discharge may be greater. **Dams with steeply sloping upstream faces** (about 1 to 1) may have coefficients nearly as high as 4, as will also a thin vertical **bulkhead with a rounded upstream corner** (radius = 2 to 8 in. = thickness of bulkhead). A **very gradually sloping approach,** *e.g.*, 5 horizontal to 1 vertical, or a **rounding crest of large radius** introduces an appreciable friction effect, and the discharge may be no greater than for a sharp-crested weir. Non-vertical upstream faces on sharp-crested dams increase the discharge if inclined downstream and decrease it if inclined upstream, the coefficient being 3.10 for a 1 to 1 upstream and 3.73 for a 2 horizontal to 1 vertical downstream inclination, coefficients for intermediate inclinations being between these values. If **air is not allowed free access under the falling sheet** of water at the crest, the discharge over any narrow-top weir or dam is increased, but is also made less certain due to the tendency of the partial vacuum so formed to break at intervals and cause pulsating flow.

Submerged weirs and dams, where the water surface downstream from the dam is at a higher level than the crest, do not show much reduction in discharge, as compared with the unsubmerged condition, until the downstream head, or backwater, is nearly one-half the upstream head above the crest. This is especially true for broad-crested dams, whether flat or rounded or with easy upstream sloping faces, since in these cases there is a considerable surface drop to the water and a decided increase in velocity even before the water leaves the crest. This condition remains practically unchanged with submergence until the downstream backwater head is over half the upstream head, *i.e.*, high enough to smother the flow.

For experimental results on weirs, see Horton, "Weir Experiments, Coefficients and Formulas." U.S. Geol. Survey, *W. S. & I. Paper* 200.

Flow of Liquids in Pipes

In any pipe or conduit through which a fluid is flowing, there is a continuous loss of head and of pressure. Figure 17 shows a portion of a pipe line through which fluid is being forced uphill from A toward B. With no flow, *i.e.*, only static fluid pressure, the head at B should be h ft less than at A. But, owing to the flow, there is loss of head along the pipe and the head at B is $(h - h_f)$ ft less than at A, where h_f designates the friction head between A and B. At the same time, the heads at both A and B are less than with the no-flow condition because of the loss of head up-stream from A.

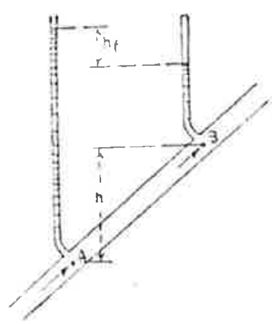

FIG. 17

The loss of head or friction head depends on (1) the kind of fluid flowing, especially its viscosity; (2) the velocity of the fluid; (3) the size (*e.g.*, hydraulic radius) of the pipe or conduit; (4) the roughness of the interior surface; and (5) the length. Pressure has practically no effect on the loss of head because the viscosity of liquids and gases varies only slightly with pressure within the range ordinarily occurring in practice. The pressure drop due to friction, $p_f = h_f w$, depends on the density and, therefore, for gases, on the pressure in the pipe. The friction head is measured in feet or centimeters of the liquid or gas flowing and is given in general by the **Darcy equation**, $h_f = f \frac{L}{4m} \frac{V^2}{2g}$, in which f is known as the **pipe friction factor** and is dimensionless; L is the length of pipe; m is the **hydraulic radius** defined as the ratio of cross-sectional area A divided by the wetted perimeter P, or $m = A/P$; V is the velocity; and g is the acceleration of gravity. This equation is applicable for either metric or English units, as long as the quantities are consistently expressed in length-time units.

Darcy's equation in the above form is valid for any shape of cross section. For circular pipes the value of $m = \pi d^2/4\pi d$, so that $4m = d$. The pipe friction formula thus assumes its more familiar form, $h_f = f \frac{L}{D} \frac{V^2}{2g}$. The equation applies regardless of the internal state of motion, whether laminar or turbulent. The internal flow conditions, however, determine the value of the friction factor f, which can in general be expressed as a function of the ratio of inertial to viscous forces R, known as Reynolds number, and of the so-called relative roughness ϵ/d. The length ϵ is a length characterizing the hydraulically effective roughness of any pipe surface and is derived from experiment. Thus $f = \phi(R, \epsilon/d)$. The practical application of Darcy's formula for the determination of head losses therefore requires knowledge concerning this function.

Laminar Flow. If the forced movement of fluid through a filled pipe occurs as a telescopic sliding of adjacent concentric layers of fluid without transverse mixing, the resistance to this type of motion is due entirely to molecular forces. In long straight

Nelson, Dan

From: Patrick Naylor <patrick.rmea@gmail.com>
Sent: Monday, August 24, 2020 11:05 AM
To: Nelson, Dan
Subject: Re: Permit 13-7996

Dan, your explanation regarding the flow-through component was quite helpful and does help to address the misunderstanding. The differences here will have little or no effect on the day-to-day operations for PacifiCorp, and the changes required to bring the 13-7998 storage water right into compliance are simple because PacifiCorp already has the capacity to self-lease water. Of course, PacifiCorp wants to be in compliance so I do not anticipate any disagreements from them. I will keep your explanation in mind for future fish projects.

Pat

Patrick N. Naylor; PE, PG., CWRE
Vice-President, Senior Hydrogeologist
482 Constitution Way, Suite 303, Idaho Falls, ID 83402
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VOICE: 208-524-2353 ||| Cell: 208-323-4444

On Mon, Aug 24, 2020 at 10:44 AM Nelson, Dan <Dan.Nelson@idwr.idaho.gov> wrote:

Patrick,

I don't need anything right now. I am turning in the file for licensing today. I just wanted to explain everything to you, so you knew what was happening.

I think I understand where the miscommunication is coming from. The flow through component is not considered part of the storage of the system. Even though it is diverted into and then out of the ponds, it doesn't contribute anything to the filling of the ponds or the evaporation and seepage losses, so it is not considered a component of the storage for this system. Storage is considered to be only the filling of the ponds, evaporation and seepage from the ponds, and any of the water stored that is diverted for another use. All of the beneficial uses involving storage have the word storage in them.

One right may have various beneficial uses such as diversion to storage, irrigation storage, irrigation from storage, and irrigation. The irrigation storage and the irrigation from storage would be limited to the amount of water being stored, and the irrigation right would be limited to the field head gate requirement at the location being irrigated. Storage water rights don't have a diversion rate, and are only quantified with an annual volume. Since storage rights don't have a diversion quantification, we use the diversion to storage component to define the amount of water being diverted to the storage reservoir.

The reasoning behind keeping the storage components and the flow through uses separated is that there may be some years, where the storage cannot be filled. By separating the volumes, we can allow the permit holder to continue to use the non-storage component. In the case of this permit, it is not as important, but if this was an irrigation right, the distinct would be the difference between being able to irrigate or not.

I hope this make sense, if not please call me.

Dan Nelson

From: Patrick Naylor [mailto:patrick.rmea@gmail.com]
Sent: Monday, August 24, 2020 9:39 AM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Subject: Re: Permit 13-7996

Dan, I just assumed that because volume was already covered by the storage rights in 13-7998, it was not needed for 13-7996. If the Department requires a storage volume for both, so be it. What else do you need from me at this point?

Pat

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On Mon, Aug 24, 2020 at 8:04 AM Nelson, Dan <Dan.Nelson@idwr.idaho.gov> wrote:

Hello Patrick,

I am going to try to explain how the Department views volume for fish propagation uses. If you want to call after you read this, I will be happy to listen to your arguments, but this is the standard that we have used for several years.

On all permits except for storage permits, a volume is not included until a license has been issued. There are also some uses that are exempt from having a volume. The Idaho Administrative Code Beneficial Use Examination Rules, IDAPA 37.03.02.035.j states the following:

> For each use of water the examiner shall report an annual diversion volume based on actual beneficial use during the development period for the permit. The method of determining the annual diversion volume shall be shown. The annual diversion volume shall account for seasonal variations in factors affecting water use, including seasonal variations in water availability. For irrigation, the volume shall be based on the field headgate requirements in the map titled Irrigation Field Headgate Requirement appended to these rules (see Appendix A located at the end of this chapter). Annual diversion volumes for heating and cooling uses may be adjusted to account for documented weather conditions during any single heating or cooling season from among the fifty (50) years immediately prior to submitting proof of beneficial use for the permit. For storage uses that include filling the reservoir and periodically replenishing evaporation and seepage losses throughout the year, the annual diversion volume shall be the sum of the amounts used for filling and for replenishment. Volumes may include reasonable conveyance losses actually incurred by the water user. The following water uses are exempt from the volume reporting requirement: (3-20-20)T

i. Diversion to storage. (Volume should be reported for the storage use, such as irrigation storage.) (3-20-20)T

ii. Domestic uses as defined in Section 42-111, Idaho Code. (3-20-20)T

iii. In-stream watering of livestock. (3-20-20)T

iv. Fire protection. (Volume is required for fire protection storage.) (3-20-20)T

v. On-stream, run-of-the-river, non-consumptive power generation uses. (3-20-20)T

vi. Minimum stream flows established pursuant to Chapter 15, Title 42, Idaho Code. (3-20-20)T

vii. Municipal use by an incorporated city or other entity serving users throughout an incorporated city, except the following situations that do require a volume to be reported: (3-20-20)T

1. The permit or amended permit was approved with a volume limitation; or (3-20-20)T
2. The permit was not approved for municipal use but can be amended and licensed for a municipal use established during the authorized development period for the permit. (3-20-20)T

viii. Irrigation using natural stream flow diverted from a stream or spring. (Volumes must be reported for irrigation uses from ponds, lakes and ground water and for irrigation storage and irrigation from storage.) (3-20-20)T

As you can see above that Fish Propagation is not included in the uses exempt from having a volume. Therefore, a volume is required on all fish propagation water rights. Water right 13-7996 is required to have a volume assigned to it according to the IDAPA Rules.

This leaves the question on how to assign a volume. The permit states that when water rights 13-7996 and 13-7998 are combined, they are limited to a maximum diversion rate of 1.00 cfs. We are limited to the maximum capacity of the system or 724 af when determining volume (1.00 cfs X 1.9835 af/day/cfs X 365 days = 723.9775 af).

Once we have the system capacity of 724 af, then we need to subtract the volume for other uses. You stated in the field report that the ponds had a volume of 4.5 af and the evaporation was 1.4 af. The total volume **NOT** associated with the flow through portion authorized by permit 13-7996 is 5.9 af (4.5 af pond storage + 1.4 af evaporation = 5.9 af). The total amount of volume that can be authorized for flow through volume is 718 af (724 af capacity – 5.9 af non-flow through volume = 718 af).

I hope the above explanation explains how we quantify the volume for fish propagation uses. We assume that the ponds will fill each year at the beginning of the year, so the permit holder still gets to divert 724 af each year. There has been an argument that once the ponds are full, that they aren't refilled again, but that was not how water right 13-7998 was approved. It was approved with a one-time fill each year, so we must carry this forward to this permit. If your client had filed a Water Supply Bank Rental to fill the ponds one time, and then filed a water right transfer to cover the evaporation losses, then we wouldn't have excluded the pond volume from these calculations. The maximum amount they can divert is 724 af each year. If they need additional water, they will need a new filing that increases the diversion rate limit to the pond.

Please call me if you have any questions.

Daniel Nelson

Water Right Analyst 3

Idaho Department of Water Resources

Telephone (208) 287-4856

Fax (208) 287-6700 (attn: Dan Nelson)

From: Patrick Naylor [mailto:patrick.rmea@gmail.com]
Sent: Friday, August 21, 2020 6:40 PM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Subject: Re: Permit 13-7996

Hi Dan

The reason I didn't include annual volume in Sections G or H is because volume is not a condition of the permit for 13-7996. The storage water right under 13-7998 does have a volume requirement, which is an overlapping but otherwise separate issue and I believe this shouldn't be a condition on the licensing for 13-7996.

I am not sure I understand what you are getting at in the last sentence of the first paragraph of your email, maybe we can discuss on Monday morning?

Thanks

Pat

On Fri, Aug 21, 2020, 4:01 PM Nelson, Dan <Dan.Nelson@idwr.idaho.gov> wrote:

Hello Patrick,

I just finished the review of your field report. You didn't include a volume in Section H. However, you did calculate the volume in the field report, so we can move forward. You calculated the volume at 724 af based on 1.00 cfs being diverted for an entire year. However, we need to remove the volume for the ponds and the evaporation losses, so the volume that will placed on the license is 718 af. The permit and 13-7998 both have a condition that limits the diversion rate when the two rights are combined to the 1.00 cfs, so we have to remove the volume for the other rights.

I also spoke with James Cefalo about the volumes in the ponds. He is going to contact Pacificorp to file a second water right transfer on 13-963 to bring the ponds up to the 5.9 af you found in your field examination (4.5 af for pond volume + 1.4 af pond evaporation = 5.9 af). That will be a separate process. We are going to move forward with the licensing of this permit.

I wanted to let you know ahead of time, so you weren't surprised when the license comes out. Let me know if you have any questions.

Respectfully,

Daniel Nelson

Water Right Analyst 3

Idaho Department of Water Resources

Telephone (208) 287-4856

Fax (208) 287-6700 (attn: Dan Nelson)

Nelson, Dan

From: Nelson, Dan
Sent: Wednesday, August 12, 2020 9:04 AM
To: 'patrick.rmea@gmail.com'
Subject: RE: Revised Beneficial Use Field Report and Statement of Completion for Water RIght 13-7996

Hello Patrick,

I just returned to the office from being out for a week. I haven't had time to review the field exam, but I wanted you to know that I have received your email. I will get to it as soon as I possibly can.

Daniel Nelson
Water Right Analyst 3
Idaho Department of Water Resources
Telephone (208) 287-4856
Fax (208) 287-6700 (attn: Dan Nelson)

From: patrick.rmea@gmail.com [mailto:patrick.rmea@gmail.com]
Sent: Friday, August 07, 2020 4:29 PM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Cc: Cefalo, James <James.Cefalo@idwr.idaho.gov>; 'Morris, Buffi (PacifiCorp)' <Buffi.Morris@pacificorp.com>; 'Stenberg, Mark (PacifiCorp)' <Mark.Stenberg@pacificorp.com>; 'Roger Warner' <rog.rmea@gmail.com>; 'Neal Artz' <nartz@cirruses.com>
Subject: Revised Beneficial Use Field Report and Statement of Completion for Water RIght 13-7996

Hi Dan

Attached are a Statement of Completion and a Revised Beneficial Use Field Report for Water Right 13-7996, pertaining to two ponds used for holding Bonneville Cutthroat Trout at the PacifiCorp Grace Cove Ponds, Grace, Idaho. The revised BUFR addresses the deficiencies identified in your April 15, 2020 Letter of Denial. This requires clarification on two points:

1. Some of the deficiencies you identified actually pertain to the separate water right for fish propagation storage under 13-7998. Nonetheless, this revised BUFR addresses most of these issues, along with applicable deficiencies. It should be understood that 13-7998 (fish propagation storage) is separate from 13-7996 (fish propagation), and all of the conditions pertaining to 13-7996 have been complied with.
2. IDWR's August 7, 1979 Administrative Memorandum is not applicable to the purposes of PacifiCorp's activities; these ponds are used for holding fish only, as explained in Supplemental Attachment A of the BUFR.

In the process of review, PacifiCorp discovered that the two holding ponds had been constructed to dimensions larger than the approved design. As soon as this was discovered, PacifiCorp contacted James Cefalo at IDWR, who confirmed that PacifiCorp could address this issue by using water currently held by PacifiCorp in its Palisades water bank reserves and leasing the water from itself for these ponds. Again, this pertains to 13-7998, not 13-7996. PacifiCorp is addressing this issue separately; a letter of explanation is attached.

A hard copy of this BUFR has been mailed to you separately. Please let me know if you have any questions.

Regards
Pat

Patrick N. Naylor; PE, PG, CWRE
Vice-President, Senior Hydrogeologist
Rocky Mountain Environmental Associates, Inc.
482 Constitution Way, Suite 303, Idaho Falls, ID 83402
P.O. Box 4773, Boise, ID 83711
E-Mail: patrick.rmea@gmail.com
VOICE: 208-524-2353 ||| Cell: 208-323-4444

Nelson, Dan

From: Nelson, Dan
Sent: Friday, August 21, 2020 10:16 AM
To: 'Patrick Naylor'
Subject: RE: Weir Measurement

Patrick,

Absolutely not! There is no reason to do that after you sent your email. I was able to understand and recreate your formula, and I was able to match your flow rate with our standard formulas that we use for flow over dams or non-sharp crested weirs. My inquiry to you was to understand what you did and how you did it to help our staff in the future for evaluation these non-standard measurement devices.

We struggle with measurement devices that are not considered standard by the Bureau of Reclamation. We use the Bureau of Reclamation Measurement Manual as the standard for evaluating measurement devices. It is generally recommended that when a non-standard device is used, that a rating table be created for that device. The reason for this is that each device is unique, so you have to address the sill (height and length), the crest width, water velocity, estimate flow range, and a number of other factors. Most rating tables for non-standard devices are created by monitoring the flows over the structure and creating a rating table or curve similar to a rated section of a stream. Creating a rating table is especially pertinent to flow over dams and weirs without a sharp crested blade and long throated flumes (also known as broad crested weirs).

Several of our staff, including myself, have taken measurement courses at the training center for the Bureau of Reclamation in Denver, Colorado, and we have worked with several of their staff to come up with a solution to measure water over boards or poured cement weirs without a blade. When measurement is required by the water right or water district, we generally recommend that a Long Throated Flume be installed or for the right holder to create a rating table.

I was really excited to see your formula, because if it tests out to be a better than using what we have, we may switch to the formula you provided. Our hope for having folks outside the Department perform field examinations is to find new ways of doing things. You may have done that with the formula you provided. I have already handed the formula you used off to a couple of our engineers to see if it can be used in other situations.

Please don't worry about changing anything to do with the field exam at this point. I am still reviewing the exam, and I will contact you if there is anything that needs addressed. Thank you very much for giving us a new way to look at these non-standard devices. It is really appreciated.

Dan Nelson

From: Patrick Naylor [mailto:patrick.rmea@gmail.com]
Sent: Friday, August 21, 2020 9:23 AM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Subject: Re: Weir Measurement

Dan, sorry for the confusion. The reference to the USBR Water Measurement Manual is correct in that the Francis Formula is shown as the standard method for calculating flow across a rectangular contracted weir where the crest length is less than 1/3 of head. See Chapter 9, Section 7 of the Manual. However, my citation does refer to "broad-crested, contracted weir", which no doubt caused the confusion. The section in the Manual on broad-crested weirs (Chapter 2, Section 13) contains a different equation which is more complicated and requires two separate coefficients, subject to the user's judgement.

Do you want me to remove the reference to broad-crested weir and resubmit?

Pat

Patrick N. Naylor; PE, PG.
Vice-President, Senior Hydrogeologist
482 Constitution Way, Suite 303, Idaho Falls, ID 83402
E-Mail: patrick.rmea@gmail.com
VOICE: 208-524-2353 ||| Cell: 208-323-4444

On Thu, Aug 20, 2020 at 3:46 PM Nelson, Dan <Dan.Nelson@idwr.idaho.gov> wrote:

Hi Patrick,

Now that I can see how you determined your coefficient, your calculations make sense. I was looking for the calculations in the Bureau of Reclamation Measurement Manual as your cited in your field report. I am actually very glad that you provided this information from the Fluid Mechanics citation.

I am very gland that you supplied this information, and I may start using this information to double check my work in the future. I would continue to calculate the flow rates with the formulas that you are comfortable with. As long as I or someone in our office can follow your calculations, I strongly encourage folks to use the formulas and calculations that work best for them. We are always open to learning new ways to address a particular issue, as long as we can recreate the information and understand the formulas.

Nice work, and thank you for this information.

Dan Nelson

From: Patrick Naylor [mailto:patrick.rmea@gmail.com]
Sent: Thursday, August 20, 2020 3:11 PM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Subject: Re: Weir Measurement

Hi Dan

I believe the most common standard equation for a broad-crested weir is $Q= C(L)h_1^{1.5}$, although the derivation of the coefficient (C) is complicated. For weirs for which the ratio of depth of flow over the weir (h) to the crest width (L) is less than about 1/3, approach velocity can generally be disregarded and critical flow is occurring across the crest; C is then approximated as 3.09. See Streeter, V.L., 1971, Fluid Mechanics, McGraw-Hill, New York, 5th ed.

On this basis,

$Q = 3.09(1.0)(0.3)^{1.5} = 0.51$ cfs.

As you noted, your calculated value matched my calculations, which are based on the Francis equation. Although specifically applicable to sharp-crested weirs, the Francis equation can be used to calculate flow across broad-crested weirs when $h/L < 0.33$, discharge is free-flowing, approach velocity can be disregarded, and a nappe with clear air gap is achieved: see http://www.wikiengineer.com/Water-Resources/Weirs#weir1. This is a useful approximation because approach velocity can be difficult to measure accurately, but if h is measured >4xh upstream and the weir is contracted, approach velocity is typically small.

If, however, you prefer that I revise the BUFR to use the equation shown here, I am fine with that, just let me know.

Pat

Patrick N. Naylor; PE, PG.

Vice-President, Senior Hydrogeologist

482 Constitution Way, Suite 303, Idaho Falls, ID 83402

E-Mail: patrick.rmea@gmail.com

VOICE: 208-524-2353 ||| Cell: 208-323-4444

On Tue, Aug 18, 2020 at 2:39 PM Nelson, Dan <Dan.Nelson@idwr.idaho.gov> wrote:

Hello Patrick,

I wanted to send you what I use for broad crested weir, and show you what I use compared to what you did. They came out exactly the same, so there are no problems. I am just curious where you found your formula.

I use the standard weir formula with a different coefficient. One of our staff found this coefficient in the Mechanical Engineers' Handbook from 1951. I have attached a copy of the citing to this email. Instead of the coefficient for a sharp crested weir of Francis's 3.33, we use 2.64 (20% less). The formula that I use is as follows:

$$Q = 2.64(L-0.2h_1)h_1^{1.5} \rightarrow 2.64 \text{ X } [1-(0.2 \text{ X } 0.3)] \text{ X } .3^{1.5} = 0.514344$$

As you can see from my calculation above, our numbers match exactly. I just haven't seen the formula that you used, and I couldn't find it in either of my Bureau of Reclamation Water Measurement Manuals. I have the Second Edition (Revised in 1984) and the Third Addition (Revised in 2001).

From what I can see so far, your field exam looks great. This will not hold the field exam back, since our numbers match. I just wanted to know where you came up with your calculations.

Dan Nelson

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY
1407 West North Temple, Suite 110, Salt Lake City, Utah 84116

August 7, 2020

To: Idaho Department of Water Resources

Re: Evaporative Loss for Water Right 13-7998

PacifiCorp is submitting an Application to Rent Water from the Water Supply Bank in an effort to mitigate for the evaporative loss at the ponds approved under water right 13-7998 *(NOTE: This explanatory is being submitted as part of the Statement of Completion for water right 13-7996)*. The lease application requests to lease two (2) acre feet of PacifiCorp water right 13-963, currently under contract with the Water Supply Bank through December 31, 2021, see *Water Supply Bank Lease Contract No. 636* ("WSB Contract"), dated October 17, 2017. Prior to the expiration of the WSB Contract, PacifiCorp will submit a request to permanently change the place of use for the water.

Sincerely,

Buffi Morris
Water Rights Administrator

Form 219 07/11

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

Clear Form

BENEFICIAL USE FIELD REPORT

A Beneficial Use Field Report is prepared by a water right examiner as the result of an examination to clearly confirm and establish the extent of the beneficial use of water established in connection with a permit during the development period authorized by the permit and any extensions of time previously approved.

A. GENERAL INFORMATION

Permit No. 13-7996

1. Owner PACIFICORP, AN OREGON CORP Phone No. Buffi Morris 801 220 7803

   Current address 1407 W NORTH TEMPLE STE 110, SALT LAKE CITY, UT 84116

2. Examiner's name Patrick Naylor EXAM DATES 08/30/2018; 03/04/2020
3. Accompanied by Mark Stenberg Email mark.stenberg@pacificorp.com

   Address 822 Grace Power Plant Road, Grace, ID 83241

   Relationship to permit holder Senior Operations Project Manager Phone No. 208 547 7305

4. Source Unnamed Stream tributary to Bear River

B. OVERLAP REVIEW

1. Other water rights with the same place of use 13-7998. See Attachment A.
2. Other water rights with the same source and point of diversion 13-7998. See Attachment A.

C. DIVERSION AND DELIVERY SYSTEM

1. **Point(s) of Diversion:**

Ident. No.	Gov't Lot	¼	¼	¼	Sec	Twp	Rge	County	Method of Determination/Remarks
		NE	SW	SW	28	10S	40E	CARIBOU	USGS Topo Map/Onsite inspection
									Lat. 42.5213, Lon. -111.7943

2. **Place(s) of Use:** Method of determination Onsite Inspection - Upper Pond (42.5156, -111.79345); Lower Pond (42.5151, -111.7939)

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
10S	40E	33					X	X		X									

3. **Delivery System Diagram**: Indicate all major components and distances between components. Indicate weir size/ditch size/pipe diameter (inside), as applicable. Use the space provided or ☒ see attached.

See Attached Figure

Scale: 1" = __________

☒ Copy of USGS Quadrangle attached showing location(s) of point(s) of diversion and place(s) of use (**required**)
☒ Aerial photo attached (required for irrigation of 10+ acres)
☒ 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

**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
Broad-Crested Rectangular Weir					12-inch	
with End Contractions (Concrete)						

2. Measurements: **Upper Pond Weir:** Height above crest (H) measured 2.0 ft upstream of weir. Weir crest length (L) = 12.0 inches (1.0 ft). 1) H = 3 5/8 inches (0.3 ft); 2) H = 3 5/8 inches (0.3 ft); 3) H = 3 5/8 inches (0.3 ft).

Lower Pond Weir: Height above crest (H) measured 2.0 ft upstream of weir. Weir crest length (L) = 12.0 inches (1.0 ft). 1) H = 3 5/8 inches (0.3 ft); 2) H = 3 5/8 inches (0.3 ft); 3) H = 3 5/8 inches (0.3 ft).

E. NARRATIVE/REMARKS/COMMENTS

System Description: Diversion is by spring box (Photo No. 1) with over-flow to Bear River (Photos No. 3 & 4). From the Spring Box into a pipeline (Photos No. 1 & 2) to the Upper & Lower Cove Ponds (Photo No. 5). The pipeline discharges into both ponds through lockable gate valves into stilling sluice boxes to Rectangular Broad Crested Weirs and into each pond through step-down sluice boxes (Photos No. 8 & 12). The Lower Cove Pond Photos are No. 6, 7, 8 & 9, and Upper Cove Pond Photos are No. 10, 11, 12, and 13. The water flows from both ponds, combines and discharges (Photos No. 14 & 15) into a ditch that flows into the Bear River. PacifiCorp reports that the Upper Pond has a capacity of 2.35 ac-ft when filled, and the Lower Pond has a capacity of 2.13 ac-ft when filled. Each pond has a maximum surface area of approximately 0.425 acres. The Upper Pond has an average depth of 5.5 ft (2.35 ac-ft/0.425 ac = 5.5 ft), with a maximum depth of 7 ft. The Lower Pond has an average depth of 5.0 ft (2.13 ac-ft/0.425 ac = 5.0 ft) and a maximum depth of 9 ft. The total calculated volume of flow through the ponds is: 1.0 cfs x 1 ac-ft/43,560 ft^3 x 86,400 sec/day x 365 days/yr = **723.97 AFA**.

Overlap Water Right: Water right 13-7998 was an existing storage water right that was transferred to this location and is used in conjunction with 13-7996. 13-7998 represents the storage component of the holding ponds. The combined flow shall not exceed 1.0 cfs. The flow was verified during the field exam. 13-7996 provides for the fish propagation component of the beneficial use, whereas 13-7998 provides for the storage component. Storage water right 13-7998 is not addressed here.

Storage Pond Loss: These are not earthen ponds, they are lined so they do not have infiltration losses. PacifiCorp's non-consumptive storage water right 13-963, from the decommissioned Cove Hydroelectric Project was placed in the water supply bank after decommissioning in 2006. PacifiCorp applied to transfer 2.8 acre-feet of this right to the Cove Ponds including 1.8 acre-feet of annual depletion/evaporation that is included in this right. After the transfer the remaining storage right was leased back to the water supply bank. No Bear River water is diverted to the ponds, this was a storage right and evaporation loss transfer to a new location. Note that 13-963 does not indicate a specific POU.

See also Attachment A, Supplemental Information.

Is the permit holder met all conditions of permit approval, including any mitigation requirements and/or measuring device installation requirements? ☒ Yes ☐ No If no, what must be done to meet the permit requirements?

F. FLOW CALCULATIONS. Additional computation sheets attached. **See Attachment A.**

Measured Method: For a standard broad-crested, contracted weir, the Francis method as presented in the U.S. Bureau of Reclamation Water Measurement Manual (*U.S. Dept. of Interior, Bureau of Reclamation, 1953 (revised 1997), Water Measurement Manual. U.S. Govt. Printing Office, Washington, D.C.*):

$Q = 0.33 \times (H)^{3/2} \times (L - 0.2H)$

where

- Q = discharge in cfs;
- H = head above weir crest in feet, measured at least 4 x H upstream of the weir;
- L = length of weir (width of crest) in feet.

For all three measurements at both the lower pond weir and upper pond weir, H = 3 5/8 inches = 0.30 ft, and L = 1.0 ft.

$Q = 0.33 \times (0.30\ \text{ft})^{3/2} \times (1.0\ \text{ft} - (0.2 \times 0.30\ \text{ft})) = 0.51$ cfs (each weir)

Each pond weir was measured at 0.51 cfs. Total measured flow = 0.51 ft + 0.51 ft = 1.02 cfs. Given the natural fluctuation of flow measurement over a broad-crested weir controlled by a gate valve, the accuracy of total flow measurement is:
Q = 1.0 cfs (total).

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation: NA

2. Volume Calculations for Other Uses:

Annual volume of water used in the ponds:

V = 1.0 cfs x 1 ac-ft/43,560 ft^3 x 86,400 sec/day x 365 days/yr = **723.97 ac-ft/yr total volume**

Storage Evaporation Losses: **1.4 AFA**, from IDWR Pond Loss Calculation Sheet, **see Attachment B**. Evaporation losses are governed under Storage Water Right 13-7998 and a pending additional storage transfer. Note evaporation losses are less than the amount associated with water bank water right 13-963, see narrative in Section E.

See also Attachment A, Supplemental Information.

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use From	Period of Use To	Rate of Diversion Q (cfs)	Annual Volume V (afa)
FISH PROPAGATION	01/01	12/31	1.00 cfs	
		Totals:	1.00 cfs	

2. Recommended Amendments

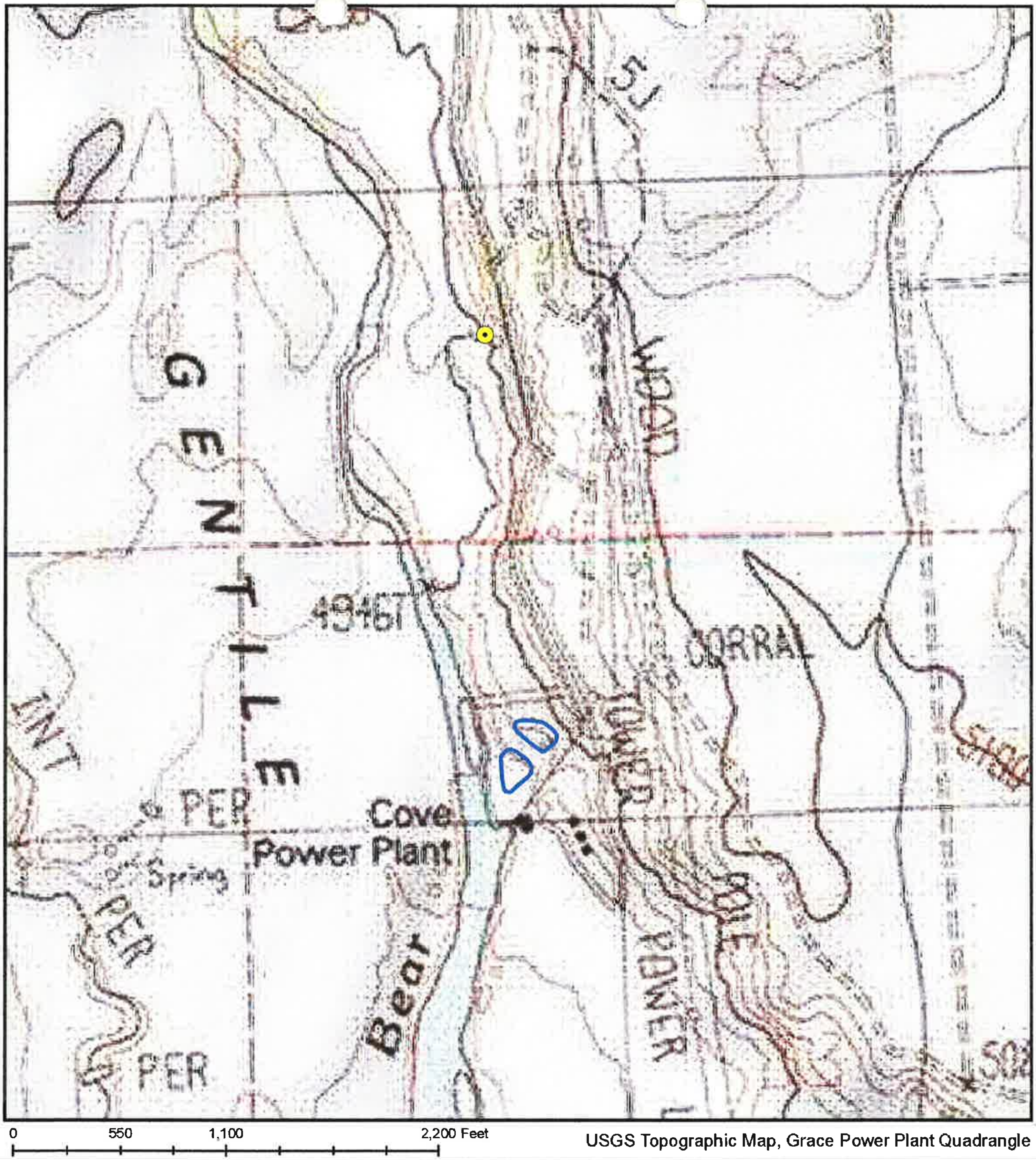
- ☐ Change P.D. as reflected on page 1
- ☐ Change P.U. as reflected on page 1
- ☐ Add P.D. as reflected on page 1
- ☒ Add P.U. as reflected on page 1
- ☐ None
- ☐ Other

I. AUTHENTICATION

Field Examiner's Signature *Patrick N Naylor* Date 7/22/2020

REGISTERED PROFESSIONAL ENGINEER 7406 STATE OF IDAHO PATRICK N. NAYLOR

Reviewer ____________________ Date ____________



USGS Topographic Map, Grace Power Plant Quadrangle

Field Exam Map No.13-7996

Pacificorp

Legend

- POD
- Ponds

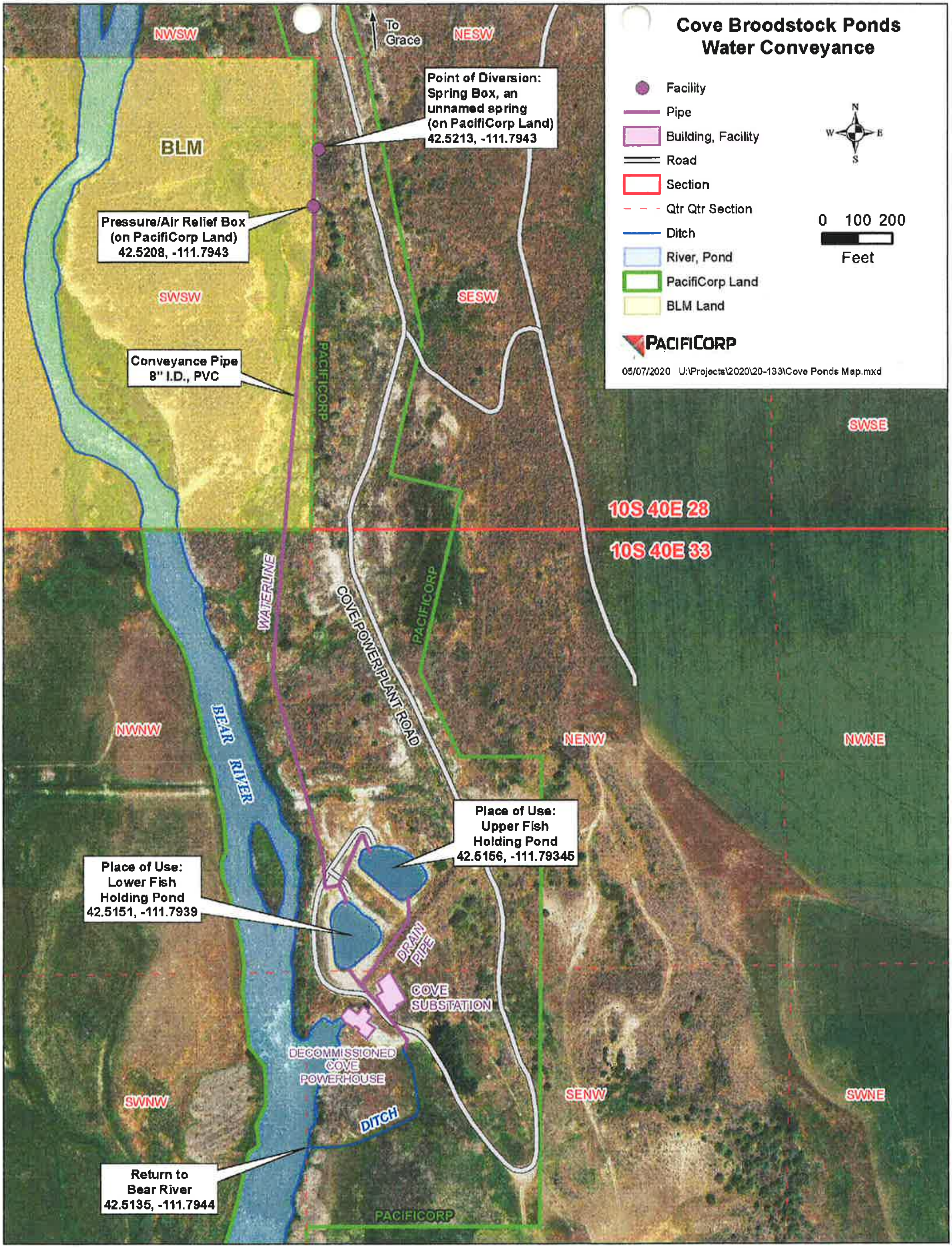
N W E S

RMEA #18-0134

by: KM

Date: 9/25/2018

Rocky Mountain ENVIRONMENTAL ASSOCIATES, INC.



Cove Broodstock Ponds
Water Conveyance
Facility
Pipe
Building, Facility
Road
Section
Qtr Qtr Section
Ditch
River, Pond
PacifiCorp Land
BLM Land
N
W
E
S
0 100 200
Feet
PACIFICORP
05/07/2020 U:\Projects\2020\20-133\Cove Ponds Map.mxd
NWSW
To Grace
NESW
Point of Diversion: Spring Box, an unnamed spring (on PacifiCorp Land) 42.5213, -111.7943
BLM
Pressure/Air Relief Box (on PacifiCorp Land) 42.5208, -111.7943
SWSW
SESW
Conveyance Pipe 8" I.D., PVC
PACIFICORP
SWSE
10S 40E 28
10S 40E 33
WATERLINE
COVE POWERPLANT ROAD
PACIFICORP
BEAR RIVER
NWNW
NENW
NWNE
Place of Use: Upper Fish Holding Pond 42.5156, -111.79345
Place of Use: Lower Fish Holding Pond 42.5151, -111.7939
DRAIN PIPE
COVE SUBSTATION
DECOMMISSIONED COVE POWERHOUSE
SWNW
SENW
SWNE
DITCH
Return to Bear River 42.5135, -111.7944
PACIFICORP

ATTACHMENT A

SUPPLEMENTAL INFORMATION

BROODSTOCK POND PROGRAM

PacifiCorp's Cove Broodstock Ponds are used exclusively for holding of captured wild Bonneville Cutthroat Trout (BCT) until they are ready to spawn. PacifiCorp, in cooperation with the Idaho Department of Fish and Game (IDFG), manages the ponds for holding BCT broodstock under a Conservation Hatchery Agreement. Every fall, IDFG collects wild BCT from local tributaries of the Bear River. Once collected, the BCT are tagged, fin clipped for genetic testing and temporarily held in tanks until genetic tests are complete. After testing, they are placed in one of the Cove Broodstock Ponds. In the ponds the BCT grow and mature until they are ready to spawn. Depending on their age class when collected, they could be held in the ponds for one or more years before they move up the fish collection ladders in the ponds, to be spawned by IDFG personnel. After spawning the males are returned to the Bear River and the females are sacrificed for bacterial kidney disease testing. The fertilized eggs are moved to the IDFG Grace fish hatchery where they are incubated and the fry raised until ready to be released into tributaries to the Bear River.. The holding ponds were designed to discourage opportunistic spawning while fish are within the ponds as they have a synthetic liner and eight inch to four inch cobble rock on top of the liner. The ponds were designed to replicate natural food source production. The cobble provides suitable substrate for macro-invertebrate production. No supplemental feeding is performed in the ponds. The average water temperature is 48° F.

CONVEYANCE SYSTEM DESCRIPTION

Originating at a spring on PacifiCorp land, the water associated with this water right enters a wood-topped concrete spring box that is connected to an 8-inch diameter PVC conveyance pipe. This pipe goes a short distance to a concrete control box with a wood lid. The control box allows entrained air to exit the pipe. The 8-inch diameter PVC pipe then conveys flow southward across BLM land until it re-enters PacifiCorp land. PacifiCorp has a Right of Way from BLM for this conveyance pipe. The PVC pipe extends into the fenced pond enclosure at which point two ductile iron valve assemblies control the flow of water from the PVC pipe into each of the two ponds. To maintain bio-security between the ponds, no water is shared between them. Water flow is measured at concrete weirs at the fish collection location in each pond. Each pond has a screened concrete outflow box. The water that flows through these is combined in a pipe that transitions to a ditch that goes a short distance to the Bear River.

FISH HOLDING QUANTIFICATION

The IDFG 2018 Bonneville Cutthroat Trout Conservation Program Hatchery Progress Report indicates the ponds held a **range of 173 to 341 fish** from 2008 to 2018, with an **average of 230 fish** over that time period. This same report indicated that the average weight for females was 288 g (0.64 lb); no weight was reported for males. Assuming that the average female weight is typical of all fish, this would be an **average of 147.2 lbs of fish** in the combined ponds at a given time. With a total of 4.5 ac-ft (196,020 ft^3) capacity in the ponds, this is an occupied amount of 0.0008 lb/ft^3. At a flowrate of 1.0 cfs, the full pond volume is replaced with fresh water every 54.5 hours, for an approximate exchange rate of 0.02 exchanges/hour. In the absence of identified published exchange rate requirements for BCT, it is apparent that this exchange rate is adequate, given that the fish have thrived in the ponds.

PUBLIC ACCESS

The ponds have a six foot security fence around them and the only access is for agency personnel and PacifiCorp. No public access is allowed to the ponds and no recreational fishing occurs at them.

Attachment B

Evaluation Loss Calculations

This spreadsheet has been designed by Idaho Department of Water Resources to estimate the annual evaporation losses from a pond.

FILE NUMBER	13-7996
REVIEWER	0
DATE	5/8/2020

User Input
Calculated value
Formula Explanations

USING THIS SPREADSHEET

Use the link below to access the Kimberly Research Center website. This website provides the Precipitation Deficit for a station most representative of the pond under examination. The Precipitation Deficit is the total amount of free water surface evaporation minus the precipitation for a given area, which gives the total amount of evaporative losses incurred by the pond. There are several weather sites that are used throughout the state. IDWR staff can find the nearest site using Arc Map. The shape file containing the sites can be found at X:/Spatial/Climate/ETIdahostations.shp.

The acronyms used on the Kimberly Research Center website are defined below:

- P = Precipitation
- ET= Evapotranspiration
- P_d = Precipitation deficit
- P_d =ET-P

Instructions:

1. Use the link below to navigate to ET Idaho 2012.
2. Select the station which is most representative to your pond location.
3. Click Submit Query.
4. Under "Land Covers with Evapotranspiration Estimates," select "Open Water - Shallow Systems (ponds, streams)" or "Open Water - small stock ponds" depending on the pond size.
5. Click the link to "Precipitation Deficit."
6. Reference and copy (ctrl + C) the first subheading "Mean" values.
7. Click the "Paste Values from ET Idaho" button. The table will automatically enter a zero (0) for any negative precipitation deficit values.

Found at: http://data.kimberly.uidaho.edu/ETIdaho/

Precipitation Deficit

Station: Twin Falls 2 NNE (NWS -- 109294)

Month	mm/day[1]	*Days per month*	mm/Month
Jan	-0.45	31	0.00
Feb	-0.10	28	0.00
March	0.32	31	9.92
April	1.33	30	39.90
May	1.23	31	38.13
June	2.95	30	88.50
July	3.75	31	116.25
August	2.95	31	91.45
September	1.74	30	52.20
October	0.58	31	17.98
November	-0.07	30	0.00
December	-0.47	31	0.00

Total mm/year = 454.33

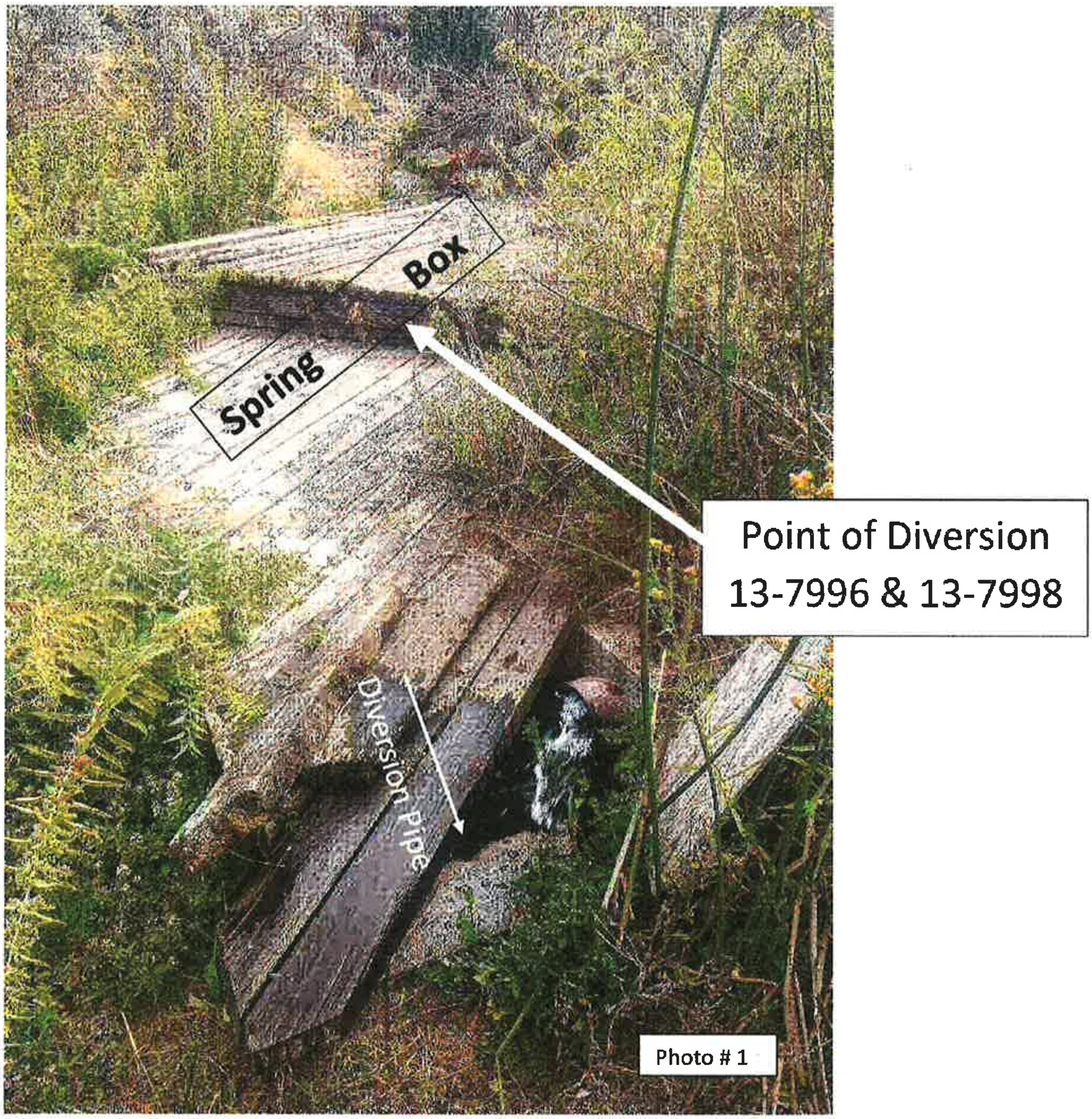
PLEASE NOTE: The seasonal average for precipitation deficit should not be used for calculations because precipitation often exceeds evaporation during wetter months of the year. If the pond is kept full, excess precipitation during wetter months does not serve to refill the pond during drier months.

For example, see Sandpoint KSPT (NWS -- 108137), the annual precipitation deficit is -106 mm. However, April through September have positive precipitation deficit values. To properly estimate the annual volume of water necessary to refill a pond due to evaporation losses, the table will automatically enter a zero (0) for each month that the precipitation value is reported as a negative value.

As described above, precipitation offsets evaporation in winter months, so the net effect is that wintertime precipitation deficit is usually zero.

[(mm/yr) ÷ (convert to feet)] X (Surface area of pond, in acres) = Evaporation Loss in Acre Feet

(454.33 ÷ 304.8) X 0.95 = 1.4 **AFA**



Project also known as Cove Pond

13-7996

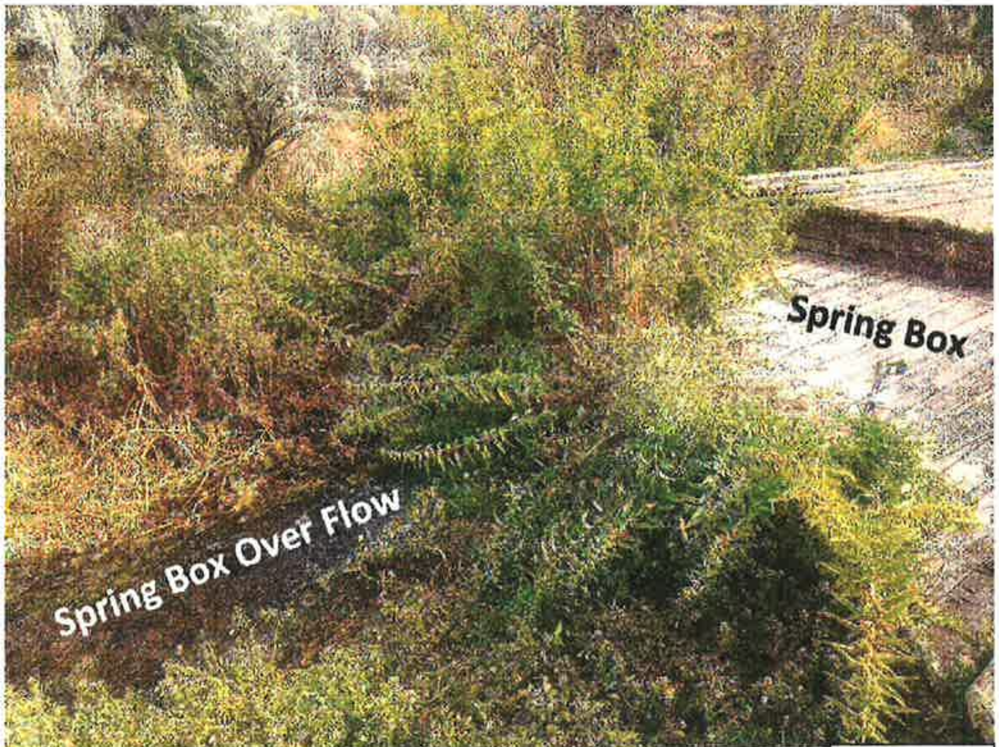


Photo # 2

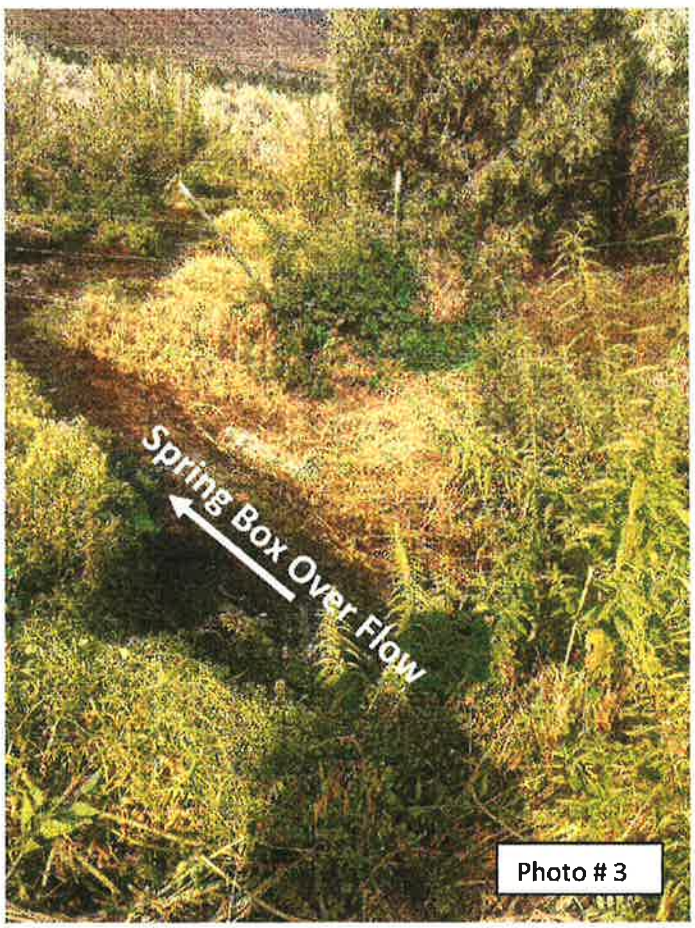
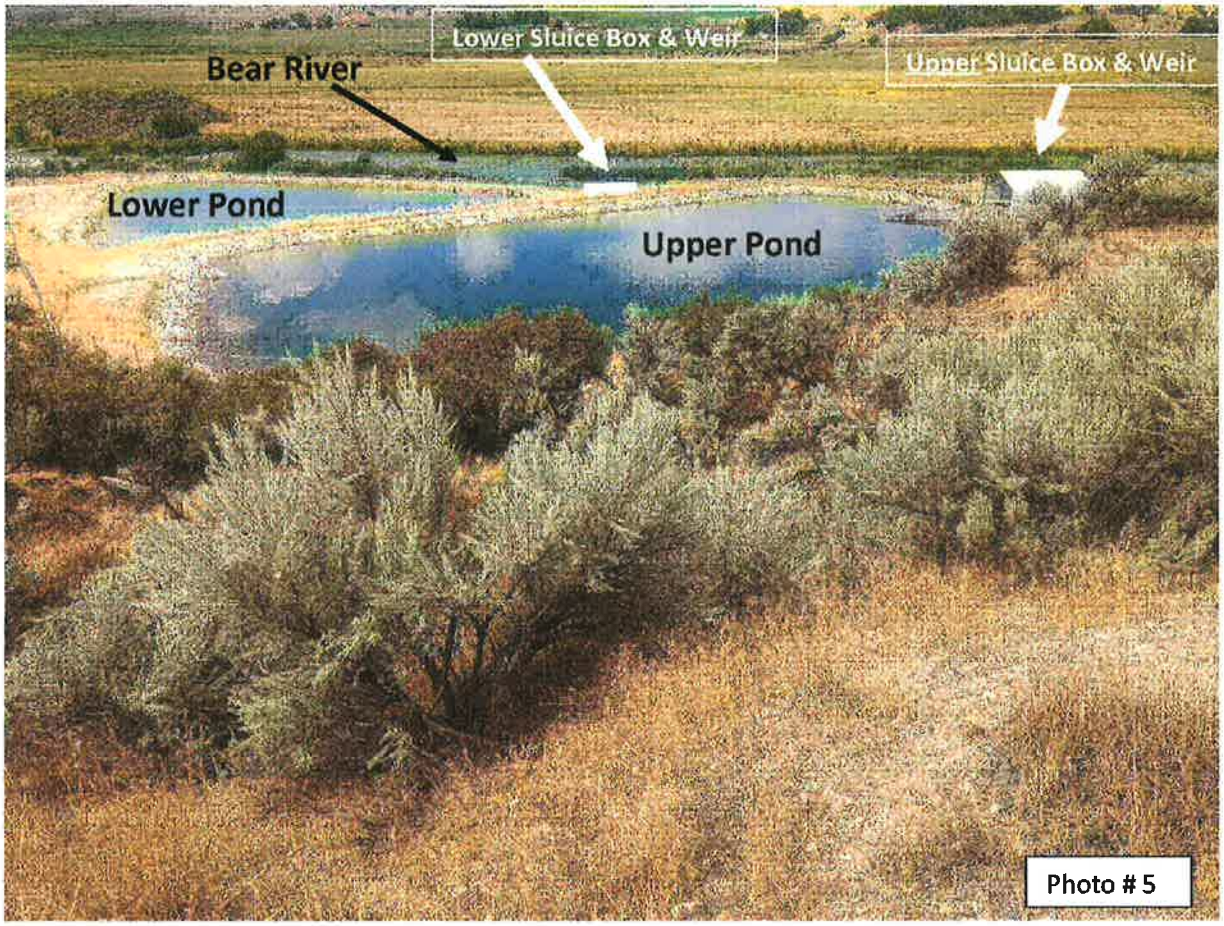


Photo # 3

13-7996

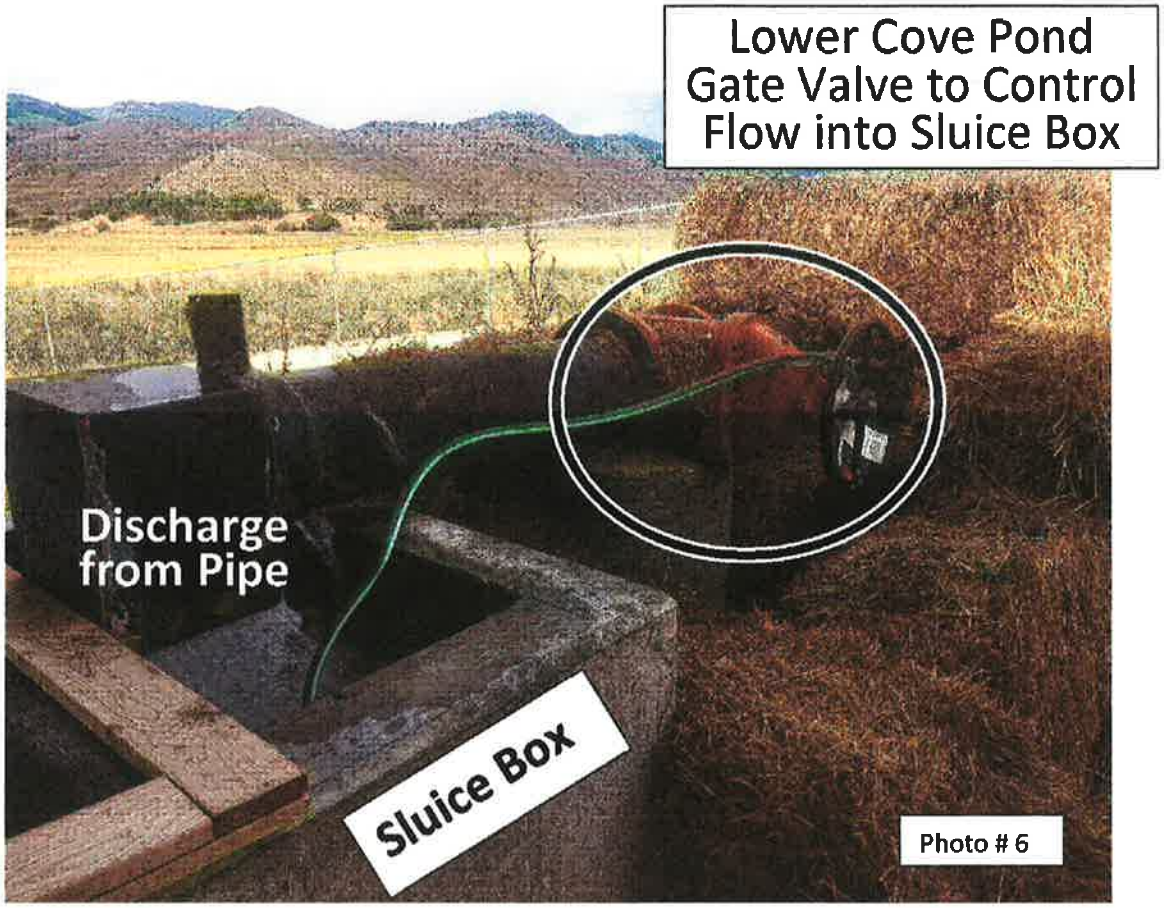
Diversion Pipe
to Ponds

13-7996

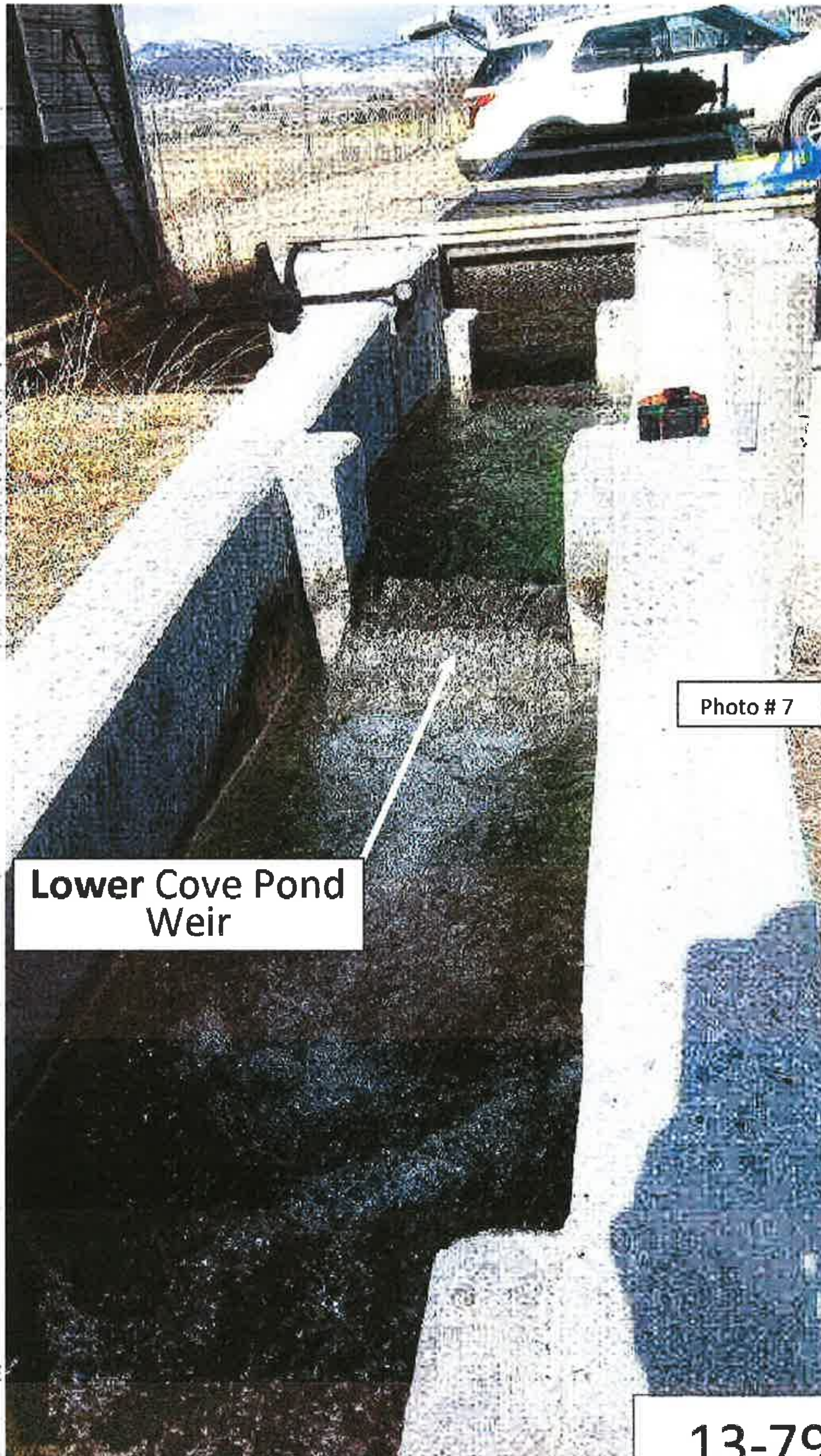


Cove Ponds

13-7996


Lower Cove Pond
Gate Valve to Control
Flow into Sluice Box
Discharge
from Pipe
Sluice Box
Photo # 6

13-7996



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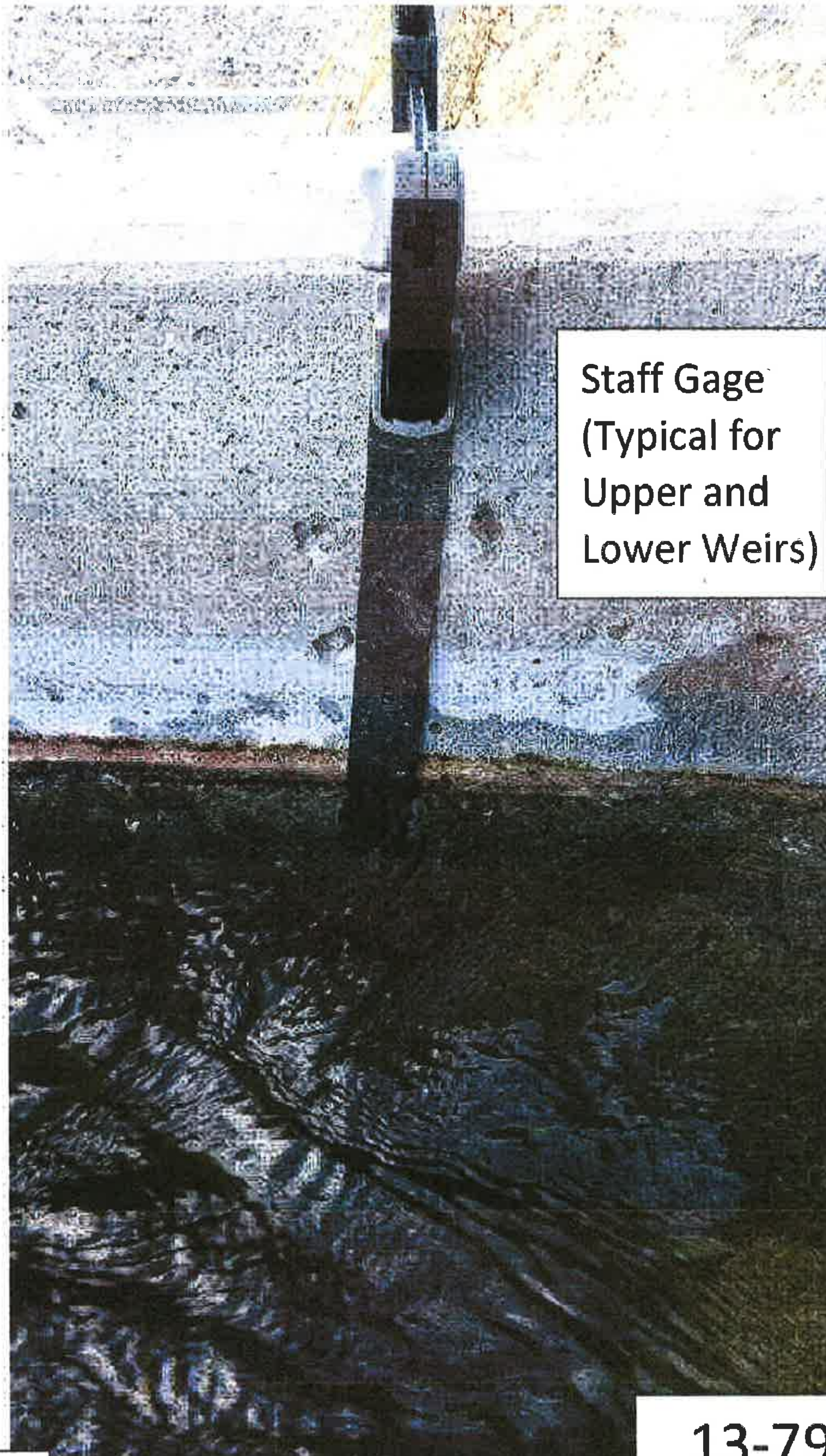
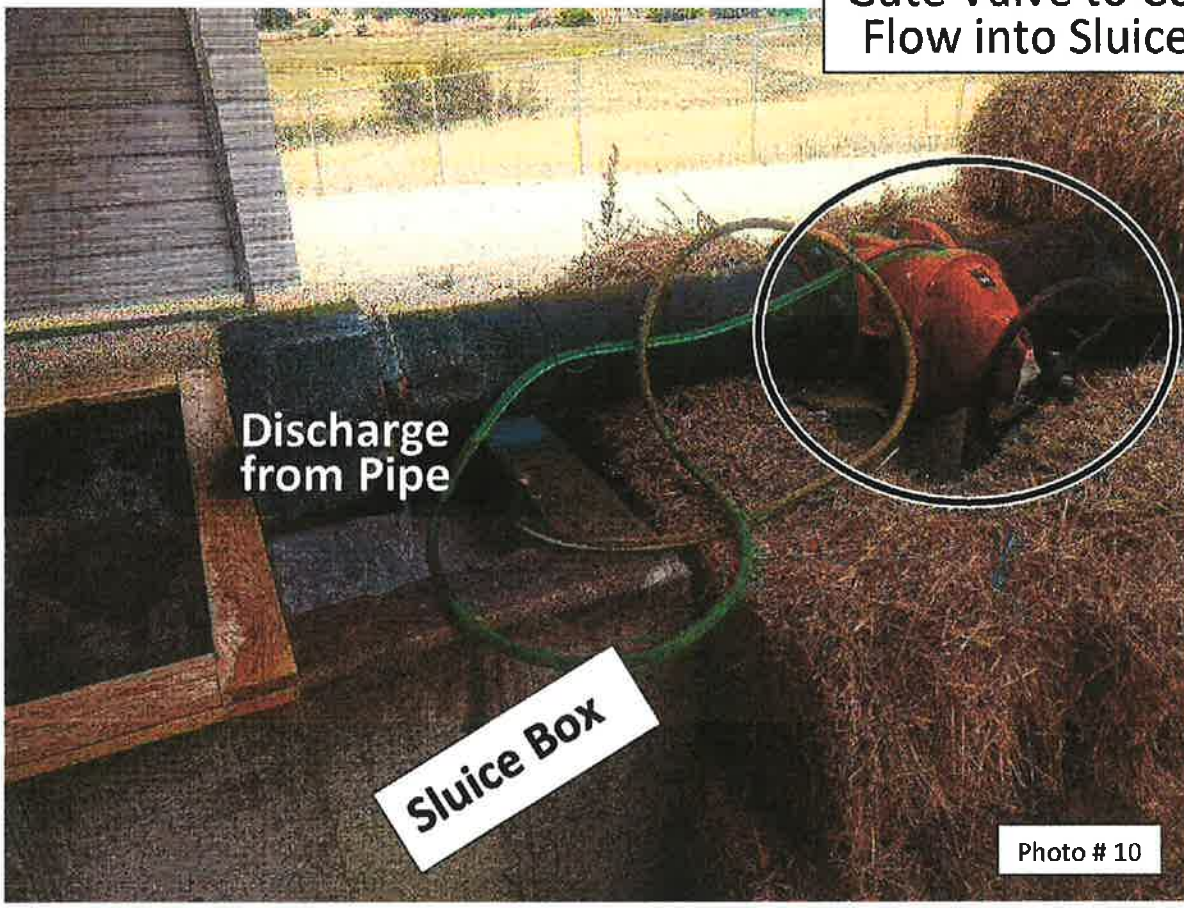


Photo # 8

13-7996

13-7996

UPPER POND



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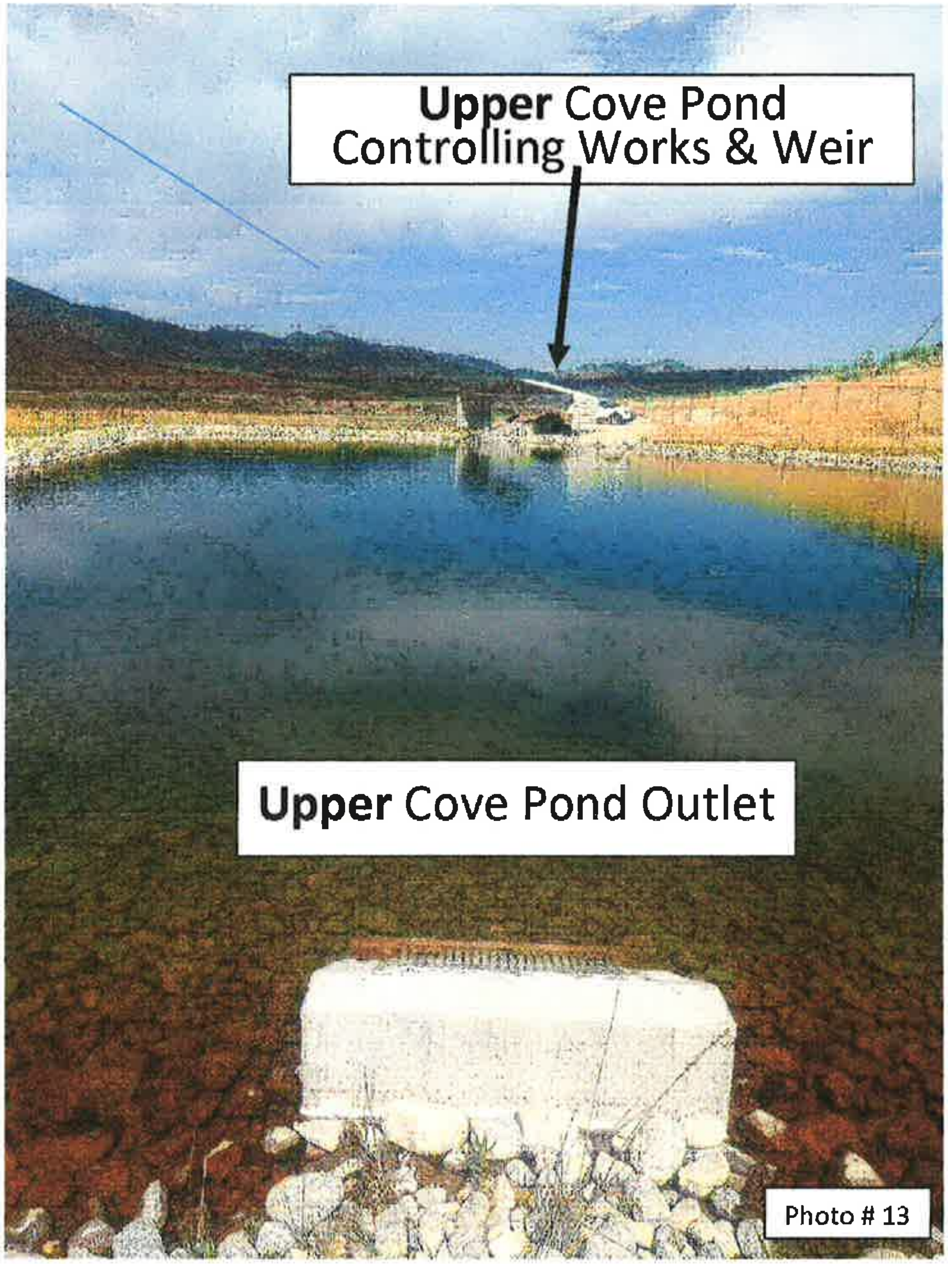
Upper Cove Pond Weir
13-7996
Photo # 11

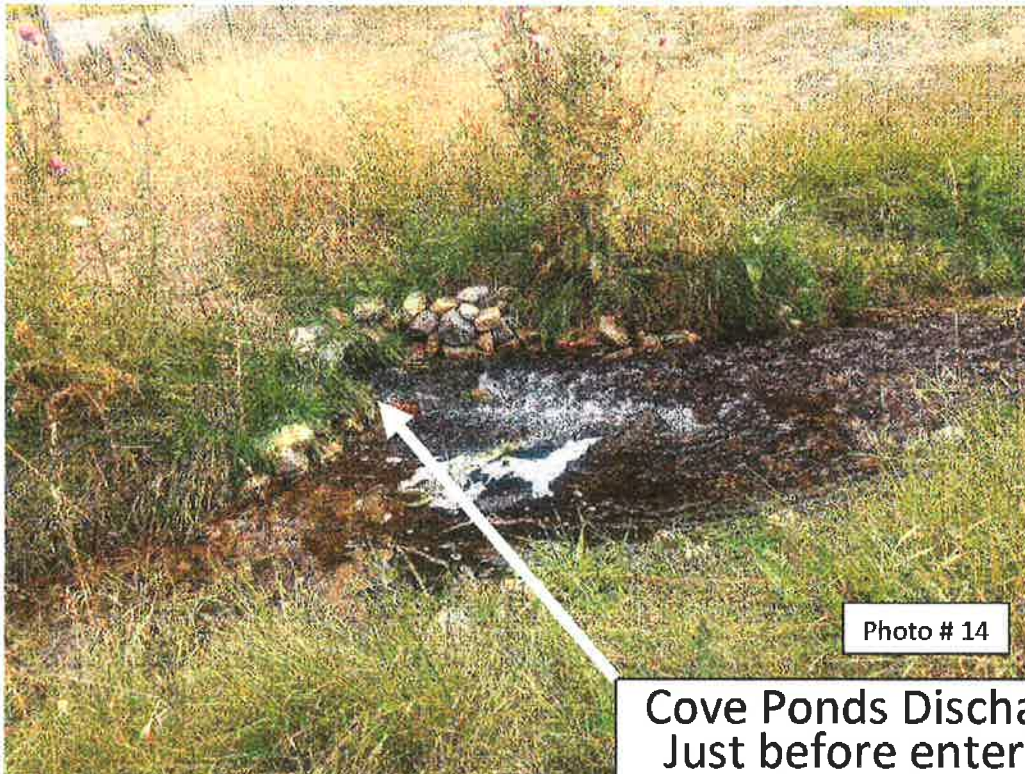

Discharge into
Upper Cove Pond
Upper Cove Pond
Weir
Photo # 12

13-7996



Upper Cove Pond
Controlling Works & Weir
Upper Cove Pond Outlet
Photo # 13

13-7996



Cove Ponds Discharge
Just before entering
Bear River

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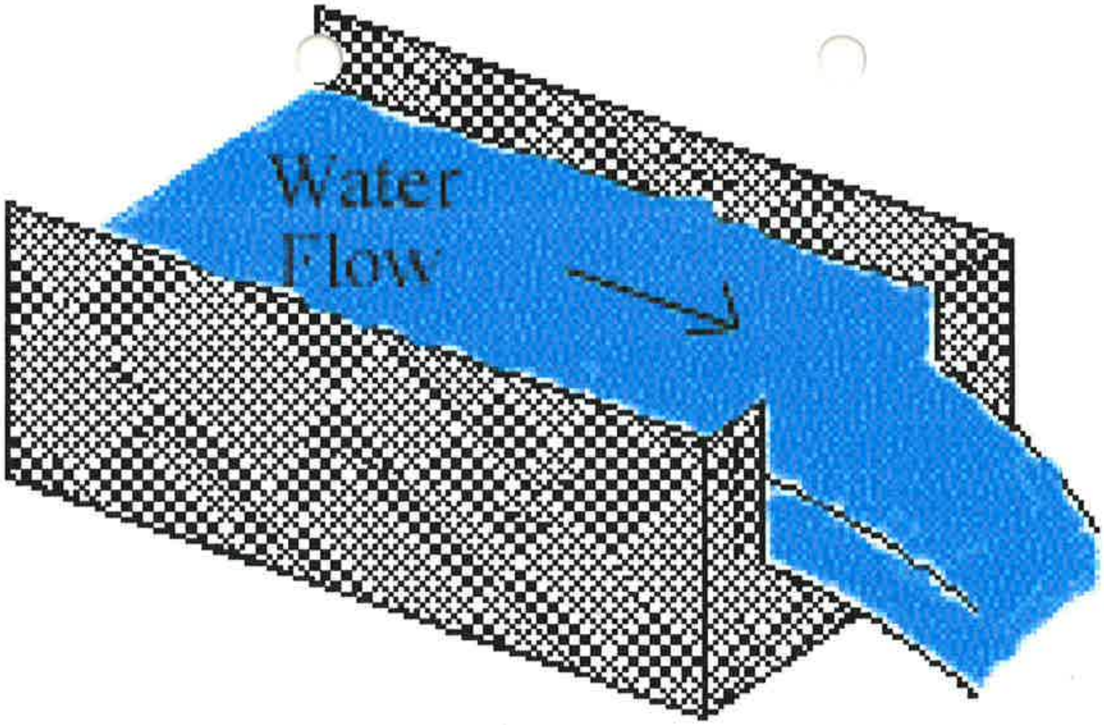
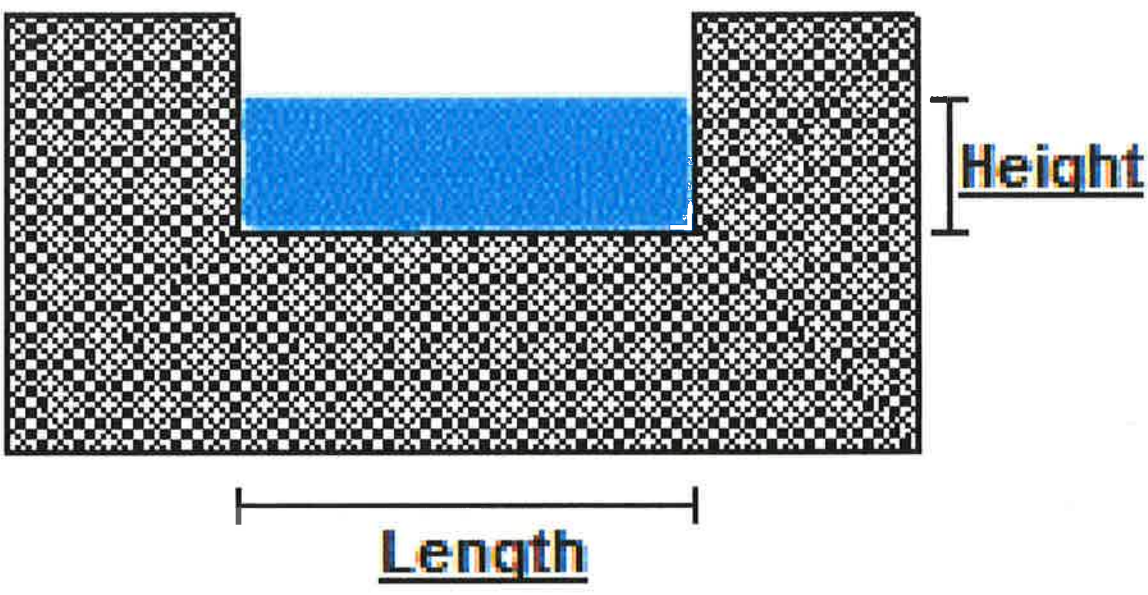

Water
Flow


Height
Length