
Memorandum

Date: November 29, 2019

To: File 95-4463

From: Craig L. Saxton

Re: Review of recommendation Fernan Lake 95-4463

95-4463 was recommended in the Basin 95 Part 1 Director's Report. An objection was filed to the right by the State of Idaho (IDL) requesting additional language be added the place of use description to state that the right didn't authorize trespass on IDL properties.

In addition, an error in the source/tributary description was discovered. The source and tributary was described as **Fernan Lake** tributary to **Fernan Lake**.

Additional questions in the recommended diversion rate and source surfaced in the review of the original recommendation.

- 1) Is the source accurately described as Fernan Lake, or should it be described as Fernan Creek.
- 2) Does the recommended volume of 1500 acre-feet accurately reflect what is being put to beneficial use?

Issue #1:

Other natural lakes in the surrounding area describe the source of the storage water as the "lake" and not as the creek/stream that feeds the lake. For Example:

95-973 – Twin Lakes

95-12A – Avondale Lake (Trib to Hayden Lake that Sinks – no Downstream Users)

95-12B – Avondale Lake (Trib to Hayden Lake that Sinks – no Downstream Users)

Fernan Lake is Tributary to Fernan Creek which feeds in to Lake Coeur D'Alene. There are no downstream users on Fernan Creek between the outlet of Fernan Lake and Lake Coeur D'Alene. Issues in regulation might be if the City of Fernan Lake Village made a call for water.

I spoke with Rob Whitney and Tim Luke to get their opinion on how the source description would affect regulation. The consensus was that since the other water rights diverted within the lake boundary describe the source as Fernan Lake, it would make sense to describe the source for 95-4463 as Fernan Lake. Rights diverted from, and tributary to, Fernan Lake would be regulated together based on priority, so the source shouldn't make that much difference as far as regulation is concerned.

In a conversation with Garrick Baxter on 11/22/2019, he recommends we recommend 95-4463 consistent with describing the source as the lake.

On 11/26/19, I met with Shelley Keen to discuss this and after looking at multiple storage rights in natural lakes around Idaho, it was determined that we could call the source Fernan Lake and be consistent with other storage rights in natural lakes in the area.

Issue #2:

The control structure (dam) was added to the outlet of Fernan Lake in 1966. The purpose was not to store water to maintain an artificially high water surface elevation throughout the recreation season.

I downloaded aerial photos dated 1953 and 1954 and had IDWR's GIS section rectify the photos so I could measure the surface area of the lake before the controls structure was in place. I also measured the surface area of the lake using 2018 aerial photos. I measured 370 (1953) and 380 (2018) acres. This is a 2.6 % difference that can vary depending how the aerial photos are rectified and how the user traces the boundaries. In practicality, there has been no major change in surface area of Lake Fernan since 1953 before the control structure was put into place.

Volume Calculation:

Surface Area:

1953 Aerial Photo: 370 ac 1953 air photos from USGS Earth Explorer
2018 Aerial Photo: 380 ac (from ESRI (1 foot) dated 8/5/2018).
Hydrologic Height: 4 Ft (consistent throughout the dam safety file) with 5" of freeboard¹
Storage Volume: $[(370 + 380)/2] * \sim(4 \text{ feet} - \text{roughly } 5'' \text{ of free board} = 3.75'') = 1406$
Evaporation losses for surface are of 380 acres = 95.5 AF ~ 96 AF

- ET Idaho Station: [Coeur d'Alene 1E \(NWS -- USC00101956\)](#)
- Open water - deep systems (lakes/reservoirs)
- Precipitation Deficit

Total Appropriated volume: 1502 AF... ~ 1500 AF

Top of Dam elevation is 2133' consistent throughout the Dam safety file.

I met with Manuel Rauhut to discuss the lake level elevation. After reviewing the Dam Safety file, Manuel said that for most dams a normal operation would be to maintain the lake level at 2129 ft which is the elevation of the lowest spillway. However, the photos in the dam safety file show that they almost always have boards in to bring the lake level up to the height of the dam which is 2133 ft. A 2013 field exam measured the hydraulic height² of 4 feet, but listed 5" of freeboard. Based on this I calculated the normal vertical storage as 3.75' feet.

¹ Free Board: The vertical distance between the top of the **dam** and the full supply level on the reservoir.

² Hydraulic Height: The vertical difference between the maximum design water level and the lowest point in the original streambed. **Height**, structural. The vertical distance between the lowest point of the excavated foundation to the top of the **dam**.

Evaporation Loss Calculations

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

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User Input
Calculated value
Formula Explanations

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

P = Precipitation
ET= Evapotranspiration
P _d = Precipitation deficit
P _d =ET-P

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>.

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	-1.95	31	0.00
Feb	-1.54	28	0.00
March	-1.32	31	0.00
April	-0.51	30	0.00
May	-0.47	31	0.00
June	-0.39	30	0.00
July	0.95	31	29.45
August	0.93	31	28.83
September	0.61	30	18.30
October	-0.01	31	0.00
November	-1.92	30	0.00
December	-2.70	31	0.00

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.

Total mm/year = 76.58

$[(\text{mm/yr}) \div (\text{convert to feet})] \times (\text{Surface area of pond, in acres}) = \text{Evaporation Loss in Acre Feet}$

$$(76.58 \div 304.8) \times 380.00 = 95.5 \text{ AFA}$$