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*Attorneys for LCSC Enterprises LLC*

BEFORE THE IDAHO DEPARTMENT OF WATER RESOURCES  
OF THE STATE OF IDAHO

IN THE MATTER OF APPLICATION  
FOR TRANSFER NOS. 84488 AND  
84490 IN THE NAME OF LCSC  
ENTERPRISES LLC

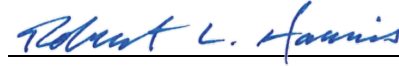
**LCSC ENTERPRISES LLC  
DISCLOSURE OF EXPERT REPORTS**

As required by the *Notice of Hearing, Notice of Status Conference, and Scheduling Order* issued in this matter, LCSC Enterprises LLC hereby serves the following expert reports to Hearing Officer James Cefalo and the parties to the above-entitled contested case listed on the certificate of service below:

1. *Transfer Nos. 84488 and 84490 (Water Right 35-14041) Report* (updated April 30, 2025).
2. *Expert Report on LCSC Enterprises LLC 2024 Field Activities* (November 25, 2024).
3. *Expert Report on Modeling Analysis Associated with LCSC Enterprises LLC Transfer Applications* (April 30, 2025).
4. *IDWR's Review of the Cumulative Effects of Water Right Transfers within the Eastern Snake Plain Aquifer (ESPA)* (September 12, 2019).

5. *Cumulative review of ESPA transfers between 2012 and 2024* (updated on December 5, 2024 for transfers approved through September 30, 2024).

Dated this 30<sup>th</sup> day of April, 2025.



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Robert L. Harris

HOLDEN, KIDWELL, HAHN & CRAPO, P.L.L.C.

## CERTIFICATE OF SERVICE

I hereby certify that on this 30<sup>th</sup> day of April, 2025, I served a true and correct copy of the following described pleading or document on the attorneys and/or individuals listed below by the method(s) indicated.

**DOCUMENT SERVED: LCSC ENTERPRISES DISCLOSURE OF EXPERT REPORTS**

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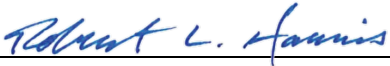
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# Transfer Nos. 84488 and 84490 (Water Right 35-14041) Report

Applicant: LCSC Enterprises, LLC

By: Jason C. Helms, P.E.



## General Information

Water right transfer applications 84488 and 84490 submitted by LCSC Enterprises LLC on October 13, 2020 meet Eastern Snake Plain Aquifer (ESPA) transient impact limitations for permanent water right transfers within the ESPA; however, approval of the transfers is held pending resolution of protests asserting negative impacts to existing water rights. The transfer applications seek to change the place of use (POU) and point of diversion (POD) for existing decreed water right 35-14041 which authorizes the legal diversion of 3.18 cfs from the ESPA for irrigation of 322.5 acres not to exceed 1,290 acre-ft per year. The transfers seek to change the POD and POU of water right 35-14041 to existing and new wells also located within the shared ESPA water resource with no increase in diversion rate or volume.

This report discusses the hydraulic modeling details of the water rights proposed for transfer in relation to the analysis of impacts calculated utilizing the Idaho Department of Water Resources (IDWR) ESPA Ground-Water Rights Transfer Spreadsheet (Transfer Spreadsheet). The Transfer Spreadsheet analysis is required to determine if filed transfers within the ESPA fall below acceptable depletions to hydraulically connected reaches of the Snake River to be approvable. When the transfer was originally filed, ESPAM (Eastern Snake Plain Aquifer Model) version 2.2 was not yet implemented. Subsequent detailed review of ESPAM 2.2 reveals reduced calibration accuracy in the reach of the Snake River (Neeley to Minidoka) closest to the proposed POD so ESPAM version 2.1 remains the basis of this impact analysis. Primary sources of information used in preparation of this report are the transfer applications and prior reports referenced at the end of this report in addition to available well driller's logs and ground water data available from IDWR and the United States Geological Survey (USGS). Additionally, a site-specific monitoring well study was

performed by Clearwater Geosciences on behalf of the applicant in 2024 monitoring the shallow alluvial (river bed) aquifer related to pumping from the proposed irrigation wells associated with Transfer 84488 showing no measurable impact.

## **ESPA Interconnectivity & Specific Mitigating Transfer Conditions**

Both the existing and proposed PODs divert from the fractured basalts of the ESPA and an analysis was prepared utilizing IDWR's official ESPA Model Transfer Spreadsheet. The Transfer Spreadsheet utilizes a calibrated ground water model of the regional aquifer and includes a certain level of complexity recognizing not only the connectedness but also the dis-connectedness of the Snake River and the aquifer system. The diversions are moving from a water table location above the American Falls Reservoir to a connected location near Lake Walcott below.

Recent non-use of the water right proposed for transfer related to enrollment in the Conservation Reserve Enhancement Program (CREP) program from 2007 through 2022 has allowed the cone of depression at the current POD to stabilize at only 5% of maximum depletions. These transient reach credits will tend to mitigate short-term impacts and make it possible for the changes sought in the transfers to commence immediately allowing full use of the authorized volume without initial pumping reductions.

## **Calculated Snake River Impacts at Existing POD**

The major Snake River reach impacts (>10% of the authorized volume) associated with irrigation diversion at the existing POD are the Shelley to Near Blackfoot and the Near Blackfoot to Neeley reaches of the Snake River comprising approximately 21% and 65% of the authorized volume, respectively, near steady state with depletions to all other reaches making up the remaining 14%. The local aquifer in this area is very stable with high transmissivity creating relatively short-term communication between aquifer diversions and river reach impacts. Water right 35-14041 also has a large mitigating factor as it has been enrolled in the CREP program since 2007. The recent non-use has allowed the aquifer at the existing POD to recover and according to the Transfer Spreadsheet, utilizing version 2.1 of the ESPA Model, the residual impacts are currently only 5% of their maximum authorized

volume within the major reaches. Of course, modeling resumption of pumping at the new POD quickly reverses the current reach gains which have accrued and approaches 95% of authorized major reach annual impacts within 10 years of resuming authorized use.

## **Calculated Impacts of Diversion at new POD**

Transfer 84488 seeks to split a portion of water right 35-14041 for diversion from existing wells associated with water right 35-2824 and 35-7740. Transfer 84490 moves the remainder proposed for diversion from two new wells that have not been constructed. The aquifer in this area is relatively stable, sloping from approximately 4,200 feet in elevation at the proposed PODs down to 4,100 feet in elevation just below Minidoka Dam. This slope is primarily a regional trend that extends northwest across the aquifer below the Great Rift area. Aquifer transmissivities and river conductivity are considered somewhat lower in this area with only partial connection between the river and aquifer which limits the extent of water table impacts. The water table at the new POD is approximately 200 feet lower in elevation than at the existing POD, but much shallower relative to land surface which will reduce annual power costs and increase efficient water delivery.

River gains and losses related to riverbed seepage are dependent upon the inundation area of Lake Walcott and the elevation of the regional water table which can cause the Snake River in this area to become variably perched during a single season. Measurements of total Neeley to Minidoka reach losses have varied from an implied net loss of over 100 cfs measured in the Spring of 2001 to a net reach gain over 1,000 cfs measured in the spring of 2002

The major Snake River reaches associated with the location of the new PODs are the Shelley to Near Blackfoot, Near Blackfoot to Neeley, and Neeley to Minidoka reaches. The Neeley to Minidoka reach represents the downstream end of the upper Snake River-ESPA aquifer connection and the river becomes disconnected to the west beyond Minidoka Dam, eventually falling below the aquifer level and later reconnecting by spill in the spring reaches. Calculated ESPAM V2.1 Snake River reach impacts near steady state in the Shelley to Near Blackfoot reach resulting from the proposed transfer are reduced from 21% to only 12% of the diversion volume and

the Near Blackfoot to Neeley reach is reduced from 65% to only 39%, while the Neeley to Minidoka reach rises to become a major reach at 21% where it was previously less than 1%. Transient impacts from resuming pumping increase moderately quickly reaching 95% of their maximum authorized impacts within 30 years.

## **Combined Impacts of Transfer**

According to results of the transfer spreadsheet, approximately 64% of the un-diverted volume at the historical place of use is currently being expressed as river reach gains directly into the Near Blackfoot to Neeley reach of the Snake River which is captured within American Falls Reservoir, a storage reservoir owned and operated by the United States Bureau of Reclamation (BOR). Modeling of the diversion at the new location indicates the after-transfer impacts in this same reach are only 39% (reduced by 25%) with an additional 21% depletion calculated in the Neeley to Minidoka reach. The additional depletions calculated in the Neeley to Minidoka reach are less than the reach credits calculated for the Near Blackfoot to Neeley reach directly above resulting in a net combined river gain between Near Blackfoot to Minidoka from approval of the transfers.

The increased impacts and mitigation requirement indicated for the Neeley to Minidoka reach would normally prevent IDWR approval of the transfer, however, physical operation of the American Falls Dam and Reservoir delivers mitigation naturally accruing as reach gains in the Near Blackfoot to Neeley combined reach resulting from the non-use at the original POD. According to the BOR: "During typical water years, Lake Walcott is maintained close to full to optimize power generation at the Minidoka Dam powerplant. During the summer months, the amount of water released from American Falls Reservoir (which enters Lake Walcott) and from Lake Walcott are set to maintain a fairly constant pool level. There are two canals that divert directly from Lake Walcott. Their headworks are included in the Minidoka Dam superstructure. During the winter months, the reservoir is maintained slightly below full and maintained at a constant level." Because of this BOR river and reservoir operation, the aquifer credits generated in the Near Blackfoot to Neeley reach (-26%) fully expressed as a result of the protected non-use of the water right under the CREP program are delivered as natural flow or physically captured within American Falls

Reservoir as storage water which is deliberately released as described above to maintain the river stage elevation at Lake Walcott exactly where the modeled increased impacts resulting from the transfers are calculated to occur. Further, when analyzed cumulatively with all other transfers as IDWR has done annually, there appears currently an overall net gain to the Neeley to Minidoka reach. Approval of transfers 84488 and 84490 will produce a slight equalization of cumulative impacts between these two upper reaches.

## **Impacts Below Milner**

Modeled impacts of the transfers show an increase in depletions below Milner at steady state. However, the impact changes calculated for all spring reaches are each less than 10% of the total calculated depletion and therefore fall below IDWR thresholds requiring mitigation. As with other reaches, IDWR's updated Cumulative review of ESPA transfers between 2012 and 2024 memo provides that all reaches below Milner show an increase in reach gains, and, based on the calculated impacts of all prior transfers the overall reach gain below Milner is 0.08 cfs and 61 acre-feet per year. As a result of these transfers, total additional depletions to all spring reaches would constitute less than 12 additional acre-ft per year.

## **Conclusion**

Relative to these transfers, the timing of historical impacts associated with the protected non-use of the water right (under the CREP program) proposed for transfer combined with the regulatory management of the American Falls and Lake Walcott systems allow combination of the Near Blackfoot to Neeley and Neeley to Minidoka reaches of the Snake River for determination of acceptable impacts. The combined impacts at every transient time-step of the combined reach impacts demonstrates a net reach gain to the major reaches of the Snake River. While the transfers are calculated to result in additional depletions from the hydraulically connected river system in the form of localized increased impacts in the Neeley to Minidoka reach, the modeled reach gains accruing to the Near Blackfoot to Neeley reach from nonuse of ground water at the originally authorized POD location provides an excess to

calculated mitigation requirements based on ESPAM 2.1 for natural flow delivery through American Falls Reservoir mitigating additional impacts to the Snake River including Lake Walcott. This is occurring in-place and in-time while also increasing opportunity for non-consumptive power generation from the water passing through American Falls Reservoir and simultaneously reducing power consumption (because of a lower pumping lift required at the proposed wells identified in the transfers) to accomplish the same diversion and beneficial use of water under water right 35-14041.

The residual credits associated with the protected non-use of the transferred water right effectively eliminate any typical initial requirement for reduced pumping associated with transient impacts. The transfers seek to transfer an existing water right for beneficial irrigation use within their authorized limitations and such use is in the local public interest for production of crops and appears acceptable under IDWR's transfer requirements within the ESPA. An appropriate analysis of ESPA impacts resulting from the proposed transfers was prepared utilizing the current authorized version of the ESPA model at the time the transfers were filed. Subsequent detailed evaluation of ESPAM 2.2 calibration results reveals lower agreement with measured flows specifically in the Neeley to Minidoka reach where the transfer is located so the ESPAM 2.1 model analysis is considered more accurate to observed site-specific conditions and is therefore preferred for modeling the impacts of these particular transfers. According to the analysis, impacts to ESPA Snake River reaches are within acceptable limits and no mitigation appears necessary other than an extended well casing seal to minimize local shallow aquifer impacts.

## References:

Lindholm, G.F., 1996, *Summary of the Snake River Plain Regional Aquifer-System Analysis in Idaho and Eastern Oregon* U.S. Geological Survey Professional Paper 1408-A, 68 p., 1 pls.

Whitehead, R.L., 1992, *Geohydrologic framework of the Snake River Plain regional aquifer system, Idaho and eastern Oregon*: U.S. Geological Survey Professional Paper 1408-B, 32 p., 6 pls.

Garabedian, S.P., 1992, *Hydrology and digital simulation of the regional aquifer system, eastern Snake River Plain, Idaho*: U.S. Geological Survey Professional Paper 1408-F, 102 p., 10 pls. (Also available at <http://pubs.usgs.gov/pp/1408f/>.)

Hortness, J.E., Vidmar, Peter, 2005, *Surface-Water/Ground-Water Interaction along Reaches of the Snake River and Henrys Fork, Idaho*: U.S. Geological Survey Scientific Investigations Report 2004-5115, 18p. 3apps.

U.S. Department of the Interior Bureau of Reclamation Pacific Northwest Region Snake River Area Office PN FONSI #19-4: Environmental Assessment (Maintenance and Rehabilitation of Spillway and Dam Structures at American Falls Dam), Minidoka Project, Power County, Idaho May, 2019. <https://www.usbr.gov/pn/programs/ea/Idaho/americanfalls/finalea.pdf>

U.S. Geological Survey, 2013c, *National Water Information System—Web interface*, USGS water data for Idaho: U.S. Geological Survey database, accessed July 2, 2021, at <http://waterdata.usgs.gov/id/nwis/nwis>.

Sukow, Jennifer, *Cumulative review of ESPA transfers between 2012 and 2024* (updated on December 5, 2024 for transfers approved through September 30, 2024).

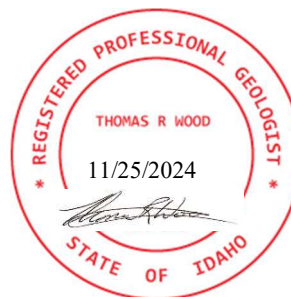


# EXPERT REPORT ON LCSC ENTERPRIZES LLC 2024 FIELD ACTIVITIES

In support of Transfer Applications  
Nos. 84488 and 84490

Prepared for:  
LCSC Enterprises LLC  
November 25, 2024

The technical material in this report was prepared by or under the supervision and direction of the undersigned, whose seal as a Professional Geologist is affixed below.



The following members of the Clearwater Geosciences, LLP staff contributed to the preparation of this report.

Thomas R. Wood, Ph.D., PG - Principal-in-Charge  
Rachel J. Geringer, PG – Senior Hydrogeologist



## **Introduction**

The LCSC site is located north of the Snake River approximately 16 miles downstream (southwest) of the American Falls Dam (Figure 1). A better understanding of the local hydrogeology is required to fully evaluate the potential impact the proposed transfers will have on water in Snake River and Eastern Snake River Plain Aquifer. To date, analyses of the impact from the proposed transfers have been based upon regional understandings of aquifer-river relationships. This study provides site specific data from two new monitoring wells and water level data collected over a five-month period from the monitoring wells and an active irrigation well immediately adjacent to the proposed Place of Use (POU) and Point of Diversion (POD).

The water table in this area is shallow, and the protestants of the transfers have asserted possible localized affects to the Snake River from pumping of the aquifer via proposed new PODs. Of particular interest for these transfers is the relationship between pumping of the regional Eastern Snake River Plain Aquifer and the nearby Snake River. This study has been designed to describe hydrogeology of the subsurface, and to evaluate how the proposed wells might impact water in the Snake River. A secondary purpose of this investigation is to determine if a well can be constructed in such a way as to pump water that is not directly connected to the Snake River.

This summary report includes: 1) description of two monitoring wells drilled to define the geology of the shallow subsurface; 2) presentation of water levels monitored in three wells on a continuous basis throughout the irrigation season; and 3) synthesis of the data into a hydrogeological conceptual model for the site.

## **Field Investigation**

### Well Drilling

Two monitoring wells were drilled in April of 2024 by American Pump and Drilling Company at locations shown in Figure 2. A casing advancing drilling technique was employed. Six-inch diameter steel casing was advanced to the total depth of the well. This method provided excellent drill cutting recovery for preparing lithologic logs. The well logs prepared from the drill cuttings accurately represent of the subsurface geology. Both MW-1 and MW-2 were constructed in a similar manner. Two-inch diameter PVC well casing with 20 ft of PVC well screen was installed inside the 6-inch steel casing. As the filter pack was installed, the 6-inch casing was withdrawn. Sand levels were carefully monitored to ensure that the filter pack sand did not bridge. The sanitary well seal consists of bentonite chips.

MW-1 was drilled 90 ft west of the active irrigation well 352874 (Vern Duffin well, 1979). Well 352874 has a completed depth of 535 ft and it is open to the regional aquifer from 256 to 535 ft (see Attachment 1). The purpose of MW-1 is to define the shallow lithology and monitor the shallow water levels adjacent to Well 352974 while it is pumped during the irrigation season.



The as-built diagram for MW-1 is provide in Figure 3. The well was drilled to 43 ft by advancing the 6-inch steel casing to depth and then building the 2-inch diameter PVC well inside the casing. Slotted (0.020") PVC casing extends from 23 to 43 ft. The filter pack is 10-20 silica sand that extends from 18 to 43 ft. The annular seal consists of bentonite chips extending from 18 ft to land surface. Materials in the well were tagged every 5 ft to ensure that bridging did not occur. The depth to water in April was 29.95 ft below casing.

The lithology at the MW-1 location consists of top soil and sand from 0 to 4 ft, basalt boulders and gravel from 4 to 23 ft, basalt boulders, gravel and sand from 23 to 37 ft and sand and gravel from 37 to 43 ft. Minor amounts of silt and clay were observed and its presence increased with depth. However, the clay and silt likely occur in thin stringers in this section.

MW-2 is approximately 500 ft north of the Snake River as shown in Figure 2. The purpose of MW-2 is to monitor the shallow water near the Snake River while ground water pumping occurs during the irrigation season. Irrigation pumping that affects the shallow water at MW-2 would be interpreted to impact the Snake River as well.

The as-built diagram for MW-2 is provide in Figure 4. The well was drilled to 43 ft by advancing the 6-inch steel casing to depth. The water level in MW-2 was 10 ft higher than in MW-1 and the decision was made to build the well such that a few feet of open screen was above the water table in case water levels in the well were to rise later in the season. Thus, the bottom five feet of the hole was back filled with silica sand. Slotted (0.020") PVC casing extends from 17.5 to 37.5 ft. The filter pack is 10-20 silica sand that extends from 15 to 43 ft. The annular seal consists of bentonite chips extending from 15 ft to land surface. Materials in the well were tagged every 5 ft to ensure that bridging did not occur. The depth to water in April was 20.30 ft below casing.

The lithology at the MW-2 location consists of top soil and sand from 0 to 4 ft, sand and basalt boulders from 4 to 14 ft, sand, gravel and basalt boulders from 14 to 29 ft, gravel, sand, and clay from 29 to 34 ft with an increasing amount of clay from 34 to 37 ft, a water bearing gravel from 36 to 37 ft and sand and gravel from 37 to 43 ft.

### Geology

The shallow geology is known from the monitoring wells, which penetrated the subsurface to 43 ft. The deep geology is known from the drilling log of LCSC irrigation Well 352874 and a well near the potato cellars Well 352857.

Well 352874 was drilled in 1979 to a depth of 535 ft. The well is cased from land surface to a depth of 256 ft and has an open hole below this to the bottom of the well. The well log is provided in Attachment 1. The lithology of the upper 40 ft of well 352874 is very similar to MW 1 and 2; consisting of a few feet of soil, a layer of basalt boulders, gravel and sand to 40 feet. The 205 ft thick interval from 40 to 245 feet is a clay rich layer of sediment. The clay is described as ranging in color from brown, yellow and white. The entire 205 ft thick interval is specified as non-water bearing on the well log. A 33 ft thick layer of brown clay is described



from 173 to 210 ft. The top of the regional basalt is at 245 ft and various textures and colors of basalt extends to 525 ft. From 525 to 535 ft the lithology is described as reddish rock with layers of crystals (this is possibly rhyolite).

The domestic Well 352857 was drilled in 1979 to a depth of 250 ft. Below the surface soil is a layer described as sandstone that extends to 98 ft. A basalt layer extends from 98 ft to 125 ft and below the basalt is 9 ft of clay and 11 ft of sandstone overlying another layer of basalt. The basalt extends from 145 to 178 ft. The lithology is described as a sandstone from 178 ft to the bottom of the well. The presence of basalt layers in Well 353857 is different than that of Well 352874, which had no basalt until a depth of 245 ft. Layers or lobes of basalt are common in this area, however, the lack of basalt in Well 352874 suggests that it may have been eroded.

A geologic cross section was prepared based on MW-1, MW-2, Well 352874 and Well 352857. as shown in Figure 5. The cross section is presented in Figure 6. On the south the lithology consists of a layer of top soil underlain by a layer of basalt boulders, coarse sand, and gravel, below this is a clay rich layer of sediment overlying a sequence of basalt flows. On land surface at the LCSC are many rounded basalt boulders taken from the farm fields. The deposits of rounded basalt boulders were formed by the erosion basalt deposited during the Bonneville flood, which was caused by the catastrophic failure of Red Rock Pass draining Lake Bonneville. These deposits are unconsolidated and poorly sorted to unsorted sand and gravel (Armstrong, et al., 1978).

Beneath the Bonneville Flood sediments is layer of unconsolidated sediment that is clay rich. The various layers in this interval all contain clay and the entire sequence is non water bearing. This sequence of sediment may be the Upper Pleistocene Alluvium and possibly associated American Falls Lake Bed sediments as described by Armstrong, et. al., 1978.

The lower basalt penetrated at a depth of 245 ft can be one of several basalt flows of Quaternary and Tertiary age; without rock sample it is not possible to know the age of the basalt.

The sandstone described at the north end of the cross-section may be the Raft Formation, which is described as massive beds of light-colored clay and silt, and thin-bedded calcareous quartzose silt and sand that is cross bedded locally (Anderson et al., 1978). The thin basalt flows penetrated by Well 352857 may be one of the several Pleistocene age basalt units mapped by Anderson et. al., 1978.

The geologic data suggests that the channel of the Snake River has been active here for a long period of time. The river has been both eroding and depositing sediment. As illustrated in the cross-section (Figure 6) the ancestral Snake River may have eroded the Raft Formation and Pleistocene Basalts creating a river channel. Subsequently, the river channel was filled by alluvium and lake bed deposits forming the clay rich sedimentary sequence. The Bonneville Flood cut into the clay rich sequence and re-deposited coarse sediment and basalt boulders.



## Water Levels in Nearby Wells

Water levels were periodically measured by hand in four wells. The elevations for these measurements are listed in Table 1. The water level elevations in the shallow monitoring wells and the distal Diamond D 336369 remained relatively constant. Well 352874 the pumped irrigation well, is cased to 256 ft and draws water from the aquifer between 256 ft and 535 ft. The fact that pumping of the deep aquifer did not impact water levels in shallow wells indicates that the upper aquifer is isolated from the lower aquifer by the clay rich sediments and clay layer between 40 and 245 ft.

Water levels were monitored continuously in MW-1, MW-2 and Well 352874 from April 28, 2024 to September 24, 2024. This period preceded the onset of irrigation and continued until the end of the irrigation season. Solinst Level Logger® transducers were installed in the wells and set to sampling intervals of 1 or 5 minutes. To download the data loggers, the transducers were removed from the wells and connected to a laptop PC periodically throughout the summer.

The hydrograph of water levels for all three wells is presented in Figure 7. Water levels in MW-1 and MW-2 remained relatively constant throughout the irrigation season. Water levels in Well 352874 were significantly impacted by pumping. When the pump cycled on water levels dropped over 35 ft to below the level of the pressure transducer. The transducer was installed as deeply as possible in Well 352874, but due to a constriction in the well it could not be set deeper. The water level in Well 352874 recovered when the pump was shut off and at the end of the irrigation season to the pre-irrigation season water level. The water level hydrograph shows that there is no hydraulic communication between the shallow aquifer tapped by MW-1 and MW-2 and the deep aquifer tapped by Well 352874. This indicates that the upper aquifer is isolated from the lower aquifer by the clay rich sediments and clay layer between 40 and 245 ft.

The recovery data for the Irrigation Well 352874 was analyzed to estimate aquifer transmissivity. Two methods for a confined aquifer were employed. The Theis solution and the Cooper-Jacob straight line method. The results are presented in Figure 8. The Theis Solution yields  $1.44 \times 10^4$  ft<sup>2</sup>/day and the Cooper-Jacob Solution yields  $1.53 \times 10^4$  ft<sup>2</sup>/day. Although the storativity value estimated from a single well pumping test is unreliable, the extremely low storativity values (on the order of  $10^{-11}$  and  $10^{-12}$ ) suggests the deep aquifer is under confined conditions due to the clay rich sediments and clay layer between 40 and 245 ft.

## **Discussion**

The field study has defined a shallow aquifer extending to about 40 ft, consisting of Bonneville Flood Deposits and Pleistocene Alluvium. The lower basalt aquifer is hydraulically isolated from the shallow aquifer by a thick sequence of clay rich sediments. The isolation of the shallow aquifer by the clay rich sediments is generally representative of perched aquifer conditions. Water level monitoring of the two shallow MW wells demonstrates hydraulic isolation from the deeper aquifer. Even though the head in the lower aquifer was decreased to more than 35 ft repeatedly during the irrigation season, the head in MW-1 only 90 ft away was unaffected.



Wells completed in the shallow perched aquifer will have a much better connection to the Snake River than deeper wells. Pumping of the shallow perched aquifer will result in relatively faster depletions of surface water. MW-2, which is 500 ft away from the Snake River, showed no seasonal response to irrigation pumping from Well 352874 (2460 ft north of MW-2). Pumping of the deeper well had no impact on the shallow perch aquifer adjacent to the Snake River because of the hydraulic isolation caused by the layer of clay rich sediments.

The non-responsive behavior of water levels in the shallow aquifer from pumping Well 352874 from the aquifer below 245 ft demonstrates that it is possible to construct a well in this location that is not directly connected to the Snake River. This isolation of the deep aquifer from the shallow aquifer was accomplished in Well 352874 with steel well casing extending from land surface to a depth of 256 ft. The well was drilled with a cable tool rig that drove the 16-inch casing 11 ft into the top of the basalt. A similar approach can be used for the wells proposed for the new PODs to ensure that pumping of the deep aquifer does not impact the Snake River. An alternative method to isolate the shallow surface water from the deep aquifer would be to overbore the drill hole and seal the annulus between the formation and well casing with grout or cement.

## **Summary**

Two 2-inch diameter, 43 ft deep monitoring wells were drilled for this project. MW-1 was drilled proximal to an existing irrigation well, that taps the deep aquifer. MW-2 was drilled near the Snake River to monitor surface water – ground water interactions. Water levels were monitored continuously in three wells for 5 months during the 2024 irrigation season. Water levels in the shallow aquifer wells were not impacted by pumping of the irrigation well even though drops in head level of the lower aquifer was greater than 35 ft. Correlation of the lithology into a north-south cross section illustrates a thick sequence of clay rich sediments that acts as a perching layer isolating the shallow aquifer from the deeper aquifer. The new and existing data demonstrates that new wells to be installed for Transfers 84488 and 84490 can be constructed to not directly impact the Snake River.

## **References**

Armstrong, R.L., J.F. Smith jr., H.R. Covington and P.L. Williams, 1978, Preliminary Geologic Map of the West Half of the Pocatello 1° x 2° Quadrangle, Idaho, USGS.



*Clearwater Geosciences, LLP*  
*Ground Water Development and Exploration*

Table 1. Periodic water elevations for wells in the LCSC area wells.

| Date             | 4/16/2024 | 4/19/2024 | 4/29/2024 | 7/2/2024 | 8/27/2024 | 9/24/2024 |
|------------------|-----------|-----------|-----------|----------|-----------|-----------|
| MW-1             | 4201.05   | 4201.25   | 4201.35   | 4200.5   | 4200.68   | 4200.74   |
| MW-2             | 4197.2    | 4197.45   | 4197.35   | 4196.69  | 4196.72   | 4196.74   |
| Diamond D 336369 |           | 4195.2    |           |          | 4196.15   |           |
| Well 352874      | 4196.8    |           | 4201.2    | 4193.55  | 4195.07   |           |



Figure 1. Location of the LCSC Site shown with a yellow pin.



Figure 2. Locations of monitoring wells, MW-1 and MW-2, drilled for this project and Irrigation Well 352874.

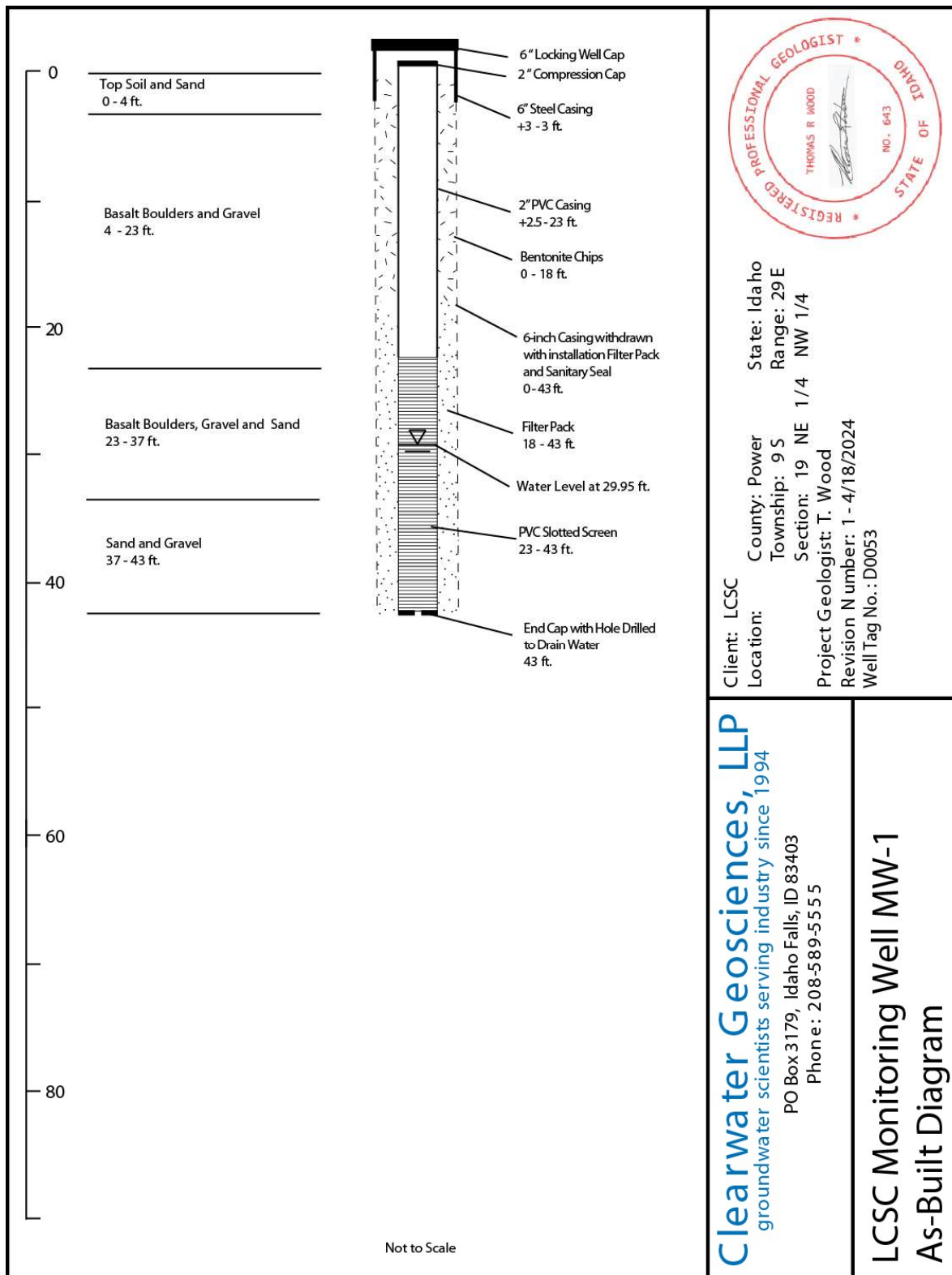


Figure 3. As-built diagram of MW-1.

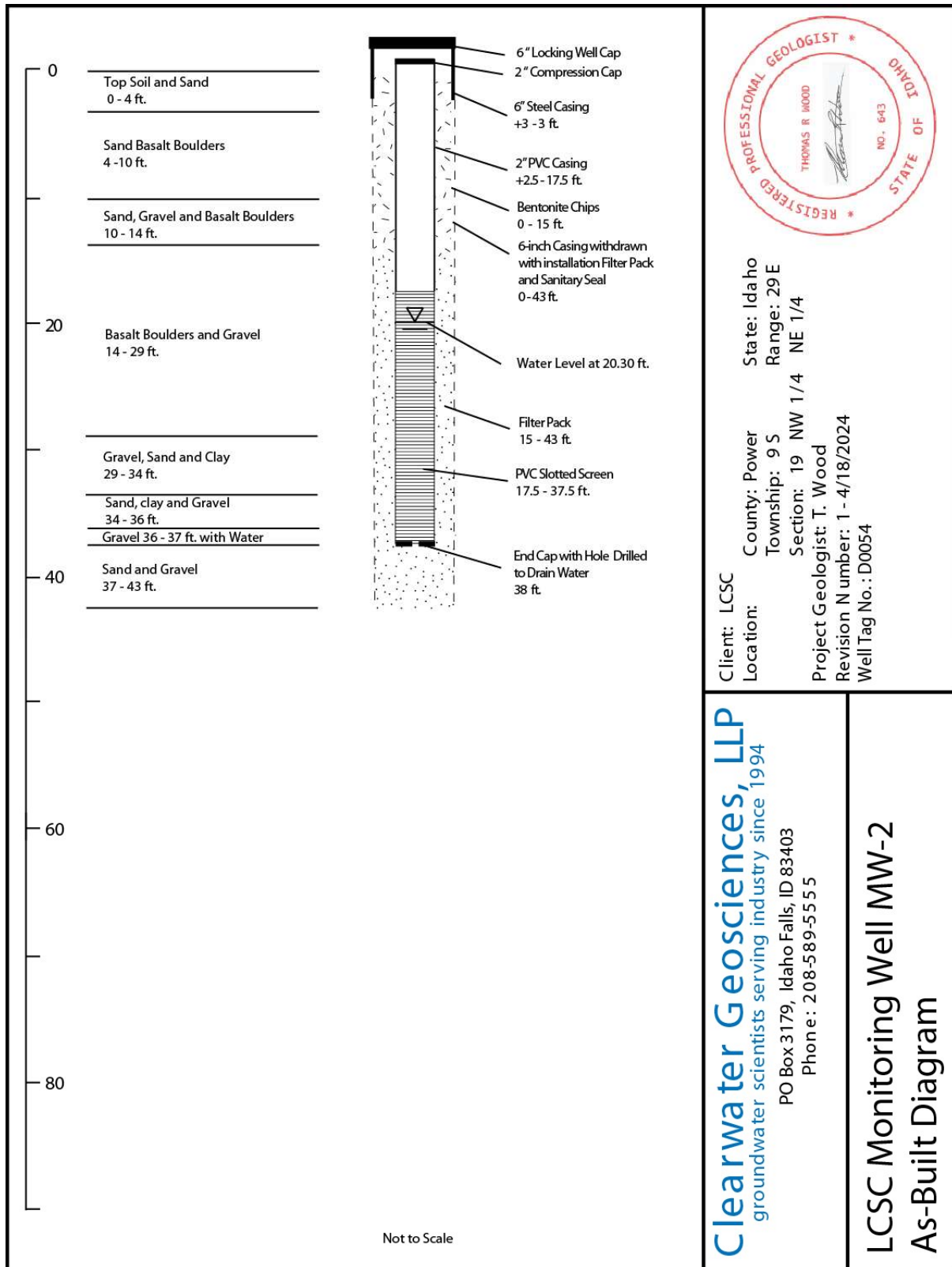


Figure 4. As-built diagram of MW-2.



Figure 5. Wells in the area of LCSC and line of geologic cross section.



## Geologic Cross Section for LCSC

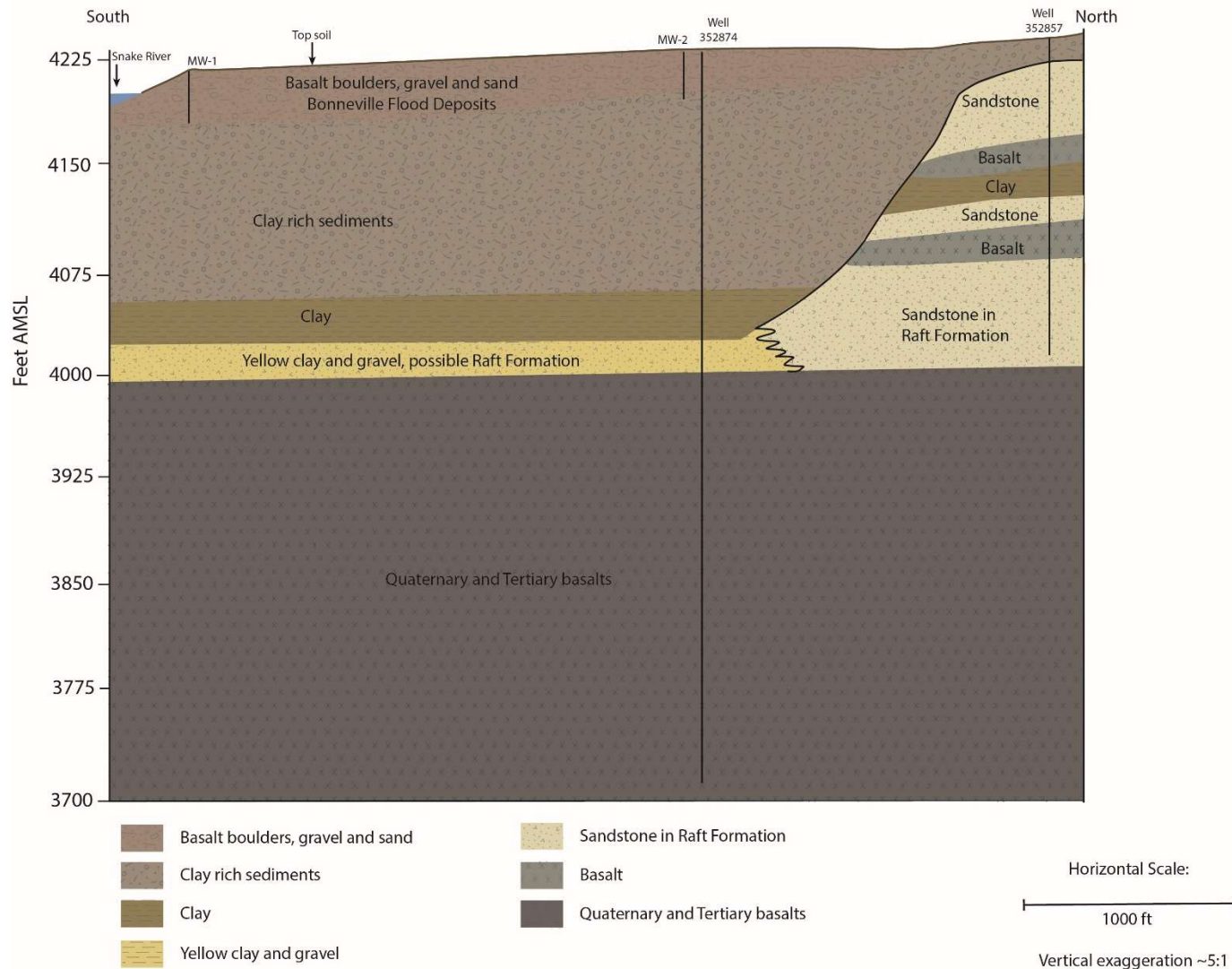


Figure 6. Geologic cross-section from the southeast at Snake River trending northwest to Well 352457.

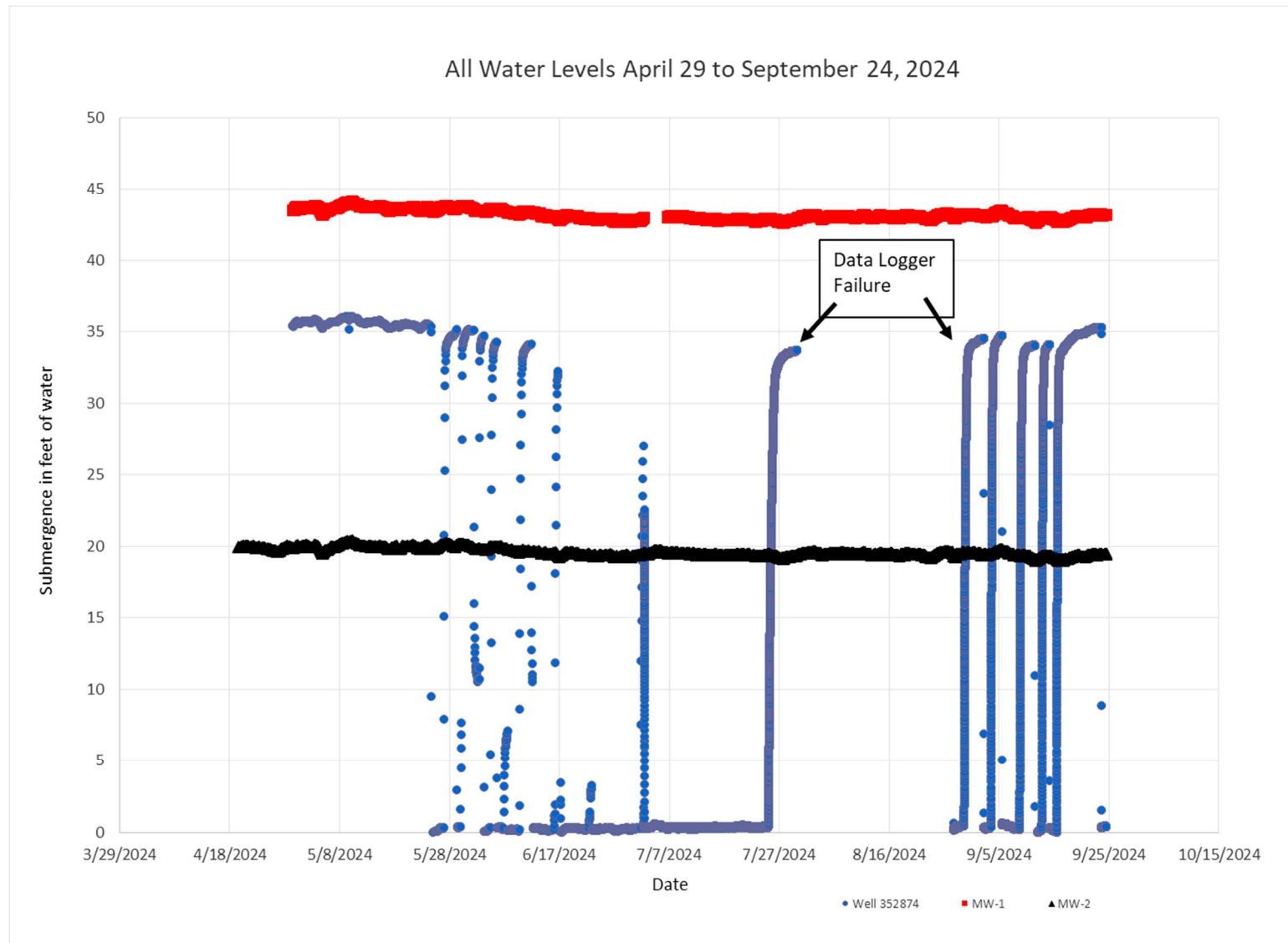


Figure 7. Water levels in MW-1, MW-2 and Well 352874 from April 29 to September 24, 2024.

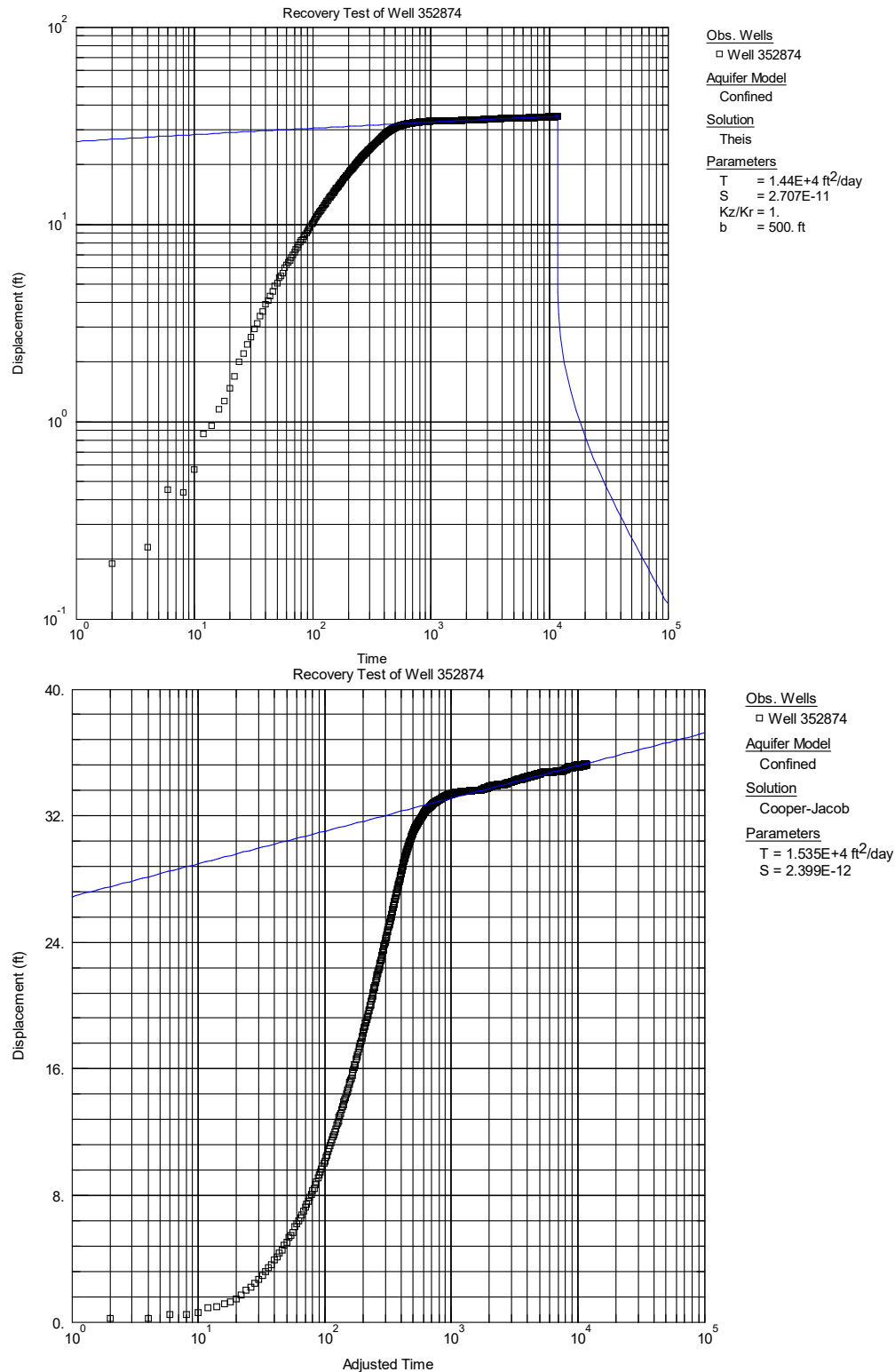


Figure 8. Time-drawdown plots and curve matching for calculating aquifer transmissivity. Top Theis Solution  $1.44 \times 10^4 \text{ ft}^2/\text{day}$ ; Bottom Cooper-Jacob Solution  $1.53 \times 10^4 \text{ ft}^2/\text{day}$ .



# ATTACHMENT 1

## WELL LOGS







Clearwater Geosciences, LLP  
Ground Water Development and Exploration

Form 238-7  
1-73



STATE OF IDAHO  
DEPARTMENT OF WATER RESOURCES  
WELL DRILLER'S REPORT

Location Corrected by IDWR To:

T09S R29E Sec. 18 SESW

By: mciscell 2012-05-09

1. WELL OWNER  
Name John Duffin  
Address Aberdeen, Ida 83210  
Owner's Permit No. \_\_\_\_\_

2. NATURE OF WORK  
☒ New well ☐ Deepened ☐ Replacement  
☐ Abandoned (describe method of abandoning) \_\_\_\_\_

3. PROPOSED USE  
☐ Domestic ☒ Irrigation ☐ Test ☐ Municipal  
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection  
☐ Other \_\_\_\_\_ (specify type)

4. METHOD DRILLED  
☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary  
☐ Cable ☐ Dug ☐ Other \_\_\_\_\_

5. WELL CONSTRUCTION  
Casing schedule: ☒ Steel ☐ Concrete ☐ Other  
Thickness \_\_\_\_\_ inches Diameter \_\_\_\_\_ inches From \_\_\_\_\_ feet To \_\_\_\_\_ feet  
Was casing drive shoe used? ☒ Yes ☐ No  
Was a packer or seal used? ☐ Yes ☒ No  
Perforated? ☐ Yes ☒ No  
How perforated? ☐ Factory ☐ Knife ☐ Torch  
Size of perforation \_\_\_\_\_ inches by \_\_\_\_\_ inches  
Number \_\_\_\_\_ From \_\_\_\_\_ To \_\_\_\_\_  
perforations \_\_\_\_\_ feet \_\_\_\_\_ feet  
perforations \_\_\_\_\_ feet \_\_\_\_\_ feet  
perforations \_\_\_\_\_ feet \_\_\_\_\_ feet  
Well screen installed? ☐ Yes ☐ No  
Manufacturer's name \_\_\_\_\_  
Type \_\_\_\_\_ Model No. \_\_\_\_\_  
Diameter \_\_\_\_\_ Slot size \_\_\_\_\_ Set from \_\_\_\_\_ feet to \_\_\_\_\_ feet  
Diameter \_\_\_\_\_ Slot size \_\_\_\_\_ Set from \_\_\_\_\_ feet to \_\_\_\_\_ feet  
Gravel packed? ☐ Yes ☐ No ☐ Size of gravel \_\_\_\_\_  
Placed from \_\_\_\_\_ feet to \_\_\_\_\_ feet  
Surface seal depth 20' Material used in seal: ☐ Cement grout  
☐ Pudding clay ☐ Well cuttings  
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing  
☐ Overbore to seal depth  
Method of joining casing: ☐ Threaded ☐ Welded ☐ Solvent  
Weld  
☐ Cemented between strata  
Describe access port 2" pipe

6. LOCATION OF WELL  
Sketch map location must agree with written location. 4/  
Subdivision Name \_\_\_\_\_  
Lot No. \_\_\_\_\_ Block No. \_\_\_\_\_  
County Bingham  
NW ¼ NW ¼ Sec. 19, T. 9 S., R. 29 E.

7. WATER LEVEL  
Static water level \_\_\_\_\_ feet below land surface.  
Flowing? ☐ Yes ☒ No G.P.M. flow \_\_\_\_\_  
Artesian closed-in pressure \_\_\_\_\_ p.s.i.  
Controlled by: ☐ Valve ☐ Cap ☐ Plug  
Temperature \_\_\_\_\_ OF. Quality \_\_\_\_\_

8. WELL TEST DATA  
☐ Pump ☐ Bailer ☐ Air ☒ Other MAR 7 1980  
Discharge G.P.M. \_\_\_\_\_ Pumping \_\_\_\_\_

9. LITHOLOGIC LOG

| Hole Diam. | Depth From | Depth To | Material                          | Water Yes No |
|------------|------------|----------|-----------------------------------|--------------|
| 16"        | 0          | 3'       | Top Soil                          |              |
|            | 3'         | 5'       | Gray sandy Clay & Rock            |              |
|            | 5'         | 10'      | Black lava Balders                |              |
|            | 10'        | 15'      | Broken Black Lava                 |              |
|            | 15'        | 35'      | Black lava Gravel & Clay          |              |
|            | 35'        | 40'      | Gravel                            |              |
|            | 40'        | 70'      | Brown Sandy Clay & Gravel         |              |
|            | 70'        | 110'     | Yellow Clay & Red Gravel          |              |
|            | 110'       | 173'     | White Silty Clay                  |              |
|            | 173'       | 270'     | Brown Clay                        |              |
|            | 270'       | 345'     | Yellow Brown Clay & Gravel        |              |
|            | 345'       | 375'     | Black lava Broken                 |              |
|            | 375'       | 395'     | Brownish lava                     |              |
|            | 395'       | 405'     | Black lava                        |              |
|            | 405'       | 318'     | Multicolored lava                 |              |
|            | 318'       | 322'     | Red lava & Clay                   |              |
|            | 322'       | 415'     | Multicolored lava                 |              |
|            | 415'       | 370'     | Red & Black lava                  |              |
|            | 370'       | 385'     | Red & Black lava & Red Clay       |              |
|            | 385'       | 387'     | Red & White Clay                  |              |
|            | 387'       | 400'     | Red lava & White Sand             |              |
|            | 400'       | 450'     | Multicolored lava & Red Clay      |              |
|            | 450'       | 455'     | White & Black Clay                |              |
|            | 455'       | 465'     | Black lava                        |              |
|            | 465'       | 470'     | Multicolored lava                 |              |
|            | 470'       | 500'     | Gray lava                         |              |
|            | 500'       | 515'     | Sharp Gray lava (No Cuttings)     |              |
|            | 515'       | 530'     | Red lava                          |              |
|            | 530'       | 535'     | Multicolored lava                 |              |
|            | 535'       | 530'     | Redist Rock with layers of Gravel |              |
|            | 530'       |          | Red Clay & Red lava & Gravel      |              |
|            | 535'       |          | End of hole                       |              |

10. Work started 10-11-78 finished 1-12-79

11. DRILLERS CERTIFICATION  
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.  
Firm Name Paul Vollmer & Son Firm No. 67  
Address Aberdeen, Ida Date 3-12-79  
Signed by (Firm Official) Harry Vollmer  
and  
(Operator) Jim Taylor

Figure 1-3. Well log for Duffin 352874.



Clearwater Geosciences, LLP  
Ground Water Development and Exploration

Form 3528-7  
1/73

STATE OF IDAHO  
DEPARTMENT OF WATER RESOURCES  
**WELL DRILLER'S REPORT**  
State law requires that this report be filed with the Director, Department of  
within 30 days after the completion or abandonment of the well

Location Corrected by IDWR To:

T09S R29E Sec. 18 NWSWSE

By: mciscell 2012-08-28

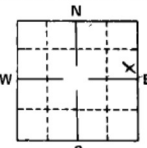
| <b>1. WELL OWNER</b><br>Name <u>Vern Duffin</u><br>Address <u>Aberdeen, Ida 83210</u><br>Owner's Permit No. _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | <b>7. WATER LEVEL</b><br>Static water level <u>85'</u> feet below land surface.<br>Flowing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No G.P.M. flow _____<br>Artesian closed-in pressure _____ p.s.i.<br>Controlled by: <input type="checkbox"/> Valve <input type="checkbox"/> Cap <input type="checkbox"/> Plug<br>Temperature _____ °F. Quality _____                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
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| <b>2. NATURE OF WORK</b><br><input checked="" type="checkbox"/> New well <input type="checkbox"/> Deepened <input type="checkbox"/> Replacement<br><input type="checkbox"/> Abandoned (describe method of abandoning) _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | <b>8. WELL TEST DATA</b> <u>Good</u><br><input type="checkbox"/> Pump <input type="checkbox"/> Bailer <input type="checkbox"/> Air <input type="checkbox"/> Other _____<br>Discharge G.P.M. _____ Pumping Level _____ Hours Pumped _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
| <b>3. PROPOSED USE</b><br><input checked="" type="checkbox"/> Domestic <input type="checkbox"/> Irrigation <input type="checkbox"/> Test <input type="checkbox"/> Municipal<br><input type="checkbox"/> Industrial <input type="checkbox"/> Stock <input type="checkbox"/> Waste Disposal or Injection<br><input type="checkbox"/> Other _____ (specify type) _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            | <b>9. LITHOLOGIC LOG</b> <table border="1"><thead><tr><th>Hole Diam.</th><th>Depth From</th><th>Depth To</th><th>Material</th><th>Water Yes</th><th>Water No</th></tr></thead><tbody><tr><td></td><td>0</td><td>3</td><td>Dirt</td><td></td><td></td></tr><tr><td></td><td>3</td><td>15</td><td>Sand Semi Solid</td><td></td><td></td></tr><tr><td></td><td>15</td><td>98</td><td>Sand Stone</td><td></td><td></td></tr><tr><td></td><td>98</td><td>125</td><td>Leva</td><td></td><td></td></tr><tr><td></td><td>125</td><td>134</td><td>Clay</td><td></td><td></td></tr><tr><td></td><td>134</td><td>145</td><td>Sandstone</td><td></td><td></td></tr><tr><td></td><td>145</td><td>178</td><td>Leva</td><td></td><td></td></tr><tr><td></td><td>178</td><td>250</td><td>Sandstone</td><td></td><td></td></tr></tbody></table> |                 | Hole Diam. | Depth From | Depth To | Material | Water Yes | Water No |  | 0 | 3 | Dirt |  |  |  | 3 | 15 | Sand Semi Solid |  |  |  | 15 | 98 | Sand Stone |  |  |  | 98 | 125 | Leva |  |  |  | 125 | 134 | Clay |  |  |  | 134 | 145 | Sandstone |  |  |  | 145 | 178 | Leva |  |  |  | 178 | 250 | Sandstone |  |  |
| Hole Diam.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Depth From | Depth To                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Material        | Water Yes  | Water No   |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0          | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Dirt            |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3          | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Sand Semi Solid |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 98         | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Leva            |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 125        | 134                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Clay            |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 134        | 145                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Sandstone       |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 145        | 178                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Leva            |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
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| <b>4. METHOD DRILLED</b><br><input checked="" type="checkbox"/> Rotary <input type="checkbox"/> Air <input type="checkbox"/> Hydraulic <input type="checkbox"/> Reverse rotary<br><input type="checkbox"/> Cable <input type="checkbox"/> Dug <input type="checkbox"/> Other _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            | <div style="text-align: center;"><b>RECEIVED</b><br/>FEB 22 1980<br/>Department of Water Resources<br/>Eastern District Office<br/><b>RECEIVED</b><br/>MAR 5 1980<br/>Department of Water Resources</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
| <b>5. WELL CONSTRUCTION</b><br>Casing schedule: <input checked="" type="checkbox"/> Steel <input type="checkbox"/> Concrete <input type="checkbox"/> Other _____<br>Thickness _____ inches Diameter _____ inches From _____ feet To _____ feet<br>_____ inches _____ inches _____ feet _____ feet<br>_____ inches _____ inches _____ feet _____ feet<br>_____ inches _____ inches _____ feet _____ feet<br>Was casing drive shoe used? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>Was a packer or seal used? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Perforated? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>How perforated? <input type="checkbox"/> Factory <input type="checkbox"/> Knife <input type="checkbox"/> Torch<br>Size of perforation _____ inches by _____ inches<br>Number _____ From _____ To _____<br>_____ perforations _____ feet _____ feet<br>_____ perforations _____ feet _____ feet<br>_____ perforations _____ feet _____ feet<br>Well screen installed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Manufacturer's name _____<br>Type _____ Model No. _____<br>Diameter _____ Slot size _____ Set from _____ feet to _____ feet<br>Diameter _____ Slot size _____ Set from _____ feet to _____ feet<br>Gravel packed? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Size of gravel _____<br>Placed from _____ feet to _____ feet<br>Surface seal depth <u>150'</u> Material used in seal: <input checked="" type="checkbox"/> Cement grout<br><input checked="" type="checkbox"/> Puddling clay <input type="checkbox"/> Well cuttings<br>Sealing procedure used: <input type="checkbox"/> Slurry pit <input type="checkbox"/> Temp. surface casing<br><input type="checkbox"/> Overbore to seal depth<br>Method of joining casing: <input type="checkbox"/> Threaded <input type="checkbox"/> Welded <input type="checkbox"/> Solvent<br><input type="checkbox"/> Cemented between strata<br>Describe access port <u>2" pipe well cap</u> |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |
| <b>6. LOCATION OF WELL</b><br>Sketch map location must agree with written location.<br><br>Subdivision Name _____<br>Lot No. _____ Block No. _____<br>County <u>Power</u><br><u>SE 1/4 NE 1/4 Sec. 22, T. 7 N, R. 31 E</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | <b>11. DRILLERS CERTIFICATION</b><br>I/We certify that all minimum well construction standards were<br>complied with at the time the rig was removed.<br>Firm Name <u>Paul Vollmer &amp; Son</u> Firm No. <u>67</u><br>Address <u>Box B Aberdeen, Ida</u> Date <u>3-12-79</u><br>Signed by (Firm Official) <u>Harry Vollmer</u><br>and<br>(Operator) <u>Harry Vollmer</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |            |            |          |          |           |          |  |   |   |      |  |  |  |   |    |                 |  |  |  |    |    |            |  |  |  |    |     |      |  |  |  |     |     |      |  |  |  |     |     |           |  |  |  |     |     |      |  |  |  |     |     |           |  |  |

Figure 1-4. Well log for Duffin 352857.



Clearwater Geosciences, LLP  
Ground Water Development and Exploration

Form 238-7  
11/97

DMD

IDAHO DEPARTMENT OF WATER RESOURCES  
WELL DRILLER'S REPORT

Office Use Only  
Inspected by \_\_\_\_\_  
Twp \_\_\_\_\_ Rge \_\_\_\_\_ Sec \_\_\_\_\_  
1/4 1/4 1/4  
Lat: \_\_\_\_\_ Long: \_\_\_\_\_

1. WELL TAG NO. D 0008780  
DRILLING PERMIT NO. 764323  
Other IDWR No. \_\_\_\_\_

2. OWNER:  
Name DIAMOND D FARMS  
Address P O BOX 204/3584 S LIBERTY LN  
City AMERICAN FALLS State ID Zip 83211

3. LOCATION OF WELL by legal description:

Sketch map location must agree with written location.

N  
W E S  
Twp. 9 North ☐ or South ☒  
Rge. 29 East ☒ or West ☐  
Sec. 18 NW 1/4 NE 1/4  
Gov't Lot \_\_\_\_\_ County POWER  
Lat: \_\_\_\_\_ Long: \_\_\_\_\_  
Address of Well Site MORGAN RD.  
City AM. FALLS  
(Give at least name of road + distance to road or landmark)

Lt. \_\_\_\_\_ Blk. \_\_\_\_\_ Sub. Name \_\_\_\_\_

4. USE:

☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation  
☐ Thermal ☐ Injection ☐ Other potato cellar

5. TYPE OF WORK check all that apply (Replacement etc.)

☒ New Well ☐ Modify ☐ Abandonment ☐ Other \_\_\_\_\_

6. DRILL METHOD

☐ Air Rotary ☒ Cable ☐ Mud Rotary ☐ Other \_\_\_\_\_

7. SEALING PROCEDURES

| SEAL/FILTER PACK<br>Material | AMOUNT |    | METHOD |
|------------------------------|--------|----|--------|
|                              | From   | To |        |
| cement                       | 19     | 5  | 10     |
| bentonite                    | 5      | 0  | 3      |

Was drive shoe used? ☐ Y ☒ N Shoe Depth(s) \_\_\_\_\_  
Was drive shoe seal tested? ☐ Y ☐ N How? \_\_\_\_\_

8. CASING/LINER:

| Diameter | From | To  | Gauge | Material | Casing                              | Liner                    | Welded                              | Threaded                 |
|----------|------|-----|-------|----------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|
| 65/8     | 2.0  | 195 | 250   | steel    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Length of Headpipe \_\_\_\_\_ Length of Tailpipe \_\_\_\_\_

9. PERFORATIONS/SCREENS

Perforations Method torch

Screens Screen Type \_\_\_\_\_

| From | To  | Slot Size | Number | Diameter | Material | Casing                              | Liner                    |
|------|-----|-----------|--------|----------|----------|-------------------------------------|--------------------------|
| 192  | 186 | 1/8       | 36     | 65/8     | steel    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

75 ft. below ground Artesian pressure \_\_\_\_\_ lb.  
Depth flow encountered \_\_\_\_\_ ft. Describe access port or  
control devices: remove well cap

11. WELL TESTS:

☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

| Yield gal./min. | Drawdown | Pumping Level | Time  |
|-----------------|----------|---------------|-------|
| 21              | 6 ft     | 81            | 4 hrs |

Water Temp. \_\_\_\_\_ Bottom hole temp. \_\_\_\_\_

Water Quality test or comments: \_\_\_\_\_

Depth first Water Encounter \_\_\_\_\_

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

| Bore Dia. | From | To  | Remarks: Lithology, Water Quality & Temperature             | Water |
|-----------|------|-----|-------------------------------------------------------------|-------|
| 10        | 0    | 2   | topsoil                                                     |       |
|           | 2    | 6   | gray sand                                                   |       |
|           | 6    | 29  | gravel & some sand                                          |       |
|           | 6    | 29  | sand & gravel                                               |       |
|           | 64   | 77  | gravel                                                      |       |
|           | 77   | 92  | brown clay                                                  |       |
|           | 92   | 146 | brown sandy clay                                            |       |
|           | 146  | 151 | brown sandstone & gravel                                    |       |
|           | 151  | 158 | brown sandy clay                                            |       |
|           | 158  | 171 | gray clay                                                   |       |
|           | 171  | 175 | brown clay                                                  |       |
|           | 175  | 184 | brown sandy clay                                            |       |
|           | 184  | 193 | cemented gravel                                             | x     |
|           | 193  | 196 | brown clay                                                  |       |
|           |      |     | put some gravel in bottom of well to hold sand from pumping |       |

RECEIVED

JUN 15 2000

Department of Water Resources  
Eastern Region

Completed Depth 193 (Measurable)

Date: Started 5-9-2000 Completed 5-15-2000

13. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name COUCH WELL DRILLING INC No. 161

Firm Official \_\_\_\_\_ Date 5-21-2000

and

Driller or Operator \_\_\_\_\_

(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

Figure 1-5. Well log for Diamond D.



# **EXPERT REPORT ON MODELING ANALYSIS ASSOCIATED WITH LCSC ENTERPRISES LLC TRANSFER APPLICATIONS**

In Support of Transfer Application  
Nos. 84488 and 84490

Prepared for:  
LCSC Enterprises LLC  
April 30, 2025

The technical material in this report was prepared by or under the supervision and direction of the undersigned, whose seal as a Professional Geologist is affixed below.



The following members of the Clearwater Geosciences, LLP staff contributed to the preparation of this report.

Thomas R. Wood, Ph.D., PG – Principal-in-Charge  
Hai Huang, Ph.D. – Principal Ground water Modeler

The following outside consultants also contributed to the preparation of this report.  
Jason Helms, P.E. – ETRAN Specialist



# 1. Overview of Transfer Applications

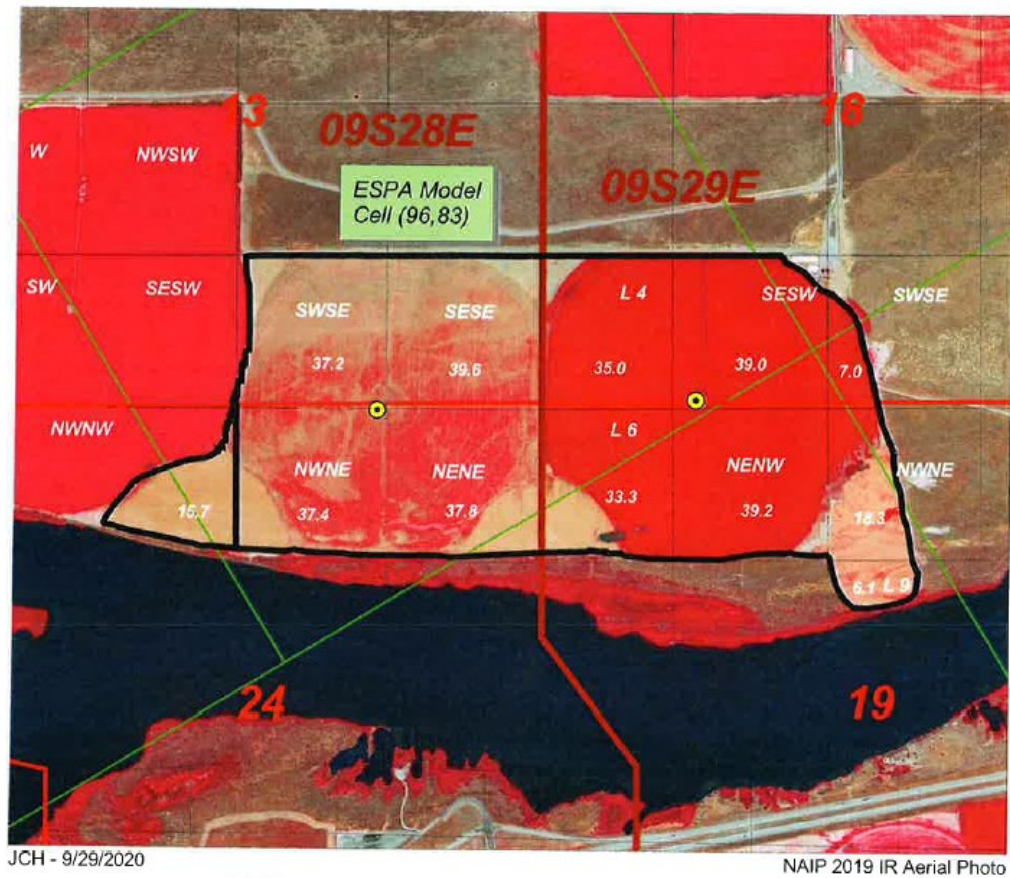
On October 13, 2020, LCSC Enterprises, LLC (“LCSC” or “Applicant”) submitted two applications for water right transfer which were administratively assigned the identification numbers of 84488 and 84490 (hereinafter individually “84448” or “84490” or collectively the “transfer applications”). The transfer applications both seek to change the place of use (“POU”) and point of diversion (“POD”) for water right 35-14041 ( “35-14041”), which was decreed on January 31, 2002, in the Snake River Basin Adjudication by the District Court for the Fifth Judicial District of the State of Idaho.

As currently described on the records of the Idaho Department of Water Resources (“IDWR” or “Department”), 35-14041 contains the following elements:

|                            |                                                              |
|----------------------------|--------------------------------------------------------------|
| <u>Current Owner:</u>      | LCSC Enterprises, LLC                                        |
| <u>Priority Date:</u>      | October 16, 1974                                             |
| <u>Source:</u>             | Ground water                                                 |
| <u>Point of Diversion:</u> | NWSE, Sec. 12, Township 01S., Range 32E.<br>(Bingham County) |
| <u>Nature of Use:</u>      | Irrigation                                                   |
| <u>Season of Use:</u>      | 04/01 to 11/01                                               |
| <u>Diversion Rate:</u>     | 3.18 cfs                                                     |
| <u>Diversion Volume:</u>   | 1290 acre-feet per year                                      |
| <u>Irrigated Acres:</u>    | 322.5 acres                                                  |

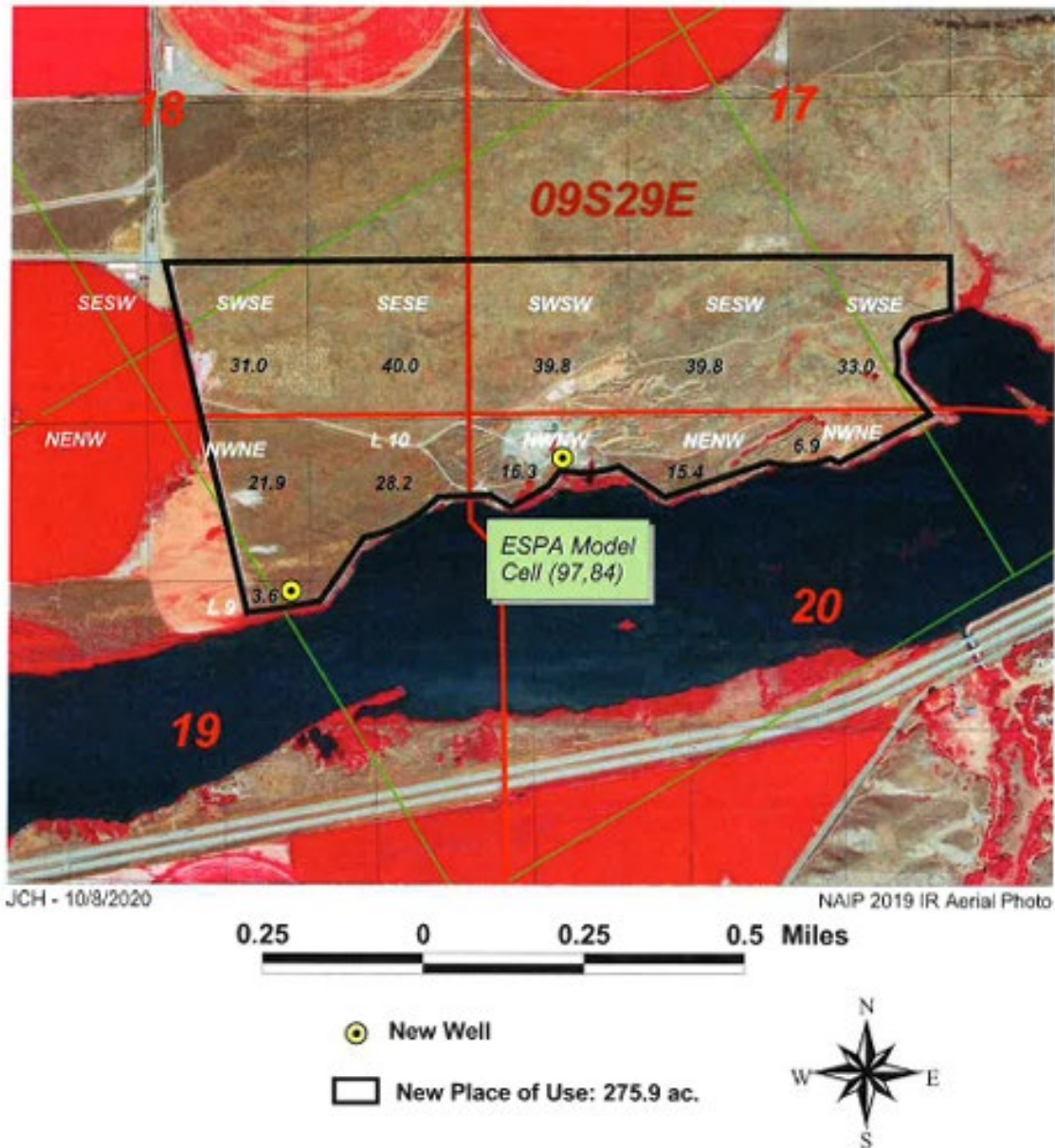
84488 proposes to change the POD for a 46.6-acre portion of 35-14041 to be diverted out of two existing wells located on LCSC property (the NWNWNE, Sec. 24, Township 09S., Range 28E. (Power County) and the SWSESW, Sec. 18, Township 09S., Range 29E. (Power County)). These existing wells are already authorized to divert two existing water rights (water right nos. 35-7740 and 35-2824).

84488 also proposes to change the POU of the 46.6-acre portion of 35-14041 to be combined with the current POU of water right nos. 35-7740 and 35-2824 for a total POU of 345.6 acres. The locations of the PODs and POU proposed by 84488 are depicted on the following map submitted in the application for 84488:

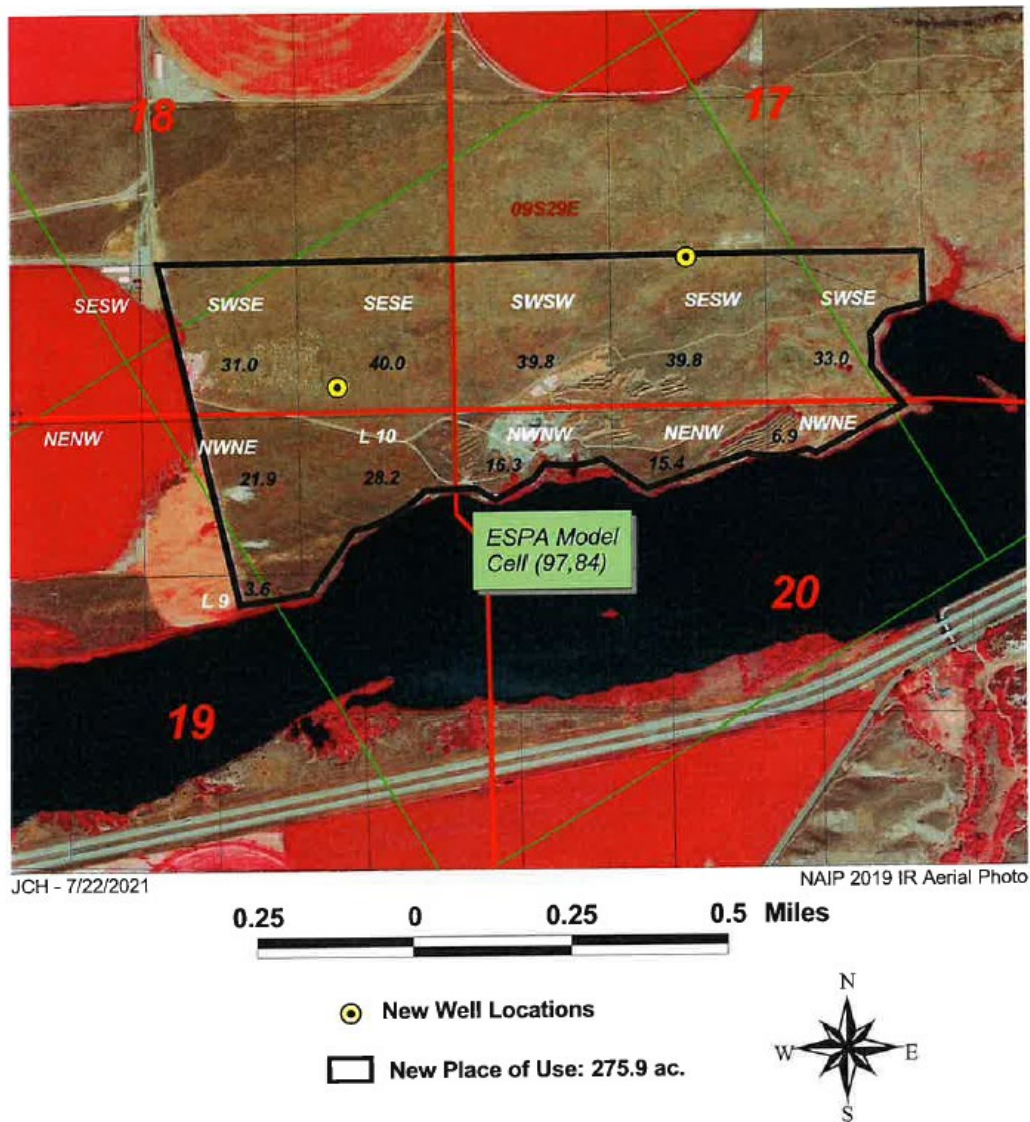


- Existing Authorized Wells
- 35-7740 (8/15/1977) 3.66 cfs, 1,160.0 afa, 290.0 ac.
  - 35-2824 (8/28/1961) 0.16 cfs, 32.7 afa, 9.0 ac.
- add
- 35-14041 (10/16/1974) 0.46 cfs, 186.4 afa, 46.6 ac.
- Total Irrigation 345.6 Acres

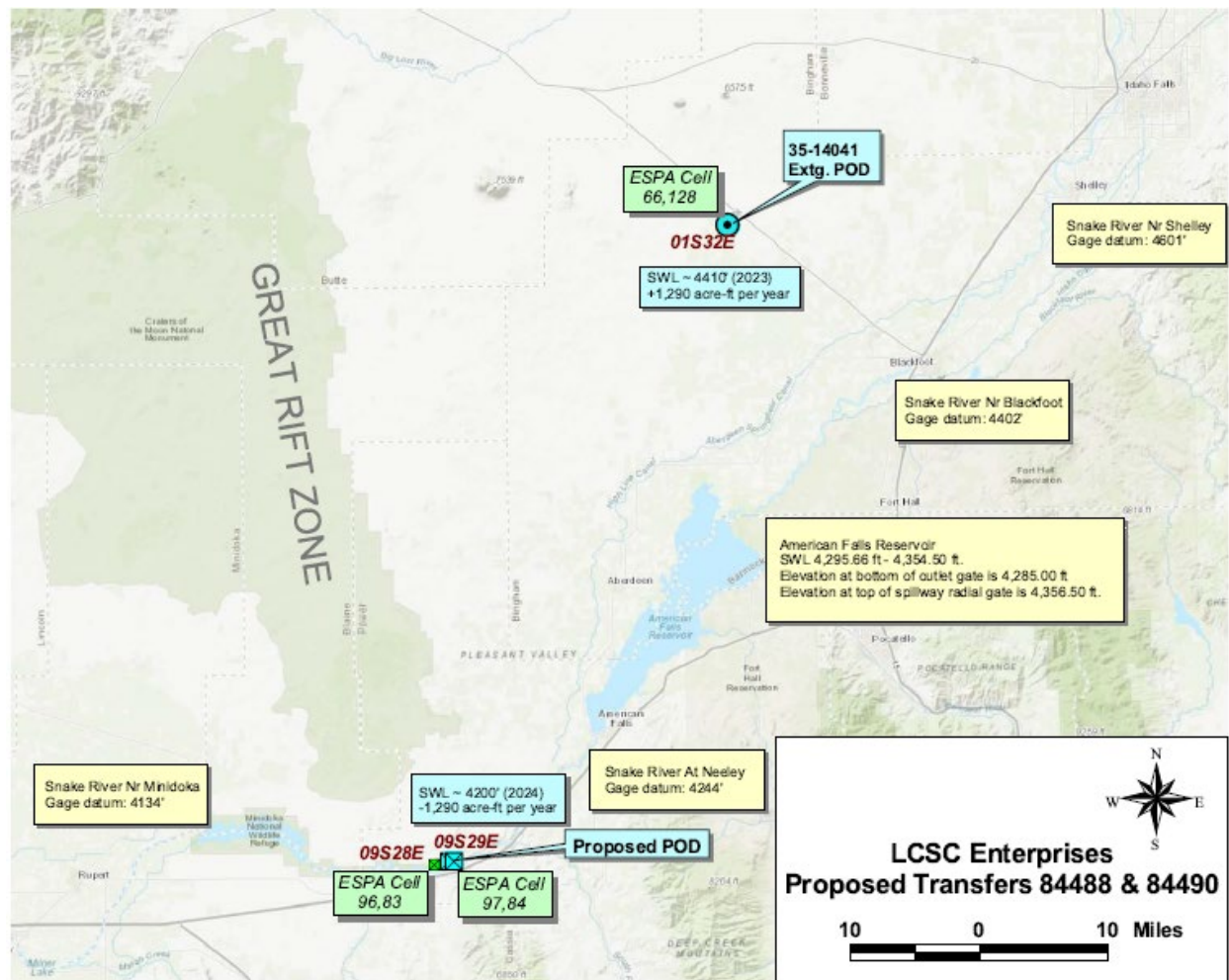
84490 proposes to change the POD of the entire remaining 275.9-acre portion of 35-14041 to be diverted out of two proposed new wells located on LCSC property. The original proposed new well locations were depicted on the following map submitted with the original application for 84490:



84490 was later amended to move the PODs further north than the originally proposed well locations further away from the Snake River to locations located in the NWSESW, Sec. 17, Township 09S., Range 29E. (Power County) and the SWSESE, Sec. 18, Township 09S., Range 29E. (Power County). The locations of the updated proposed PODs and the 275.9-acre POU now proposed by 84490 are depicted on the following map submitted with the amendment of 84490:



A map showing the overall changes proposed by the transfer applications is set forth here:



The transfer applications do not propose to increase the rate, volume, or authorized irrigated acres currently described for 35-14041. The entirety of 35-14041 was leased annually to the Idaho Water Supply Bank since expiration of a CREP contract which was active from 2007 through 2022.

In its review of applications for transfer, IDWR utilizes an Eastern Snake River Plan Aquifer (ESPA) Model Transfer Spreadsheet (ETRAN). Included with the transfer applications submitted in October of 2020 were the necessary analyses utilizing ETRAN3.2 (a simplified version of the fully populated ESPAM2.1 model). Submission of modeling was required at the time and remains required under current IDWR policies and procedures.<sup>1</sup> Modeling analysis

<sup>1</sup> Administrator's Memorandum, Transfer Processing No. 24, October 1, 2024, at 16 (the "Transfer Memo") (Ground Water Points of Diversion in the Eastern Snake Plain Aquifer (ESPA). Consistent with the application form, an application proposing to change the point of diversion for a ground water right within the model boundary of the ESPA must include information about the effect of the proposed change on the Snake River. Guidance for modeling and quantifying the effects of ground water transfers on the Snake River is set forth in separate resource documents. Guidance for evaluating the effects of such transfers is set forth in a separate administrative memo.).



addresses the potential for injury to other water rights as described in Idaho Code § 42-222. *See, e.g., Transfer Memo* at 15 (“Injury is generally understood as a reduction in the quantity of water available to supply existing water rights.”).

The analyses submitted with the transfer applications demonstrated that the transfer applications were below Snake River reach impact limits for approval of permanent water right transfers in the ESPA based on IDWR transfer application processing policies and procedures under each of the three “mitigation checks” for steady state analysis and two “mitigation checks” for transient state analysis. These mitigation checks are depicted on IDWR’s “mitigation analysis tool” spreadsheet set forth below and summarized below within associated guidance memoranda as follows:

|                          |                                           |
|--------------------------|-------------------------------------------|
| Steady State Analysis    | Mitigation Check 1 - > 10% of Historical: |
|                          | Mitigation Check 2: > 2 AF/T:             |
|                          | Mitigation Check 3 - >10% of Total:       |
|                          | Mitigation Required?:                     |
|                          | Mitigation Vol. Req'd (ac-ft):            |
| Transient State Analysis | Mitigation Check 1 - > 10% of Historical: |
|                          | Mitigation Check 2: > 2.01 AF/T:          |
|                          | Mitigation Required?:                     |
|                          | Mitigation Vol. Req'd (ac-ft):            |

8.7.1. Steady State Analysis: Depletions to the Snake River require adjustment or mitigation when all three steady state conditions below occur for any reach:

- ***Net increased depletion caused by the transfer is greater than 10% of the historical depletion volume.***
- ***Depletion increases are greater than 2 acre-feet/trimester.***
- ***The depletion in a specific reach is greater than 10% of the total depletion to all reaches.***

For those reaches where all three conditions occur, the increase in depletion

volume must be fully mitigated. It is not acceptable for the applicant to mitigate only enough to fall below one of the criteria in the steady state.

8.7.2. Transient State Analysis: Depletions to the Snake River require adjustment or mitigation when both of the two conditions below occur for any reach:

- ***Net increased depletion caused by the transfer is greater than 10% of the historical depletion volume.***
- ***Depletion increases are greater than 2 acre-feet/trimester.***

For those reaches where both conditions occur, the increase in depletion volume must be fully mitigated. It is not acceptable for the applicant to mitigate only enough to fall below one of the two criteria in the transient state.



*Use of the ESPA Model Transfer Spreadsheet (ETRAN) & Mitigation Analysis Spreadsheet for Water Right Transfers in the Eastern Snake Plain Aquifer, October 2016, at 13-14 (available at <https://idwr.idaho.gov/wp-content/uploads/sites/2/forms/waterrightsforms/Use-of-ESPA-Modeling-Spreadsheet-for-WR-Transfers-in-ESPA.pdf>). Notably, IDWR also continually tracks the cumulative impacts of approved transfers approved since January 1, 2012, on the various Snake River reaches, with its most recent update through September 30, 2024. See <https://idwr.idaho.gov/wp-content/uploads/sites/2/water-rights/ESPAXferMemo2024final.pdf>.*

The transfer applications satisfied all modeling mitigation checks described above. As part of the ETRAN modeling analysis, the Department's historic policy of allowing the combination of the Near Blackfoot to Neeley and Neeley to Minidoka reaches of the Snake River was utilized. The aquifer credits (Snake River gains including spring flows into American Falls Reservoir) generated in the Near Blackfoot to Neeley reach because of the non-use of 35-14041 are physically captured within American Falls Reservoir which is deliberately operated to maintain the river stage elevation at Lake Walcott below exactly where the increased impacts resulting from the transfer are calculated to occur. The physical operation of the American Falls Dam and Reservoir directly delivers reach gains from the Near Blackfoot to Neeley reach resulting from the non-use of 35-14041 at the original POD. According to the United States (Bureau of Reclamation):

During typical water years, Lake Walcott is maintained close to full to optimize power generation at the Minidoka Dam powerplant. During the summer months, the amount of water released from American Falls Reservoir (which enters Lake Walcott) and from Lake Walcott are set to maintain a fairly constant pool level. There are two canals that divert directly from Lake Walcott. Their headworks are included in the Minidoka Dam superstructure. During the winter months, the reservoir is maintained slightly below full and maintained at a constant level.

(United States, 2019).

The transfer applications were protested by the A&B Irrigation District, American Falls Reservoir District #2, Burley Irrigation District, Milner Irrigation District, Minidoka Irrigation District, North Side Canal Company, and Twin Falls Canal Company (collectively the "Coalition"), and the Idaho Power Company ("IPCO").

Following submittal of the transfer applications in 2020, and after the transfer applications were protested by the Coalition and IPCO, IDWR subsequently released ETRAN3.4 (a simplified version of the ESPAM 2.2 model) in July of 2021. Anticipating that the Department would require use of ETRAN3.4 to analyze the transfer applications in the contested case on the transfer applications, the Applicant elected to repeat its modeling analysis with the new transfer tool version. Results using ETRAN3.4 showed the combined reach impacts no longer fell below ESPA mitigation requirements and the impacts in the Neeley to Minidoka reach of the Snake River increased to over 300% of the impacts calculated by ESPAM 2.1. The purpose of this report is to analyze both



ESPAM models and the substantial changes in modeling outputs between the versions and conclude which model version should be utilized for purposes of the transfer applications.

## **2. Comparison of ESPAM to ETRAN Results**

ETRAN was designed for individuals with little or no experience using ground water modeling software. The ETRAN3.4 spreadsheet acts as a user interface for a supposition model (Sukow, 2021a), i.e., the computational engine of ETRAN, which is a simplified version of the fully populated ESPAM2.2 (Sukow, 2021b). The fully populated version of the model represents all components of aquifer stress, including recharge on irrigated and non-irrigated lands, ground water pumping for agricultural and municipal purposes, tributary underflow, perched river/canal seepage, spring discharges, river gains from and/or losses to the ESPA, etc. The superposition version of the model is a simplified version that can be used to predict the response of a single component of the water stress. This approach simplifies analysis and presentation of results for simulations involving managed recharge, curtailment of ground water pumping, transfer of water right diversion locations, and mitigation activities (Sukow, 2021a). Essentially, the ETRAN Excel workbook allows the user to quickly review the calculated effects of the transfer proposal on reach gains and losses along the Snake River (IDWR, 2025a).

We performed a side-by-side comparison of the output of the ESPAM2.2 Model to the results generated by ETRAN V3.4. This was done mainly to understand the validity of the ETRAN V3.4 predictions. Both the ESPAM2.2 and ETRAN 3.4 simulations were carried out for a proposed transfer scenario of 1103.6 acre-ft/year (the amount of water proposed to be moved under 84490 only). ESPAM2.2 was run multiple times as follows: (1) the base case (i.e., with all existing aquifer sources and sinks based on averaged 2009 through 2018 water year budgets (Sukow, 2021a)); (2) pumping at the existing water right location (i.e., equivalent to the effect of “**From Well**” in ETRAN); (3) pumping at the transfer target location (i.e., equivalent to the effect of “**To Well**” in ETRAN) and (4) pumping at the transfer target location while shutting off the pumping at the existing water right location (i.e. equivalent to the “**Net Transfer Effect**” in ETRAN).

Table 1 provides the detailed comparison of results for the simulated long-term, steady-state reach depletions associated with the transfer applications from ESPAM2.2 and ETRAN3.4, respectively. By comparing results from the various cases (i.e. finding the differences) we were able to arrive at the conclusion that the results are, in general, comparable to each other for most reaches along the Snake River, with differences typically less than 1-10%, except for a few extreme outliers, mostly for reaches below Minidoka. The differences between the ESPAM2.2 and ETRAN3.4 predictions are caused primarily by the simplifications of the fully populated ESPAM2.2 model.



It is worth noting that the differences of simulation results between ESPAM2.2 and ETRAN3.4 become larger when the applied ground water pumping location is closer to the Snake River. Therefore, caution is needed when applying the ETRAN model for assessing the effects of ground water pumping at locations near the Snake River.

Nevertheless, both ETRAN3.4 and ESPAM2.2 predicted excessive depletion of the Near Neeley to Minidoka Reach that needs to be mitigated, which is contrary to the prediction result of ETRAN3.2, which is based on the simplifications of the earlier version of ESPAM2.1 model (IDWR, 2013).

The contradictory predictive results of ETRAN3.2 and ETRAN3.4 motivated us to examine the details of the model input files and changes of model parameters between the fully populated ESPAM2.2 and ESPAM2.1 models. We focused on the Near Neeley to Minidoka Reach because it drives the issue for the transfer applications. The key model parameter that determines the aquifer-river water exchange rate is the parameter labeled as “Riverbed Conductance.” The calibrated Riverbed Conductance of the Near Neeley to Minidoka Reach is **1625.975 ft<sup>2</sup>/day in ESPAM2.1** (IDWR, 2013) and **5965.499 ft<sup>2</sup>/day in ESPAM2.2** (see Sukow, 2021b), respectively. Riverbed Conductance in this reach was increased by a factor of nearly **3.7**, implying that for any given amount of ground water level decrease underneath the reach caused by ground water pumping, the simulated depletions for Near Neeley to Minidoka Reach by ESPAM2.2 and ETRAN3.4 will be increased by a factor of ~3.7. This explains why ETRAN3.2 and ETRAN3.4 were producing contradictory results, as described in the previous section.

The general notion, for which we agree, is that the ESPAM2.2 is a more robust regional-scale model than ESPAM2.1 due to many improvements made during the development and calibration processes of ESPAM 2.2, such as more spring discharge and reach gain/loss measurements as calibration targets, more accurate riverbed elevations and so on (Sukow, 2021b).

However, neither ESPAM2.1 nor ESPAM2.2 are very reliable for evaluating impacts from the transfer applications along the Near Neeley to Minidoka Reach. Of the two versions, it is our expert opinion, based on the lower R<sup>2</sup> value, that ESPAM2.1 represents the potential impacts to this particular river reach more reliably.

The Near Neeley to Minidoka Reach abuts the target transfer locations and the magnitude of Riverbed Conductance greatly impacts the transfer applications. Therefore, the significant increase of the Riverbed Conductance for this reach should have strong technical justification, for example, better matches to the measured reach gains and(or) losses for the Near Neeley to Minidoka Reach. However, this is not the case.

Figure 1 shows the side-by-side comparison of calibration results between ESPAM2.1 (IDWR, 2013) and ESPAM2.2 (Sukow, 2021b) for the Near Neeley to Minidoka Reach. It is obvious that both ESPAM2.1 and ESPAM2.2 models *failed to match the measured reach gains and losses* to any reasonably satisfactory degree. The scatter plots of the modeled vs. measured values of both models collapsed to a nearly horizontal line, instead of randomly scattering around the 1:1



“perfect matching” line, clearly indicating that the models are not adequately representing the complex river-aquifer interaction nature for the Near Neeley to Minidoka Reach.

The  $R^2$  values of both models provide a quantitative measure of the “goodness of fit”, that is, how well a model fits a set of observations. An  $R^2$  of 1 means the model fits the measurements perfectly. An  $R^2$  of 0 means the worst possible model fits to the measured data. Both ESPAM2.1 and 2.2 have very small  $R^2$  values for the Near Neeley to Minidoka Reach, 0.0147 and 0.0079, respectively, strongly indicating **very poor fittings** to the data by both models for this reach. In fact, the smaller  $R^2$  value of ESPAM2.2 model suggests an even worse match to the measured data at Near Neeley to Minidoka Reach, compared with ESPAM2.1. It is also critical to understand that for most other reaches and springs along the Snake River, both the ESPAM2.1 and ESPAM2.2 models achieved much more satisfactory fittings to measured reach gains and losses.

The IDWR modeling report for ESPAM 2.2 lists **5000 ft<sup>2</sup>/day** as the “preferred” riverbed conductance value of the Near Neeley to Minidoka Reach (see Table 1 in Sukow, 2021b) during the model calibrations, without providing technical justification about such choice. Thus, during the model calibration process, the automated parameter estimation software PEST used by the ESPAM model developers to calibrate the model would preferentially set the model parameters to its preferred value unless the measured data informs the PEST software to vary the model parameters from the preferred values. The fact that the final calibrated Riverbed Conductance of **5965.499 ft<sup>2</sup>/day** for the Near Neeley to Minidoka Reach is very close to the preferred value of **5000 ft<sup>2</sup>/day** clearly indicates that the measured reach gains of Near Neeley to Minidoka Reach were not weighted appropriately to influence the parameter adjustments during model calibration using PEST software.

Justification of 5000 ft<sup>2</sup>/day as the preferred value is not provided in any IDWR-generated document. This is especially concerning. How was this value selected? Where the goodness-of-fit, as measured by the  $R^2$  value, was reduced for this reach, why is it still preferred? Overall, the selection of the Riverbed Conductance value appears to be arbitrary because there is no technical justification for the selected value for ESPAM2.2.

IDWR states on their webpage (<https://idwr.idaho.gov/water-rights/transfers/resources/>)

*The calibration of ESPAM Version 2.2 incorporated groundwater flow modeling improvements to the representation of aquifer interaction with the Snake River in the Heise to Shelley, near Blackfoot to Neeley, and Neeley to Minidoka reaches, and the extension of the calibration period to include water years 2009 through 2018. ESPAM Version 2.2 is **accepted as the best available science**.*

(emphasis added). This statement, authored by IDWR, may be valid for the entire upgraded model ESPAM2.2 when taken as a whole. However, ESPAM2.2 is not the best available science for the Near Neeley to Minidoka Reach of the river. The ESPAM2.2 model developers realized this short coming and explicitly recommended “Research groundwater-surface water interaction



*in the Neeley to Minidoka reach. Consider whether the model representation of uniform riverbed conductance within this reach is appropriate and whether additional subreach targets could be developed for this reach to support calibration of subreach conductance values” (see Sukow, 2021b, page 179).*

Because of the apparent inadequacy of the ESPAM2.2 and ETRAN3.4 for representing the complex river-aquifer interaction nature for the Neeley to Minidoka Reach, the predicted river depletion for the Neeley to Minidoka Reach by these models is not robust or reliable, particularly when the proposed transfer pumping locations are near this river reach.

### **3. Implications of Site Characterization on Modeling**

The modeling discussion in the preceding sections provide an analysis of the impact from the transfer applications based upon regional understandings of aquifer-river relationships. ESPAM employs a one mile by one mile grid in a single layer, which is designed to provide regional and sub-regional understandings of ground water flow in the Eastern Snake River Plain Aquifer. As the area of consideration becomes smaller, local characteristics must be considered by any simulation of ground water flow. ESPAM is not capable of the refinement necessary to understand ground water behavior at the local scale. For instance, in this transfer, the “to” locations are adjacent to the active model domain boundary and share the cells with the Snake River channel. In this section we will describe local hydrologic characteristics of the site defined by field work conducted specifically for the transfer applications.

Clearwater Geosciences conducted a field investigation in 2024 and the details of the work are presented in a final report previously submitted to the parties (Clearwater, 2024). The study provides site specific data from two new monitoring wells and water level data collected over a five-month period from the monitoring wells and an active irrigation well that is already authorized to divert two existing water rights (water right nos. 35-7740 and 35-2824) and is one of the proposed PODs for 84488 and is directly adjacent to the proposed POU for 84490. Of particular interest for these transfers is the relationship between proposed pumping of the regional Eastern Snake River Plain Aquifer and the nearby Snake River. The study was designed to describe the local hydrogeology of the subsurface, and to evaluate how the proposed new wells described in the application for 84490 might impact water in the Snake River. A secondary purpose of the investigation was to determine if a well can be constructed in such a way as to fully ensure that water pumped from the well will not be directly connected to the Snake River (i.e., a deep completion that pulls water from depth in the aquifer).

For the LCSC site characterization project, two 2-inch diameter, 43 ft deep monitoring wells were drilled. One well, MW-1, was drilled 90 ft west of the existing irrigation well. The other



well, MW-2, was drilled 500 ft north of the Snake River to monitor if the shallow surface water near the river was impacted by pumping of the deep aquifer during the irrigation season. The active irrigation well (352874) water levels were also monitored. Well 352874 has a completed depth of 535 ft and it is open to the regional aquifer from 256 to 535 ft. A clay rich sequence extends from 40 to 245 ft. The top of the regional Snake River Basalt is at a depth of 245 ft. Water levels were monitored continuously in the three wells for 5 months during the 2024 irrigation season. Water levels in both monitoring wells showed no relationship to fluctuating water levels in the deep irrigation well (water level declines during pumping of the irrigation well were greater than 35 ft). During the irrigation season the pump was on for long periods of time dropping the water level in the well. No corresponding decline in water levels were observed in either MW-1 or MW-2. This indicates significant isolation of the shallow aquifer (hydraulically connected with the Snake River) from the deep aquifer. It also suggests that pumping of the deep aquifer near the river does not cause change ongoing local reach-gain relationships near the LCSC farmland.

This LCSC farm location has been subject to erosion during flooding, for instance, the catastrophic draining of ancient Lake Bonneville eroded deep channels in the Portneuf and Snake River drainages. Backwater flooding of this area deposited tens of feet of fine-grained sediments when the Snake River was dammed by lava flows. The Raft Formation (45% clay, 15% sandy clay and 40% sand) was formed in a lake caused by damming of the ancestral Snake River. Houser (1992) states that the lava flow that dammed the Snake River may have been near the mouth of the Raft River, which is about 6 miles downstream of the LCSC farm. The local geologic history has generated a complex geologic sequence beneath this property, which are not (and cannot be) incorporated into the single layer, one-mile by one-mile grid cell resolution contained in ESPAM models.

The LCSC study illuminated the complexity of the local hydrogeology. In this location the one mile by one mile and single layer grid of the ESPAM is not adequate. The study also demonstrated that new wells planned for 84490 can be constructed without directly impacting flows the Snake River.

## **4. Discussion**

The previous sections of this report identify material concerns associated with using ETRAN3.4 and ESPAM2.2 to evaluate the impacts of the transfer applications. As part of our analysis, we have reviewed the expert reports presented by the protestants prepared by LRE Water (2021) and Idaho Power (Schreuder and Blew, 2021). The consultants used different versions of the ETRAN models developed by IDWR (IDWR, 2016) to calculate the impacts of planned transfers upon gaining and losing river reaches but made the same observation—the ESPAM models (one-mile by one-mile grid resolution) are too coarse to provide reliable evaluation of the impact of near-river pumping. We agree with these expert opinions. The expert reports go on to criticize the blind applications of the ESPAM model for local-scale, site specific studies. We agree with these expert opinions as well.



After careful reviews of both expert reports, calculation methods used, all relevant ESPAM modeling reports, driller logs near the LCSC proposed well locations, and our hydrogeological characterization effort, we conclude that calculations presented in the two expert reports, are unreliable because they do not represent the local site geological/hydrogeological conditions.

ESPAM is a 2-D model, i.e., it has one layer, thus in the context of the model, the well construction is not considered. Conceptually, in ESPAM, water is pulled from a grid cell one mile on a side from the entire thickness of the aquifer. In a similar manner, the river penetrates the entire thickness of the grid cell. Obviously, the Snake River does not fully penetrate the model cell. If modeled correctly with a 3-D model, we could show attenuation of river leakage with depth because the river only penetrates a few tens of feet into the aquifer and the wells draw from depth. Generally,  $K$  (hydraulic conductivity) horizontal is about ten times greater than  $K$  vertical. We know that a thick, low permeability layer exists at this site, limiting communication in a vertical direction in the upper 245 ft of the local aquifer. This anisotropy pulls water preferentially in a horizontal direction. None of this can be represented in ESPAM at the scale of relevance for the transfer applications.

The LRE report on page 10 devotes a section to perched well impacts. The case for perched water is difficult to support with the available data. However, during pumping of the deep irrigation well, perched conditions may have existed. If there is perched water at this location it supports a position for complete isolation of surface water from the regional aquifer. If the Snake River is perched in this area, then pumping of the regional aquifer will have no impact locally on the adjacent Snake River.

For the transfer applications, it is obvious that any blind application of ETRAN/ESPAM models will lead to unreliable and unfavorable predicted impacts. While IDWR policies describe the need of using ETRAN for water right transfer assessments, the models are more appropriate in evaluating regional, broad-scale responses to changes of regional aquifer stresses (Sukow, 2021b, page 177),

*“...user should avoid the temptation to model localized phenomena, such as the impact of a single well on a specific spring”.*

Realizing such model limitations, IDWR (2016, page 2) also explicitly states in its ETRAN User Guide,

*“This document is a general resource, and it will not prevent IDWR from allowing variances in sound analysis methodology on a case-specific basis”.*

It is our expert opinion that the application of ESPAM 2.2 to the transfer applications specific to this matter are not appropriate for evaluating injury to water rights because ESPAM2.2 is less able to match Riverbed Conductance along this reach of the river than ESPAM2.1. If any ESPAM should be used to evaluate the transfer applications, it is ESPAM2.1. This is because the particular component of ESPAM2.2 critical to the proper evaluation of the transfer



applications, Riverbed Conductance, is not the best available science for evaluation of the transfer applications.

Further, the large grid cells found in ESPAM cannot honor or supersede important local data obtained for the transfer applications. Grid refinement and multiple layers in the model near the target reach of the river would surely improve predictions of impact, but in any event, the data obtained during the previously conducted pump test on the LCSC property must be considered the best available science and information by IDWR in this contested case because it is site and case specific.

## **5. Conclusions**

It is our expert opinion that:

1. ESPAM is not capable of the refinement necessary to understand ground water behavior at the local scale.
2. Site specific data is the best available science and information for evaluating the transfer applications. Clearwater Geosciences conducted a field investigation in 2024, and the details of the work are presented in a final report previously submitted to the parties (Clearwater, 2024). The study provides site specific data from two new monitoring wells and water level data collected over a five-month period from the monitoring wells and an active irrigation well that is already authorized to divert two existing water rights (water right nos. 35-7740 and 35-2824) and is one of the proposed PODs for 84488 and is directly adjacent to the proposed POU for 84490. Water levels in the shallow aquifer wells were not impacted by pumping of the irrigation well even though drops in head level of the lower aquifer was greater than 35 ft.
3. Based on the Clearwater Geosciences field work, isolation of the deep aquifer from the shallow aquifer was accomplished in Well 352874 with steel well casing extending from land surface to a depth of 256 ft, and a similar approach will be used by the Applicant for the new wells described in 84490 to fully ensure that pumping of the deep aquifer does not impact flows in the Snake River and injure other water users.
4. Pumping from the existing irrigation well (which has steel casing to a depth of 256 ft) of the 46.6-acre portion of 35-14041 under 84488 will not impact flows in the Snake River and therefore will not injure other water rights.
5. Pumping from the new irrigation wells with a steel casing to a depth of 256 feet for the 275.9-acre portion 35-14041 under 84490 will not impact flows in the Snake River and therefore will not injure other water rights.

In addition to the foregoing, and to the extent ESPAM is also considered for evaluation of injury to existing water rights in this matter, it is our expert opinion that:



6. The calibrated Riverbed Conductance of the Near Neeley to Minidoka Reach is **1625.975 ft<sup>2</sup>/day in ESPAM2.1** (IDWR, 2013) and **5965.499 ft<sup>2</sup>/day in ESPAM2.2** (see Sukow, 2021b), respectively. Riverbed Conductance in this reach was increased by a factor of nearly 3.7.
7. Change to the Riverbed Conductance parameter for the Neeley to Minidoka Reach in ESPAM2.2 resulted in a decrease in the goodness-of-fit for the Near Neeley to Minidoka Reach when compared to the goodness-of-fit in ESPAM2.1 for the same river reach. This is the most poorly calibrated section of the Snake River.
8. Modelers “preferred” a high Riverbed Conductance number for Near Neeley to Minidoka Reach during the calibration process of ESPAM2.2 without sufficient or scientifically supported justification for this change, suggesting that the change was arbitrary.
9. For the relevant reaches of the Snake River implicated by the transfer applications, ESPAM2.2 code is not the best available science. The ESPAM2.1 model should be utilized as the best available science because it provides a better fit to the data as evidenced by higher R<sup>2</sup> values.
10. Use of ESPAM2.1 for analysis of the transfer applications demonstrates that the transfer applications are below Snake River reach impact limits for approval of permanent water right transfers in the ESPA based on IDWR transfer application policies and procedures under each of three “mitigation checks” for steady state analysis and two “mitigation checks” for transient state analysis.
11. Utilizing ESPAM2.1, the transfer applications do not impact other reaches of the Snake River above the described mitigation thresholds.
12. Pumping from the transfer applications will not injure other water rights under ESPAM2.1 because the modeled outputs are below IDWR-established mitigation thresholds.

## 6. References

- Clearwater Geosciences, LLP, 2024, Expert Report on LCSC Enterprises LLC 2024 Field Activities, Prepared for LCSC Enterprises, LLC, November 4, 2024.
- Houser, B.B., 1992, Quaternary Stratigraphy of an area Northeast of American Falls Reservoir, Easter Snake River Plain, Idaho, Geological Society of America Memoir 179.
- IDWR, 2025, Quick Guide to the ESPA Modeling Tools, <https://idwr.idaho.gov/water-rights/transfers/resources/>, downloaded April 23, 2025.
- IDWR, 2016, Use of the ESPA Model Transfer Spreadsheet (ETRAN) & Mitigation Analysis spreadsheet for Water Right Transfers in the Eastern Snake Plain Aquifer
- IDWR, 2013, ENHANCED SNAKE PLAIN AQUIFER MODEL VERSION 2.1
- LRE Water, 2021, Expert Report on LCSC Transfer Applications Nos. 84488 and 84490, prepared for: The Surface Water Coalition July 16, 2021, 1604FLE01-21



Schreuder, W. and D. Blew, 2021, Expert Report on LCSC Transfers T84488 and T84990  
Sukow, 2021a, COMPARISON OF SUPERPOSITION MODEL WITH FULLY-  
POPULATED MODEL FOR EASTERN SNAKE PLAIN AQUIFER MODEL  
VERSION 2.2

Sukow, 2021b, MODEL CALIBRATION REPORT EASTERN SNAKE PLAIN AQUIFER  
MODEL VERSION 2.2

U.S. Department of the Interior Bureau of Reclamation Pacific Northwest Region Snake River  
Area Office PN FONSI #19-4: Environmental Assessment (Maintenance and  
Rehabilitation of Spillway and Dam Structures at American Falls Dam), Minidoka  
Project, Power County, Idaho May, 2019 (*available at*  
<https://www.usbr.gov/pn/programs/ea/Idaho/americanfalls/finalea.pdf>).



*Clearwater Geosciences, LLP*  
*Ground Water Development and Exploration*

Table 1. Comparison of ESPAM2.2 to ETRAN V3.4 results.

| Above Minidoka                                                        |                |                |                      |                       |                  | Below Minidoka |                |                |               |               |                |
|-----------------------------------------------------------------------|----------------|----------------|----------------------|-----------------------|------------------|----------------|----------------|----------------|---------------|---------------|----------------|
| <b>ESPAM2.2 -Base Case: Existing Conditions</b>                       | Ashton-Rexburg | Heise-Shelley  | Shelley-Nr Blackfoot | Nr. Blackfoot-Neelley | Neelley-Minidoka | Dev. Wbl. Buhi | Buhi-Kspr      | Kspr           | Kspr-Malad    | Malad         | Malad-Bancroft |
| River Loss (ft <sup>3</sup> /day)                                     | 42,231,360.00  | 64,740,070.00  | 64,310,700.00        | 3,097,673.00          | 1,148,008.00     | 23,783,820.00  | 18,829,690.00  | 53,492,630.00  | 8,436,079.00  | 0.00          | 29,684,270.00  |
| River Gain (ft <sup>3</sup> /day)                                     | 13,755,910.00  | 19,856,740.00  | 1,439,213.00         | 161,581,500.00        | 6,672,897.00     | 62,024,910.00  | 102,825,200.00 | 90,464,410.00  | 3,667,694.00  | 86,527,620.00 | 5,721,527.00   |
| Net River Gain-Existing (ft <sup>3</sup> /day)                        | -28,475,450.00 | -44,883,330.00 | -62,871,487.00       | 158,493,827.00        | 5,524,889.00     | 85,808,730.00  | 121,654,890.00 | 143,957,040.00 | 12,103,773.00 | 86,527,620.00 | 35,405,797.00  |
| Net River Gain-Existing (acre-ft/trimester)                           | -79,541.42     | -125,374.10    | -175,621.62          | 442,726.09            | 15,432.86        | 239,692.39     | 339,822.66     | 402,120.00     | 33,809.87     | 241,700.49    | 98,900.19      |
| <b>Effect of Pumping at Existing Water Right Location</b>             |                |                |                      |                       |                  |                |                |                |               |               |                |
| River Loss (ft <sup>3</sup> /day)                                     | 42,228,800.00  | 64,736,310.00  | 64,286,310.00        | 3,094,759.00          | 1,147,854.00     | 23,784,020.00  | 18,829,750.00  | 53,492,750.00  | 8,436,125.00  | 0.00          | 29,684,320.00  |
| River Gain (ft <sup>3</sup> /day)                                     | 13,756,570.00  | 19,858,330.00  | 1,441,607.00         | 161,679,600.00        | 6,674,011.00     | 62,026,040.00  | 102,826,200.00 | 90,465,040.00  | 3,667,817.00  | 86,528,160.00 | 5,721,543.00   |
| Net River Gain (ft <sup>3</sup> /day)                                 | -28,472,230.00 | -44,877,980.00 | -62,844,703.00       | 158,564,841.00        | 5,526,157.00     | 85,810,060.00  | 121,655,960.00 | 143,957,790.00 | 12,103,942.00 | 86,528,160.00 | 35,405,863.00  |
| Induced Reach Depletion (ft <sup>3</sup> /day)                        | 3,220.00       | 5,350.00       | 26,764.00            | 91,014.00             | 1,268.00         | 1,330.00       | 1,060.00       | 750.00         | 169.00        | 540.00        | 86.00          |
| ETRAM3.4 Simulated Reach Depletion (acre-ft/trimester)                | 8.9677         | 14.9753        | 74.8723              | 254.3389              | 3.5376           | 3.6937         | 2.9943         | 1.3644         | 1.2739        | 1.4557        | 0.1922         |
| ESPAM2.2 Simulated Reach Depletion (acre-ft/trimester)                | 8.9945         | 14.9443        | 74.8166              | 254.2324              | 3.5419           | 3.7151         | 2.9609         | 2.0950         | 0.4721        | 1.5084        | 0.1844         |
| Prediction error                                                      | -0.08%         | 0.21%          | 0.07%                | 0.04%                 | -0.12%           | -0.58%         | 1.13%          | -34.87%        | 169.85%       | -3.49%        | 4.24%          |
| <b>Effect of Pumping at Transfer Target Location</b>                  |                |                |                      |                       |                  |                |                |                |               |               |                |
| River Loss (ft <sup>3</sup> /day)                                     | 42,231,980.00  | 64,740,810.00  | 64,315,620.00        | 3,098,664.00          | 1,172,543.00     | 23,783,250.00  | 18,829,520.00  | 53,492,280.00  | 8,435,960.00  | 0.00          | 29,684,120.00  |
| River Gain (ft <sup>3</sup> /day)                                     | 13,756,750.00  | 19,856,390.00  | 1,438,763.00         | 161,568,100.00        | 6,606,691.00     | 62,021,660.00  | 102,822,300.00 | 90,462,810.00  | 3,667,347.00  | 86,526,130.00 | 5,721,479.00   |
| Net River Gain (ft <sup>3</sup> /day)                                 | -28,476,230.00 | -44,884,420.00 | -62,876,857.00       | 158,469,496.00        | 5,436,148.00     | 85,804,910.00  | 121,651,820.00 | 143,954,890.00 | 12,103,297.00 | 86,526,130.00 | 35,405,599.00  |
| Induced Reach Depletion (ft <sup>3</sup> /day)                        | 760.00         | 1,090.00       | 5,370.00             | 24,331.00             | 88,741.00        | 3,820.00       | 3,670.00       | 2,150.00       | 476.00        | 1,490.00      | 198.00         |
| ETRAM3.4 Simulated Reach Depletion (acre-ft/trimester)                | 1.6767         | 2.7332         | 14.6286              | 66.6834               | 250.9683         | 10.3011        | 8.3087         | 3.7740         | 3.5037        | 3.9603        | 0.5219         |
| ESPAM2.2 Simulated Reach Depletion (acre-ft/trimester)                | 2.1788         | 3.0447         | 15.0002              | 67.9646               | 247.8832         | 10.6705        | 8.5755         | 6.0057         | 1.3296        | 4.1821        | 0.5521         |
| Prediction error                                                      | -23.04%        | -10.23%        | -2.48%               | -1.89%                | 1.25%            | -3.46%         | -3.11%         | -37.16%        | 163.51%       | -4.85%        | -5.64%         |
| <b>Net Transfer Effect</b>                                            |                |                |                      |                       |                  |                |                |                |               |               |                |
| River Loss (ft <sup>3</sup> /day)                                     | 42,229,290.00  | 64,737,010.00  | 64,291,220.00        | 3,095,692.00          | 1,172,370.00     | 23,783,450.00  | 18,829,580.00  | 53,492,400.00  | 8,435,995.00  | 0.00          | 29,684,170.00  |
| River Gain (ft <sup>3</sup> /day)                                     | 13,756,440.00  | 19,858,030.00  | 1,441,160.00         | 161,656,100.00        | 6,609,796.00     | 62,022,770.00  | 102,823,300.00 | 90,463,230.00  | 3,667,467.00  | 86,526,660.00 | 5,721,496.00   |
| Net River Gain after transfer (ft <sup>3</sup> /day)                  | -28,472,850.00 | -44,878,980.00 | -62,850,060.00       | 158,560,408.00        | 5,437,396.00     | 85,806,220.00  | 121,652,880.00 | 143,955,630.00 | 12,103,462.00 | 86,526,660.00 | 35,405,686.00  |
| Transfer-Induced Net Change of Reach Depletion (ft <sup>3</sup> /day) | -2,600.00      | -4,350.00      | -21,427.00           | -66,581.00            | 87,493.00        | 2,510.00       | 2,610.00       | 1,410.00       | 311.00        | 900.00        | 131.00         |
| ETRAM3.4 Simulated Net Change of Reach Depletion (acre-ft/trimester)  | -7.3110        | -12.2421       | -60.2437             | -187.6555             | 247.4507         | 6.6074         | 5.3144         | 2.4096         | 2.2298        | 2.5046        | 0.3297         |
| ESPAM2.2 Simulated Net Change of Reach Depletion (acre-ft/trimester)  | -7.2627        | -12.1510       | -59.8528             | -185.9829             | 244.3971         | 7.0113         | 5.6146         | 3.9386         | 0.8687        | 2.6816        | 0.3659         |
| Prediction error                                                      | 0.67%          | 0.75%          | 0.65%                | 0.90%                 | 1.25%            | -5.76%         | -5.35%         | -38.82%        | 156.67%       | -8.60%        | -8.90%         |

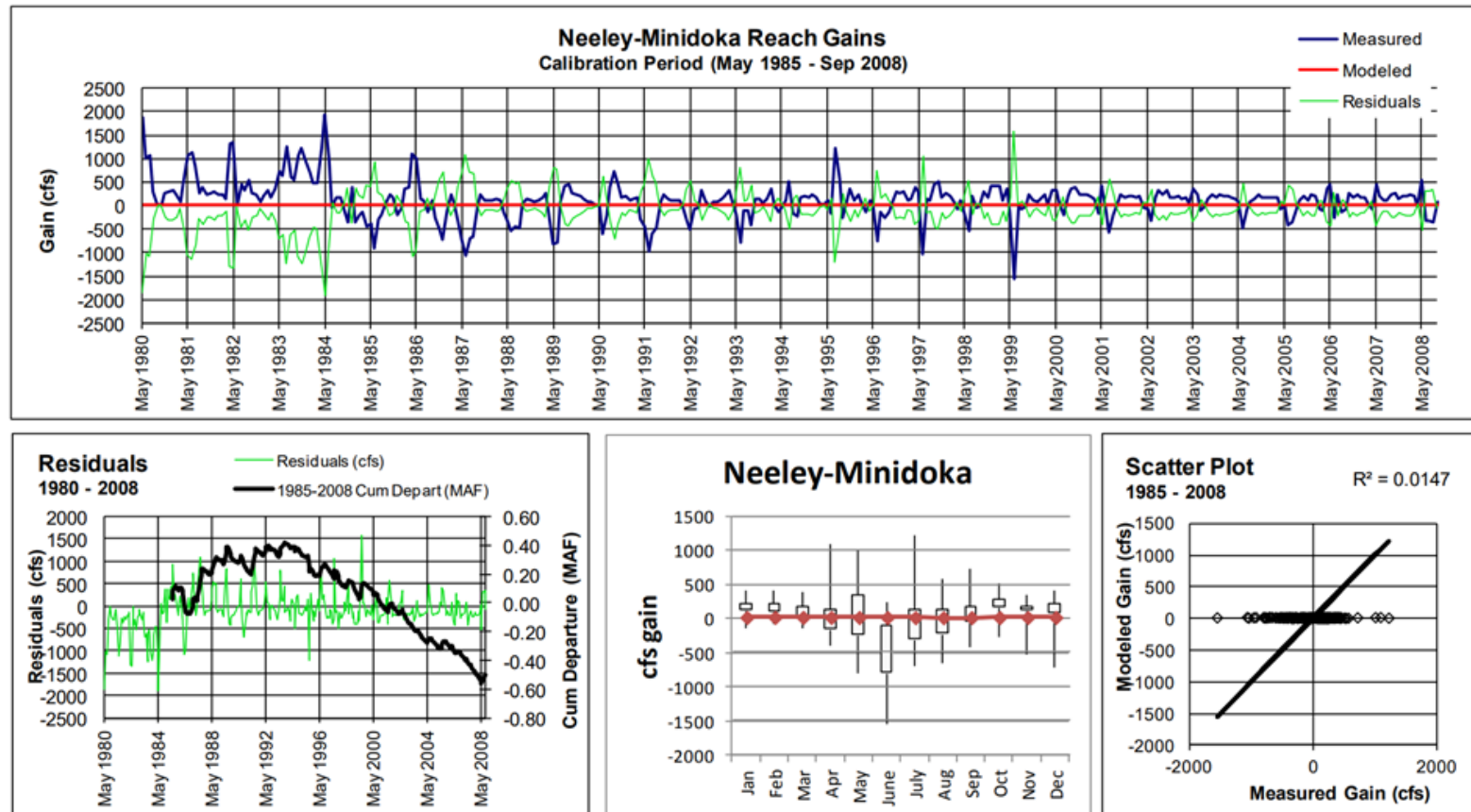


Figure 82. Reach gains in the Neeley-to-Minidoka reach. The top chart shows the measured gains, modeled gains, and residual over the calibration period. The lower chart figure shows the cumulative departures. The lower middle chart is a Box-and-Whisker plot of the gains. The lower right chart is a scatter plot of modeled gains against measured gains.

Figure 1. Comparison of calibration results at Neely-Minidoka Reach between ESPAM2.1 (above) and ESPAM2.2 (next page)

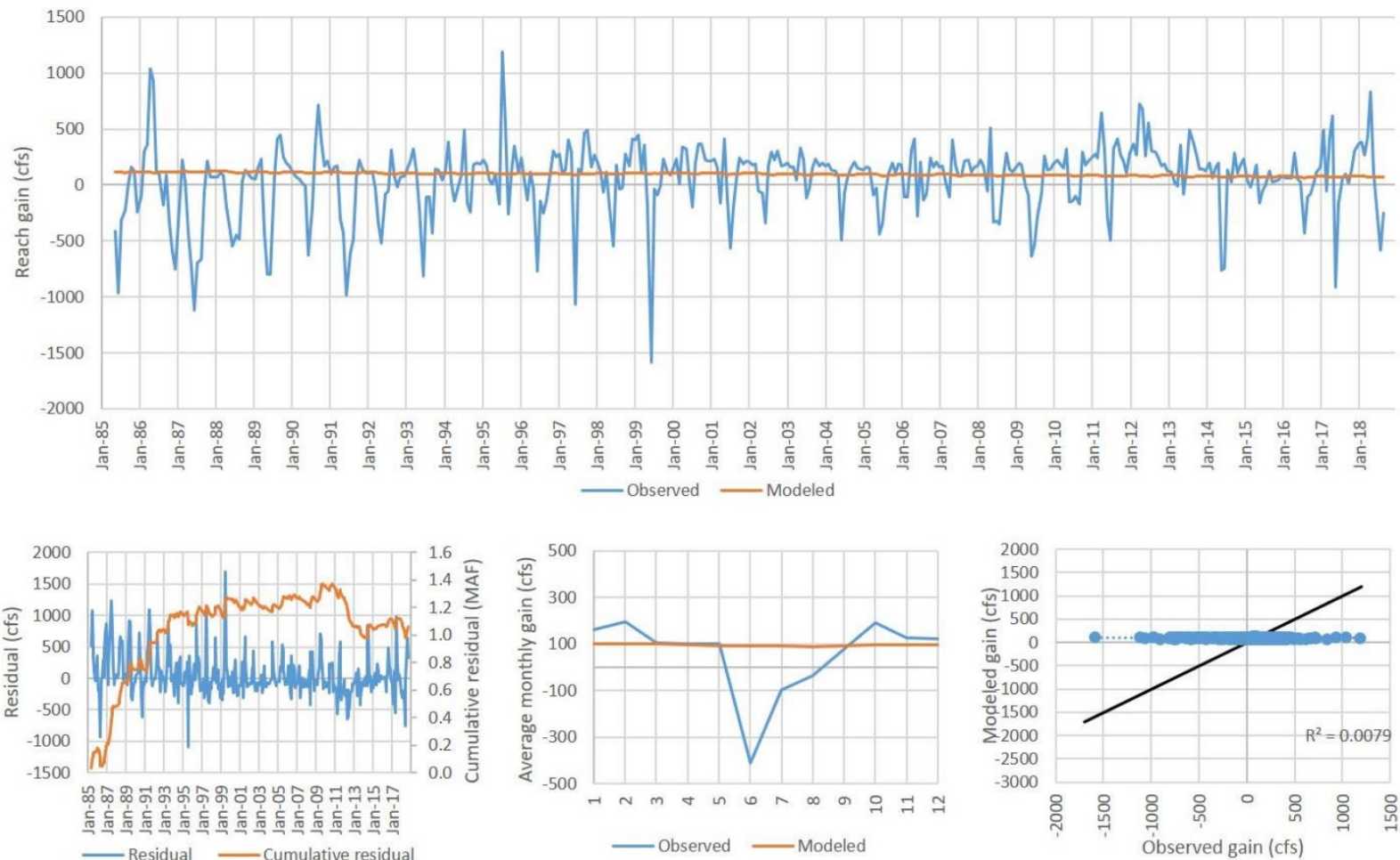


Figure 120. Observed and modeled Neeley to Minidoka reach gain  
 Figure 1.(con't)



# IDWR's Review of the Cumulative Effects of Water Right Transfers within the Eastern Snake Plain Aquifer (ESPA)

Presented by Shelley Keen

Date: September 12, 2019

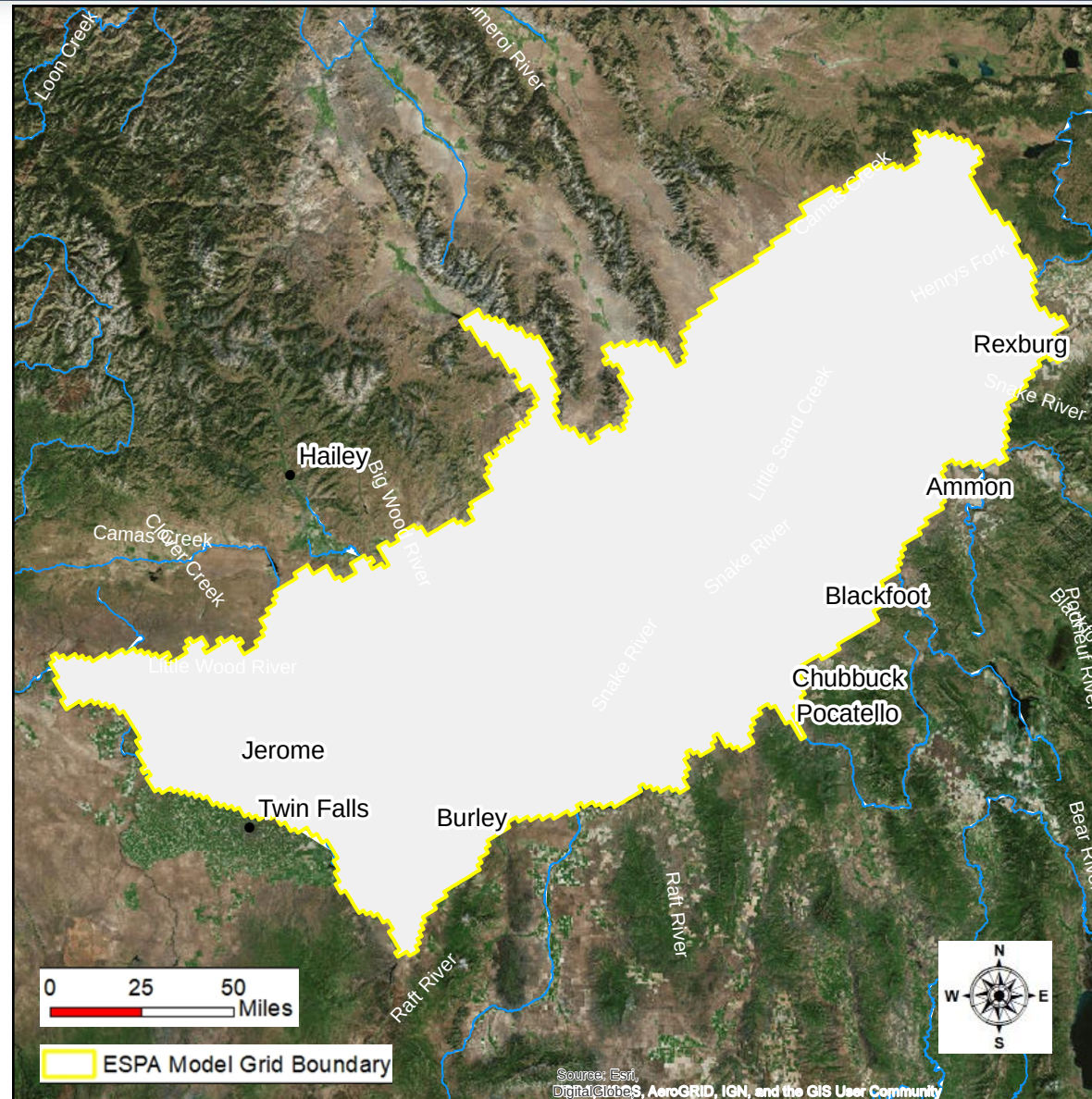


# Discussion Points

- ESPA Transfer Evaluation Policy
- Cumulative ESPA Transfer Review Process
- Results of IDWR's Cumulative Transfer Review
  1. All Transfers
  2. Transfers moving > 1 mile



- Since 1992 a **moratorium** order has been in place on new appropriations within the ESPA
- Main way to acquire a water right to divert from the ESPA is through a **transfer**



# Transfer Policy: What is the purpose?

- Changes to ground water use can impact the Snake River and spring flows and the water rights that depend on them.
- Surface water in the Snake River and many tributary springs is fully appropriated at certain times.



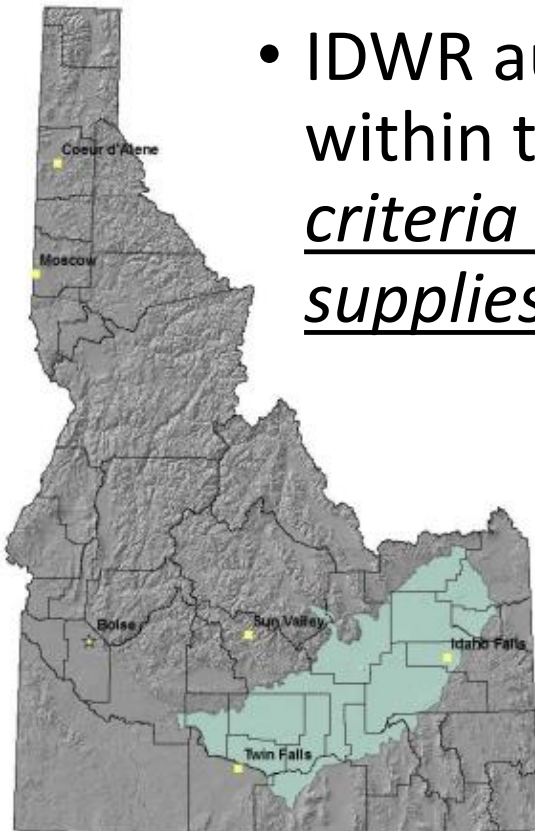
# ESPA Transfer Evaluation Policy

- In 2009 IDWR implemented its current policy for transfers of ground water rights within the ESPA.
- The policy is intended to allow some water right transfers while preventing injury to water rights that divert and use water from the Snake River and from springs tributary to the Snake River.



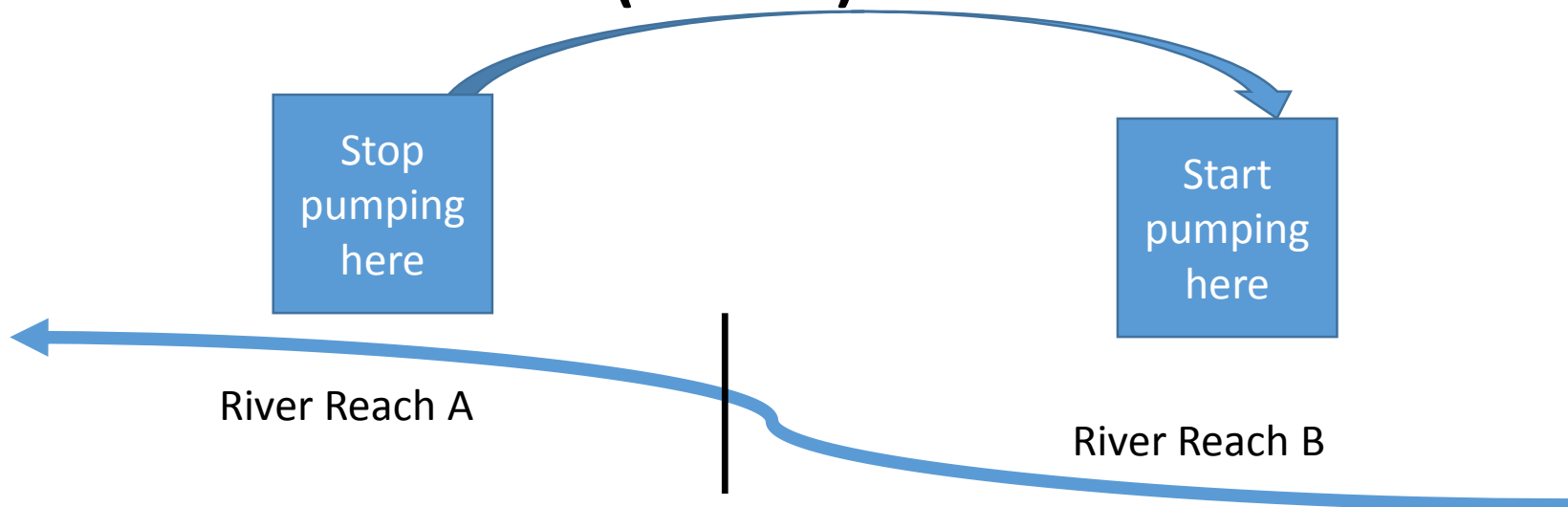
# ESPA Transfer Evaluation Policy

- IDWR authorizes point-of-diversion transfers within the ESPA only when certain threshold criteria are met, or if the transfer applicant supplies mitigation.



# ESPA Transfer Evaluation Policy

- If the application for transfer proposes to move the point of diversion for a ground water right from one location to another within the ESPA, the applicant must submit an attachment with results from the **ESPA transfer tool (ETRAN)**.



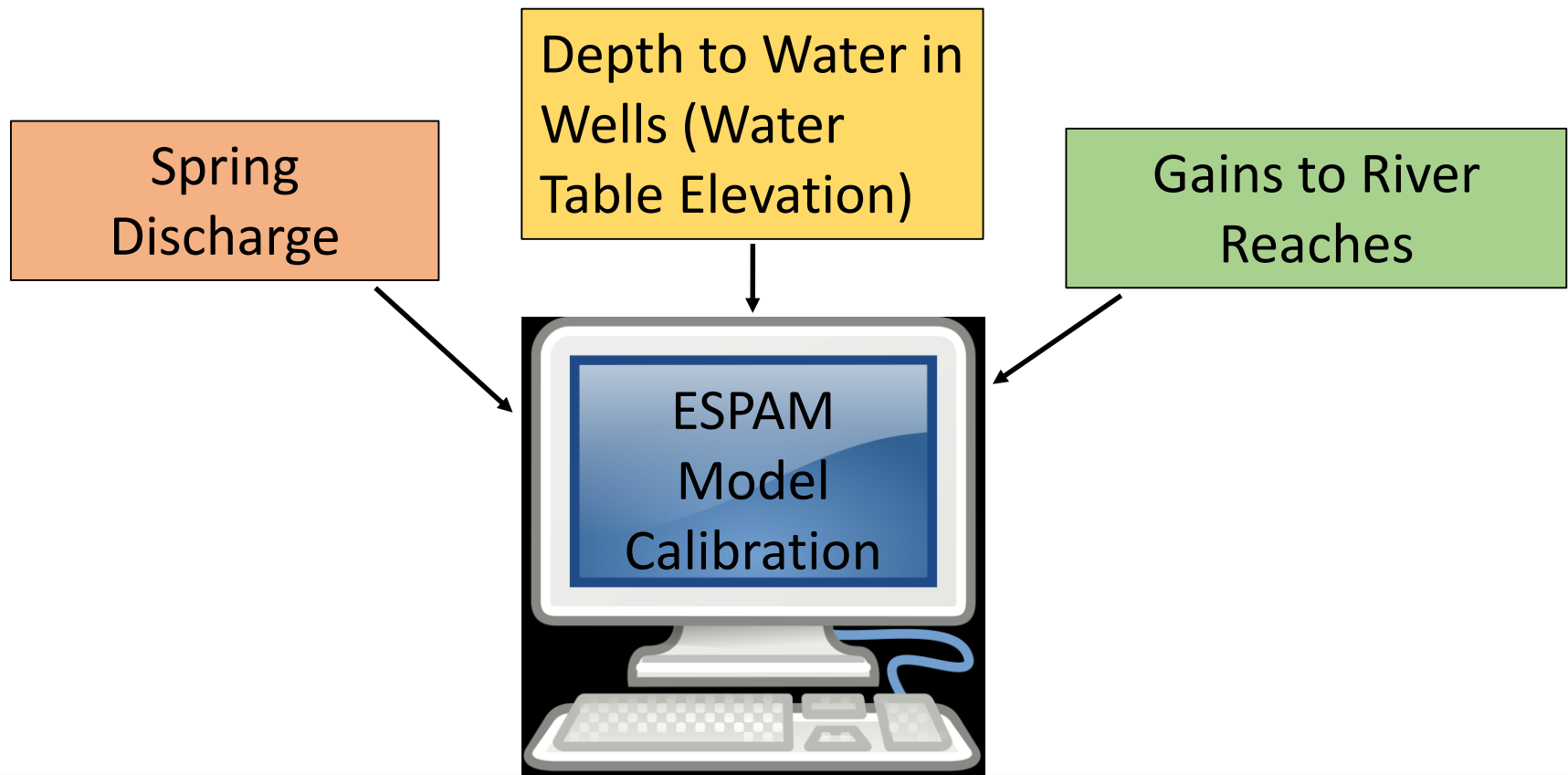
# What is the ESPA Transfer Tool?



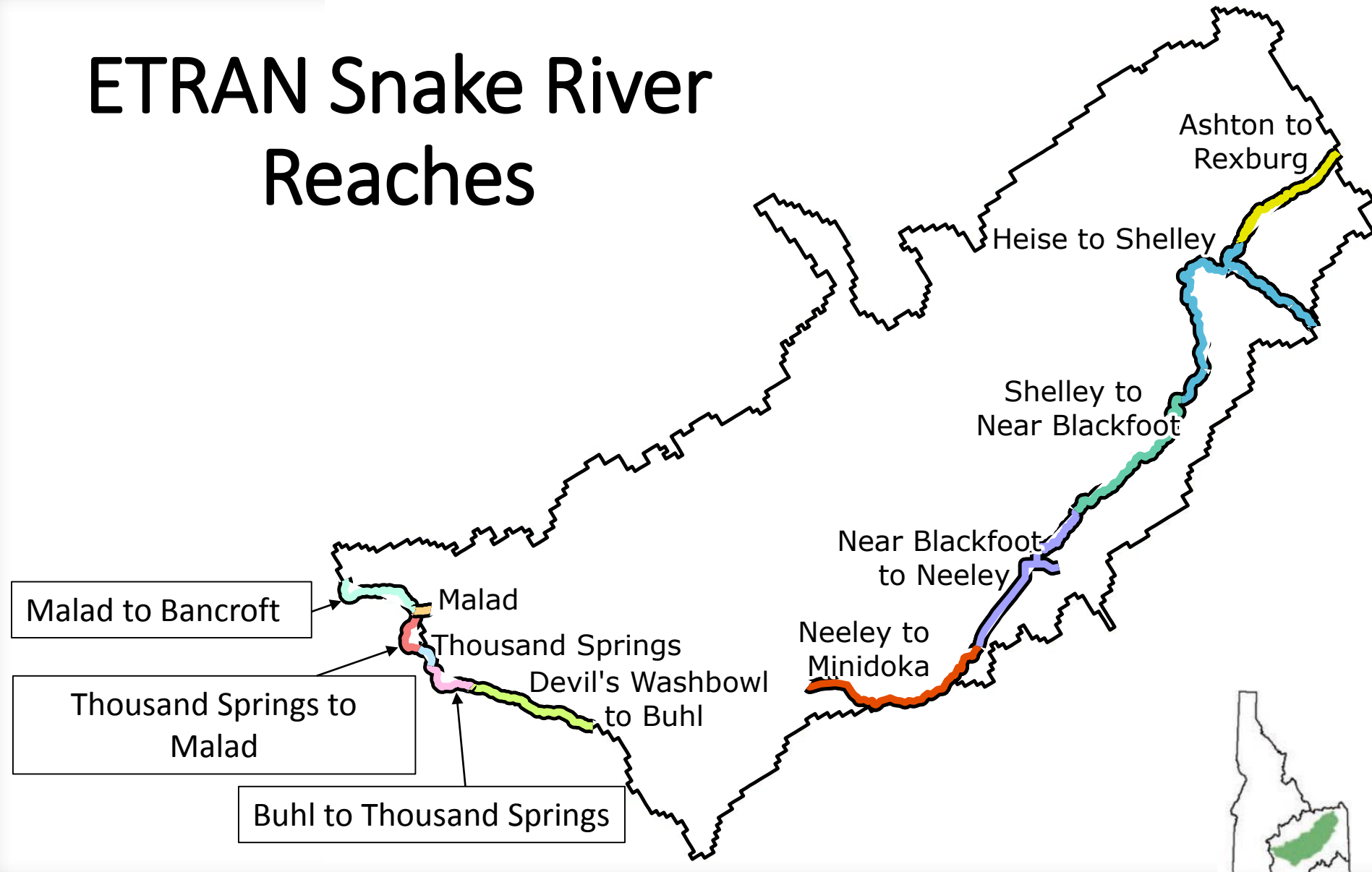
- The ESPA Transfer Tool (ETRAN) uses the ESPA Model (ESPAM) to quantify changes in depletions to each of the designated Snake River reaches *if the proposed transfer were authorized.*

# ESPA Model Predictive Quality

What observations are used to calibrate the model?



# ETRAN Snake River Reaches

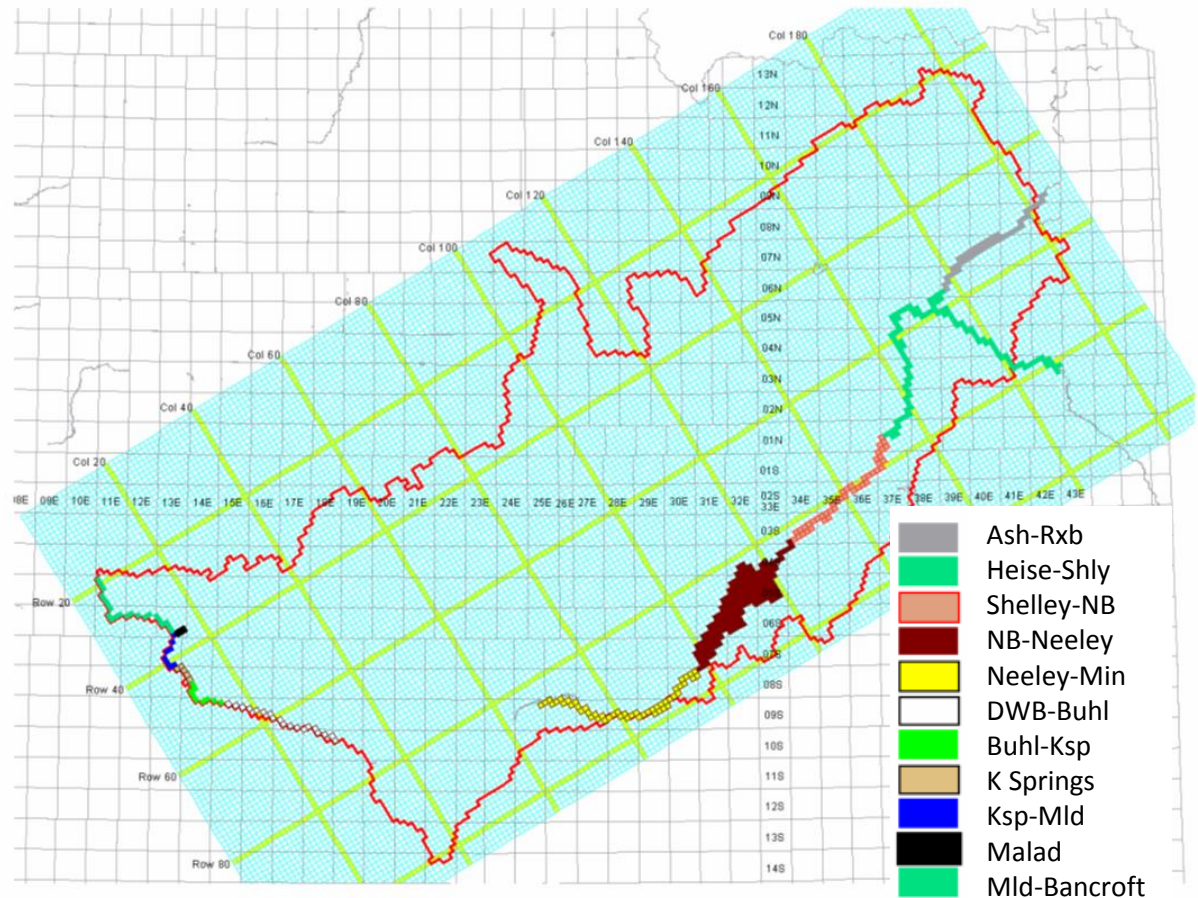


# Three Part Test to Determine Whether Mitigation is Required for a Specific Reach

- IDWR does not require the ETRAN analysis if the new point of diversion is within the **same model grid cell or an adjacent cell**.

\* Note: Each model grid cell is one square mile

- Otherwise, IDWR applies the following three tests to the ETRAN results for each of the 11 Snake River reaches.



# Three Part Test to Determine Whether Mitigation is Required for Transfer Approval

The transfer will not be approved or mitigation will be required if...

- 1.) The depletion to any reach increases by 10% or more, unless . . .
- 2.) The depletions in the reach increase by 2 ac-ft/trimester or less, or . . .
- 3.) The depletion to the reach is *no greater* than 10% of the total volume pumped.



# Three Part Test to Determine Whether Mitigation is Required for Transfer Approval

- If the three conditions are not met for any single hydraulically-connected reach of the Snake River . . .

the applicant **must fully** mitigate the effects of the proposed transfer on that reach, or . . .

the transfer **will not** be approved.



# Three Part Test to Determine Whether Mitigation is Required for Transfer Approval

If the depletions exceed the policy thresholds, the applicant can:

- Adjust the transfer proposal (and re-run the transfer proposal in ETRAN), or
- Offer mitigation.



# IDWR's Cumulative Review Overview

- **426** transfers between **1/1/2012** and **8/31/2018** involving pumping from the ESPA.
- Approximately 400 personnel hours from Water Rights Section Staff
- Model grid cells and average annual pumping rate were determined for 685 ***“TO”*** wells and 679 ***“FROM”*** wells.
- The cumulative effects of the 426 ESPA transfers were analyzed using version 2.1 of the ESPAM (IDWR, 2013).

# TO and FROM Wells

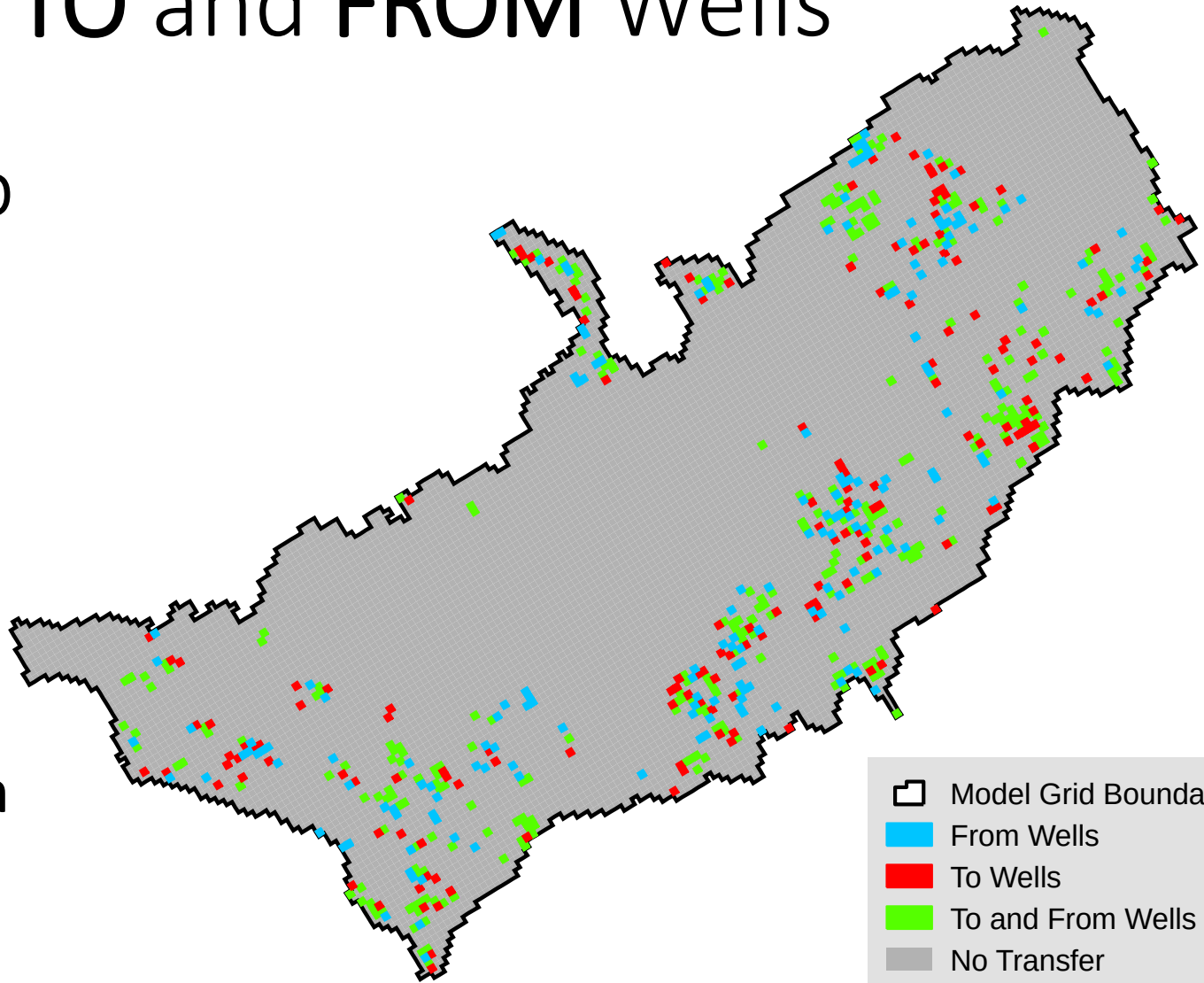
**RED** =

extraction = TO  
well

**Blue** =

cessation =  
FROM well

**Green** = both  
TO and FROM  
wells



# IDWR's Cumulative Review

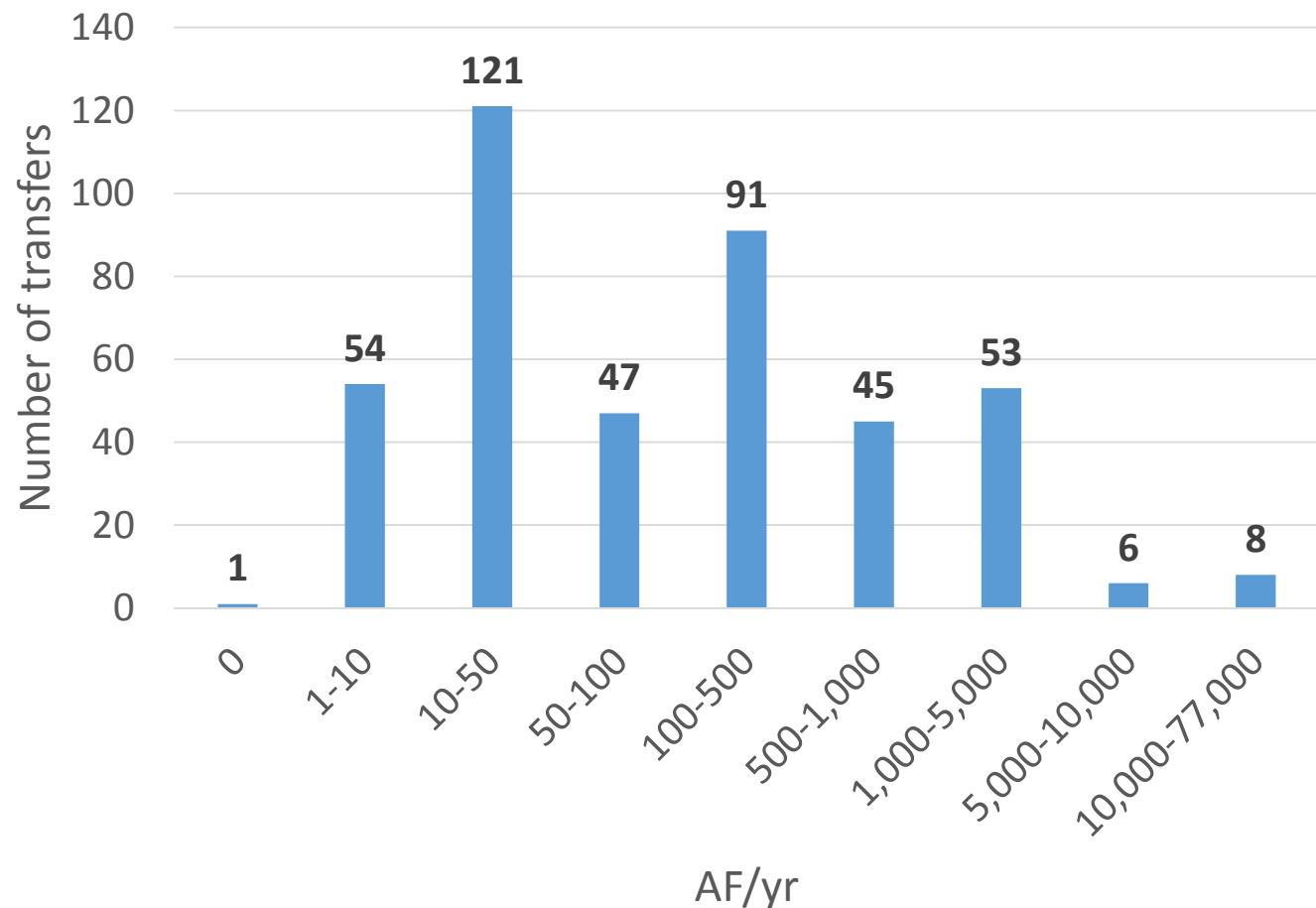
- Reduced pumping at the **FROM** wells total about 412,728 AF of positive (+) impact to the aquifer
- Increased pumping at the **TO** wells total about 412,210 AF of depletion (-) to the aquifer.

\*This indicates that the 426 transfers do not inadvertently result in an increase in aquifer depletions as a whole.



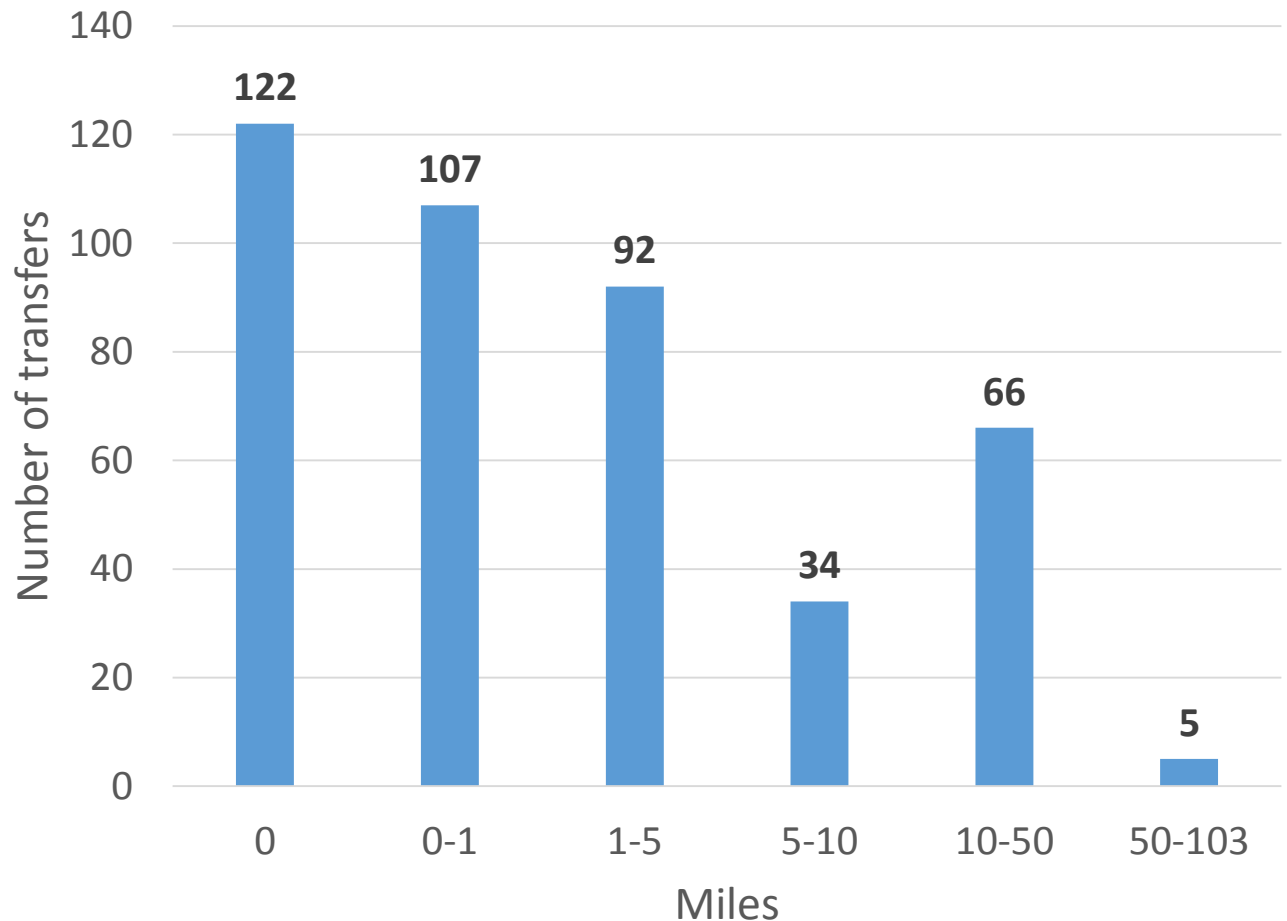
# Transfer Pumping Volume

- Most transfers involve small amounts of water
- Approximately 50% of transfers relocate 100 AF/yr (0.14 cfs) or less

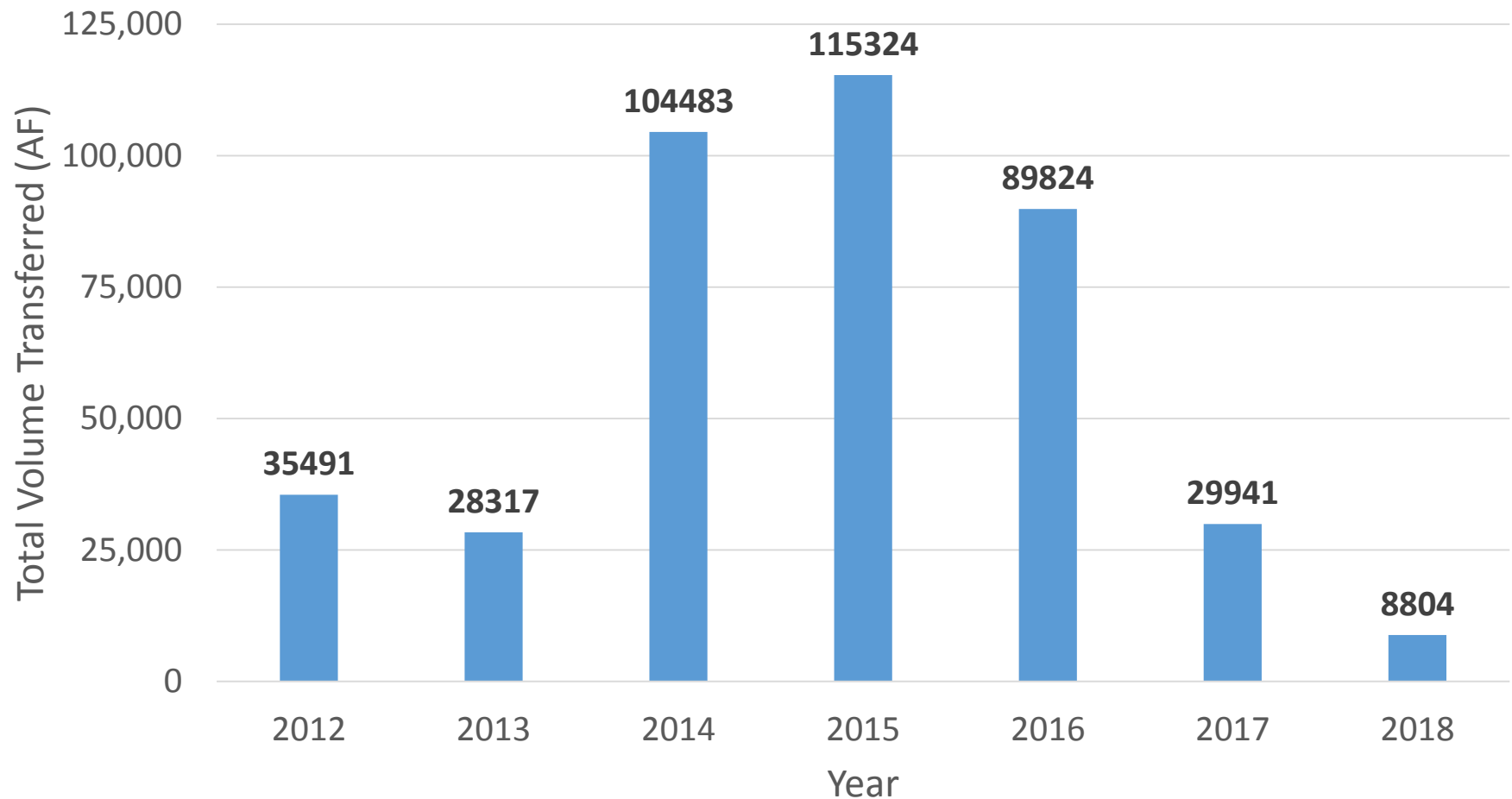


# Transfer Distance

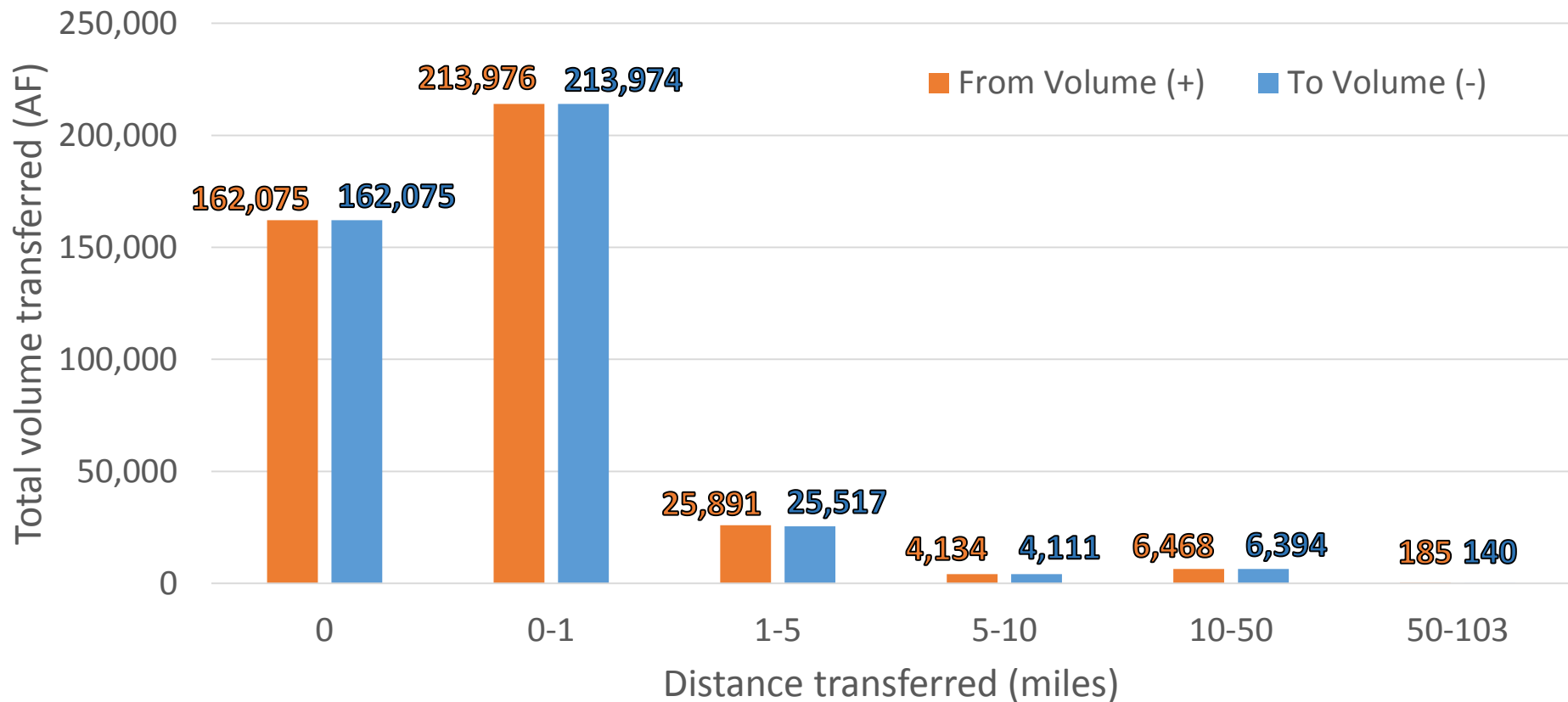
- Most transfers move short distances
- Approximately 75% of transfers move five miles away or less



# Volume Transferred by Year



# Volume Transferred by Distance 2012-2018



☐ Model Grid Boundary

### Model Cells

■ Decrease in GW Pumping

■ Increase In GW Pumping

### River Reaches

■ Ashton - Rexburg

■ Heise - Shelley

■ Shelley - nr Blackfoot

■ Near Blackfoot - Neeley

■ Neeley - Minidoka

■ Devil's Washbowl - Buhl

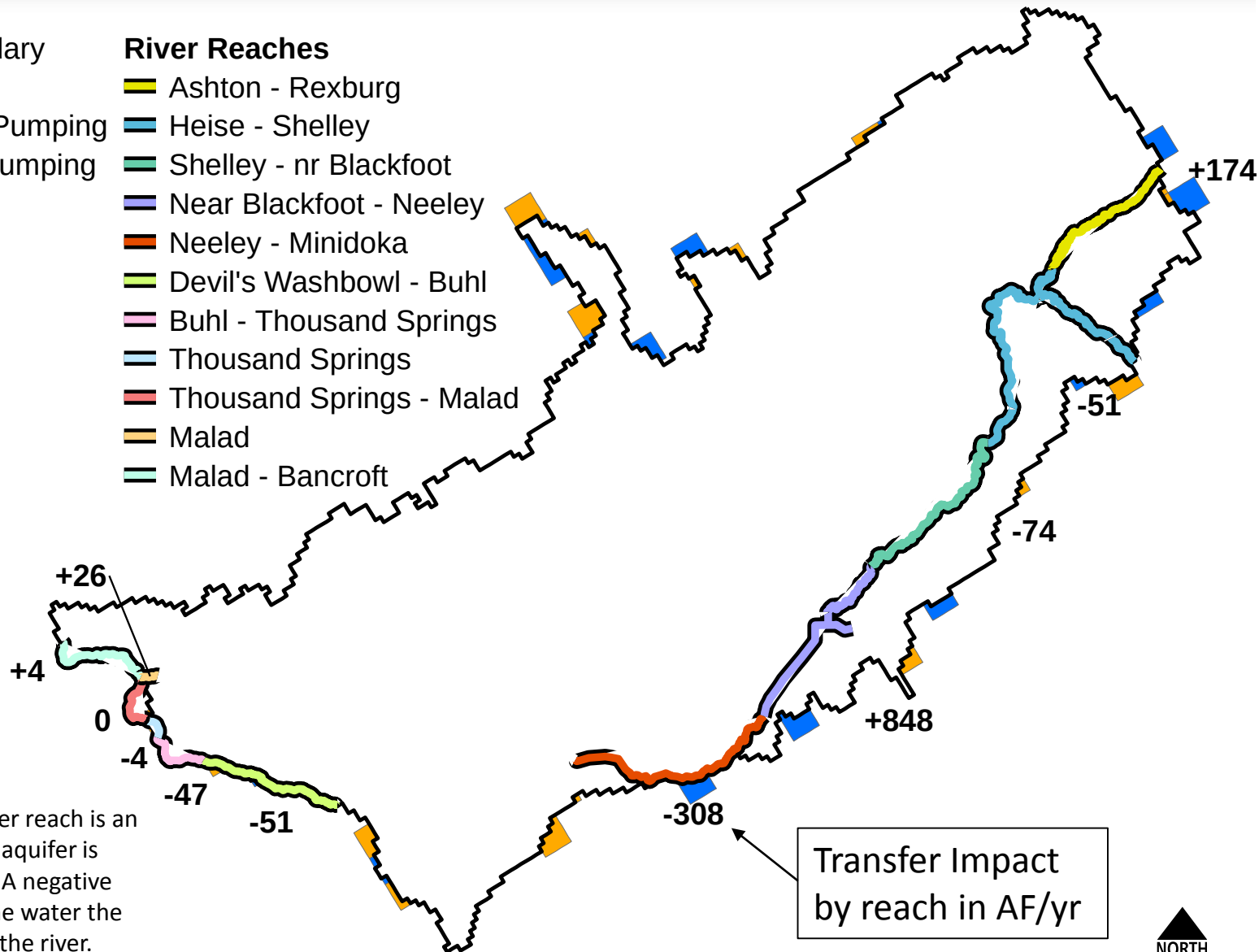
■ Buhl - Thousand Springs

■ Thousand Springs

■ Thousand Springs - Malad

■ Malad

■ Malad - Bancroft



A positive gain (+) in a river reach is an increase in the water the aquifer is contributing to the river. A negative gain (-) is a decrease in the water the aquifer is contributing to the river.



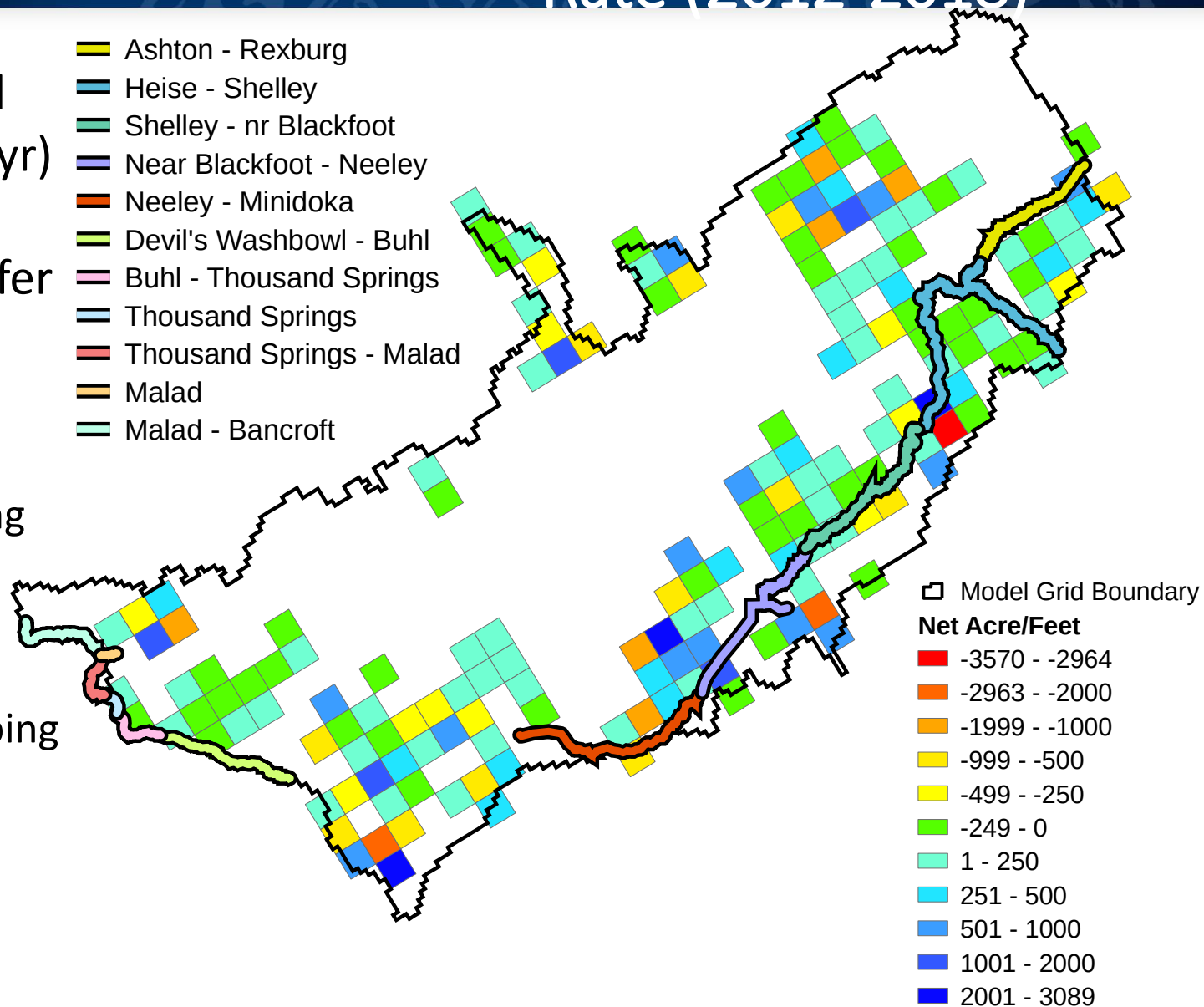
# Cumulative Annual Pumping Rate (2012-2018)

Cumulative annual  
pumping rate (AF/yr)  
for all model cells  
involved in a transfer  
(2012-2018)

- Ashton - Rexburg
- Heise - Shelley
- Shelley - nr Blackfoot
- Near Blackfoot - Neeley
- Neeley - Minidoka
- Devil's Washbowl - Buhl
- Buhl - Thousand Springs
- Thousand Springs
- Thousand Springs - Malad
- Malad
- Malad - Bancroft

• **Red** = Less Pumping

• **Blue** = More Pumping



Model Grid Boundary

### Net Acre/Feet

-3570 - -2964

-2963 - -2000

-1999 - -1000

-999 - -500

-499 - -250

-249 - 0

1 - 250

251 - 500

501 - 1000

1001 - 2000

2001 - 3089

Ashton - Rexburg

Heise - Shelley

Shelley - nr Blackfoot

Near Blackfoot - Neeley

Neeley - Minidoka

Devil's Washbowl - Buhl

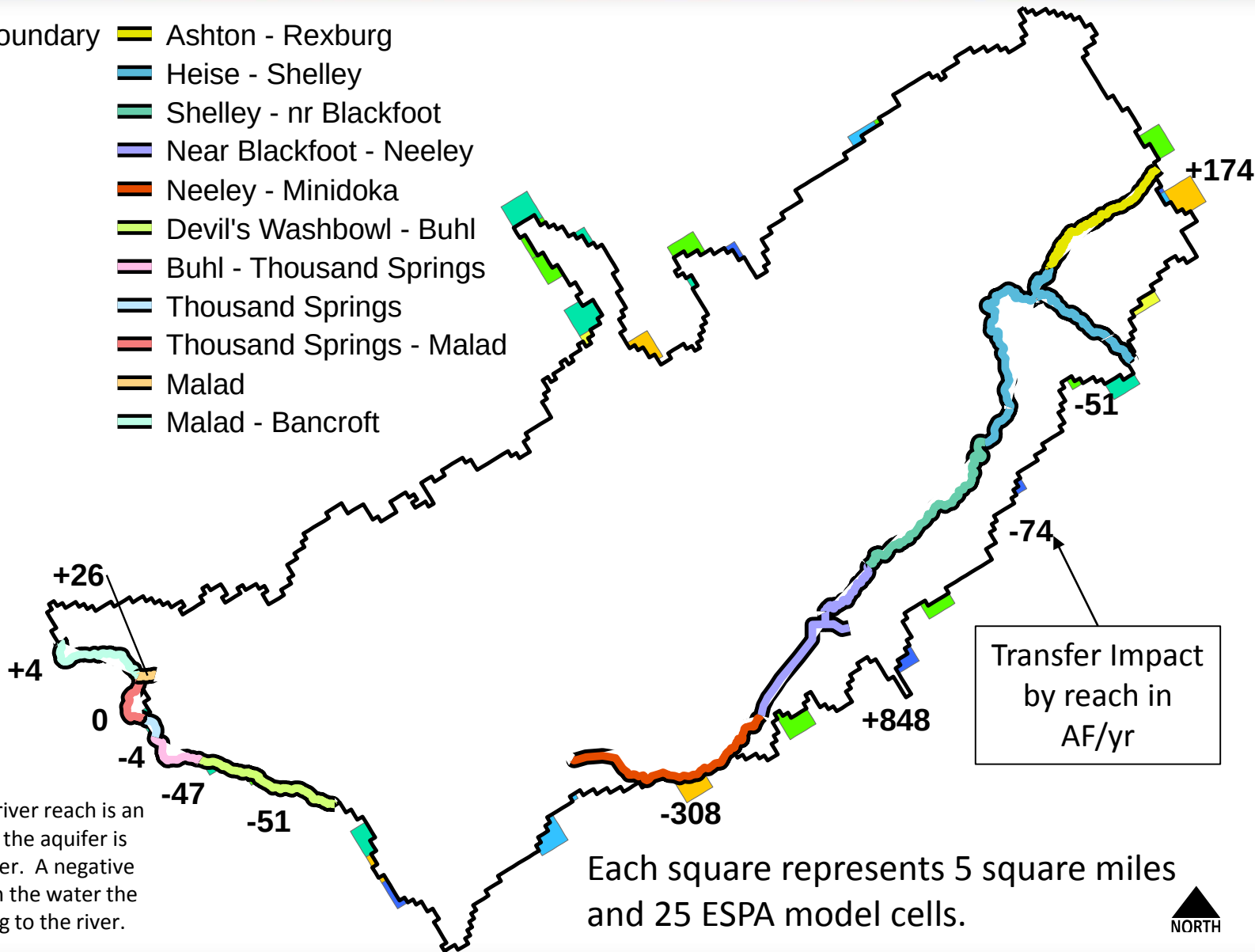
Buhl - Thousand Springs

Thousand Springs

Thousand Springs - Malad

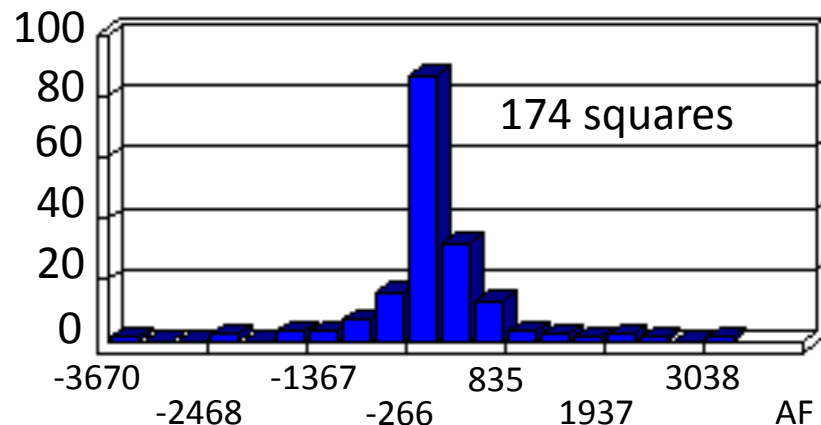
Malad

Malad - Bancroft



A positive gain (+) in a river reach is an increase in the water the aquifer is contributing to the river. A negative gain (-) is a decrease in the water the aquifer is contributing to the river.

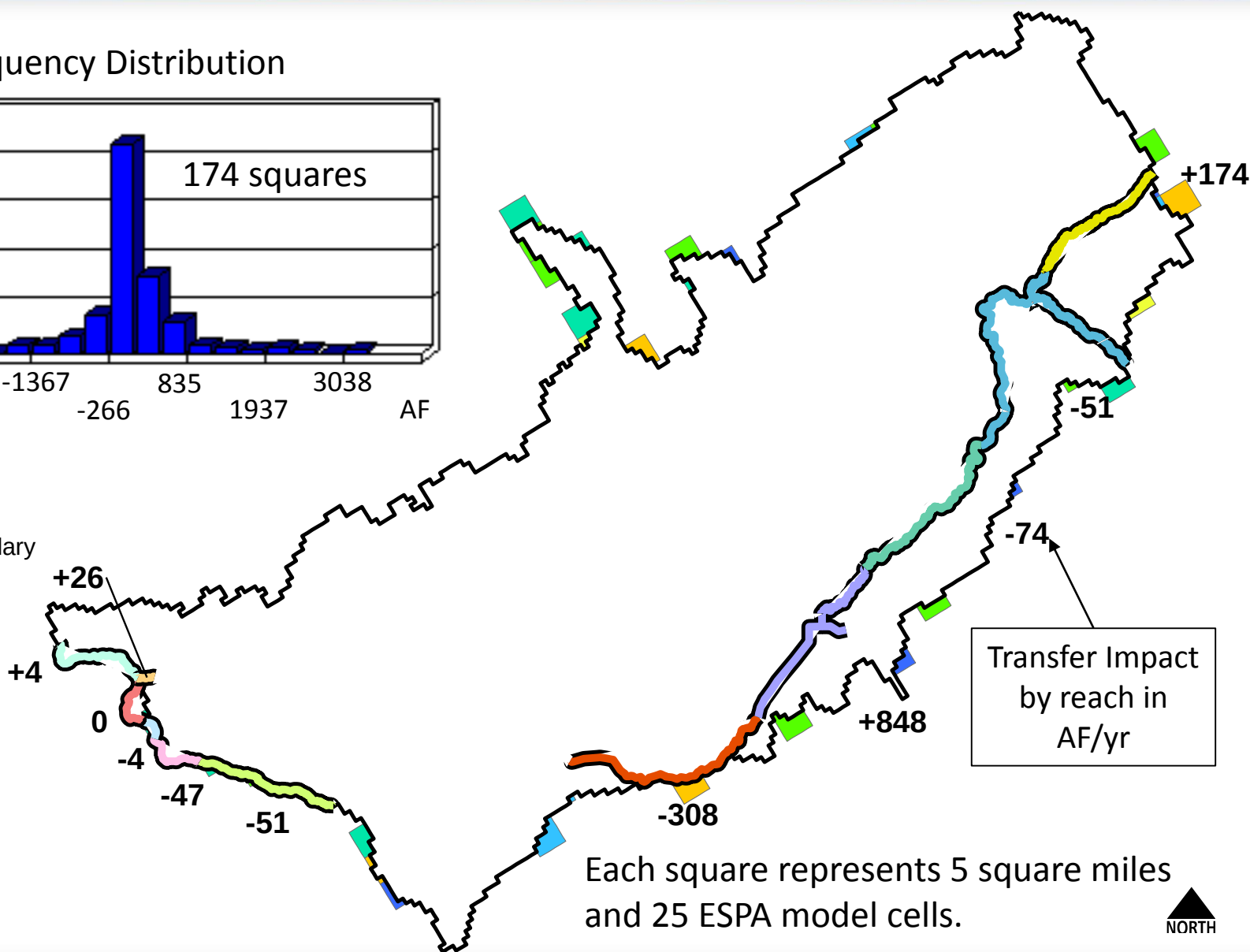
Frequency Distribution



Model Grid Boundary

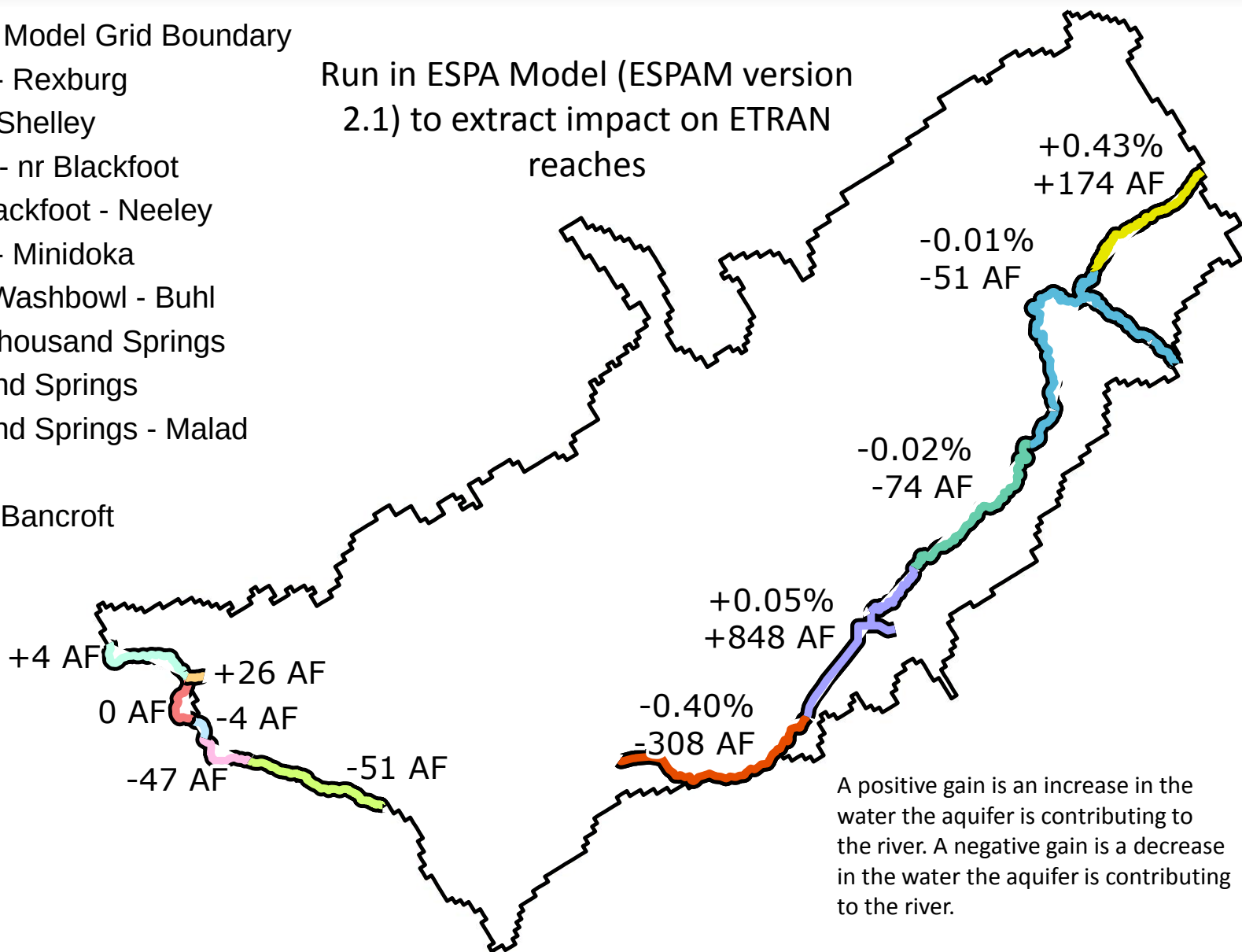
Net Acre/Feet

- -3570 - -2964
- -2963 - -2000
- -1999 - -1000
- -999 - -500
- -499 - -250
- -249 - 0
- 1 - 250
- 251 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 3089



-  ESPAM Model Grid Boundary
-  Ashton - Rexburg
-  Heise - Shelley
-  Shelley - nr Blackfoot
-  Near Blackfoot - Neeley
-  Neeley - Minidoka
-  Devil's Washbowl - Buhl
-  Buhl - Thousand Springs
-  Thousand Springs
-  Thousand Springs - Malad
-  Malad
-  Malad - Bancroft

Run in ESPA Model (ESPAM version  
2.1) to extract impact on ETRAN  
reaches



# Impact of all ESPA 2012-2018 Transfers by Reach

| Reach                                        | Transfer Impact |             | Average Reach Gain |               | % change<br>in reach<br>gain |
|----------------------------------------------|-----------------|-------------|--------------------|---------------|------------------------------|
|                                              | (AF/yr)         | (cfs)       | (AF/yr)            | (cfs)         |                              |
| Ashton-Rexburg                               | 174             | 0.24        | -40,100            | -55           | +0.43%                       |
| Heise-Shelley                                | -51             | -0.07       | -535,500           | -739          | -0.01%                       |
| Shelley-Near Blackfoot                       | -74             | -0.10       | -466,800           | -644          | -0.02%                       |
| <b>Subtotal above Near Blackfoot</b>         | <b>49</b>       | <b>0.07</b> | <b>-1,042,400</b>  | <b>-1,439</b> | <b>+0.00%</b>                |
| Near Blackfoot-Neeley                        | 848             | 1.17        | 1,598,200          | 2,206         | +0.05%                       |
| Neeley-Minidoka                              | -308            | -0.43       | 77,600             | 107           | -0.40%                       |
| <b>Subtotal Near Blackfoot-<br/>Minidoka</b> | <b>539</b>      | <b>0.74</b> | <b>1,675,800</b>   | <b>2,313</b>  | <b>+0.03%</b>                |

Note: Increase in river reach gain is positive (+) and a decrease to river reach gain is negative (-)

# Impact of all ESPA 2012-2018 Transfers by Reach

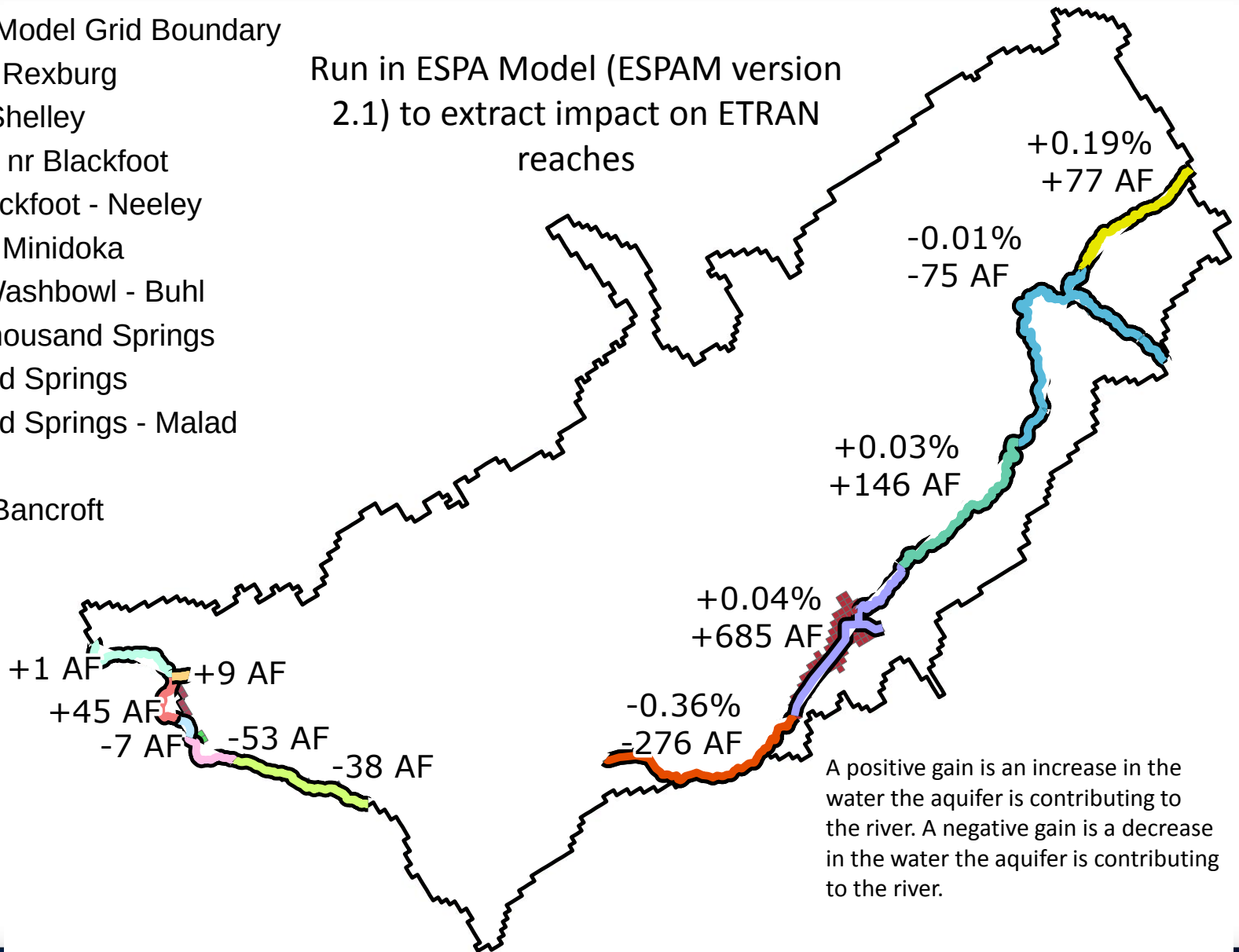
| Reach                              | Transfer Impact |              | Average Reach Gain |              | % change<br>in reach<br>gain |
|------------------------------------|-----------------|--------------|--------------------|--------------|------------------------------|
|                                    | (AF/yr)         | (cfs)        | (AF/yr)            | (cfs)        |                              |
| Devil's Washbowl -Buhl             | -51             | -0.07        | 1,121,400          | 1,548        | 0.00%                        |
| Buhl-Thousand Springs              | -47             | -0.06        |                    |              |                              |
| Thousand Springs                   | -4              | -0.01        |                    |              |                              |
| Thousand Springs-Malad             | 0               | 0.00         |                    |              |                              |
| Malad                              | 26              | 0.04         |                    |              |                              |
| Malad-Bancroft                     | 4               | 0.01         |                    |              |                              |
| <b>Subtotal Kimberly-King Hill</b> | <b>-70</b>      | <b>-0.10</b> | <b>4,088,500</b>   | <b>5,644</b> | <b>0.00%</b>                 |
| <b>Total for all reaches</b>       | <b>518</b>      | <b>0.71</b>  | <b>4,721,900</b>   | <b>6,518</b> | <b>0.01%</b>                 |

Note: Increase in river reach gain is positive (+) and a decrease to river reach gain is negative (-)

# Impact of all ESPA 2012- 2018 transfers > 1 mile

-  ESPAM Model Grid Boundary
-  Ashton - Rexburg
-  Heise - Shelley
-  Shelley - nr Blackfoot
-  Near Blackfoot - Neeley
-  Neeley - Minidoka
-  Devil's Washbowl - Buhl
-  Buhl - Thousand Springs
-  Thousand Springs
-  Thousand Springs - Malad
-  Malad
-  Malad - Bancroft

Run in ESPA Model (ESPAM version  
2.1) to extract impact on ETRAN  
reaches



# Impact of ESPA 2012-2018 Transfers by Reach Greater than 1 mile

| Reach                                        | Transfer Impact |             | Average Reach Gain |               | % change<br>in reach<br>gain |
|----------------------------------------------|-----------------|-------------|--------------------|---------------|------------------------------|
|                                              | (AF/yr)         | (cfs)       | (AF/yr)            | (cfs)         |                              |
| Ashton-Rexburg                               | 77              | 0.11        | -40,100            | -55           | 0.19%                        |
| Heise-Shelley                                | -75             | -0.10       | -535,500           | -739          | -0.01%                       |
| Shelley-Near Blackfoot                       | 146             | 0.20        | -466,800           | -644          | 0.03%                        |
| <b>Subtotal above Near Blackfoot</b>         | <b>148</b>      | <b>0.20</b> | <b>-1,042,400</b>  | <b>-1,439</b> | <b>0.01%</b>                 |
| Near Blackfoot-Neeley                        | 685             | 0.95        | 1,598,200          | 2,206         | 0.04%                        |
| Neeley-Minidoka                              | -276            | -0.38       | 77,600             | 107           | -0.36%                       |
| <b>Subtotal Near Blackfoot-<br/>Minidoka</b> | <b>409</b>      | <b>0.56</b> | <b>1,675,800</b>   | <b>2,313</b>  | <b>0.02%</b>                 |

Note: Increase in river reach gain is positive (+) and a decrease to river reach gain is negative (-)

# Impact of ESPA 2012-2018 Transfers by Reach Greater than 1 mile

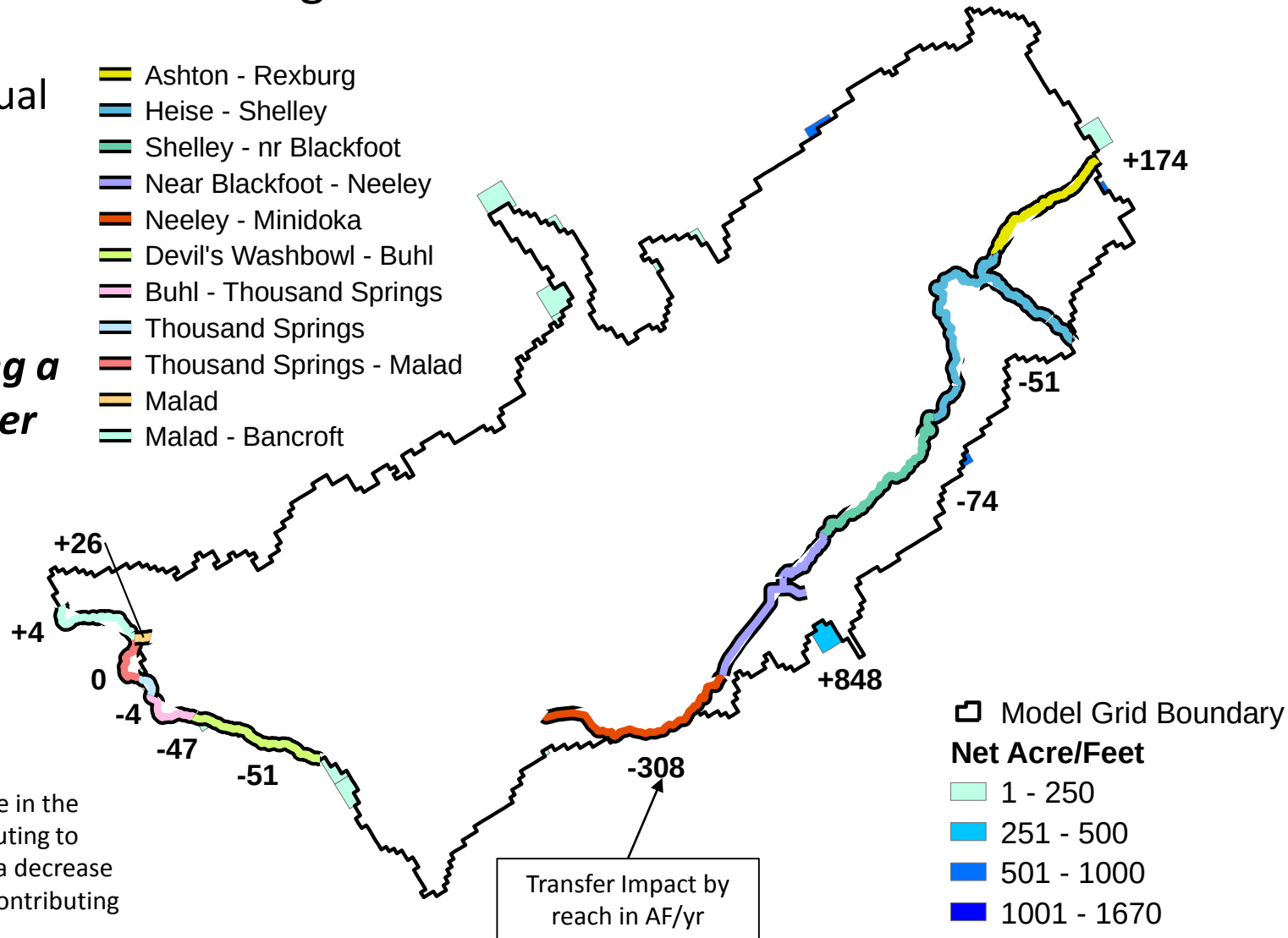
| Reach                              | Transfer Impact |             | Average Reach Gain |       | % change<br>in reach<br>gain |
|------------------------------------|-----------------|-------------|--------------------|-------|------------------------------|
|                                    | (AF/yr)         | (cfs)       | (AF/yr)            | (cfs) |                              |
| Devil's Washbowl -Buhl             | -38             | -0.05       | 1,121,400          | 1,548 | 0.00%                        |
| Buhl-Thousand Springs              | -53             | -0.07       |                    |       |                              |
| Thousand Springs                   | -7              | -0.01       |                    |       |                              |
| Thousand Springs-Malad             | 1               | -0.01       |                    |       |                              |
| Malad                              | 45              | 0.06        |                    |       |                              |
| Malad-Bancroft                     | 9               | 0.01        |                    |       |                              |
| <b>Subtotal Kimberly-King Hill</b> | <b>-42</b>      | <b>0</b>    |                    |       |                              |
| <b>Total for all reaches</b>       | <b>516</b>      | <b>0.69</b> |                    |       |                              |

Note: Increase in river reach gain is positive (+) and a decrease to river reach gain is negative (-)

## Transfers Moving a Distance Greater than 1 mile

- **Increased** annual pumping rate (AF/yr) for all model cells involved in a transfer *moving a distance greater than 1 mile*

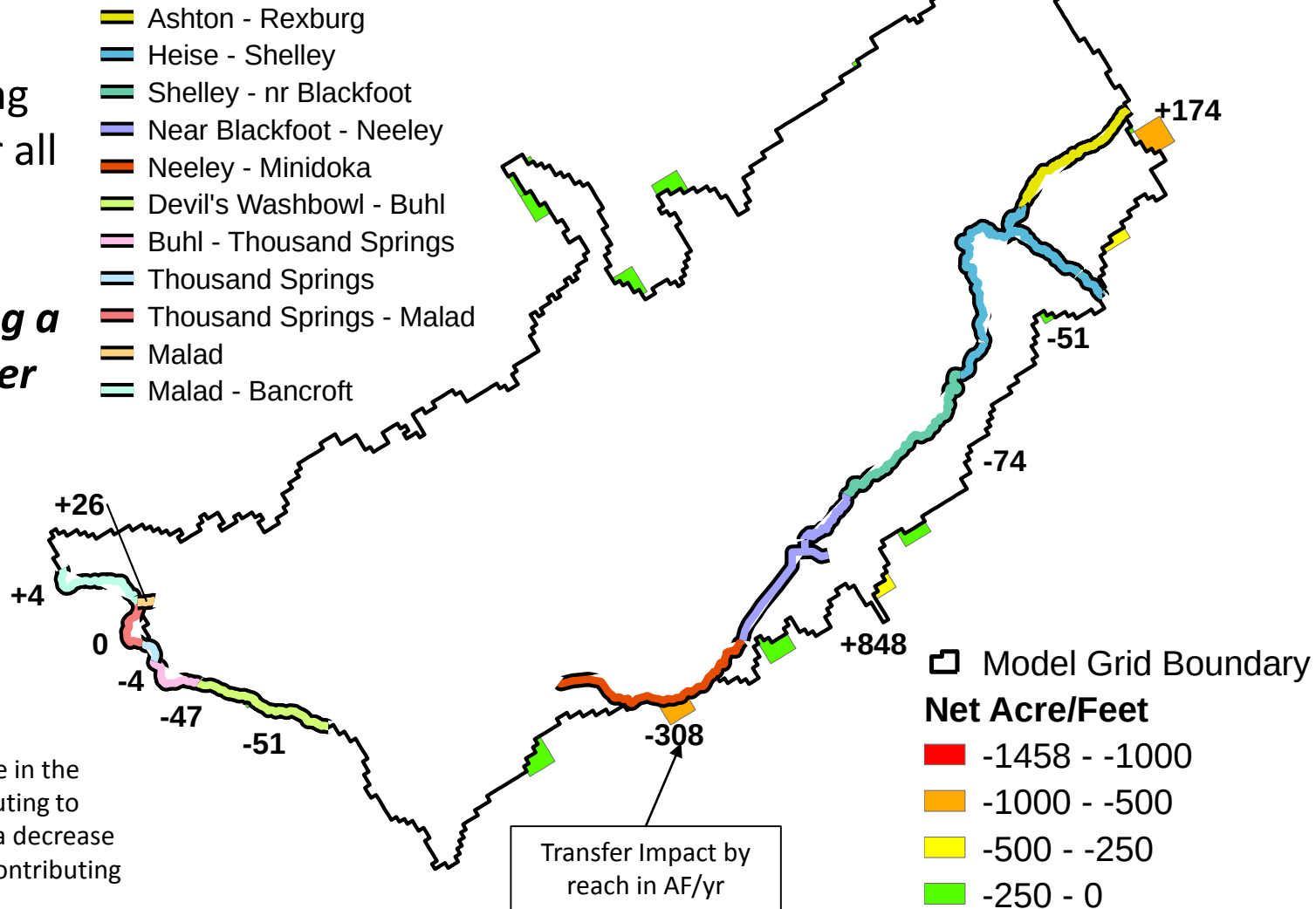
Ashton - Rexburg  
 Heise - Shelley  
 Shelley - nr Blackfoot  
 Near Blackfoot - Neeley  
 Neeley - Minidoka  
 Devil's Washbowl - Buhl  
 Buhl - Thousand Springs  
 Thousand Springs  
 Thousand Springs - Malad  
 Malad  
 Malad - Bancroft



A positive gain is an increase in the water the aquifer is contributing to the river. A negative gain is a decrease in the water the aquifer is contributing to the river.

## Transfers Moving a Distance Greater than 1 mile

- **Decreased**  
annual pumping  
rate (AF/yr) for all  
model cells  
involved in a  
transfer *moving a  
distance greater  
than 1 mile*



A positive gain is an increase in the water the aquifer is contributing to the river. A negative gain is a decrease in the water the aquifer is contributing to the river.

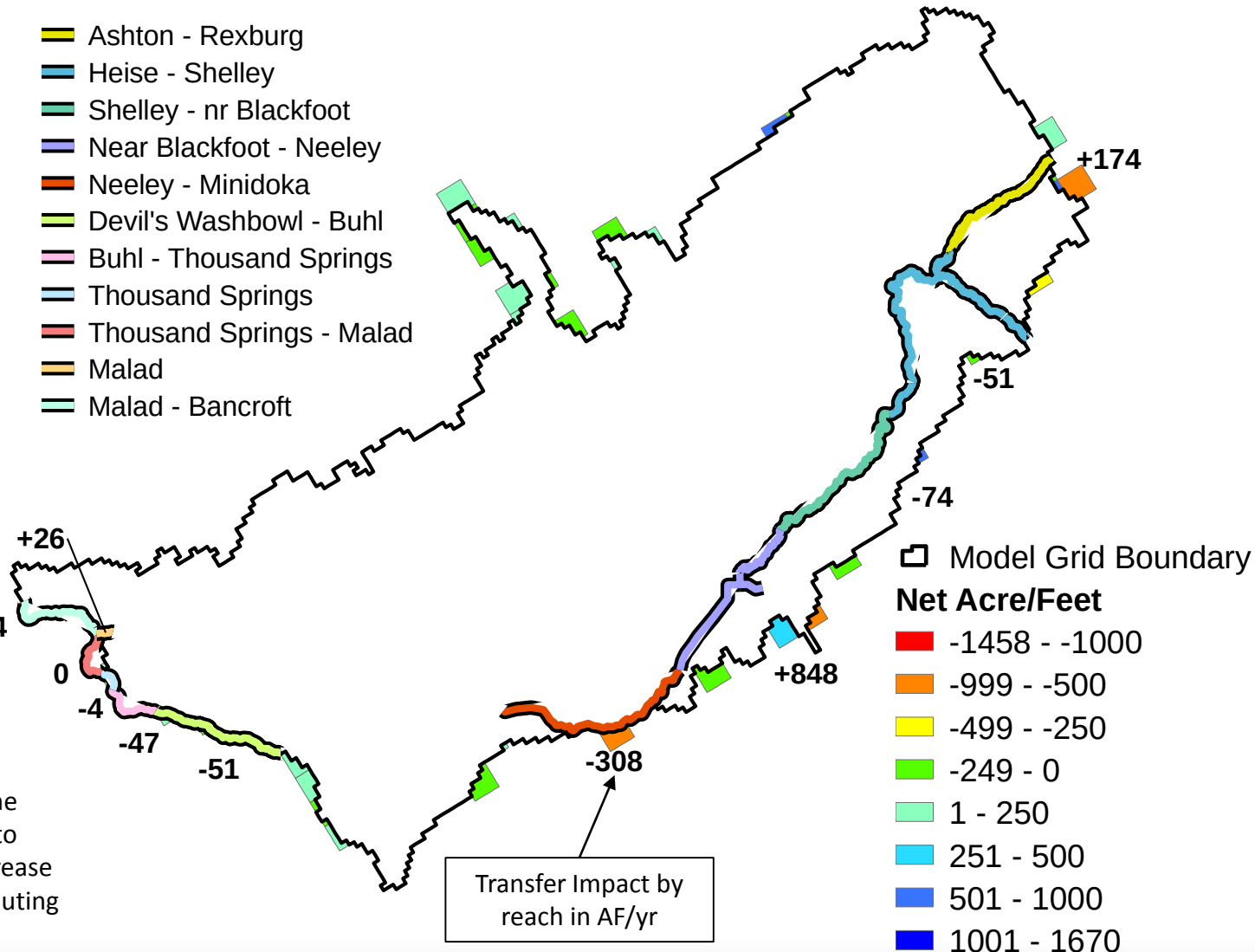
## Transfers Moving a Distance Greater than 1 mile

- Cumulative** annual pumping rate (AF/yr) for all model cells involved in a transfer *moving a distance greater than 1 mile*

- Red** = Less Pumping

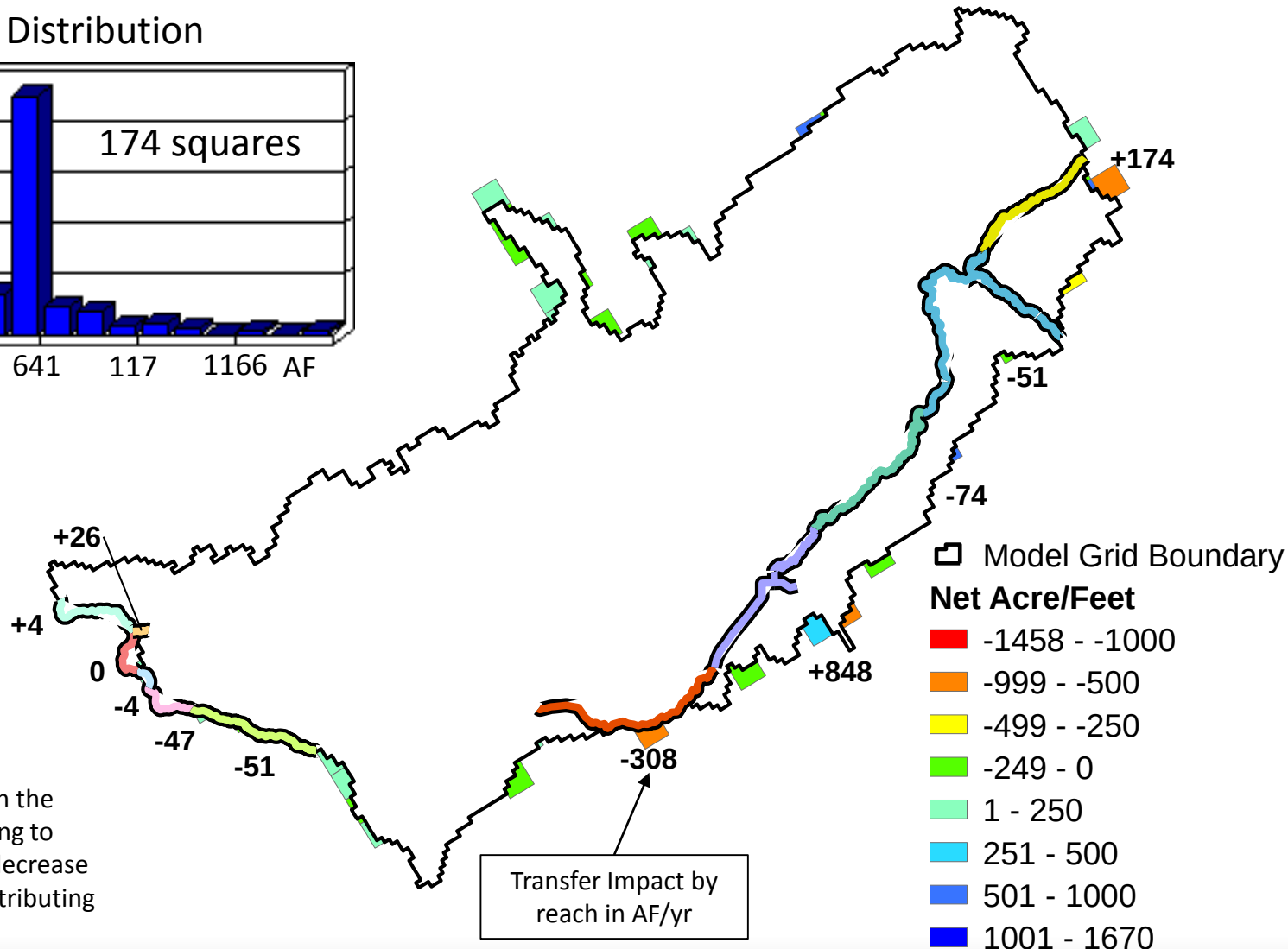
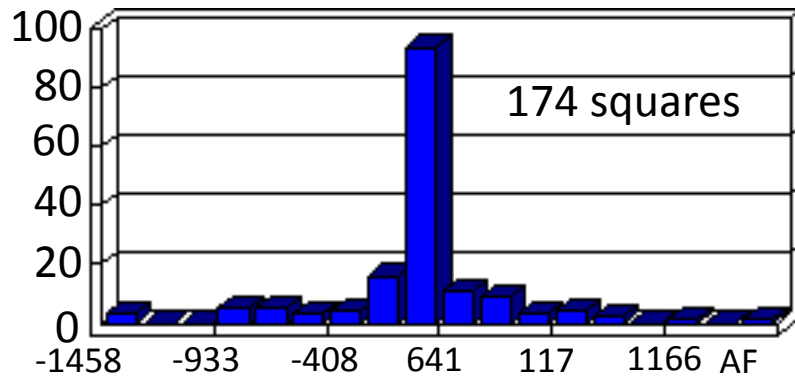
- Blue** = More Pumping

- Ashton - Rexburg
- Heise - Shelley
- Shelley - nr Blackfoot
- Near Blackfoot - Neeley
- Neeley - Minidoka
- Devil's Washbowl - Buhl
- Buhl - Thousand Springs
- Thousand Springs
- Thousand Springs - Malad
- Malad
- Malad - Bancroft



## Transfers Moving a Distance Greater than 1 mile

Frequency Distribution



A positive gain is an increase in the water the aquifer is contributing to the river. A negative gain is a decrease in the water the aquifer is contributing to the river.

# IDWR's Commitment to Updating this ESPA Cumulative Transfer Analysis

1. State office will maintain and update a record of ESPA transfers as they are approved by regional staff
2. Model will be processed and analyzed once a year, during mid to late November when field season has concluded



# Where do we go from here?

- Does the current policy protect senior surface water users while allowing transfers for economic development?
- Do adjustments need to be made:
  - To enable transfers to be completed more easily?
  - To better protect senior water users?



Questions?



# MEMO

## State of Idaho

### Department of Water Resources

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

Phone: (208) 287-4800 Fax: (208) 287-6700

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**Date:** December 5, 2024  
**To:** Phill Hummer, Water Rights Section Manager  
**Cc:** Shelley Keen, Deputy Director  
**From:** Jennifer Sukow, P.E., P.G., Hydrology Section 15  
**Subject:** Cumulative review of ESPA transfers between 2012 and 2024

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In 2019, the Idaho Department of Water Resources (IDWR) began analyzing and reporting the cumulative effect of water right transfers involving pumping from the Eastern Snake Plain aquifer (ESPA). IDWR's report is updated each year. The last analysis included water right transfers approved between January 1, 2012, and September 30, 2023 (Sukow, 2024).<sup>1</sup> This memorandum presents the results of an updated cumulative review including water right transfers approved between January 1, 2012, and September 30, 2024.

Water Allocation Bureau staff identified 52 transfers approved between October 1, 2023, and September 30, 2024, involving PODs located within the Eastern Snake Plain Aquifer Model Version 2.2 (ESPAM2.2) boundary. For each transfer, Water Allocation Bureau staff assigned "TO" and "FROM" well locations to a model row and column. For transfers involving a well location outside of the active model boundary, the well location was assigned to the model row and column of the nearest active model cell. Water Allocation Bureau staff also provided an annual pumping volume for each well. Figure 1 shows the locations of model cells with TO and FROM wells representing the 52 recently approved transfers. Figure 2 shows the cumulative change in annual pumping volume by model cell for the recently approved transfers.

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<sup>1</sup> Sukow, J., 2024. *Cumulative review of ESPA transfers between 2012 and 2023*, Idaho Department of Water Resources, memorandum to Angela Hansen dated May 29, 2024, 12 p., <https://idwr.idaho.gov/wp-content/uploads/sites/2/water-rights/ESPAXferMemo2023final.pdf>.

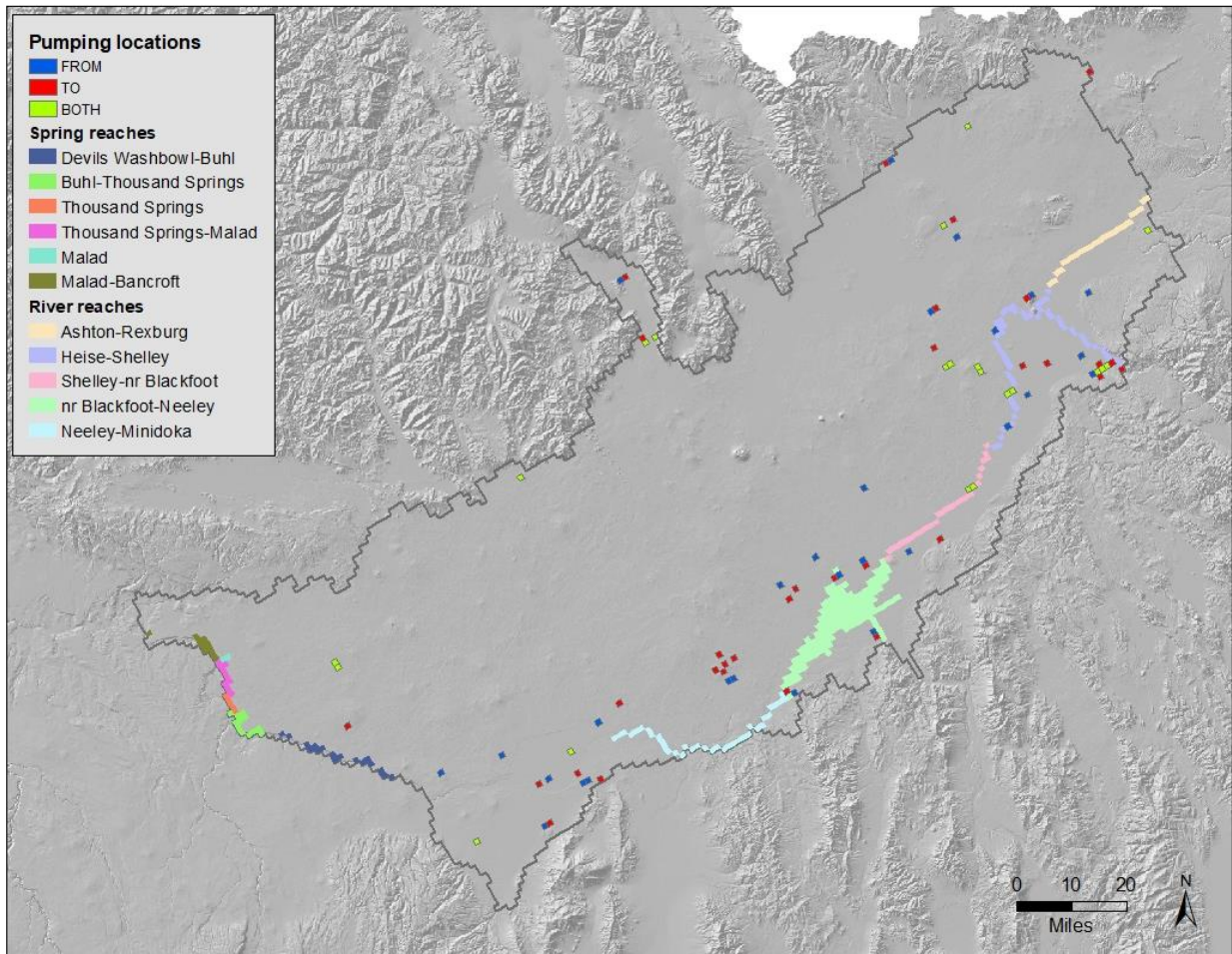


Figure 1. Locations of TO and FROM wells for transfers approved between October 1, 2023, and September 30, 2024

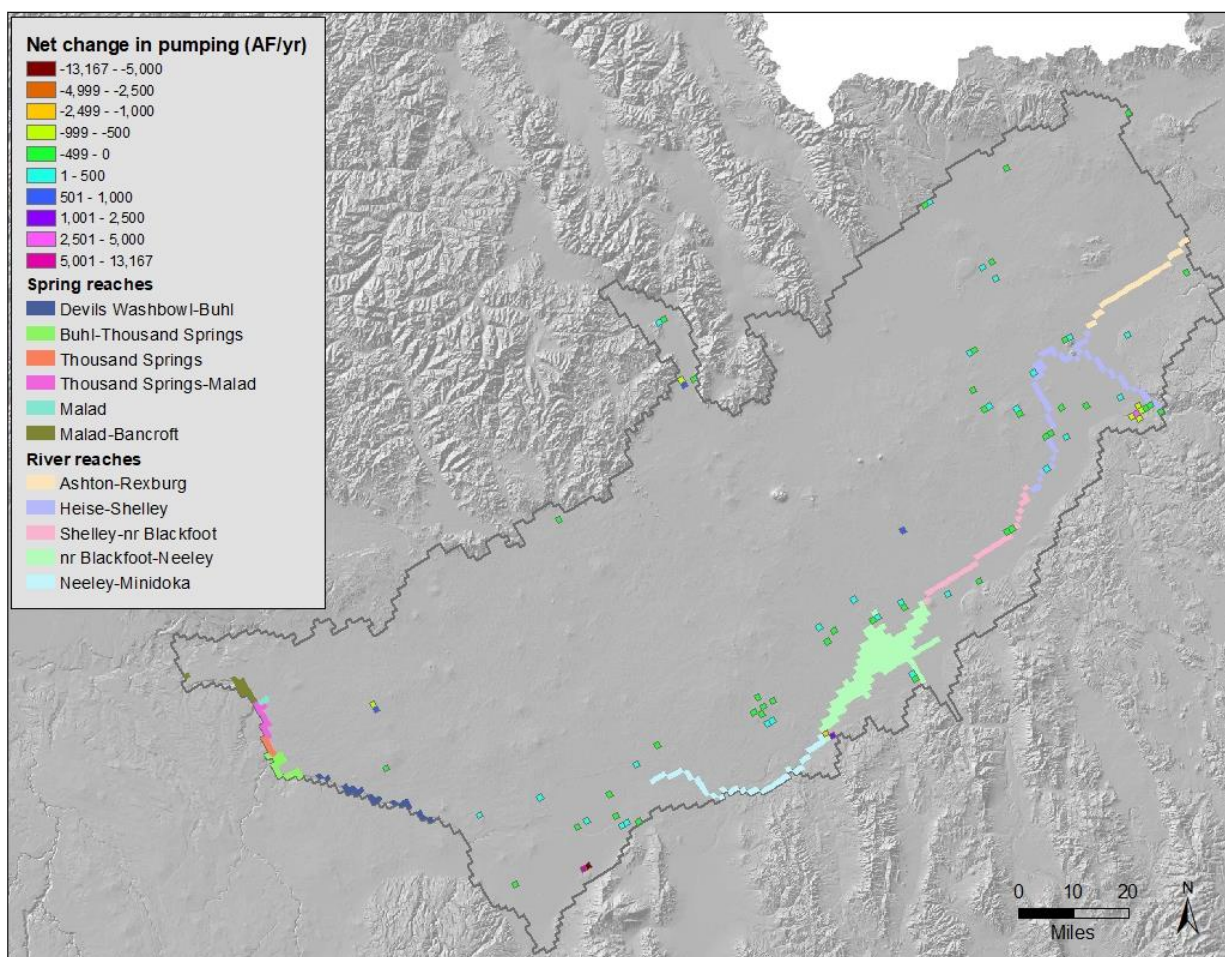


Figure 2. Net change in pumping resulting from transfers approved between October 1, 2023, and September 30, 2024

For the cumulative review, changes in pumping resulting from the recently approved transfers were added to changes in pumping resulting from the 743 transfers analyzed previously in Sukow (2024). The updated analysis includes a total of 795 transfers. Figure 3 shows the locations of model cells with TO and FROM wells representing the transfers approved between January 1, 2012, and September 30, 2024. Figure 4 shows the cumulative change in annual pumping volume by model cell for these transfers.

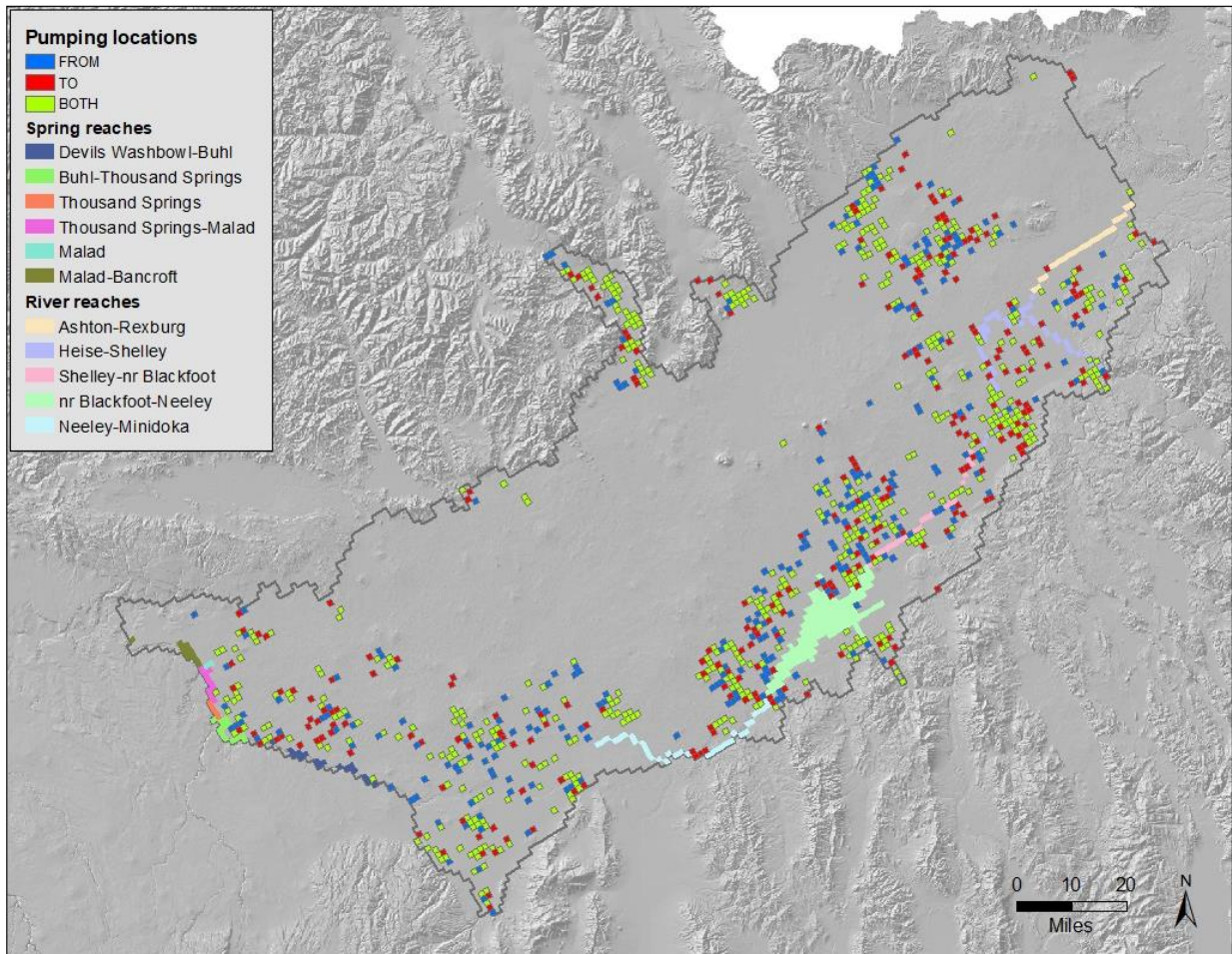


Figure 3. Location of TO and FROM wells for transfers approved between January 1, 2012, and September 30, 2024

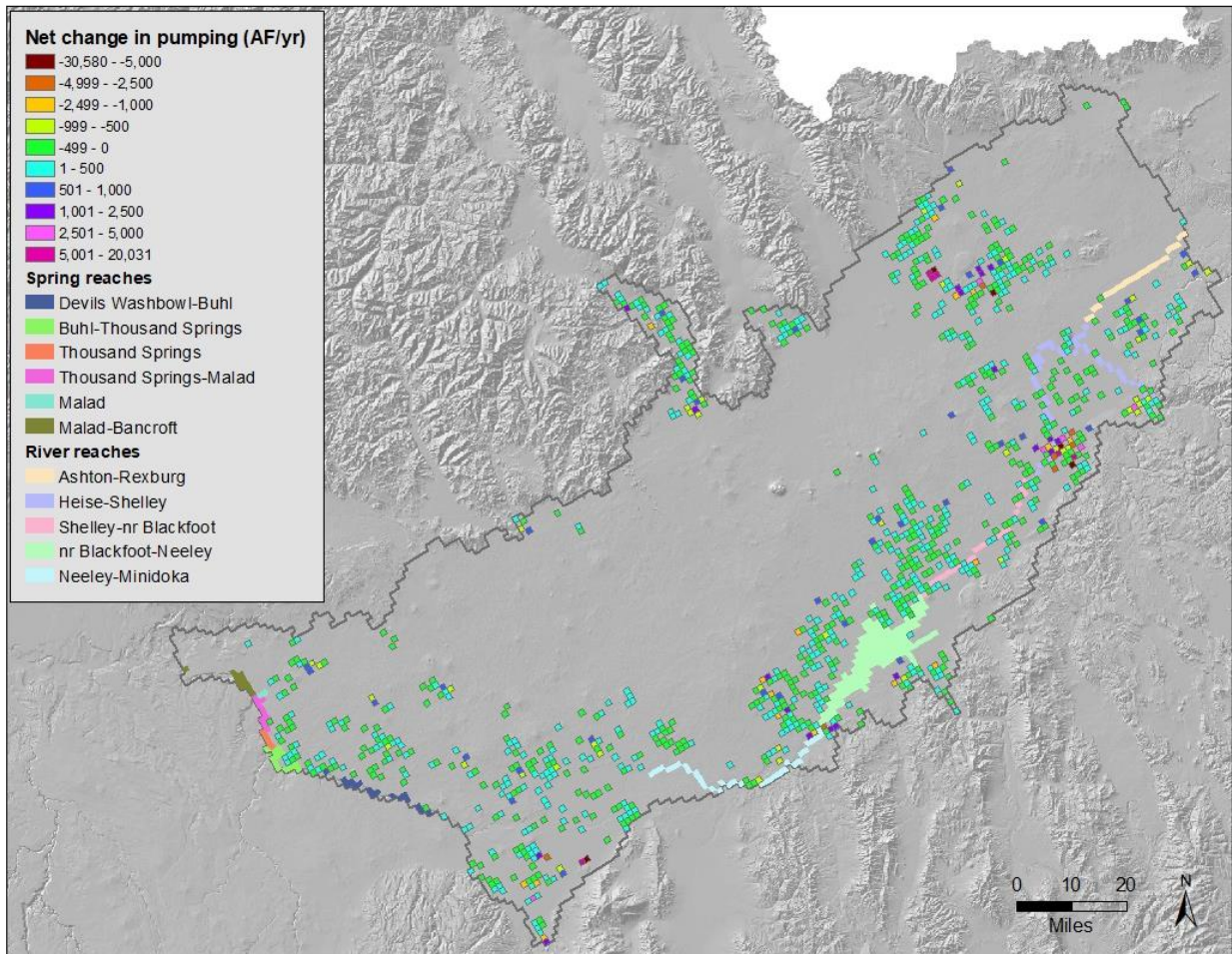


Figure 4. Net change in pumping resulting from transfers approved between January 1, 2012, and September 30, 2024

Most transfers involve relatively small amounts of water (Figure 5) or move points of diversion a relatively short distance (Figure 6). Figure 7 shows the cumulative volume of water transferred by the average distance between TO and FROM wells. Because mitigation was required for some transfers with longer distances, the cumulative TO volumes are less than the cumulative FROM volumes for all categories greater than one mile.

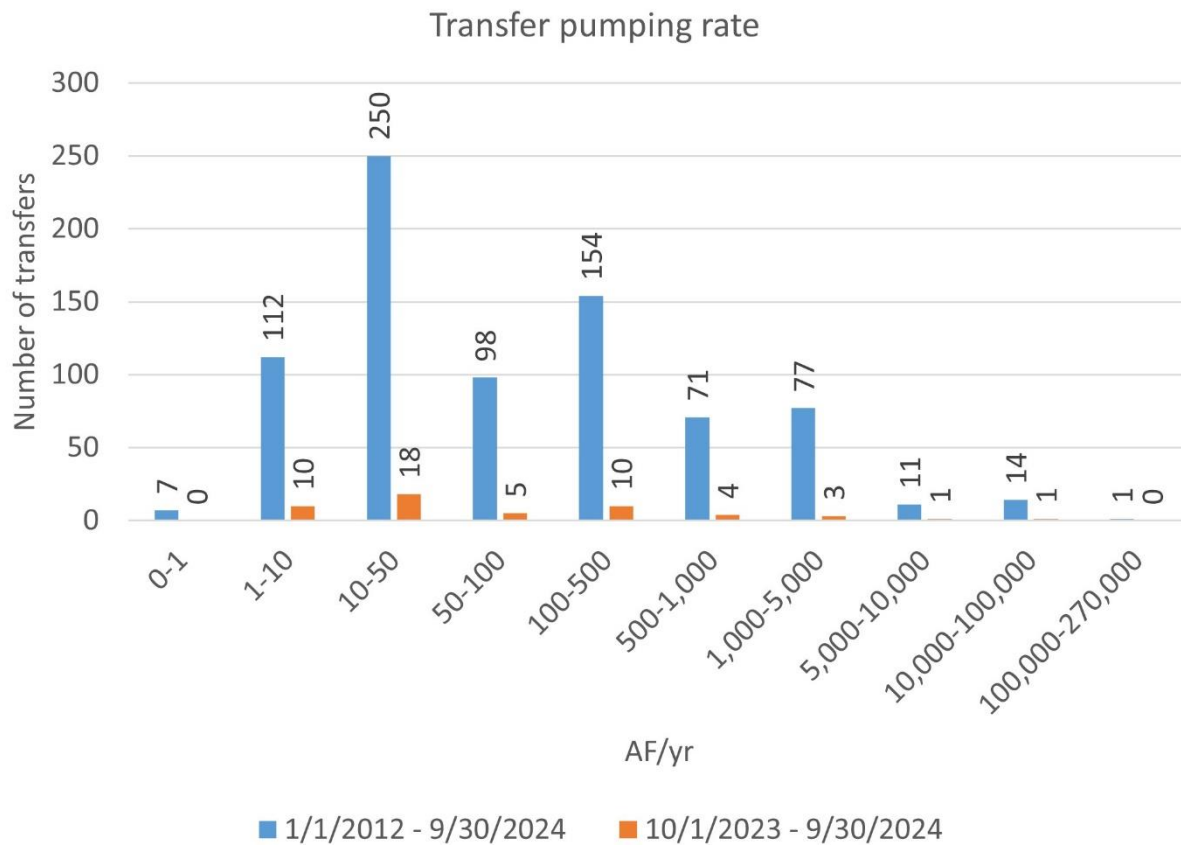


Figure 5. Transfer pumping volume



Figure 6. Average distance between TO and FROM wells

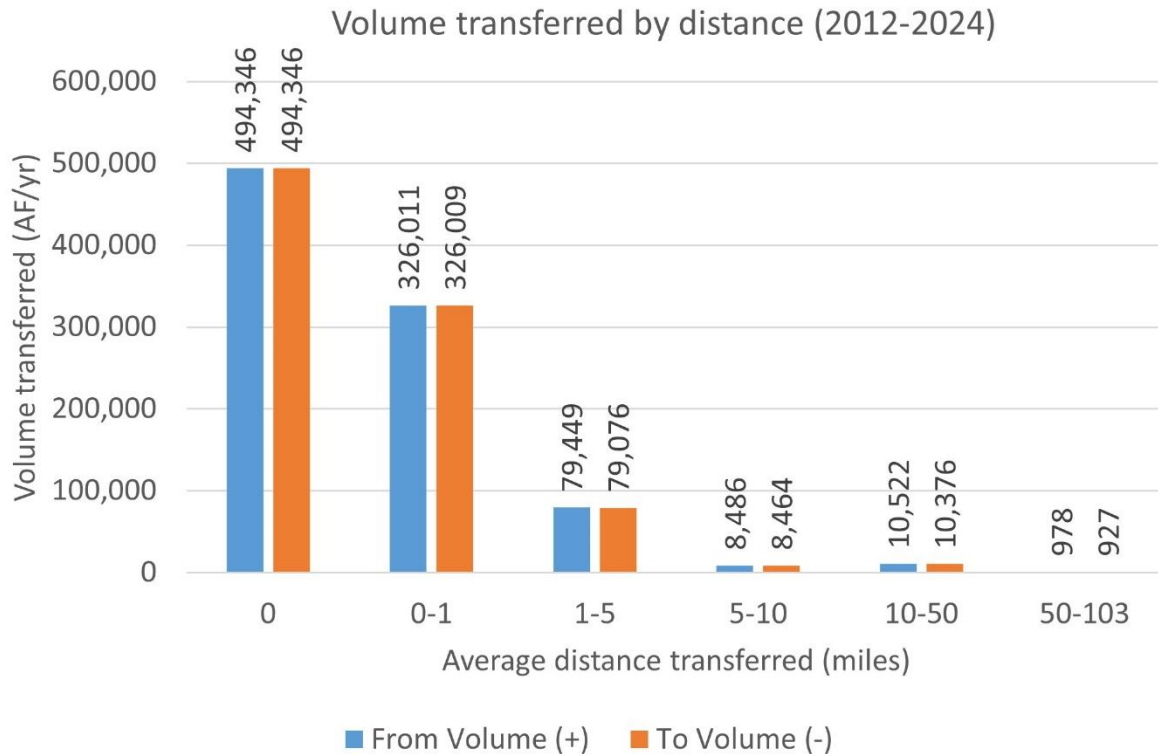


Figure 7. Cumulative volume transferred by distance transferred (1/1/2012 – 9/30/2024)

The Eastern Snake Plain Aquifer Model version 2.2 (ESPAM2.2)<sup>2</sup> was used to simulate the cumulative effects of the transfers on steady-state reach gains equivalent to the reaches represented in the ESPA Model Transfer Spreadsheet (ETRAN), which is commonly used as a tool by transfer applicants and Water Allocation Bureau staff to analyze the hydrologic impacts of individual transfers. ETRAN simulates the effects of changes in pumping location using the ESPAM2.2 groundwater flow model, but the ETRAN user interface only supports the simulation of a limited number of points of diversion. Because the cumulative analysis requires simulation of a large number of points of diversion, ESPAM2.2 was used with other pre- and post-processing tools to perform the analyses.

Transfer data provided by Water Allocation Bureau staff were reformatted to create MODFLOW input files. FROM wells were represented as a positive stress to simulate a decrease in pumping at these locations. TO wells were represented as a negative stress to simulate an increase in

<sup>2</sup> Sukow, J., 2021. *Model Calibration Report, Eastern Snake Plain Aquifer Model Version 2.2*, Idaho Department of Water Resources, May 2021, 226 p., [https://research.idwr.idaho.gov/files/projects/espam/browse/ESPAM22\\_Reports/ModelCalibrationRpt/](https://research.idwr.idaho.gov/files/projects/espam/browse/ESPAM22_Reports/ModelCalibrationRpt/).

pumping at these locations. The superposition version of ESPAM2.2<sup>3</sup> was used to simulate the effects of the changes in pumping at steady state.

The cumulative effect of changes in pumping on reach gains in each of the eleven reaches of the Snake River was extracted from the model output. Results are summarized in Table 1. Changes in reach gains resulting from the transfers are very small compared to average reach gains (less than +/- 1.5%). The largest changes are an increase of 1,890 AF/yr (2.6 cfs) in the near Blackfoot to Neeley reach and a decrease of 928 AF/yr (-1.3 cfs) in the Neeley to Minidoka reach. The cumulative effect on the near Blackfoot to Minidoka reach is an increase of 962 AF/yr (1.3 cfs).

Table 1. Cumulative effect of transfers approved between January 1, 2012 and September 30, 2024 on reach gains in the Snake River

| Reach                          | Transfer Impact |       | Average Reach Gain <sup>4</sup> |       | % change in reach gain |
|--------------------------------|-----------------|-------|---------------------------------|-------|------------------------|
|                                | (AF/yr)         | (cfs) | (AF/yr)                         | (cfs) |                        |
| Ashton-Rexburg                 | 295             | 0.41  | -19,756                         | -27   | 1.493%                 |
| Heise-Shelley                  | -307            | -0.42 | -214,459                        | -296  | -0.143%                |
| Shelley-Near Blackfoot         | -293            | -0.40 | -400,694                        | -553  | -0.073%                |
| Subtotal above nr Blackfoot    | -305            | -0.42 | -634,908                        | -876  | -0.048%                |
| Near Blackfoot-Neeley          | 1,890           | 2.61  | 1,720,822                       | 2,375 | 0.110%                 |
| Neeley-Minidoka                | -928            | -1.28 | 71,706                          | 99    | -1.294%                |
| Subtotal nr Blackfoot-Minidoka | 962             | 1.33  | 1,792,528                       | 2,474 | 0.054%                 |
| Devil's Washbowl -Buhl         | -39             | -0.05 | 787,690                         | 1,087 | -0.005%                |
| Buhl-Thousand Springs          | -47             | -0.07 |                                 |       |                        |
| Thousand Springs               | -6              | -0.01 |                                 |       |                        |
| Thousand Springs-Malad         | 1               | 0.00  |                                 |       |                        |
| Malad                          | 24              | 0.03  |                                 |       |                        |
| Malad-Bancroft                 | 6               | 0.01  |                                 |       |                        |
| Subtotal Kimberly-King Hill    | -61             | -0.08 | 4,248,456                       | 5,864 | -0.001%                |
| Total                          | 596             | 0.82  | 5,406,075                       | 7,462 | 0.011%                 |

<sup>3</sup> Sukow, J., 2021, *Comparison of Superposition Model with Fully-populated Model for Eastern Snake Plain Aquifer Model Version 2.2*, Idaho Department of Water Resources, March 2021, 14 p., [https://research.idwr.idaho.gov/files/projects/espam/browse/ESPAM22\\_Reports/Scenarios/Super\\_FullyPop\\_Final.pdf](https://research.idwr.idaho.gov/files/projects/espam/browse/ESPAM22_Reports/Scenarios/Super_FullyPop_Final.pdf).

<sup>4</sup> Average reach gains were calculated from data compiled for development of ESPAM2.2 for water years 1981 through 2018.

Figure 8 shows the trend in the cumulative effect of transfers approved on or after January 1, 2012, on reaches of the Snake River above Minidoka. For reaches of the Snake River above the near Blackfoot gage, there is not an apparent trend in the cumulative effect of the transfers. For these reaches, the cumulative effect of transfers approved during a given year resulted in increases in reach gains for some years and decreases in reach gains for other years. For the near Blackfoot to Neeley reach, the cumulative effect of the transfers approved during a given year has resulted in a very small increase in reach gains for most years. For the Neeley to Minidoka reach, the cumulative effect of the transfers approved during a given year has resulted in a very small decrease in reach gains for most years. The cumulative effect on the combined near Blackfoot to Minidoka reach has been a very small increase in reach gains for most years. The slope of the trends in the near Blackfoot to Neeley, Neeley to Minidoka, and near Blackfoot to Minidoka reaches was generally greater prior to 2017 than after 2017.

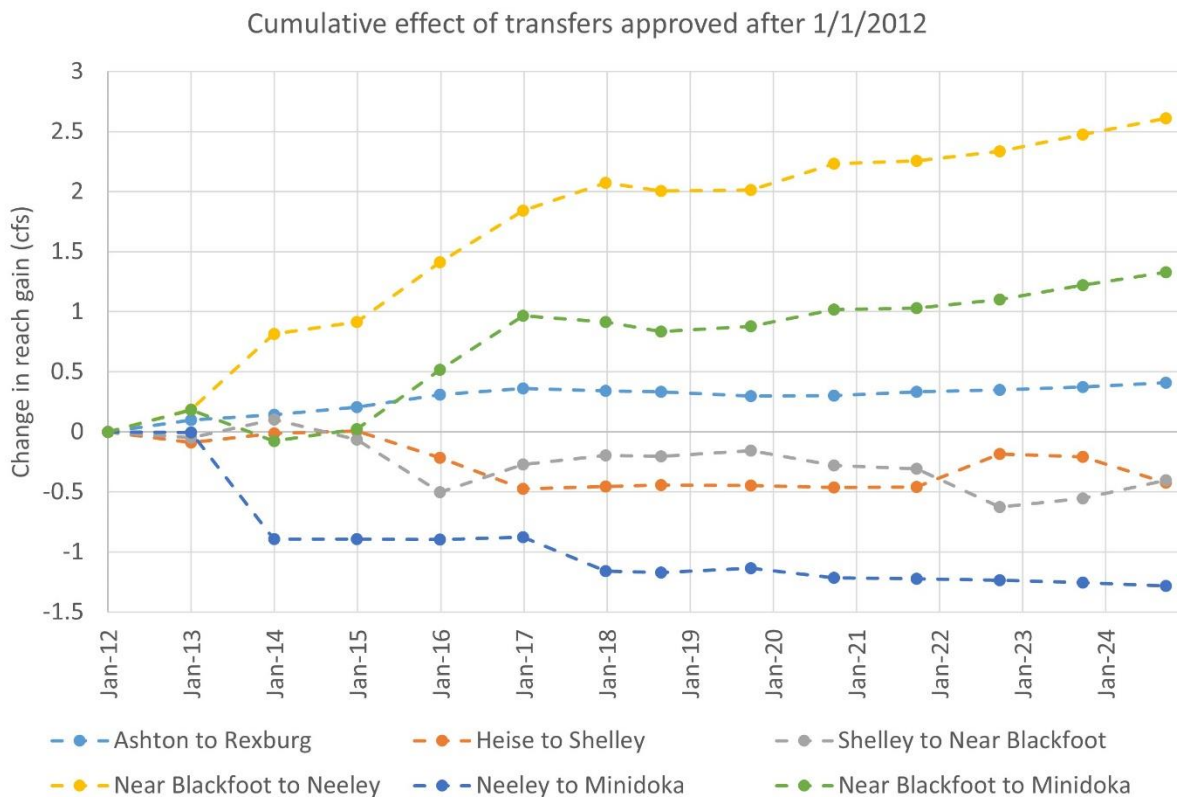


Figure 8. Trend in cumulative effect of transfers approved on or after January 1, 2012, on reaches of the Snake River above Minidoka

Figure 9 shows the trend in the cumulative effect of transfers approved on or after January 1, 2012, on reaches of the Snake River between Kimberly and King Hill. For reaches between Kimberly and King Hill, the cumulative effect of transfers approved during a given year resulted in increases in reach gains for some years and decreases in reach gains for other years. The effect on the Devil's Washbowl to Buhl reach has been a very small decrease in reach gains for seven of the thirteen years. The effect on the Buhl to Thousand Springs reach has been a very small decrease in reach gains for nine of the thirteen years. The total effect on the Kimberly to King Hill reach has been a very small decrease in reach gains for eight of the thirteen years, a very small increase for four of the thirteen years, and near zero impact for one year. In general, the cumulative effect of transfers approved between 2012 and 2018 was a very small increase in Kimberly to King Hill reach gains. The cumulative effect of transfers approved during water years 2019 through 2024 has been a very small decrease in reach gains.

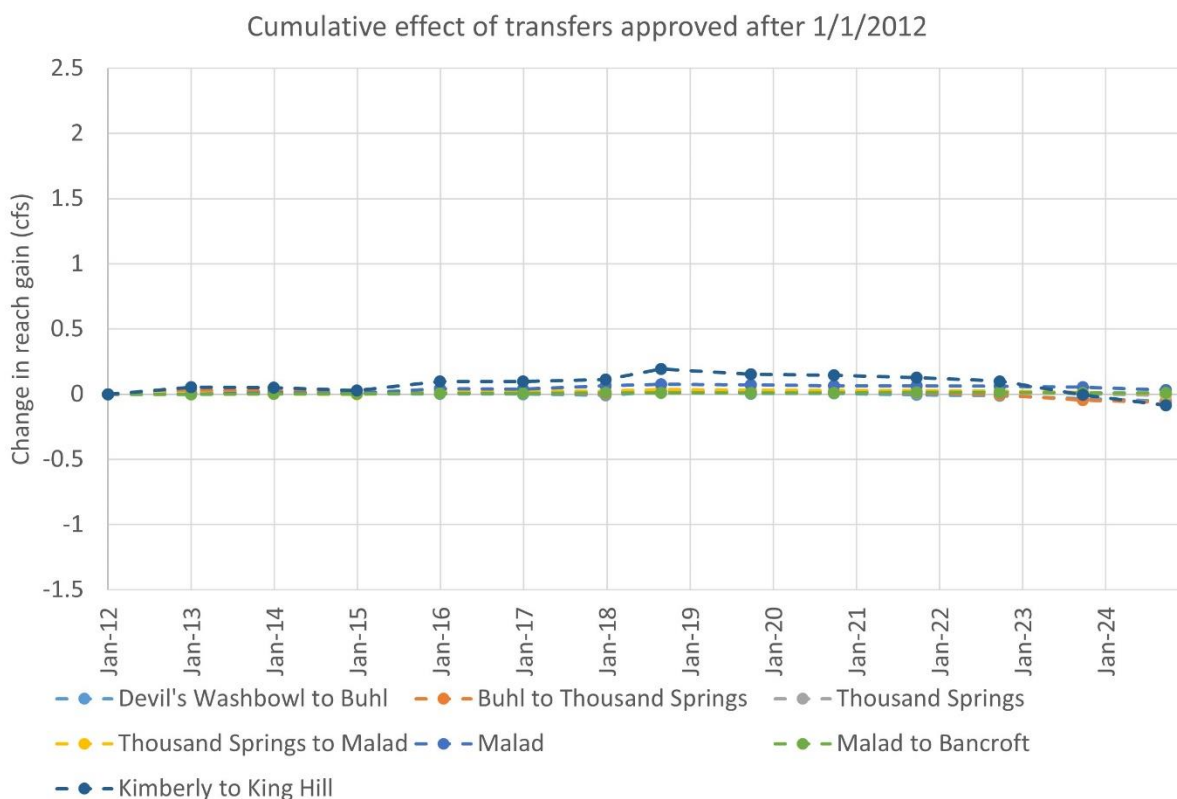


Figure 9. Trend in cumulative effect of transfers approved on or after January 1, 2012, on reaches of the Snake River between Kimberly and King Hill

Of the 795 transfers included in the cumulative analysis, 375 transfers had an average distance of greater than 1.0 mile between the TO and FROM model cell locations (Figure 10). The cumulative effects of these 375 transfers were simulated using the superposition version of ESPAM2.2. Results of the simulation are summarized in Table 2. The results are similar to the results of the simulation that included all of the transfers. Changes in reach gains resulting from the transfers are very small compared to average reach gains (less than  $\pm 1.5\%$ ). The largest changes are an increase of 1,262 AF/yr (1.7 cfs) in the near Blackfoot to Neeley reach and a decrease of 765 AF/yr (-1.1 cfs) in the Neeley to Minidoka reach. The cumulative effect on the near Blackfoot to Minidoka reach is an increase of 497 AF/yr (0.7 cfs).

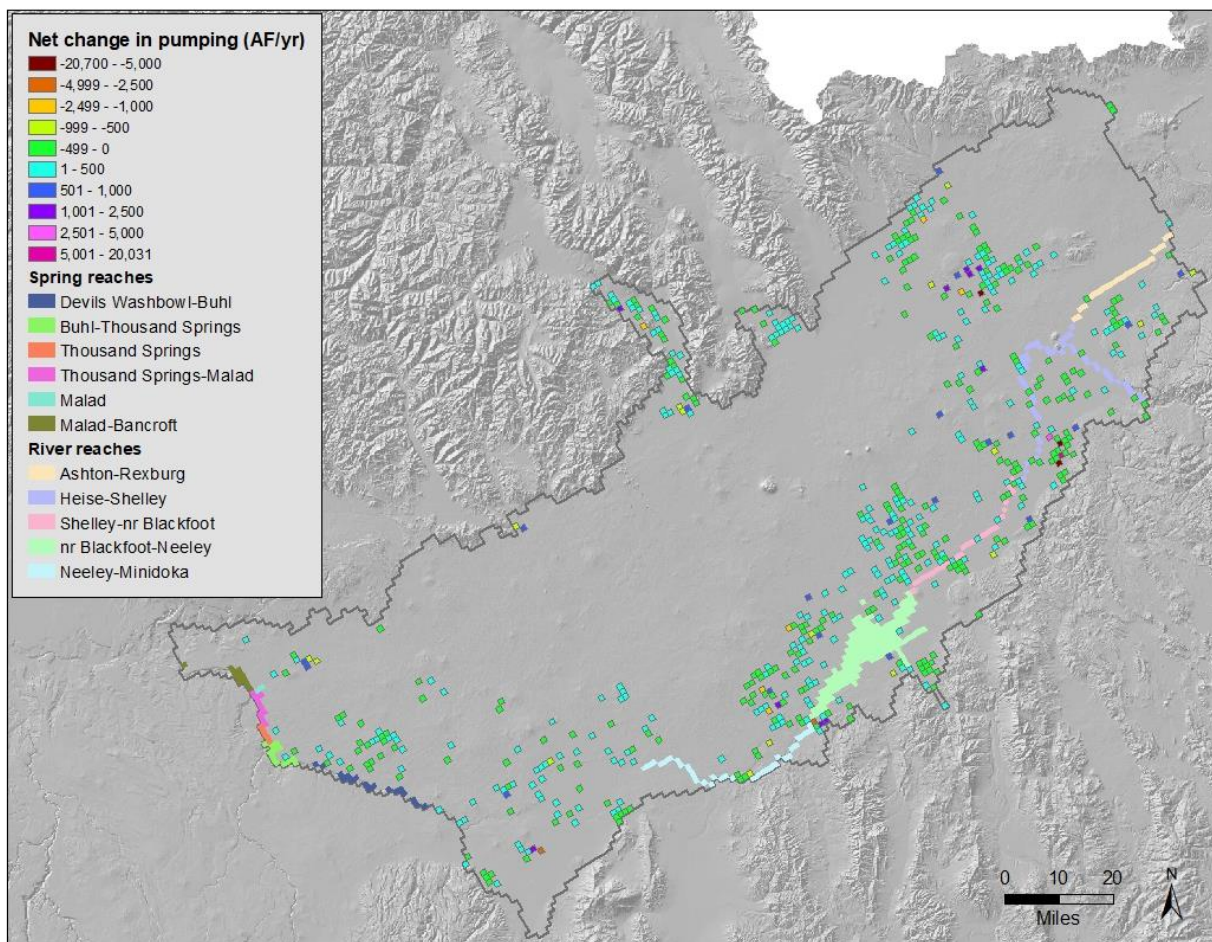


Figure 10. Net change in pumping resulting from transfers with an average distance of greater than one mile (approved between January 1, 2012, and September 30, 2024)

Table 2. Cumulative effects of transfers with an average distance greater than one mile on reach gains in the Snake River (for transfers approved between January 1, 2012, and September 30, 2024)

| Reach                          | Transfer Impact |       | Average Reach Gain |       | % change in reach gain |
|--------------------------------|-----------------|-------|--------------------|-------|------------------------|
|                                | (AF/yr)         | (cfs) | (AF/yr)            | (cfs) |                        |
| Ashton-Rexburg                 | 215             | 0.30  | -19,756            | -27   | 1.086%                 |
| Heise-Shelley                  | 60              | 0.08  | -214,459           | -296  | 0.028%                 |
| Shelley-Near Blackfoot         | -75             | -0.10 | -400,694           | -553  | -0.019%                |
| Subtotal above nr Blackfoot    | 200             | 0.28  | -634,908           | -876  | 0.031%                 |
| Near Blackfoot-Neeley          | 1,262           | 1.74  | 1,720,822          | 2,375 | 0.073%                 |
| Neeley-Minidoka                | -765            | -1.06 | 71,706             | 99    | -1.067%                |
| Subtotal nr Blackfoot-Minidoka | 497             | 0.69  | 1,792,528          | 2,474 | 0.028%                 |
| Devil's Washbowl -Buhl         | -66             | -0.09 | 787,690            | 1,087 | -0.008%                |
| Buhl-Thousand Springs          | -39             | -0.05 |                    |       |                        |
| Thousand Springs               | -13             | -0.02 |                    |       |                        |
| Thousand Springs-Malad         | -5              | -0.01 |                    |       |                        |
| Malad                          | 16              | 0.02  |                    |       |                        |
| Malad-Bancroft                 | 5               | 0.01  |                    |       |                        |
| Subtotal Kimberly-King Hill    | -103            | -0.14 | 4,248,456          | 5,864 | -0.002%                |
| Total                          | 594             | 0.82  | 5,406,075          | 7,462 | 0.011%                 |