Streamflow is changing in rivers across Alberta: assessing regional variation in changing hydrologic indices

by

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Abstract

The flow regime is a crucial factor in the well-being of aquatic and riparian ecosystems. Many components of those ecosystems, ranging for nutrient transport to morphology, are impacted by various hydrologic parameters. The parameters help define and quantify five important hydrologic regime characteristics: magnitude, duration, timing, frequency, and rate of change. Our study utilized the Indicators of Hydrologic Alteration (IHA) indices to (1) determine how various ecologically relevant components of streamflow are changing across Alberta's various natural regions; and (2) examine the similarities and differences between streamflow trends and climate trends. The overarching goal of these objectives is to create a foundation upon which water management practices can be created or modified.

Region-specific water management is required to balance the residential, commercial, and industrial water needs of a particular region with ecological concerns and conservation initiatives. Understanding the trends in hydrologic parameters is an important step in recognizing the vulnerabilities of each region. Streamflow at Water Survey of Canada stations was assessed for linear trends using a Mann-Kendall Trend Analysis. Our approach of assessing overall trends on a regional basis was validated when looking at trends in magnitude. The average daily flow rate for spring and summer months was found to be decreasing in the Boreal Natural Region but increasing in the Grassland Natural Region. Other hydrologic indices were found to exhibit significant trends on a province-wide level. Annual minimum and maximum flow conditions over a variety of durations were observed to be merging across the province. Similarly, the rate of change of streamflow between consecutive days is decreasing across Alberta.

To determine whether these results were the function of climate oscillation patterns, a composite analysis was performed to determine the effect of the El Niño–Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO) on hydrologic indices. Only 8% of parameters were found to be significantly influenced by PDO patterns and 4% influenced by ENSO patterns.

Preface

This thesis is an original work by W. Kyle Hamilton. No parts of this thesis have been previously published.

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1 Introduction

It is widely understood that the flow regime is a primary driver in the health and well-being of aquatic and riparian ecosystems (Bunn & Arthington, 2002; Lytle, 2001; Mims & Olden, 2013; Poff et al., 1997; Poff & Zimmerman, 2010). Alteration to the natural flow regime presents a major threat to the ecological sustainability of these important ecosystems (Bunn & Arthington, 2002; Sparks, 1995; Ward et al., 1999). A flow regime with high spatial and temporal variability helps promote species diversity in riverine environments (Ward et al., 1999). Bunn & Arthington (2002) identified four principles that describe the effect of the flow regime on aquatic biodiversity: 1) flow has a significant influence on the physical habitat in streams, and therefore also has a significant influence on the biotic composition in those streams; 2) life history strategies have been developed in direct response to natural flow regimes; 3) many species rely on the longitudinal and lateral connectivity of streams; and 4) flow alteration may enable the invasive species in streams (Bunn & Arthington, 2002).

Influence on Physical Habitat

The characteristics of the flow regime (e.g. magnitude and duration) interact with local geology and topography to establish many components of a river channel, including its shape and size, the distribution of riffle and pool segments, and substrate deposition (Bunn & Arthington, 2002; Cobb et al., 1992; Frissell et al., 1986; Newbury & Gaboury, 1993). The combination of flow and physical habitat is a major driver in the species distribution of a riverine community (Bunn & Arthington, 2002; Poff & Allan, 1995; Ward et al., 1999). Naturally, it is easy to conclude that hydrological alteration has an impact on fish assemblage and functional organization (Bunn & Arthington, 2002). For example, salmon larvae and juvenile salmonids live in the stream substrates during the low-flow conditions over winter and are vulnerable to being stranded in the event of flow reductions (Bradford, 1997; Bradford et al., 1995).

Evolution of Life History Strategies

A species' life history strategy dictates its favourable habitat conditions, including the variability, predictability, and seasonality of the flow regime (Lytle, 2001; Mims & Olden, 2012). Critical life events, such as phenology of reproduction, spawning behavior, larval survival, growth patterns, and recruitment, are deeply impacted by the flow regime (Copp, 1989, 1990; Humphries et al., 1999; Junk et al., 1989; Sparks, 1995; Welcomme, 1985). For example, coho salmon (*Oncorhynchus kisutch*) begin migrating for reproduction

following high flow conditions in the fall. In southeastern Alaska, autumn precipitation in September and October triggers migration, whereas migration in Washington and Oregon does not begin until the rains start in November (Naiman et al., 2002).

Longitudinal and Lateral Connectivity

Many species require the ability to move within a stream network, both within a single river and between multiple rivers. Dams in particular can greatly impact the connectively of streams. This impact is not limited to presenting a barrier to fish passage, but can also include reducing peak flow conditions which limits floodplain inundation (Bunn & Arthington, 2002). Temporary inundation of the floodplain provides valuable spawning, nursery, and foraging habitat for many fish species (Cadwallader, 1986; Junk et al., 1989; Lowe-McConnell, 1985; Ward et al., 1999; Welcomme, 1985).

Facilitating Invasive Species

When the flow regime changes, species that have evolved life-history traits for the natural flow regime become ill-equipped to handle their new habitat. This creates an opportunity for species with life-history traits that favour the new flow and physical habitat conditions. Waterbodies that have been dammed, diverted, or where variability in the flow regime is reduced are particularly vulnerable to invasive species (e.g., Arthington et al., 1990; Moyle, 1986). Flow regulation, for example, provides seasonally stable, low flows (Bunn & Arthington, 2002). This makes native species vulnerable as they struggle to adapt away from their preferred variable flows and heterogeneous habitat conditions. In some Australian rivers, invasive fish species such as carp (*Cyprinus carpio*) and mosquitofish (*Gambusia affinis*) have taken advantage of the altered flow conditions, which is more favourable to their life-history traits (Faragher & Harris, 1994; Gehrke et al., 1999; Pusey et al., 1993; Walker et al., 1995).

In Alberta, an increasing population has increased the risk of hydrologic alteration. The population of Alberta increased by almost 5,000% between 1901 and 2011 (Statistics Canada, 2011), resulting in an increasing demand for residential and industrial water consumption (Government of Alberta, 2010), flood control, and energy production. Increased energy production has included the construction of several hydroelectric dams between 1900 and today, including The Bighorn Hydro Plant in 1972 on the North Saskatchewan River system (TransAlta Corporation, 2018a). Dam construction alters habitat by capturing sediment, altering stream temperatures, and reducing the magnitude and frequency of high flow events (Chien, 1985). Another potential cause of

hydrologic alteration is the increase in oil operations. Canada produced triple the amount of oil in 2006 as in 1990. Alberta plays a large role in this, as the province accounts for approximately 69% of Canadian oil production (Natural Resources Canada, 2014). Water is used in the production process and process-affected discharge is not discharged. With most of the water used coming from the Athabasca River, this has the potential to impact aquatic habitat downstream (Royal Society of Canada Expert Panel, 2010). These are just two possible anthropogenic impacts on Alberta's flow regime. Irrigation, urban water use, and flood protection are also possible impacts.

This study is unique in that it compares streamflow trends across Alberta's natural regions. Alberta is comprised of six natural regions: Boreal, Grassland, Parkland, Rocky Mountain, Foothills, and Canadian Shield. This framework is a form of land classification based on a variety of features, including hydrology, geology, landform, climate, soils, flora, and fauna. Each natural region is introduced below, and important hydrologic and climate characteristics are identified.

Boreal Natural Region

The Boreal Natural Region covers 58% of Alberta's land area and is in the northern portion of the province. It is characterized by its short summers, long winters, and large forests. Precipitation typically peaks in summer, with 60% to 70% of annual precipitation falling between April and August. As a result, watercourses in the region are characterized by a pluvial flow regime. Major rivers flowing through the region include: The Peace River, North Saskatchewan River, and Athabasca River. The region is species-rich with native fish, including Arctic Grayling, Lake Whitefish, a variety of *Cyprinidae*, northern pike, burbot, and walleye. Land use in the region is quite diversified, with agriculture, oil and gas, forestry, coal mining, and recreation all being found in the region (Natural Regions Committee, 2006).

Grassland Natural Region

The Grassland Natural Region covers 14% of Alberta's land area and is in the southeast corner of the province. The region is characterized by gently undulating terrain and is Alberta's warmest and driest natural region. Streamflow in the region is primarily driven by snowmelt, with influence from annual precipitation peaks in June, resulting in a nival flow regime (Dumanski et al., 2015). This region features the Milk River Basin, South Saskatchewan River Basin, which includes the Oldman River, Bow River, and Red Deer River. Native fish species of the region include a variety of *Cyprinidae*, and fish that can tolerate

the turbid, oxygen-poor habitat conditions that are characteristic of the region's watercourses.

Land use in the region is primarily agriculture due to the long growing season, with oil and gas also present (Natural Regions Committee, 2006). With the semi-arid climate in the region, irrigation is a necessary tool for the success of the agricultural industry.

Parkland Natural Region

The Parkland Natural Region covers 9% of Alberta's land area and is in the central portion of the province. Shrublands and grasslands characterize the region, with soils ideal for agriculture. The climate within the region represents a transition between the Grassland Natural Region to the south and west, and the Boreal Natural Region to the north. As a result, the mean annual temperature, growing season and mean annual precipitation values are all in between the two neighbouring natural regions. The transitional nature of the region's climate results in spatial differences in winter temperature, where the northern portion of the region is cooler, and the southern portion of the region is warmer dues to chinooks. Maximum precipitation typically occurs in summer months because of rainfall, resulting in pluvial flow regimes. Major rivers flowing through the region include: The Peace River, North Saskatchewan River, Red Deer River, and Bow River. Native fish species of the region include a variety of *Cyprinidae*, northern pike, and trout-perch (Natural Regions Committee, 2006).

Land use in the region is primarily agriculture and oil and gas, but the region also is the most heavily populated natural region in Alberta, as it includes Calgary, Edmonton, and Red Deer (Natural Regions Committee, 2006). As a result, this region features a variety of water uses, including urban, industrial, and agricultural. The southern portion of the region is in the South Saskatchewan River basin, which features sub-basins that are fully allocated (i.e. Bow River) or approaching their allocation limits (i.e. Red Deer River) (Alberta Environment and Parks, 2006).

Rocky Mountain Natural Region

The Rocky Mountain Natural Region covers 7.4% of Alberta's land area and is in the southwest portion of the province. It is characterized by mountains, tall foothills, and deep glacial valleys. The flow regime receives most of its water from glacial melt, resulting in glacial flow regimes. As a result, the watercourses in this region are characterized by distinct diurnal melting peaks as air temperatures rise, with annual maximums occurring

into the summer when air temperatures are highest (Zeiringer et al., 2018). These conditions are favourable to the native fish species of the region, including lake trout, bull trout, rainbow trout, and cutthroat trout.

Due to its elevation, the Rocky Mountain Natural Region has the coolest summers of any natural region in Alberta. It also has the highest mean annual precipitation and has the most snow of any natural region. Having said that, the climate within the Rocky Mountain Natural Region is highly variable due to highly variable elevations: The Montane Subregion tends to be drier and has more mild winters than the higher-elevation Alpine and Subalpine Subregions (Natural Regions Committee, 2006).

Due to the challenging terrain of the region, land use in the region is primarily wildlife habitat, but also includes recreational areas, timber harvesting, cattle, oil and gas, and coal (Natural Regions Committee, 2006). While some water is used within the region for industrial purposes, the region includes the headwaters of some of Alberta's major rivers, including the Athabasca River, North Saskatchewan River, Bow River, and Oldman River. These rivers provide a substantial amount of the water used in water licenses, particularly in Southern Alberta where the Bow River, Oldman River, and South Saskatchewan River sub-basins have already reached their limit of allocations (Alberta Environment and Parks, 2006).

Foothills Natural Region

The Foothills Natural Region covers 10% of Alberta's land area and is in the west portion of the province. It is characterized by highly variable topography, ranging from sharp, ridges near the mountains to rolling and undulating terrain in the north and east. Due to the range in elevation, precipitation and temperature are also variable throughout the region. Generally, the Foothills Natural Region has relatively high precipitation, including some of the wettest summer conditions. At lower elevations, at points further away from the mountains, temperatures are warmer in the summer and colder in the winter (Natural Regions Committee, 2006).

Due to its proximity to the mountains, the flow regime still receives a large amount of its water from glacial melt. However, with high summer precipitation, the flow regime will also experience pluvial influences, resulting in a mixed flow regime (Zeiringer et al., 2018). These conditions are favourable to the native fish species of the region, including Rocky Mountain whitefish, bull trout, Arctic grayling, burbot, and white sucker (Natural Regions Committee, 2006).

Land use in the region features timber harvesting, coal, oil and gas, and cattle grazing. Major rivers within the region include the North Saskatchewan River and Athabasca. While the region does not feature much standing water, the region is home to the Brazeau Reservoir, one of Alberta's largest hydroelectric generation facilities (TransAlta Corporation, 2018b).

Canadian Shield Natural Region

The Canadian Shield Natural Region covers 1.5% of Alberta's land area and is in the northeast corner of the province. The region is characterized by hummocky and rolling terrain and large amounts of exposed bedrock. The climate is defined by short summers and cold winters. While precipitation peaks in July, snowfall accounts for approximately 40% of the annual precipitation. As a result, watercourses in the region are characterized by a mixed flow regime, with both pluvial and nival influences. The regional hydrology is compromised mostly of wetlands and small lakes. However, the region is bordered by the Slave River to the west and Lake Athabasca to the south. Nature fish species of the region include northern pike, walleye, lake whitefish, and lake trout. Land use in the region is quite diversified, with agriculture, oil and gas, forestry, coal mining, and recreation all being found in the region (Natural Regions Committee, 2006).

The greatest benefit in analyzing the trends on a regional level is the creation of the conceptual ecological models as part of the risk management process. For example, the needs going forward for risk management within the Boreal Natural Region may vary from those for the Grassland Natural Region. That is not to say the policy decisions for each natural region should be done in a vacuum, as this may make policy implementation and success difficult to attain in downstream natural regions.

It is also important to consider watershed specific influences in interpreting regional results. For example, the Athabasca River is the only major river in Alberta that does not flow through a dam for flow regulation (Athabasca Watershed Council, 2018). In contrast, the Peace River flows through several dams that have been constructed for power generation and flow regulation. Hydrometric stations downstream of these structures may show different trends than stations on the Athabasca River, which may influence our observations on trends within the Boreal Natural Region. Therefore, the trends found within each of Alberta's major river basins have been compared for each region to determine if the trends are consistent throughout the region, across all major river basins.

Alberta consists of seven major river basins: Hay, Peace/Slave, Athabasca, Beaver, North Saskatchewan, South Saskatchewan, and Milk. Each of the major river basins is introduced below.

Hay River Basin (including Great Slave Basin)

The Hay River Basin is in the northwest corner of Alberta. The headwaters of the basin are in the Rocky Mountains in northeast British Columbia and the basin drains into the Arctic Ocean as part of the Mackenzie River system. The basin has a drainage area of 47,900 km^2 (of which 40,000 km^2 is in Alberta, approximately 6% of Alberta's surface area) and a mean annual discharge of 3,630,000,000 m^3 at the Alberta-Northwest Territories border, which is approximately 3% of annual outflow from Alberta. Sub-basins within the basin include the Chinchaga and the Little Hay River systems (Government of Alberta, 2010).

As of 2005, surface and groundwater allocations within the basin totaled 6,598,000 m^3. The oil and gas industry accounted for 75% of the allocations within the basin, while other industries accounted for 15%. With a population of approximately 7,000 people, municipal allocations accounted for the remaining 10% (Alberta WaterPortal Society, 2019d).

Peace/Slave River Basin

The Peace/Slave River Basin is Alberta's largest river basin, with a drainage area of 293,000 km^2 (of which 180,000 km^2 is in Alberta, approximately 30% of Alberta's surface area). The headwaters of the basin are in British Columbia and the basin flows into the Slave River, eventually draining into the Arctic Ocean as part of the Mackenzie River system. The Peace River Basin has a mean annual discharge of 68,200,000,000 m^3 at the mouth where the river flows into the Slave River. This discharge is approximately 60% of the annual outflow from Alberta (Government of Alberta, 2010). Sub-basins within the basin include the Smoky/Wapiti, Upper Peace, Central Peace, Lower Peace, Wabasca, and Slave River Basin (Alberta WaterPortal Society, 2019g; Mighty Peace Watershed Alliance, 2015a).

As of 2013, surface and groundwater allocations within the basin totaled 216,566,133 m^3. Industrial, commercial, municipal, and agricultural sectors have all received water allocations within the Basin (Mighty Peace Watershed Alliance, 2015b).

Athabasca River Basin

The Athabasca River Basin originates in the Rocky Mountains of Alberta, flowing northeast towards Lake Athabasca. The basin is part of the Mackenzie River system, which eventually

flows into the Arctic Ocean. The basin has a drainage area of 140,000 km^2 (approximately 23% of Alberta's surface area) and a mean annual discharge of 24,000,000,000 m^3 at Lake Athabasca, which is approximately 20% of annual outflow from Alberta. Sub-basins within the basin include the McLeod, Pembina, and Clearwater river systems (Alberta WaterPortal Society, 2019b).

As of 2005, surface and groundwater allocations within the basin totaled 849,639 m^3. The oil and gas industry accounted for 68% of the allocations within the basin, while other industries accounted for 17%. Municipal allocations accounted for 5% of water allocations (Alberta WaterPortal Society, 2019b).

Beaver River Basin

The Beaver River Basin is located on the east side of Alberta, extending across Saskatchewan and Manitoba. The headwater of the basin is Beaver Lake and the basin drains into Hudson's Bay as part of the Churchill River system. The basin has a drainage area of 16,000 km^2 (approximately 3% of Alberta's surface area) and a mean annual discharge of 613,000,000 m^3 at the Alberta-Saskatchewan border, which is approximately 1% of annual outflow from Alberta (Government of Alberta, 2010).

As of 2005, surface and groundwater allocations within the basin totaled 47,718,000 m^3. The oil and gas industry accounted for 44% of the allocations within the basin, while other industries accounted for 25%. With a population of approximately 40,000 people, municipal allocations accounted for 10% of the total allocations (Alberta WaterPortal Society, 2019c).

North Saskatchewan River Basin

The headwaters of the North Saskatchewan River Basin are in the Rocky Mountains of southwestern Alberta. The basin flows east towards the Alberta-Saskatchewan border and eventually drains into Hudson's Bay as part of the Nelson River system. The basin has a drainage area of 55,000 km^2 (approximately 9% of Alberta's surface area) and a mean annual discharge of 7,160,000,000 m^3 at the Alberta-Saskatchewan border, which is approximately 6% of annual outflow from Alberta (Government of Alberta, 2010). Sub-basins within the basin include the Battle, Brazeau, Nordegg, Ram, Clearwater, Sturgeon, and Vermilion River systems (Alberta WaterPortal Society, 2019f).

As of 2005, surface and groundwater allocations within the basin totaled approximately 2,000,000 m^3. Industry allocations accounted for over 80% and the oil and gas industry accounted for 5% of the total water allocation quantity for the basin. The basin includes

major urban municipalities, such as Edmonton, Drayton Valley, Fort Saskatchewan, and Lloydminster. In 2001, the population within the basin was approximately 1,000,000 people, resulting in municipal allocations accounting for 8% of the total water allocation quantity (Alberta WaterPortal Society, 2019f). The basin also features two large hydroelectric dam facilities: the Big Horn Dam, which drains Lake Abraham, and the Brazeau Dam, which drains the Brazeau Reservoir (TransAlta Corporation, 2018a, 2018b).

South Saskatchewan River Basin

The South Saskatchewan River Basin is in southern Alberta. The headwaters of the basin are in the Rocky Mountains and the basin flows to the east into Saskatchewan and Manitoba. The South Saskatchewan River meets the North Saskatchewan River before draining into Hudson's Bay as part of the Nelson River system. The basin has a drainage area of 122,000 km^2 (approximately 18% of Alberta's surface area) and a mean annual discharge of 9,280,000,000 m^3 at the Alberta-Saskatchewan border, which is approximately 8% of annual outflow from Alberta. Sub-basins within the basin include the Red Deer, Bow, and Oldman river systems (Government of Alberta, 2010).

As of 2009, irrigation accounted for 72% of the total allocations for the basin (Government of Alberta, 2010). Other users include the oil and gas industry and municipal services.

Milk River Basin

The Milk River Basin is in the southeast corner of Alberta. With a drainage area of approximately 11,900 km^2 (of which 6,500 km^2 is in Alberta, approximately 2% of Alberta's surface area), the basin is Alberta's smallest major river basin. The headwaters of the basin are in Montana in the United States. Approximately 106,000,000 m^3 enters Alberta, much of which is from the St. Mary River diversion (Caring For Our Watersheds, 2018; Government of Alberta, 2010). The basin has a mean annual discharge of 167,000,000 m^3, leaving through a variety of watercourses along the borders with Saskatchewan to the east and Montana to the south (Government of Alberta, 2010). Flow then travels to the Gulf of Mexico through the Mississippi River Basin.

Land in the Milk River Basin is predominantly used for agriculture, with some oil and gas presence. As of 2005, agriculture accounted for 88% of surface and groundwater allocations, which totaled 58,440,000 m^3 (Alberta WaterPortal Society, 2019e).

Many of the studies to this point have focused on trends in annual magnitude measurements. However, this ignores the other components of streamflow that are relevant

to aquatic and riparian ecosystems. Magnitude is only one piece of the equation. By analyzing trends in all parameters within the Indicators of Hydrologic Alteration (IHA) methodology, this study looks at all the ecologically relevant parameters of streamflow: magnitude, duration, timing, frequency, and rate of change. Finding significant trends in one aspect of flow may have more, or less, impact than finding the same in another.

The objectives of this research were to (1) determine how various ecologically relevant components of streamflow are changing across Alberta's various natural regions; and (2) examine the similarities and differences between streamflow trends and climate trends. These objectives are intended to support and improve Alberta's policies that address in-stream flow needs, as well as set the stage for further research to determine the impact of the human activity and fish community structure in Alberta's streams.

2 Methods

2.1. Study Area

The Water Survey of Canada (WSC) monitors streamflow at river stations across Canada. This data, measured as a daily median flow rate, is readily available online (www.wsc.ec.gc.ca). The WSC monitors 1063 stations across Alberta, but heavily concentrated in the southern watersheds. Figure 1 is a map illustrating the location of these stations and Figures 2 to 7 show the station location relative to their natural region and major river basin. Appendix A provides information on the streamflow station, including station name and number, watershed, natural region, and latitude and longitude (Water Survey of Canada, 2020).

These records are largely variable in their length and completeness of the record. As a result, data was analyzed for a variety of analysis periods, ranging from 10 years to 90 years in length, with all periods ending in 2019.

This is similar to the approach used by Burn et al. (2008). That study focused on stations that were missing no more than four years of data over 30, 35, and 40-year periods. Our study analyzes longer periods. Only stations that contained a minimum of 90% of the years within a particular period were analyzed for that period (e.g. for a 70-year period, only stations with at least 63 years of data were analyzed). This was done to keep the sample size high enough for statistical methods. The total number of stations analyzed for each period is listed in Table 1. Note that the seasonal nature of the daily streamflow data

collection may reduce the number of stations available for analysis. As such, some stations may be available for analyses of some variables, but not others.

For the purposes of this paper, we focused on the period from 1970-2019 as a compromise between the number of stations available for analysis and having an adequate length of record to properly analyze trends.

2.2. Hydrological variables

Richter et al. (1996) created a method that defined a series of ecologically relevant parameters in which to analyze hydrologic alteration. This method calculates 31 parameters, measuring the five key hydrologic characteristics for fish life-history: magnitude, timing, duration, frequency, and rate of change (Table 2). An example of how each of these five characteristics impact a life-history trait is shown in Table 3.

Several other hydrologic indices have been developed over the years. Olden & Poff (2003) assessed 171 indices that had been used in literature at that time and determined that the IHA method was adequate in calculating the major components of the flow regime.

Note that the data was analyzed such that results are in reference to the water year (October to September) as opposed to the calendar year.

2.3. Climate variables

Climate data was generated using Climate NA software (Hamann et al., 2013). This software calculates a variety of climate variables based on location latitude and longitude. Using this software, annual climate data was generated for all Alberta hydrometric stations. The list of climate variables generated can be found in Table 4.

The data set generated is a complete data set, spanning the years 1902 to 2012. No missing years are found in this data set.

2.4. Trend analysis

The Mann-Kendall non-parametric analysis (Kendall, 1948; Mann, 1945) has been commonly used to determine the presence of significant trends in hydrological data (Burn et al., 2008; Gan, 1998; Zhang et al., 2001) and climate data (Gan, 1998). The Mann-Kendall test determines whether a variable of interest increases or decreases with time. The nonparametric trait of the analysis is beneficial in that it is suitable for non-normally distributed data series, with missing data (Hirsch & Slack, 1984). This is useful for

hydrological data. However, this approach requires the data series to be serially independent. This may not occur with hydrological data. Certain hydrological time series characteristics, such as mean annual streamflow, frequently contain statistically significant serial correlation (Hirsch & Slack, 1984).

Yue et al. (2002) examine three influences worth investigating when detecting trends in hydrologic data series: 1) the influence of the lag-1 serial correlation process (AR(1)) on Type 1 error; 2) the effect of a trend on serial correlation; and 3) the effect of AR(1) on trend.

Time series data with positive serial correlation have exhibited an increased probability that a significant trend will be found using the Mann-Kendall test (von Storch, 1999). Several papers have looked at addressing autocorrelation when it comes to detecting trends (Bayazit & Onoz, 2007; von Storch, 1999; Yue et al., 2002). von Storch (1999) addressed this problem by proposing a procedure called "Prewhitening". This objective of this procedure is to remove a serial correlation component from a time series data set (Kulkarni & Von Storch, 1995) and has been used to reduce the impact of AR(1) of hydrological data in several studies, including Douglas et al. (2000) and Zhang et al. (2001).

The second consideration Yue et al. (2002) discussed was the possibility of a trend causing a false detection of an AR(1). This error would result in analyzing and interpreting the data series incorrectly. As a result, in data series that exhibit a trend, significant serial correlation could be detected, when in reality the data series does not contain serial correlation.

Conversely, the effect of an AR(1) on trend detection should also be considered. Yue et al. (2002) concluded that the variance of the slope estimates is altered by a positive AR(1) process.

Yue et al. (2002) proposed and tested a procedure. This procedure has been followed by other studies, including Burn et al. (2008), and will be applied in this study. The first step is to estimate the slope of the data series. The slope of the trend is estimated using the Theil-Sen Approach (TSA) according to the following formula:

$$b = Median\left(\frac{X_j - X_l}{j - l}\right) \forall l < j \qquad (1)$$

where b is the estimate of the slope and X_l is the l-th observation in the data series, X (Sen, 1968; Theil, 1950). If b is approximately equal to 0, then no further analysis is required, as

there is no trend present. However, if b is not equal to 0, then an assumption of linearity is made. The sample data are then "detrended" by:

$$X'_t = X_t - T_t = X_t - bt \tag{2}$$

where T_t is the identified trend (Yue et al., 2002).

The second step takes the detrended data set and removes the AR(1) component. First, the lag-1 serial correlation coefficient is removed by:

$$r_1 = \frac{\frac{1}{n-1}\sum_{t=1}^{n-1}[X_t - E(X_t)] \cdot [X_{t+1} - E(X_t)]}{\frac{1}{n}\sum_{t=1}^{n-1}[X_t - E(X_t)]^2} \tag{3}$$

$$E(X_t) = \frac{1}{n}\sum_{t=1}^{n} X_t \tag{4}$$

where r_1 is the lag-1 correlation coefficient of the sample data, X_t, $E(X_t)$ is the mean of the data series and n is the sample size (Yue et al., 2002). r_1 is then used to remove the AR(1) using:

$$Y'_t = X'_t - r_1 \cdot X'_{t-1} \tag{5}$$

This "trend-free pre-whitening" (TFPW) procedure results in a data series, Y'_t, that is independent (Yue et al., 2002).

The third step blends the trend component of the sample data, T_t, and the residual, AR(1)-free component, Y'_t using the following:

$$Y_t = Y'_t + T_t \tag{6}$$

Finally, the Mann-Kendall test is applied to the blended data series, Y_t. As the above steps maintain the true trend of the data, while removing the AR(1) component, violations of serial correlation are no longer a concern.

The non-parametric Mann-Kendall trend analysis tests a null hypothesis that states the probability of variable Y increasing as time, T, increases is equal to 0.5, as shown in equation 7 (Helsel & Hirsch, 2002).

$$H_0: \quad Prob[Y_j > Y_i] = 0.5, where\ time\ T_j > T_i \tag{7}$$

Kendall's S statistic is calculated using the Y,T data pairs using Equation 8. To reject the null hypothesis, S must be significantly different from zero. A monotonic trend in Y over time occurs when the null hypothesis is rejected (Helsel & Hirsch, 2002).

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} sgn(Y_j - Y_i) \tag{8}$$

$$sgn(\theta) = \begin{cases} 1, & if\ \theta > 0 \\ 0, & if\ \theta = 0 \\ -1, & if\ \theta < 0 \end{cases}$$

2.5. The Influence of Climate Oscillation Patterns

Another issue to consider with the Mann-Kendall trend analysis is the influence of climate oscillation patterns, such as the El Niño–Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO) (Burn et al., 2008; St. Jacques et al., 2010). Significant trends can be artificially detected, while the data is being influenced by climate variability patterns. von Storch & Zwiers (1999) discussed a composite analysis approach that examines the link between two sets of variables.

In this case, a subset of the data is taken of the years associated with the ten largest and ten smallest values of ENSO and PDO indices, respectively. The hydrologic indices associated with the largest values and smallest values of each index are then compared to the series mean using a t-test to determine if the mean of the subset is significantly different from the series mean of the whole data set (Burn et al., 2008).

2.6. Comparison of Reference Hydrometric Basin Network

The Reference Hydrometric Basin Network (RHBN) is a subset of WSC stations with long records and minimal human impacts. These stations are located on watercourses that have not experienced alterations due to flow regulation, water diversion, or major land-use changes (Burn & Whitfield, 2017). As a result, these stations can be assessed with a focus on determining the hydrological response to climate change (Burn et al., 2012; Mostofi Zadeh et al., 2020).

In Alberta, there are 25 RHBN stations located throughout the province (Figure 1). For the purposes of this study, results can be compared between RHBN and non-RHBN stations to determine if trends may be attributed to climate change or other human influences (such as

flood control, land use, etc.). To accomplish this, the number of RHBN stations with a significant trend was compared to those from non-RHBN stations for each IHA parameter.

3 Results

3.1. Mann Kendall Trend Analysis Results

The trend results for each station are presented in Appendix B and C. Overall trends across the province can be found in Figures 8 to 12 for streamflow variables and Figures 13 and 14 for climate variables. To address the objectives of this study in an adequate yet concise manner, the focus of the results and discussion will be on addressing the data over the 50-year period (1970-2019).

Note that many hydrologic variables were not measured at a sufficient number of stations. This paper only assessed variables that were measured for at least 90% of stations across the province for a given period. The following IHA parameters did not have sufficient data to be analyzed and will not be discussed in this paper: November, December, January, February, March, High Pulse Length, Low Pulse Length, and Low Pulse Number.

3.1.1. Monthly Median Streamflow (Group 1)

The percentage of stations with significant trends for monthly magnitude flow variables ranged from 31% to 57% (Table 5). However, August was the only month were the difference between positive and negative-trending stations was greater than 10%. The direction of the overall trend across the province varied by month, with two months showing overall position trends, four months showing overall position trends, and one month (September) showing an equal amount of positive and negative-trending stations.

Figure 15 shows spatial variation in monthly magnitude variables is evident across Alberta's natural region. All natural regions experienced both positive and negative trends. The Boreal Natural Region experienced negative overall trends for all months analyzed, with very few stations recording significant positive trends for any of the months. The Grassland Natural Region experienced positive overall trends for all months analyzed but had upwards of 19% of stations showing significant negative trends for some months. The Rocky Mountain and Parkland Natural Regions were more balanced, recording both positive and negative overall trends.

3.1.2. Magnitude and Duration of Annual Extreme Conditions (Group 2)

The overall province-wide results are found in Table 6. The results for all maximum extreme conditions were consistent with one another, with 6% of stations exhibiting a positive trend, while the percentage of stations showing negative trends ranged from 43% to 47%. The opposite was found for minimum flow condition variables, with 38-45% of stations showing significant positive trends and 10-19% of stations showing significant negative trends.

Regional results for significant trends in the various maximum and minimum extreme flow conditions were largely consistent across all variables (i.e. the 1-day maximum flow for stations in the Boreal Natural Region were similar to those of the 3-, 7-, 30- and 90-day maximum flow variables). Figure 15 and Table 7 depict the decreasing nature of the maximum flow condition variables and the largely increasing attribute of the minimum flow conditions. The Boreal, Foothills, Grassland, and Rocky Mountain Natural Regions were found to have a greater percentage of stations exhibiting negative significant trends, averaging between 36% and 72%. Only the Grassland Natural Region does not appear consistent with this observation, with a similar number of stations experiencing positive trends in maximum flow variables as those experiencing negative trends. The opposite was found for minimum flow condition variables, where all natural regions experienced more stations with significant positive trends than those with negative trends. This reflects the overall provincial trend results found in Table 6.

3.1.3. Timing of Annual Extreme Conditions (Group 3)

The overall provincial results for the trends in timing of annual extreme flow events are found in Table 8. The Julian date of the maximum flow was observed to be increasing at 34% of stations in Alberta, meaning the 1-day maximum daily flow is occurring later in the water year. Similar results were found for the Julian date of the minimum flow.

Regional results are slightly variable. For each variable, four of the five natural regions reported positive trends (Figure 15 and Table 9), reflecting the province-wide results presented in Table 8. However, the Boreal Natural Region is relatively evenly split between significant positive and negative trends for the date of the maximum flow. Likewise, the Grassland Natural Region is evenly split between significant positive and negative trends, with slightly more stations exhibiting negative trends.

3.1.4. Frequency and Duration of High and Low Pulses (Group 4)

Only one of the four variables within this group was eligible for analysis: the high number of streamflow pulses. 160 stations were eligible for analysis for this variable. 8% showed significant positive trends, while 21% showed significant negative trends. Figure 15 and Table 10 illustrate the variation displayed across Alberta's natural regions. All five natural regions included more stations displaying negative trends than positive.

3.1.5. Rate and Frequency of Change in Water Conditions (Group 5)

The trend results reflect a "narrowing" of hydrographs across the province. The rise rate, the amount the flow increases from one day to the next, is decreasing, while the fall rate, the amount the flow decreases from one day to the next, is also decreasing (Table 11). However, the number of reversals, the number of times streamflow went from increasing to decreasing or vice-versa, increased over the same period. In other words, streamflow across the province is changing more frequently, but in smaller increments. All natural regions reflect the province-wide results (Figure 15).

3.1.6. Climate Parameters

Seasonal variation was evident for all five climate parameters analyzed (Table 12). Generally, minimum, maximum, and average temperatures were found to be increasing throughout Alberta in the summer, fall, and winter. Most stations showed an increasing winter temperature, while the trends for all the temperature variables for summer and fall ranged from 27-38%. Spring temperatures did not experience consistent significant trends in either direction. There was also a notable decrease in winter precipitation.

Figure 16 illustrates the regional variation for the climate variables. The patterns seen in Table 12 largely remain the same. All natural regions experience relatively little change in fall precipitation followed by significant decreasing winter precipitation. Spring and summer precipitation remained relatively constant as well for most of the natural regions. However, 53% of stations in the Rocky Mountains showed increasing trends in summer precipitation.

Seasonal average temperatures were found to be increasing within most natural regions for the summer, fall, and winter seasons. However, two exceptions were observed: The Grassland and Rocky Mountain Natural Regions both experienced overall negative trends in summer average temperature. The Boreal Natural Region consistently included the highest proportion of stations showing increasing trends for seasonal average temperatures, ranging

from 57% in the fall to 94% in the winter. No significant trends were observed in any region for average temperatures during spring.

3.2. Detecting the Impact of the Climate Oscillation Patterns

The influence of the ENSO and PDO patterns was analyzed to determine whether they influenced the detection of significant trends in the hydrologic variables. A composite analysis approach was used to determine if the hydrologic variables in years exhibiting low ENSO or PDO were significantly different from those in years exhibiting high ENSO or PDO metrics. Significant differences indicate influence from the ENSO and PDO patterns on a given variable.

Of the analyses performed (i.e. each station for each variable) for the 50-year period, 8% were found to be significantly influenced by PDO patterns and 4% were influenced by ENSO patterns. The provincial and regional results are summarized in Table 13 for PDO patterns and Table 14 for ENSO patterns. Four variables had at least 20% of stations across the province record significantly different data subsets for high and low PDO years: June, July, the 30-day maximum, and the 90-day maximum. There were far less significant results found when comparing high and low-ENSO metric years. No variables resulted in at least 20% of stations with significant results.

3.3. Trends Observed at Regional Hydrometric Basin Network Stations

For the period of analysis, 21 RHBN stations were analyzed for trends in IHA parameters. Table 15 summarizes the percentage of RHBN and non-RHBN stations that have exhibited significant trends for each IHA parameter across all natural regions. Minor differences are observed in Groups 2. For annual maximum extreme flow condition parameters, 29% to 48% of RHBN stations exhibited significant negative trends, compared to 41% to 46% of non-RHBN stations. However, no RHBN stations exhibited significant positive trends for any of the maximum extreme flow parameters (compared to 6-7% of non-RHBN stations). Similar findings were found for the minimum extreme flow parameters: 29% to 48% of RHBN stations exhibited significant positive trends (compared to 35% to 45% of non-RHBN stations) and 5% to 10% of RHBN stations exhibited significant negative trends (compared to 10% to 19% of non-RHBN stations).

Minor differences in results between RHBN and non-RHBN stations were also observed in Group 5 variables. The rise rate was found to be decreasing at 48% of RHBN stations compared to 46% of non-RHBN stations. However, non-RHBN stations included a higher number of stations exhibiting significantly increasing rise rates (12% of non-RHBN stations

compared to 0% of RHBN stations). Similar results were found for the fall rate, where 43% of RHBN stations exhibited significantly increasing trends compared to 45% of non-RHBN stations. Only 5% of RHBN stations displayed significant negative trends in fall rate, compared to 9% of non-RHBN stations. Significant trends in the number of reversals were found to be the same, regardless of RHBN classification: both datasets experience more stations exhibiting significant positive trends than significant negative trends.

More prominent differences were found when comparing the results of the two datasets for Group 1. Significant trends were found far less among RHBN stations than non-RHBN stations for most months. Only two months, October and April, featured more than 25% of RHBN stations with significant trends.

4 Discussion

The trends observed over the period of analysis have shown that the magnitudes and rates of change of Alberta's streams are changing. Four main conclusions have been drawn from the trend analysis results.

1. The magnitude of streamflow for the spring and summer is decreasing in the Boreal Natural Region.
2. Conversely, the magnitude of streamflow for the same seasons is increasing in the Grassland Natural Region.
3. The annual maximum and minimum streamflow conditions are converging in all of Alberta's natural regions.
4. Streamflow variation between consecutive days is decreasing in all of Alberta's natural regions.

These findings have ecological repercussions that are not fully understood for Alberta's aquatic ecosystems. While evaluating the resulting impact on Alberta's aquatic ecosystem is outside of the scope of this study, we evaluate other literature that discuss potential ecological impacts because of changes to these hydrologic parameters.

4.1. Climate

With the increasing threat of climate change, there has been greater effort put forth to understand how much the climate conditions have changed, the role humans played in those changes, and predicting where the climate is heading. From a hydrologic standpoint, it is important to understand how exactly the climate is changing. Changes in precipitation cause different reactions in hydrology than changes in temperature. Trends in precipitation

tend to affect volumes, whereas temperature trends tend to affect the timing of the runoff (Barnett et al., 2005). Studies have found that watercourses in snowmelt-dominated regions can be greatly affected by increases in winter temperature (Barnett et al., 2005; Nijssen et al., 2001; Stewart et al., 2004). Snow accumulation is an important factor in determining several hydrologic parameters, including annual peak flows, and winter and spring magnitudes. Precipitation in the form of rain that results in runoff contributes to the stream hydrology in a relatively short timeframe, whereas precipitation as snow may not contribute to runoff for weeks or months, essentially acting as a water storage reservoir (Barnett et al., 2005; Nijssen et al., 2001).

The second-generation Adjusted Precipitation for Canada – Daily (APC2-Daily) was prepared and presented in 2011 (Mekis & Vincent, 2011). Studies on this dataset have shown decreases in annual total snowfall (Mekis & Vincent, 2011; Vincent & Mekis, 2006). In the 2006 study, significant trends in annual total snowfall were observed at almost 20% of stations (Vincent & Mekis, 2006), while the 2011 study noted that the British Columbia, Alberta, and Saskatchewan all showed significant decreases in snowfall. These findings are consistent with this study, where winter precipitation and precipitation as snow over the winter are far and away the most consistent trend found across the province; over 90% of stations analyzed exhibited negative significant trends for these two variables.

Zhang et al. (2000) analyzed temperature trends across Canada across the period of 1950-1998 and found that the mean daily temperature has increased by more than 3°C in western Canada in both the winter and spring. This is consistent with the findings of this study, where significant increases in mean daily temperature were found for all seasons, but were most consistently found in the winter, where 56% of the stations exhibited significant positive trends. Possible impacts of this result include a reduction in annual snow pack, earlier snowmelt, and an increase in the length of low flow periods (Barnett et al., 2005). Alberta, which has a large agriculture sector, is susceptible to the impacts of increasingly severe and more frequent droughts. The Alberta WaterPortal Society suggests that droughts have been known to cause an economic impact in agriculture (Skerritt, 2015), energy (Harto & Yan, 2011), and recreation and tourism (Alberta WaterPortal Society, 2019a).

4.2. Overall Trends in Alberta and the Potential Impacts on Fish Communities

The ecologically relevant parameters that make up the indicators of hydrologic alteration (IHA) methodology measures five key hydrologic characteristics for fish life-history: magnitude, timing, duration, frequency, and rate of change (Richter et al., 1996). A species'

response to these environmental factors is largely determined by a species' life history strategy (Lytle, 2001).

When an ecosystem is disturbed, and these hydrological conditions change, species currently residing in the ecosystem may no longer favour the conditions, while another species that utilize a different life-history strategy, may find an opportunity to move into the ecosystem. Olden et al. (2006) analyzed the change in species composition in the Colorado River basin. Native fish were characterized as opportunistic life-history strategists, which favour the extreme and low predictability of the basin's historic hydrology (Fradkin, 1981). However, conditions found at the time of the study were low variation. Non-native species, who were characterized as equilibrium life-history strategists, favoured the new conditions, and took the opportunity to establish new populations in the basin (Olden et al., 2006). This is just one case where a change in hydrology has opened a niche opportunity.

In determining risk management practices, it is important to know how each hydrology characteristic impacts to fish life-history traits and habitat needs, specifically as it pertains to the aquatic species found in that ecosystem (Mathews & Richter, 2007). A conceptual ecological model can instruct the policymakers of the flow-ecology relationships by stating current knowledge and known data gaps and showing the results of monitoring and research (Mathews & Richter, 2007).

4.2.1. Group 1 – Monthly Magnitudes

Previous studies have consistently found that monthly streamflow magnitudes are decreasing throughout the year, with the strongest decreases occurring from August to October (Gan, 1998; Zhang et al., 2001). Most positive trends were found in winter months and have been associated with the earlier start of spring runoff (Gan, 1998). Due to the limitations of the data set, we did not analyze the months between November and March. However, our findings for the remaining months of the year are largely in agreement with the results of previous work. Our strongest findings occurred in the summer and fall months, where 27% to 35% of stations displayed negative trends in monthly streamflow magnitude.

Poff & Zimmerman (2010) performed a literature review of studies that analyzed the impacts of flow alteration on aquatic and riparian organisms. They analyzed the findings of 71 different papers that examined this relationship with respect to changes in flow magnitudes. 66 of these studies were found to have decreased ecological responses (Poff & Zimmerman, 2010). These impacts include reduced diversity (e.g. Gehrke et al., 1995; Humphries et al., 2002; Humphries & Lake, 2000), reduced abundance (e.g. Koel & Sparks,

2002), loss of sensitive species (e.g. Kinsolving & Bain, 1993; Travnichek et al., 1995) and increase in non-native species (e.g. Meffe, 1984; Moyle, 1986; Stanford & Nelson, 1994).

4.2.2. Group 2 – Annual Extreme Condition Variables

The division between the maximum and minimum extreme condition variables is evident in Figures 9 and 15. An overall negative trend is found in all maximum variables across the province, while an overall positive trend in minimum flow variables is found in three of the four regions, with the Boreal region being the exception. However, the negative trend for the maximum flow variables is still far greater than that of the minimum flow variables for the Boreal region. As a result, the range between the maximum and minimum extreme condition variables is still shrinking in all four regions. An example of the "narrowing" of the hydrograph is illustrated in Figure 17, which shows the trends for the 1-, 7- and 30-day minimum and maximums for the Peace River hydrometric station.

Burn et al. (2008) analyzed the trends in spring snowmelt runoff peak flow and found that most stations were exhibiting a decreasing trend in spring peak flow. It was concluded that this was because of the decreasing trend in precipitation as snow and an increasing trend in winter temperature. This is consistent with the findings of this study. The percentage of stations within a given region with significant negative trends in maximum annual extreme flow conditions ranged from 36-72% (Table 7).

Additionally, this "narrowing" of the hydrograph may also be, at least in part, due to the increased implementation of flow control and power generation structures. Dams and weirs have been shown to stabilize flow by reducing maximum flows and increasing minimum flows (Morgan et al., 1991), and prolong low flow conditions in many cases (Magilligan & Nislow, 2005). The decreased maximum flows limit the stream channel's use of the floodplain. This is important as floodplains provide natural flood mitigation, are areas of great biodiversity, and are a source of needed nutrients within the aquatic habitat.

4.2.3. Group 5 – Rate and Frequency of Change Variables

Like the annual extreme condition flow variables (Group 2), the rate and frequency of change in water condition variables (Group 5 variables) demonstrated a changing variability in Alberta's streamflow. The decreasing rise rate and increasing fall rate reflects a change in the variability of Alberta's hydrographs. Figure 18 illustrates an example of this in the South Saskatchewan River, which is under the influence of several dam operations. The introduction of flow control structures may be bringing the peaks and valleys of streamflow closer together. Using a pre- and post-impact assessment, Magilligan & Nislow (2005) found

that significant changes were found for Group 5 variables as a direct result of dam operation. Both the rise rate and fall rate were found to be decreasing (Magilligan & Nislow, 2005). Graf (2006) found similar results in dams across the United States, finding that the dams generally reduced the annual maximum discharge, increased the number of reversals, and decreased the rate of change.

Mims & Olden (2013) assessed the effects of dam operations on fish assemblage. They found that downstream of dams, flow variability was reduced, and the seasonal and predictable nature of flow was altered. In those locations, they observed that fish assemblage had changed: the proportion of opportunistic strategist species was reduced, while the proportion of equilibrium strategists increased. This is consistent with the life history theory summarized in Table 16 (Winemiller & Rose, 1992). Mims & Olden (2013) also note that dams also change thermal regimes of streams, which may adversely affect fish assemblage. Water temperature also plays a role in life history traits, nutrient cycling, and productivity (Caissie, 2006).

4.3. Regional Results

Several indicators of hydrologic alteration are changing across Alberta. But any trends identified more significantly in one bioregion than another may indicate that region is at a higher risk and in greater need of risk management practices. Various hydrology characteristics may alter the strategies used in the event that risk management is required. Therefore, it is important to understand the different characteristics defining each bioregion. New policies that are attempting to alter trends affecting hydrologic parameters or to protect aquatic ecosystems from changing hydrologic parameters may be different for a region with steep headwater watercourses to a region with slow, meandering rivers and streams. The land uses of each region are also an important consideration. The Grassland Region, for example, is the driest region in Alberta (Natural Regions Committee, 2006). As such, there are vast irrigation networks to service the large agricultural presence within the region. Risk management in this region may vary from others as a result.

It is also important to consider watershed specific influences in interpreting regional results. As a result, the results between each of the watersheds present within each natural region will be compared.

4.3.1. Boreal Region

The immense Boreal Natural Region is home to several large rivers that contribute to the Mackenzie Valley basin to the north and the Saskatchewan River system to the east. The

large river systems allow for the Boreal Natural Region to have enough stream gauge stations with adequate data to draw conclusions about trends in the region's hydrology. The large river systems, combined with the relatively undisturbed environment of Northern Alberta, provide ample fish habitat and have resulted in the region being species-rich in fish species (Natural Regions Committee, 2006). Previous studies have hypothesized about the heightened sensitivity of the northern river basins to climate change and its impacts. The Intergovernmental Panel on Climate Change (IPCC), for example, noted increasing precipitation in northern regions and predicted changes in flood frequencies, and runoff magnitudes (Intergovernmental Panel on Climate Change, 2001). For this reason, it is important that studies are completed that evaluated the trends and causes of streamflow in Northern Alberta. This can lead to enabling risk management practices to prevent any further damage to important aquatic ecosystems.

The Boreal Natural Region included the highest percentage of stations showing negative trends in four of the seven months analyzed and was the only region in which the percentage of stations showing a negative trend was higher for all seven months (Figure 15). To assess whether the trend patterns discussed above are consistent across the natural region, the trend results were plotted spatially for all streamflow and climate parameters (Appendix C). Results for June to October median streamflow are largely consistent across the region, while the results for April and May median streamflow appear to be grouped by watershed (Figures C2 to C7 in Appendix C).

The trends found in this study were somewhat consistent with other findings in the region. Abdul Aziz & Burn (2006), using a similar methodology of the Mann-Kendall trend analysis coupled with the TFPW approach to assess the hydrological regime of the Mackenzie River Basin, found decreasing trends for May, June, and October, while a significant number of trends were not found for the rest of the spring and summer months. Other studies, including Peterson et al. (2002) and Lammers et al. (2001) have found similar results in boreal river systems across Europe and Asia. Woo et al. (2008) studied boreal rivers across the world and found mixed results. The Great Bear River, located in the Northwest Territories, showed decreasing streamflow magnitudes, including summer monthly magnitudes, while the Upper Laird River showed the opposite, despite being located approximately 700 km away. Other rivers in Ontario and Quebec were also found to have decreasing monthly magnitudes (Woo et al., 2008). Déry & Wood (2005) also concluded decreasing magnitudes, but only studied annual flow metrics.

Trends in maximum extreme flow condition variables were most evident in the Boreal Natural Region, where 72% of stations showed negative trends for all maximum variables (Figure 15). This logically follows the decreasing trends of monthly magnitudes found at most of the region's stations in the high flow months in the spring and early summer. Looking at the region's results spatially, the annual extreme maximum flow conditions are consistently decreasing across the region for all five durations (Figures C8 to C12). The annual extreme minimum conditions variables are more irregular across the region. Stations in the northern portion of the region were more likely to exhibit positive trends for these variables, while stations in the southern portion of the region, particularly were concentrated in the Athabasca River and Beaver River basins (Figures C13 to C17).

The Boreal Natural Region is comprised of six of Alberta's major river basins: Hay, Peace/Slave, Athabasca, Beaver, North Saskatchewan, and South Saskatchewan River Basins (Figure 2). These basins vary significantly in land use and water requirements, with varying populations and industry presence. Table 17 compares the overall trend results of the six major river basins within the Boreal Natural Region. Results for the monthly magnitude variables largely reflect those shown across the region (Figure 15): most stations are exhibiting significantly decreasing trends for all months analyzed.

Results for annual extreme condition variables are consistent with those discussed above: the maximum extreme flow condition variables were largely decreasing across the region's major river basins and findings for minimum extreme flow condition variables were inconsistent across the region (Table 17). However, the percentage of stations showing significant negative trends is less in the southern basins than in the northern basins. This culminates in the results of the South Saskatchewan River Basin being largely inconsistent and not reflective of observations found in the rest of the region. Results for the frequency and rate of change were consistent across the region's major river basins: all basins exhibited an overall decreasing rise rate and fall rate.

The results between the region's two biggest river basins (Peace/Slave and Athabasca) are largely consistent. However, the comparison between the two basins may not reflect differences in trends found as a result of the presence of major hydroelectric facilities on the Peace River. On the Peace River in northeast British Columbia, the W.A.C. Bennett Dam was completed in 1968 and the Peace Canyon Dam was built in 1980 (BC Hydro, 2020). In comparison, the Athabasca River is the only major river in Alberta without flow regulation infrastructure (Athabasca Watershed Council, 2018). When comparing the results at stations on the Peace River (such as Peace River at Peace River [07HA001]) to stations on the

Athabasca River (such as Athabasca River at Hinton [07AD002]), results are generally consistent. This indicates the presence of large dam facilities may not be impacting the detection of trends as much as might be expected.

4.3.2. Grassland Region

The Grassland region is an important region hydrologically, as the region is home to much of Alberta's agriculture, and the climate in the region is the driest in Alberta. In the mid-1800s, a Canadian survey expedition concluded that the region would "'forever be completely useless' for agriculture." (Wolfe et al., 2013). The region is part of a larger prairie region known as the Palliser Triangle, which stretches from Calgary, Alberta to Brandon, Manitoba, and from the Canada-United States border in the south to Saskatoon, Saskatchewan in the north. Recently, the area has been described as "Canada's productive dryland agricultural region (Wolfe et al., 2013). The semi-arid climate in the region makes irrigation a necessary tool for a variety of stakeholders. The enhanced crop production is beneficial to producers (Klein et al., 2012; Samarawickrema & Kulshreshtha, 2008), food processers, and other goods and services providers (Irrigation Water Management Study Committee, 2002; Paterson Earth and Water Consulting, 2015). Throughout the South Saskatchewan River Basin, irrigation is used as a water supply for communities, commercial purposes, and rural residents. With growing populations and economic development within the region, the water demand can be expected to increase (Bennett et al., 2017). This will only increase the strain put on the region's watercourses. Understanding the changes and the drivers of those changes in the region's river networks can help guide risk management policies and assist in aquatic ecosystem conservation efforts.

The Grassland Region experienced a positive overall trend for all seven months analyzed (Figure 15). In viewing the trend results spatially, the stations with significant positive trends were concentrated in the western portion of the region (Figures C1 to C7). Stations in the eastern portion of the region were largely inconsistent, with significant negative results in some months and significant positive results or non-significant results in others. As a result, the overall regional trend may not be the result of regional influences (e.g. land use). Rather, increases in summer precipitation in the southwest portion of the region (Figure C28) may be the driving factor in the increasing summer trends.

Similar results were found in a study on the Smith Creek Research Basin in Saskatchewan, an unregulated basin in an area with significant agricultural and wetland influences. Results from that study indicated annual streamflow volume had increased since 1975 (Dumanski et

al., 2015). Costigan & Daniels (2012) studied ten river systems within the Great Plains region of the United States, including two river systems in states bordering the Canadian Prairies: The Upper Missouri and the Red River of the North. The results of their analysis for monthly magnitude discharge conditions (Group 1) were largely inconsistent. Three rivers, all located in the middle of the study area, experienced increased magnitudes for all months, while two rivers, including the Red River of the North, experienced decreased magnitudes for all months. They attributed the different results on various effects on streamflow discharge, such as seasonal shifts in temperature and precipitation, dam construction, and discharge requirements for barge navigation (Costigan & Daniels, 2012).

While the maximum annual extreme flow conditions (Group 2) of the Alberta Grassland Natural Region yielded mixed trends resulting in no overall trend for the region, the minimum annual extreme flow conditions (Group 2) all experienced increasing overall trends. These are reflected in the spatial figures, where maximum annual conditions appear inconsistent across the region and the minimum annual conditions are consistently increasing (Figures C8 to C17) across the region.

Costigan & Daniels (2012) found similar results for annual extreme flow conditions (Group 2) in their study. Of the 10 rivers analyzed, four were found to have increasing minimum extreme conditions at a significance level of 1% for all time periods (i.e. 1-day, 3-day, 7-day, 30-day, and 90-day) analyzed. Three other stations exhibited increasing minimum extreme conditions at a significance level of 5% for at least one period analyzed. Only two stations showed decreasing minimum conditions at a significance level of 5% for any period, with one river (The Republican River) showing significant decreases across all periods. For maximum extreme conditions, five of the rivers showed significant negative trends at a significance level of 5% for all time periods. Only one river (The Red of the North River) showed significant increasing maximum conditions for all time periods (Costigan & Daniels, 2012).

The Grassland Natural Region is comprised of three of Alberta's major river basins: the North Saskatchewan, South Saskatchewan, and Milk River Basins (Figure 3). The basin is dominated by agricultural land use and is heavily reliant on irrigation (Government of Alberta, 2010). Table 18 compares the overall trend results of the three major river basins within the Grassland Natural Region. Most stations within the region are located in the South Saskatchewan River Basin. As a result, drawing conclusions on the differences between basins may not reflect real differences between the basins due to the small sample size in the other basins. With that in mind, the results of this study indicate that streamflow

at stations within the Milk River Basin is changing differently than those found in the South Saskatchewan River Basin.

Overall increasing trends were observed for monthly magnitudes in all months analyzed for the South Saskatchewan River Basin. In contrast, a higher proportion of stations in the Milk River Basin exhibited significant negative trends for monthly magnitude variables. This reflects the observations shown in Figure 15, which indicate that monthly magnitude trends vary region to region more than other IHA parameters.

Observations in the Grassland portion of the South Saskatchewan River Basin appear to contrast some of the extreme flow condition observations throughout the rest of the province. Increases in minimum extreme flow condition variables are consistent with results for annual extreme condition variables that are consistent with those discussed in Section 4.2.2. However, trends in maximum extreme flow condition variables appear to be balanced in direction, resulting in no overall trend direction (Table 18, Figure 15). This was not found in the Milk River, where stations showed significant decreases in maximum extreme flow condition variables and no change in minimum extreme flow condition variables.

Results for the frequency and rate of change were consistent across the region's major river basins.

4.3.3. Parkland Natural Region

Overall trends found within the Parkland Natural Region are consistent with those found throughout the province. Maximum annual extreme condition variables are largely decreasing, while minimum annual extreme condition variables are largely increasing, representing a "narrowing" of the hydrograph as discussed above (Figure 15). The rise rate and fall rate are generally decreasing across the region. Results for the monthly magnitude variables were exhibited weak overall trends: slightly decreasing in April and May and increasing from June to October.

Spatially, significant trends in the maximum annual extreme condition variables were concentrated in the northern portion of the region in the North Saskatchewan River watershed and the central portion of the region in the Battle River watershed (Figures C8 to C12). However, trends in the minimum annual extreme condition variables were concentrated in the western portion of the region (Figures C13 to C17). The rate of change variables were evenly distributed throughout the region (Figures C21 and C22).

The Parkland Natural Region is comprised of three of Alberta's major river basins: Peace/Slave, North Saskatchewan, and South Saskatchewan (Figure 4). The basin is Alberta's most populated region, but also has a large agriculture and oil and gas presence, resulting in varied water requirements (Natural Regions Committee, 2006). Table 19 compares the overall trend results of the three major river basins within the Parkland Natural Region.

Overall trends in the South Saskatchewan River Basin within the Parkland Natural Region were found to be decreasing for the minimum annual extreme flow condition variables (Table 19). Maximum annual extreme flow condition variables were not increasing or decreasing. This results in a decreasing mean annual flow, which has been found in other studies (Alberta WaterPortal Society, 2018; Sauchyn, 2014; St. Jacques et al., 2010).

These observations are not consistent with those found in the North Saskatchewan River Basin in the Parkland Natural Region. Overall trends in the basin for minimum annual extreme flow condition variables were slightly decreasing, while overall trends for maximum annual extreme flow condition variables were decreasing at most stations (Table 19). Previous studies on the North Saskatchewan River basin appear to be inconsistent in their findings. In 2004, hydrologists at Alberta Environment found that mean annual streamflow in the North Saskatchewan River was significantly decreasing (Seneka, 2004), while more recently hydrologists with the Alberta WaterPortal Society found that annual maximum flow conditions were decreasing, but not at a significant level (Alberta WaterPortal Society, 2018).

4.3.4. Rocky Mountain Natural Region

Trends in annual extreme condition variables within the Rocky Mountain Natural Region are consistent with those found throughout the province: maximum annual extreme condition variables are largely decreasing, while minimum annual extreme condition variables are largely increasing (Figure 15). Spatially, these trends are consistent across the region (Figures C8 to C17). Another study showed a reduction of maximum annual extreme conditions in Rocky Mountain rivers and hypothesized three potential causes as a result of climate change: declining annual streamflow conditions; winter warming altering the distribution of precipitation; and, spring warming, causing a lengthened snowmelt interval (Rood et al., 2016).

While monthly trends were largely inconsistent for the Rocky Mountain Natural Region, other studies have found that summer and early-fall streamflow magnitudes are decreasing

in Rocky Mountain rivers (Rood et al., 2005, 2008). This would have a profound impact on the health of these ecosystems. Summer and fall are the warm and dry periods of the year when evapotranspiration potential is at its highest. As a result, reduced streamflow would reduce groundwater recharge and create drought conditions in the riparian portions of the ecosystem (Rood et al., 2008).

The Rocky Mountain Natural Region is comprised of four of Alberta's major river basins: Peace/Slave, Athabasca, North Saskatchewan, and South Saskatchewan (Figure 5). Table 20 compares the overall trend results of the four major river basins within the Rocky Mountain Natural Region. Like the Grassland Natural Region, most stations are located in the South Saskatchewan River Basin. As a result, determining confident conclusions on the differences between basins may not be possible due to small sample size in the other basins. However, basin results generally reflect those found across the region for monthly magnitude and annual extreme flow condition variables (Figure 15). However, results for the rate of change variables differ among the basins. The South Saskatchewan River Basin in particular does not reflect the changes observed across the rest of the region and province. Overall trend results for the rise rate and fall rate within the basin are weak (Table 20).

4.3.5. Foothills Natural Region

Observations about the overall trends found within the Foothills Natural Region are challenging to make with confidence, as the region contains 15 stations with an adequate record between 1970 and 2019. Generally speaking, the results within the region are consistent with those found throughout the province and are most similar to those found in the Boreal Natural Region: maximum annual extreme condition variables are largely decreasing, while minimum annual extreme condition variables are largely increasing; and the rise rate and fall rate are generally decreasing across the region (Figure 15). Results for the monthly magnitude variables were inconsistent. However, the small number of stations available for analysis of these variables may limit how representative this is of the region's overall trends.

Spatially, significant trends in the maximum annual extreme condition variables were concentrated in the northern portion of the region (Figures C8 to C12). However, trends in the minimum annual extreme condition variables (Figures C13 to C17) and rate of change variables (Figures C21 and C22) were evenly distributed throughout the region.

The Foothills Natural Region is comprised of four of Alberta's major river basins: Peace/Slave, Athabasca, North Saskatchewan, and South Saskatchewan (Figure 6). Table 21 compares the overall trend results of the four major river basins within the Foothills Natural Region. The results for each basin are representative of those shown across the region (Figure 15).

4.3.6. Canadian Shield Natural Region

Only one station within the Canadian Shield Natural Region was assessed for trends between 1970 and 2019: Slave River at Fitzgerald (07NB001). While observations of regional trends cannot be drawn due to small sample size, the trend results for the station reflect some of the general trends shown across the province. Negative significant trends were found in summer and fall months; maximum extreme flow conditions were all found to be significantly decreasing; and the fall rate was significantly increasing.

The Canadian Shield Natural Region is comprised of two of Alberta's major river basins: Peace/Slave and Athabasca (Figure 7). However, all stations within the region are located in the Peace/Slave River Basin.

5 Conclusion

The flow regime is considered one of the most important factors in the health and longevity of river and riparian ecosystems (Bunn & Arthington, 2002). Hydrologic parameters of a stream shape its morphology and transport nutrients, providing variability in the aquatic habitat required for a nourishing, sustainable environment for fish to thrive. However, humans are also reliant on these waterbodies to provide the water necessary to meet our residential, commercial, and industrial needs. For example, Sinnatamby et al., 2020 found that damming, municipal river engineering, and agricultural requirements led to limiting natural geomorphic processes, causing depleted riparian woodlands and numbers of fish species. Without careful consideration of our anthropogenic needs, this reliance can result in dire consequences for the river and riparian ecosystems that all species rely on. Humans included. Water management practices can minimize or even eliminate the potential for negative impacts on these ecosystems.

To create effective water management practices, it is important to understand the areas where each waterbody is vulnerable from a flow regime perspective. Is there a species at risk that may see a decrease in population with decreased flow magnitudes? Will an ecosystem be vulnerable to invasive species because of a change in flow variability? Are

there particular societal needs that require consideration? These are just a few examples of questions that should be considered when establishing a water management plan. Unfortunately, this becomes complicated when the answers to some of these questions vary by region or watershed. As such, these decisions should be considered on a regional scale to address the ecological and anthropogenic needs of each region.

Understanding the trends in hydrologic parameters is an important step in recognizing the vulnerabilities of each region, which allows for region-specific decision-making. This study identified four takeaways from the results of the trend analysis (Figure 15). First, the average daily flow rate for the spring and summer months is increasing in the boreal region. Second, the average daily flow rate for the same months is decreasing in the grassland region. Third, the annual maximum extreme flow conditions are decreasing while the minimum extreme flow conditions are increasing in all of Alberta's regions. And fourth, the rate of change of streamflow between consecutive days is decreasing across Alberta.

Quantifying the ecological repercussions of these flow regime changes is outside the scope of this study. Keeping in mind the four principles describing the effect of the flow regime on aquatic biodiversity that were identified by Bunn & Arthington (2002), policymakers must continue to identify areas where Alberta's riverine communities are at risk and weigh those risks against the benefits of current or proposed developments. To that end, Alberta currently has four approved water management plans: the Battle River water management plan (located in the parkland region), Cold Lake-Beaver River water management plan, the Lesser Slave Basins water management plan (both located in the boreal region), and the South Saskatchewan River Basin water management plan (located in the grassland region; Government of Alberta, 2020). These plans provide guidance and restrictions to water extraction activities and identify instream flow needs and minimum flow recommendations in some of Alberta's most vulnerable watersheds. The hard work of creating and adapting water management plans to protect Alberta's vulnerable aquatic ecosystems must continue.

Tables

Table 1: Number of stations available for streamflow trend analysis.

Time Period for Analysis	Boreal	Canadian Shield	Foothills	Grassland	Parkland	Rocky Mountain	Total
2010-2019	47	1	13	78	23	16	178
2000-2019	65	1	22	86	26	22	222
1990-2019	95	1	23	89	37	28	273
1980-2019	89	1	18	78	38	27	251
1970-2019	67	1	15	65	22	21	191
1960-2019	25	1	3	46	11	12	98
1950-2019	6	1	1	28	6	9	51
1940-2019	2	-	-	19	4	6	31
1930-2019	1	-	-	15	4	4	24

Table 2: Hydrologic parameters analyzed with the Indicators of Hydrologic Alteration methodology.

IHA Statistics Group	Hydrologic Regime Characteristics	Hydrologic Parameters
Group 1: Monthly magnitudes	Magnitude, Timing	Median value for each calendar month
Group 2: Magnitude and duration of annual extreme conditions	Magnitude, Duration	Maximum and minimum of 1-, 3-, 7-, 30-, and 90-day means
Group 3: Timing of annual extreme conditions	Timing	Julian date of the annual maximum and minimum daily flow
Group 4: Frequency and duration of high and low pulses	Magnitude, Frequency, Duration	Number of high and low pulses each year Mean duration of high pulses and low pulses each year
Group 5: Rate and frequency of change in water conditions	Frequency, Rate of Change	Median of all positive and negative differences between consecutive daily flows Number of times streamflow rises one day and falls the next, or vice versa

Table 3: An example of a conceptual ecological model presented in Mathews & Richter (2007), showing the effects of each of the five hydrologic characteristics on successful spawning.

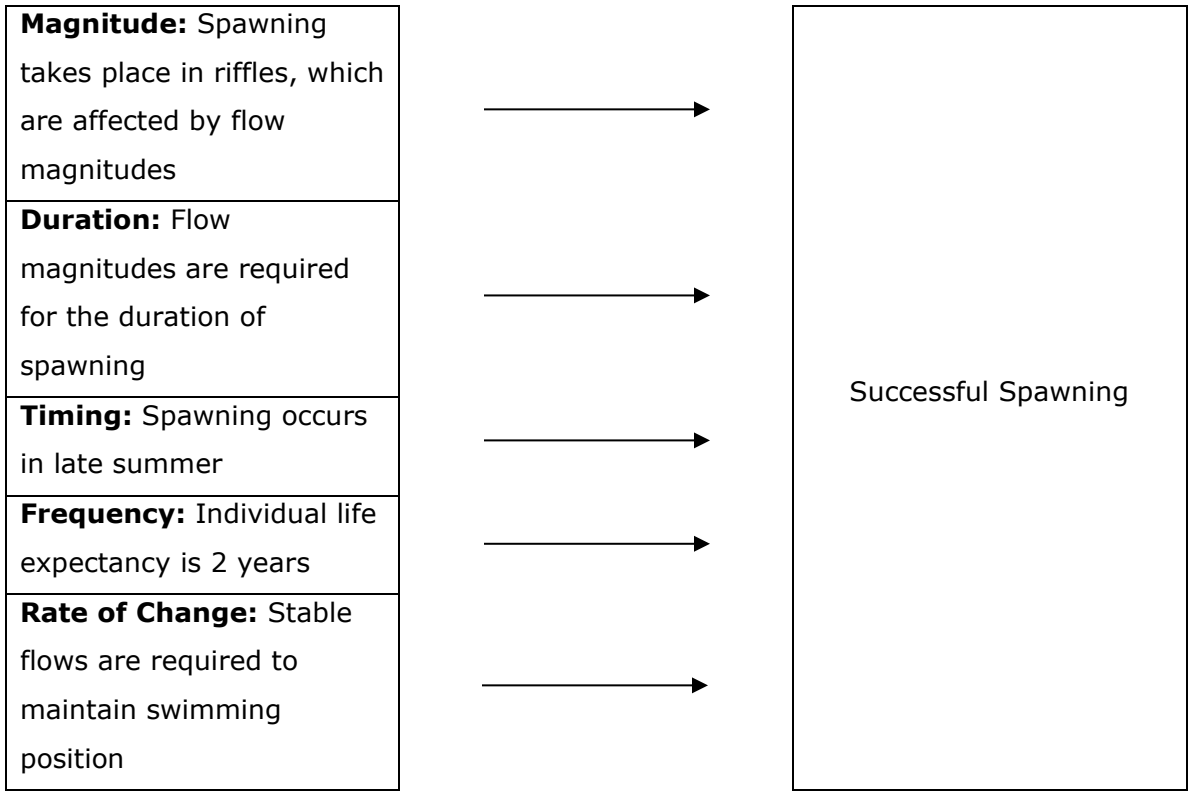

Table 4: Climate variables analyzed for trends.

Climate Variable	Abbreviation
Average temperature (°C)	Tave
Minimum Temperature (°C)	Tmin
Maximum temperature (°C)	Tmax
Precipitation (mm)	PPT
Precipitation as snow (mm) between August in previous calendar year and July in current year	PAS

Table 5: Trends in monthly flow magnitudes.

Monthly Magnitude Variables	Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends		
		Positive	Negative	Total
October	164	25%	32%	57%
April	129	22%	16%	38%
May	145	14%	17%	31%
June	143	21%	15%	36%
July	140	21%	27%	48%
August	141	18%	35%	53%
September	143	28%	28%	56%

Table 6: Trends in annual extreme flow conditions.

Annual Extreme Streamflow Condition Variables		Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends	
			Positive	Negative
Maximum	1-Day Flow	138	6%	44%
	3-Day Average Flow	138	6%	43%
	7-Day Average Flow	138	6%	43%
	30-Day Average Flow	138	6%	47%
	90-Day Average Flow	138	6%	45%
Minimum	1-Day Flow	124	38%	10%
	3-Day Average Flow	138	42%	10%
	7-Day Average Flow	138	45%	11%
	30-Day Average Flow	138	45%	10%
	90-Day Average Flow	138	40%	19%

Table 7: Average proportion of stations showing significant trends across all extreme flow condition variables.

Group 2 Variables	Boreal		Foothills		Grassland		Parkland		Rocky Mountain	
	P	N	P	N	P	N	P	N	P	N
Maximum Flow Variables	1%	72%	1%	36%	15%	16%	5%	39%	0%	50%
Minimum Flow Variables	28%	22%	37%	8%	50%	5%	43%	14%	66%	10%

Table 8: Trends in timing of annual extreme streamflow conditions.

Timing of annual extreme conditions	Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends	
		Positive	Negative
Date of the annual maximum daily flow	191	34%	8%
Date of the annual minimum daily flow	191	30%	13%

Table 9: Regional results for timing of annual extreme streamflow condition parameters.

Timing of annual extreme conditions	Region	Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends	
			Positive	Negative
Date of the annual maximum daily flow	Boreal	67	15%	16%
	Foothills	15	27%	7
	Grassland	65	48%	5%
	Parkland	22	64%	0%
	Rocky Mountain	21	29%	0%
Date of the annual minimum daily flow	Boreal	67	40%	9%
	Foothills	15	40%	13%
	Grassland	65	17%	22%
	Parkland	22	14%	5%
	Rocky Mountain	21	48%	5%

Table 10: Regional results for frequency of high pulse events.

Frequency and Duration Variable of Pulse Events	Region	Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends	
			Positive	Negative
Number of High Pulses	Boreal	54	0%	19%
	Foothills	15	0%	47%
	Grassland	52	22%	23%
	Parkland	19	11%	16%
	Rocky Mountain	20	0%	15%

Table 11: Trends in streamflow rate and change frequency parameters.

Rate and Change Frequency Variables	Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends	
		Positive	Negative
Rise Rate	179	11%	50%
Fall Rate	191	9%	47%
Number of Streamflow Reversals	179	38%	28%

Table 12: Trends in seasonal climate variables.

Climate Variable	Season	Total Number of Stations Eligible for Analysis	Percentage of Stations with Significant Trends	
			Positive	Negative
Precipitation as Snow (PAS)	Fall	184	0%	8%
	Winter	168	0%	92%
	Spring	182	7%	1%
	Summer	152	1%	1%
Precipitation (PPT)	Fall	184	0%	1%
	Winter	168	0%	93%
	Spring	185	5%	1%
	Summer	185	14%	3%
Average Temperature (Tave)	Fall	191	31%	0%
	Winter	191	56%	0%
	Spring	191	0%	0%
	Summer	191	38%	19%
Maximum Temperature (Tmax)	Fall	191	27%	0%
	Winter	191	76%	0%
	Spring	191	0%	0%
	Summer	191	29%	0%
Minimum Temperature (Tmin)	Fall	191	31%	0%
	Winter	191	78%	0%
	Spring	191	1%	12%
	Summer	191	27%	43%

Table 13: To determine the impact of climate oscillation patterns on the dataset, a composite analysis was run on each station for each IHA variable. A significant composite analysis result indicates a significant difference between two subsets of data. A significant difference between years with high and low PDO values indicates the data is significantly impacted by the PDO pattern. The percentage of stations where particular IHA parameters are impacted by PDO are summarized by region and across the province.

Variable	Percentage of Stations Significantly Impacted by PDO Patterns						Number of Stations
	Boreal	Foothills	Grassland	Parkland	Rocky Mountain	Province	
October	0	25	4.8	0	5	3.7	164
April	0	75	10	0	44.4	12.4	129
May	18.6	28.6	11.9	18.8	26.3	17.2	145
June	26.2	62.5	43.9	56.2	52.6	42	143
July	4.8	37.5	14.3	14.3	68.4	20	140
August	0	12.5	5.4	14.3	5.3	5	141
September	0	0	5.4	0	0	2.1	143
1-Day Minimum	6.1	0	7.8	0	15	6.4	172
3-Day Minimum	7.6	0	4.7	0	15	5.9	188
7-Day Minimum	6.1	0	4.7	4.5	5	4.8	188
30-Day Minimum	7.6	0	7.8	13.6	15	8.5	188
90-Day Minimum	4.5	0	6.2	4.5	15	5.9	188
1-Day Maximum	4.5	6.7	15.6	4.5	35	11.7	188
3-Day Maximum	4.5	6.7	18.8	13.6	40	14.4	188
7-Day Maximum	6.1	20	21.9	18.2	40	17.6	188
30-Day Maximum	6.1	33.3	34.4	18.2	55	24.5	188
90-Day Maximum	10.6	33.3	29.7	13.6	55	23.9	188
Base Index	4.6	20	10.9	4.8	40	11.9	177
Zero Flow Days	0	0	4.7	7.7	0	3.1	96
Date of Minimum Flow	0	6.7	7.7	9.1	0	4.2	191
Date of Maximum Flow	0	0	1.5	4.5	9.5	2.1	191
High Pulse Number	3.7	13.3	5.8	0	5	5	161
Rise Rate	1.5	0	7.3	0	19	5	179
Fall Rate	1.5	0	3.6	0	4.8	2.2	179
Number of Reversals	13.4	13.3	4.6	0	4.8	7.9	191

Table 14: To determine the impact of climate oscillation patterns on the dataset, a composite analysis was run on each station for each IHA variable. A significant difference between years with high and low ENSO values indicates the data is significantly impacted by the ENSO pattern. The percentage of stations where particular IHA parameters are impacted by ENSO are summarized by region and across the province.

Variable	Percentage of Stations Significantly Impacted by ENSO Patterns						Number of Stations
	Boreal	Foothills	Grassland	Parkland	Rocky Mountain	Province	
October	0	0	1.6	0	5	1.2	164
April	0	25	0	0	0	0.8	129
May	2.3	42.9	0	0	47.4	9	145
June	11.9	0	0	12.5	10.5	6.3	143
July	14.3	12.5	0	7.1	36.8	10.7	140
August	0	0	0	0	5.3	0.7	141
September	4.8	0	5.4	12.5	5	5.6	143
1-Day Minimum	3	0	2	5.3	5	2.9	172
3-Day Minimum	3	0	0	0	5	1.6	188
7-Day Minimum	3	0	0	4.5	15	3.2	188
30-Day Minimum	3	0	3.1	9.1	10	4.3	188
90-Day Minimum	4.5	0	1.6	0	5	2.7	188
1-Day Maximum	13.6	0	4.7	13.6	10	9	188
3-Day Maximum	13.6	0	4.7	9.1	10	8.5	188
7-Day Maximum	15.2	6.7	3.1	4.5	15	9	188
30-Day Maximum	9.1	6.7	1.6	0	25	6.9	188
90-Day Maximum	13.6	6.7	0	0	20	7.4	188
Base Index	4.6	6.7	3.6	4.8	0	4	177
Zero Flow Days	0	0	0	0	0	0	96
Date of Minimum Flow	0	0	6.2	4.5	0	2.6	191
Date of Maximum Flow	1.5	0	6.2	4.5	28.6	6.3	191
High Pulse Number	7.4	20	7.7	10.5	0	8.1	161
Rise Rate	0	6.7	0	9.5	0	1.7	179
Fall Rate	1.5	0	1.8	14.3	0	2.8	179
Number of Reversals	7.5	33.3	3.1	9.1	4.8	8.4	191

Table 15: A comparison of the significant trends in IHA parameters between RHBN and non-RHBN stations in Alberta across all natural regions.

Indicator of Hydrologic Alteration Variables	Percentage of non-RHBN Stations with Significant Trends		Percentage of RHBN Stations with Significant Trends	
	Positive	Negative	Positive	Negative
April	13%	12%	29%	0%
May	11%	14%	5%	5%
June	17%	13%	5%	0%
July	16%	22%	5%	5%
August	15%	27%	5%	19%
September	22%	23%	14%	5%
October	21%	29%	29%	14%
Maximum 1-Day Flow	7%	43%	0%	43%
Maximum 3-Day Average Flow	6%	41%	0%	48%
Maximum 7-Day Average Flow	6%	42%	0%	43%
Maximum 30-Day Average Flow	7%	46%	0%	43%
Maximum 90-Day Average Flow	7%	46%	0%	29%
Minimum 1-Day Flow	35%	10%	29%	5%
Minimum 3-Day Average Flow	42%	10%	38%	5%
Minimum 7-Day Average Flow	44%	12%	43%	5%
Minimum 30-Day Average Flow	45%	11%	43%	5%
Minimum 90-Day Average Flow	39%	19%	48%	10%
Date of the annual maximum daily flow	34%	9%	38%	0%
Date of the annual minimum daily flow	31%	14%	29%	5%
Number of High Pulses	8%	20%	0%	5%
Rise Rate	12%	46%	0%	48%
Fall Rate	45%	9%	43%	5%
Reversals	38%	28%	38%	29%

Table 16: Life-history strategies and their favoured hydrologic conditions (Mims & Olden, 2012; Winemiller & Rose, 1992).

Life-history Strategy	Characteristics of Strategy	Favoured Hydrological Conditions
Opportunistic	- Small-bodied - Early maturation - Low juvenile survivorship	- High annual variation - Low flow predictability - Low base flow
Periodic	- Large body size - Late maturation - High fecundity - Low juvenile survivorship	- Low annual variation - Low high pulse count - Larger high pulse duration
Equilibrium	- Small to medium body size - Intermediate times to maturity - Low fecundity per spawning event - High juvenile survivorship	- Low annual variation - High flow predictability - Larger high pulse count - Lower high pulse duration

Table 17: Comparison of significant trends found each of the major watersheds within the Boreal Natural Region. The proportion of stations with significant negative trends is indicated in each "N" column; the proportion of stations with significant positive trends is indicated in each "P" column; and the total number of stations available for analysis is indicated in each "#" column.

Variable	Hay/Great Slave			Peace/Slave			Athabasca			Beaver			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#	N	P	#	N	P	#	N	P	#
Group 1 – Monthly magnitudes																		
October	0%	0%	2	83%	6%	18	70%	0%	20	80%	0%	5	0%	33%	3	25%	0%	4
April	0%	50%	2	8%	25%	12	24%	0%	17	80%	0%	5	50%	0%	2	50%	0%	2
May	0%	0%	2	17%	0%	12	11%	0%	19	40%	0%	5	33%	0%	3	0%	0%	2
June	0%	0%	2	58%	0%	12	11%	0%	18	20%	0%	5	33%	0%	3	0%	50%	2
July	0%	0%	2	58%	0%	12	53%	5%	19	50%	0%	4	33%	0%	3	0%	0%	2
August	0%	0%	2	58%	0%	12	58%	0%	19	40%	0%	5	33%	33%	3	0%	50%	2
September	0%	0%	2	58%	0%	12	56%	6%	18	40%	0%	5	33%	0%	3	0%	0%	2
Group 2 – Annual extreme flow conditions																		
1-Day Min	0%	67%	3	10%	24%	21	19%	26%	27	50%	0%	6	20%	20%	5	25%	50%	4
3-Day Min	0%	100%	3	10%	33%	21	26%	22%	27	50%	0%	6	20%	20%	5	25%	50%	4
7-Day Min	0%	100%	3	10%	29%	21	26%	26%	27	50%	0%	6	20%	20%	5	25%	50%	4
30-Day Min	0%	100%	3	5%	29%	21	26%	26%	27	33%	0%	6	20%	20%	5	0%	75%	4
90-Day Min	0%	33%	3	24%	29%	21	30%	30%	27	33%	33%	6	60%	0%	5	50%	25%	4
1-Day Max	100%	0%	3	81%	0%	21	81%	0%	27	83%	0%	6	40%	0%	5	0%	0%	4
3-Day Max	100%	0%	3	81%	0%	21	78%	0%	27	67%	0%	6	40%	0%	5	0%	0%	4

Variable	Hay/Great Slave			Peace/Slave			Athabasca			Beaver			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#	N	P	#	N	P	#	N	P	#
7-Day Max	100%	0%	3	71%	0%	21	70%	0%	27	67%	0%	6	40%	0%	5	0%	0%	4
30-Day Max	100%	0%	3	86%	0%	21	78%	0%	27	67%	0%	6	40%	0%	5	25%	25%	4
90-Day Max	33%	0%	3	95%	0%	21	78%	0%	27	67%	0%	6	40%	0%	5	50%	25%	4
Group 3 – Timing of annual extreme conditions																		
Min Date	0%	33%	3	5%	62%	21	7%	36%	28	17%	50%	6	40%	0%	5	0%	0%	4
Max Date	0%	0%	3	19%	5%	21	25%	14%	28	0%	17%	6	0%	40%	5	0%	50%	4
Group 4 – Frequency and duration of high and low pulses																		
High Pulse Number	0%	0%	3	12%	0%	17	28%	0%	25	0%	0%	5	0%	0%	2	50%	0%	2
Group 5 – Frequency and Rate of Change Variables																		
Fall Rate	67%	0%	3	57%	10%	21	68%	4%	28	50%	0%	6	75%	0%	4	75%	0%	4
Rise Rate	33%	0%	3	57%	10%	21	82%	4%	28	50%	0%	6	75%	0%	4	100%	0%	4
Number of Reversals	0%	33%	3	29%	24%	21	21%	36%	28	17%	17%	6	40%	60%	5	25%	50%	4

Table 18: Comparison of significant trends found each of the major watersheds within the Grassland Natural Region. The proportion of stations with significant negative trends is indicated in each "N" column; the proportion of stations with significant positive trends is indicated in each "P" column; and the total number of stations available for analysis is indicated in each "#" column.

Variable	North Saskatchewan			South Saskatchewan			Milk River		
	N	P	#	N	P	#	N	P	#
Group 1 – Monthly magnitudes									
October	0%	0%	1	17%	43%	54	0%	0%	7
April	0%	0%	0	7%	18%	44	0%	50%	6
May	0%	0%	0	23%	38%	53	0%	0%	6
June	0%	0%	0	14%	43%	51	17%	0%	6
July	0%	0%	0	14%	46%	50	50%	0%	6
August	0%	0%	0	20%	42%	50	33%	0%	6
September	0%	0%	0	16%	56%	50	50%	0%	6
Group 2 – Annual extreme flow conditions									
1-Day Min	0%	0%	1	4%	52%	46	0%	0%	4
3-Day Min	0%	100%	1	4%	57%	56	0%	0%	7
7-Day Min	0%	100%	1	7%	59%	56	0%	0%	7
30-Day Min	0%	100%	1	5%	61%	56	0%	0%	7
90-Day Min	0%	0%	1	7%	50%	56	14%	14%	7
1-Day Max	0%	0%	1	16%	18%	56	14%	0%	7
3-Day Max	0%	0%	1	14%	18%	56	14%	0%	7
7-Day Max	0%	0%	1	14%	18%	56	29%	0%	7
30-Day Max	100%	0%	1	20%	18%	56	14%	0%	7
90-Day Max	0%	0%	1	14%	16%	56	29%	0%	7
Group 3 – Timing of annual extreme conditions									
Min Date	0%	0%	2	25%	16%	56	0%	29%	7
Max Date	0%	100%	2	5%	45%	56	0%	57%	7

Variable	North Saskatchewan			South Saskatchewan			Milk River		
	N	P	#	N	P	#	N	P	#
Group 4 – Frequency and duration of high and low pulses									
High Pulse Number	0%	0%	0	25%	23%	48	0%	0%	4
Group 5 – Frequency and Rate of Change Variables									
Fall Rate	100%	0%	1	28%	14%	50	50%	0%	4
Rise Rate	100%	0%	1	26%	22%	50	0%	0%	4
Number of Reversals	0%	50%	2	29%	41%	56	29%	14%	7

Table 19: Comparison of significant trends found each of the major watersheds within the Parkland Natural Region. The proportion of stations with significant negative trends is indicated in each "N" column; the proportion of stations with significant positive trends is indicated in each "P" column; and the total number of stations available for analysis is indicated in each "#" column.

Variable	Peace/Slave			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#
Group 1 – Monthly magnitudes									
October	0%	0%	2	44%	0%	9	0%	70%	10
April	0%	0%	2	75%	25%	4	30%	20%	10
May	0%	0%	2	50%	0%	4	10%	0%	10
June	0%	0%	2	50%	0%	4	0%	50%	10
July	0%	0%	2	67%	0%	3	0%	33%	9
August	0%	0%	2	50%	0%	2	20%	30%	10
September	0%	0%	2	50%	0%	4	10%	50%	10
Group 2 – Annual extreme flow conditions									
1-Day Min	0%	0%	0	38%	13%	8	0%	64%	11
3-Day Min	0%	0%	2	11%	22%	9	0%	73%	11
7-Day Min	0%	0%	2	11%	22%	9	0%	73%	11
30-Day Min	0%	0%	2	33%	11%	9	0%	73%	11
90-Day Min	50%	0%	2	67%	11%	9	0%	73%	11
1-Day Max	0%	0%	2	67%	0%	9	9%	9%	11
3-Day Max	0%	0%	2	78%	0%	9	9%	9%	11
7-Day Max	0%	0%	2	89%	0%	9	9%	9%	11
30-Day Max	50%	0%	2	78%	0%	9	9%	9%	11
90-Day Max	50%	0%	2	89%	0%	9	9%	18%	11
Group 3 – Timing of annual extreme conditions									
Min Date	0%	0%	2	0%	33%	9	9%	0%	11
Max Date	0%	50%	2	0%	44%	9	0%	82%	11

Variable	Peace/Slave			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#
Group 4 – Frequency and duration of high and low pulses									
High Pulse Number	0%	50%	2	43%	0%	7	0%	10%	10
Group 5 – Frequency and Rate of Change Variables									
Fall Rate	50%	0%	2	88%	0%	8	18%	18%	11
Rise Rate	0%	0%	2	100%	0%	8	27%	9%	11
Number of Reversals	50%	50%	2	44%	44%	9	27%	55%	11

Table 20: Comparison of significant trends found each of the major watersheds within the Rocky Mountain Natural Region. The proportion of stations with significant negative trends is indicated in each "N" column; the proportion of stations with significant positive trends is indicated in each "P" column; and the total number of stations available for analysis is indicated in each "#" column.

Variable	Peace/Slave			Athabasca			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#	N	P	#
Group 1 – Monthly magnitudes												
October	0%	0%	1	0%	0%	2	0%	67%	3	7%	43%	14
April	0%	0%	1	0%	100%	2	0%	33%	3	8%	33%	12
May	0%	0%	1	0%	0%	2	0%	0%	3	23%	0%	13
June	0%	0%	1	0%	0%	2	0%	0%	3	0%	15%	13
July	0%	0%	1	0%	0%	2	0%	0%	3	23%	15%	13
August	100%	0%	1	50%	0%	2	67%	0%	3	46%	0%	13
September	0%	100%	1	0%	0%	2	0%	33%	3	14%	21%	14
Group 2 – Annual extreme flow conditions												
1-Day Min	0%	0%	1	0%	100%	3	0%	0%	3	0%	54%	13
3-Day Min	0%	0%	1	0%	100%	3	0%	33%	3	0%	62%	13
7-Day Min	0%	100%	1	0%	100%	3	0%	67%	3	8%	69%	13
30-Day Min	0%	100%	1	0%	100%	3	0%	67%	3	8%	62%	13
90-Day Min	0%	100%	1	0%	100%	3	0%	67%	3	8%	69%	13
1-Day Max	100%	0%	1	100%	0%	3	67%	0%	3	23%	0%	13
3-Day Max	0%	0%	1	100%	0%	3	100%	0%	3	31%	0%	13
7-Day Max	0%	0%	1	100%	0%	3	100%	0%	3	46%	0%	13
30-Day Max	0%	0%	1	67%	0%	3	100%	0%	3	46%	0%	13
90-Day Max	100%	0%	1	33%	0%	3	33%	0%	3	38%	0%	13

Variable	Peace/Slave			Athabasca			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#	N	P	#
Group 3 – Timing of annual extreme conditions												
Min Date	0%	100%	1	0%	33%	3	0%	33%	3	7%	50%	14
Max Date	0%	0%	1	0%	0%	3	0%	33%	3	0%	36%	14
Group 4 – Frequency and duration of high and low pulses												
High Pulse Number	0%	0%	1	0%	0%	2	0%	0%	3	21%	0%	14
Group 5 – Frequency and Rate of Change Variables												
Fall Rate	0%	100%	1	0%	0%	3	33%	0%	3	21%	14%	14
Rise Rate	0%	100%	1	100%	0%	3	100%	0%	3	7%	21%	14
Number of Reversals	0%	0%	1	0%	67%	3	0%	100%	3	50%	29%	14

Table 21: Comparison of significant trends found each of the major watersheds within the Foothills Natural Region. The proportion of stations with significant negative trends is indicated in each "N" column; the proportion of stations with significant positive trends is indicated in each "P" column; and the total number of stations available for analysis is indicated in each "#" column.

Variable	Peace/Slave			Athabasca			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#	N	P	#
Group 1 – Monthly magnitudes												
October	100%	0%	1	75%	0%	4	0%	0%	2	0%	100%	1
April	0%	0%	0	0%	50%	2	0%	50%	2	0%	0%	0
May	0%	0%	1	0%	0%	3	0%	0%	2	0%	0%	1
June	0%	0%	1	0%	0%	4	0%	0%	2	0%	0%	1
July	0%	0%	1	50%	0%	4	0%	0%	2	0%	0%	1
August	100%	0%	1	25%	0%	4	50%	0%	2	0%	0%	1
September	100%	0%	1	50%	0%	4	0%	0%	2	0%	100%	1
Group 2 – Annual extreme flow conditions												
1-Day Min	100%	0%	1	0%	43%	7	0%	50%	6	0%	100%	1
3-Day Min	100%	0%	1	0%	29%	7	0%	33%	6	0%	100%	1
7-Day Min	100%	0%	1	0%	43%	7	0%	33%	6	0%	100%	1
30-Day Min	100%	0%	1	0%	43%	7	0%	33%	6	0%	100%	1
90-Day Min	100%	0%	1	14%	14%	7	0%	33%	6	0%	100%	1
1-Day Max	100%	0%	1	43%	0%	7	17%	17%	6	100%	0%	1
3-Day Max	100%	0%	1	43%	0%	7	0%	0%	6	100%	0%	1
7-Day Max	100%	0%	1	43%	0%	7	0%	0%	6	100%	0%	1
30-Day Max	100%	0%	1	57%	0%	7	0%	0%	6	0%	0%	1
90-Day Max	100%	0%	1	71%	0%	7	0%	0%	6	0%	0%	1

Variable	Peace/Slave			Athabasca			North Saskatchewan			South Saskatchewan		
	N	P	#	N	P	#	N	P	#	N	P	#
Group 3 – Timing of annual extreme conditions												
Min Date	100%	0%	1	0%	29%	7	17%	67%	6	0%	0%	1
Max Date	0%	0%	1	14%	29%	7	0%	33%	6	0%	0%	1
Group 4 – Frequency and duration of high and low pulses												
High Pulse Number	0%	0%	1	43%	0%	7	50%	0%	6	100%	0%	1
Group 5 – Frequency and Rate of Change Variables												
Fall Rate	100%	0%	1	86%	0%	7	73%	0%	6	0%	0%	1
Rise Rate	100%	0%	1	57%	0%	7	83%	0%	6	100%	0%	1
Number of Reversals	0%	100%	1	43%	14%	7	17%	50%	6	100%	0%	1

Figures

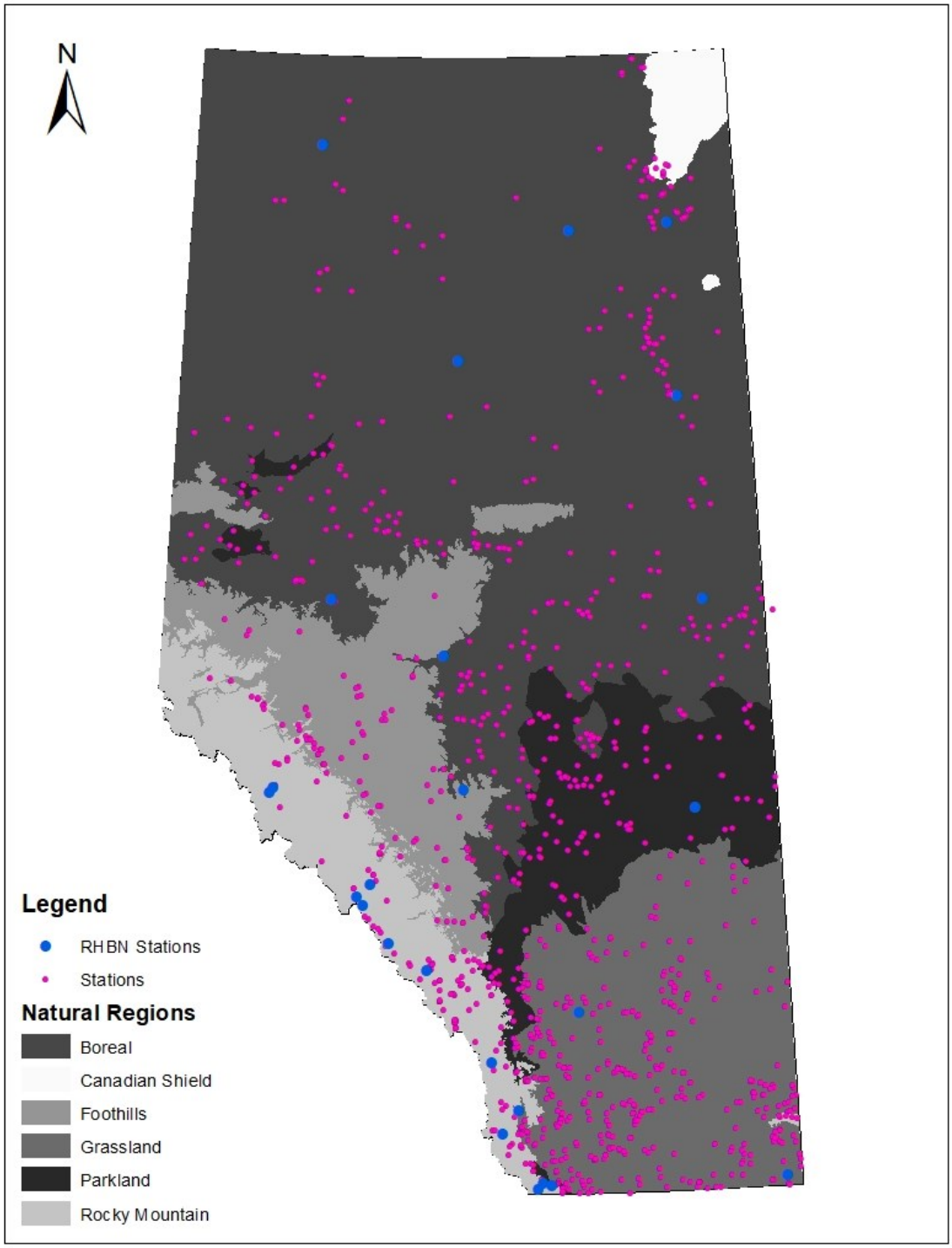

Figure 1: Water Survey of Canada stream gauge locations across the various natural regions in Alberta. Reference Hydrometric Basin Network stations are also shown.

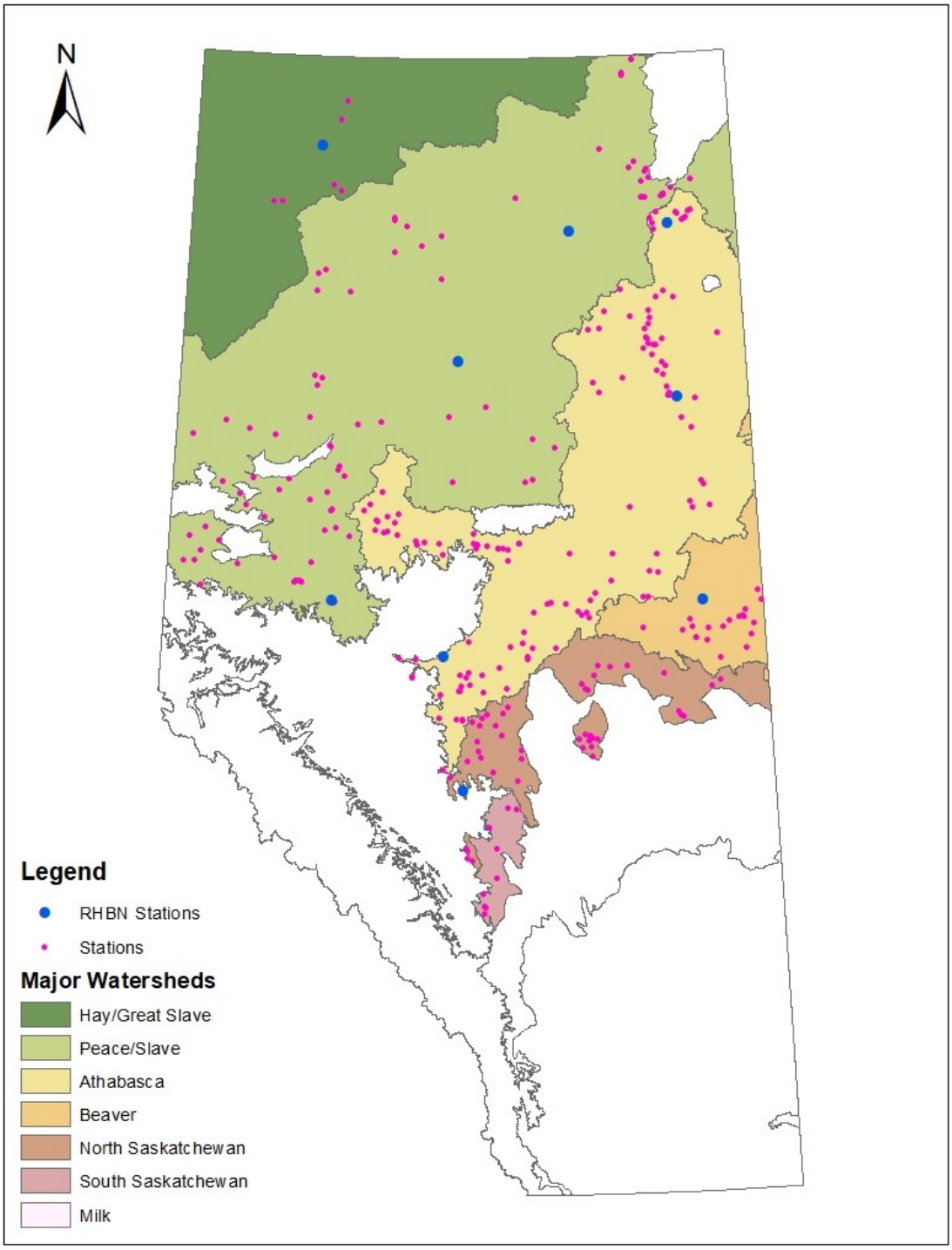

Figure 2: Water Survey of Canada stream gauge locations across the Boreal Natural Region. The region is comprised of six of the major watersheds: Hay/Great Slave, Peace/Slave, Athabasca, Beaver, North Saskatchewan, and South Saskatchewan River Basins.

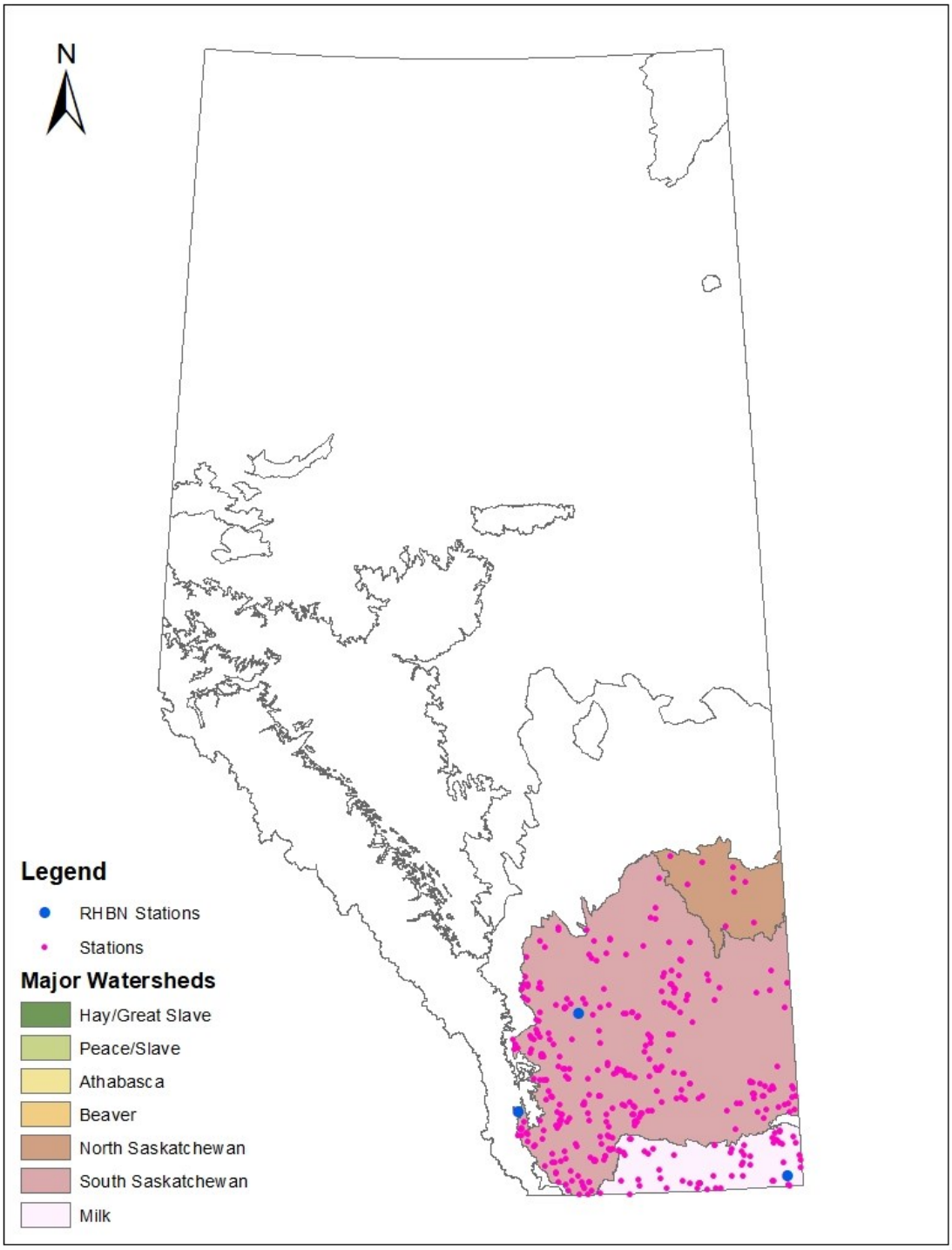

Figure 3: Water Survey of Canada stream gauge locations across the Grassland Natural Region. The region is comprised of three of the major watersheds: North Saskatchewan, South Saskatchewan, and Milk River Basins.

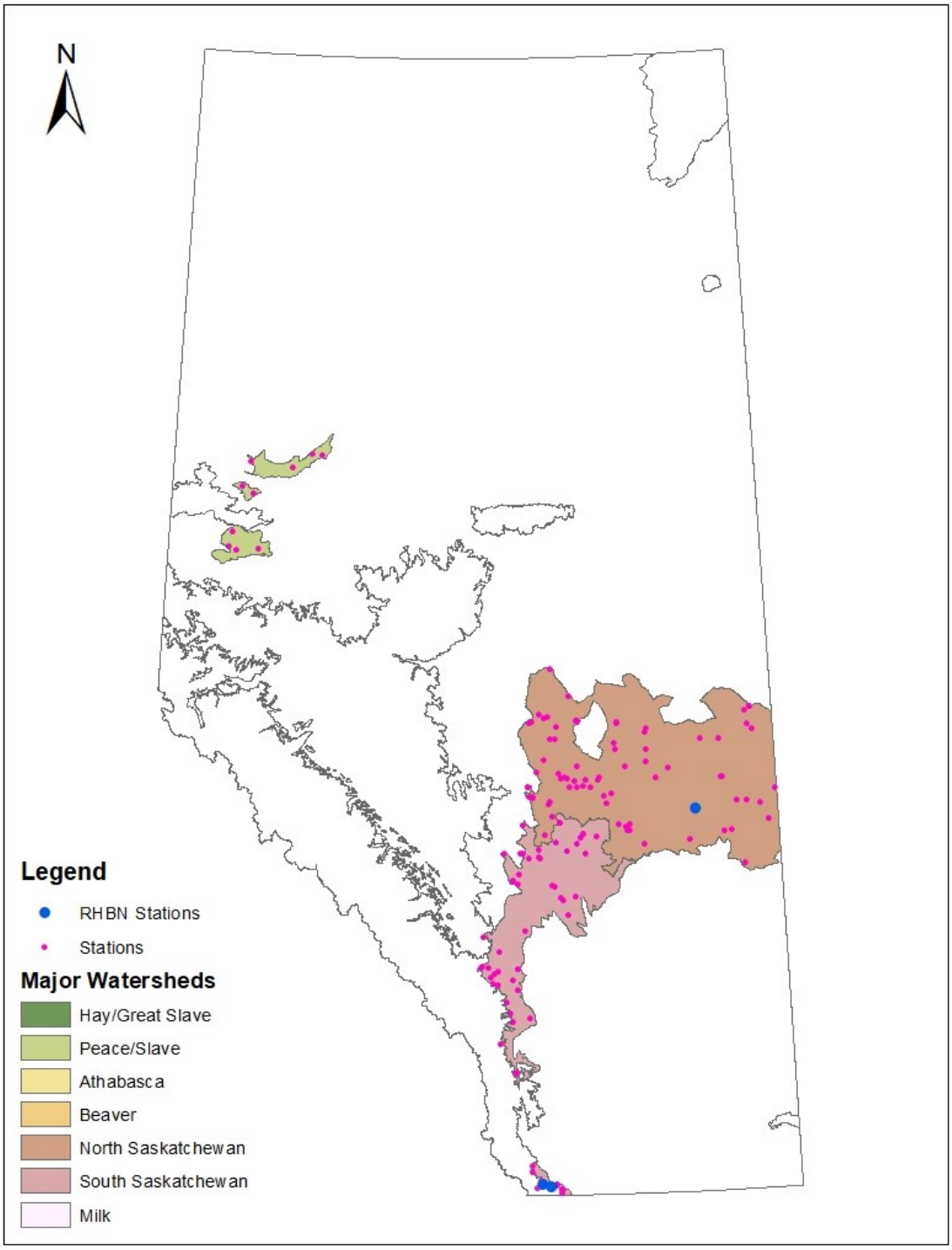

Figure 4: Water Survey of Canada stream gauge locations across the Parkland Natural Region. The region is comprised of three of the major watersheds: Peace/Slave, North Saskatchewan, and South Saskatchewan River Basins.

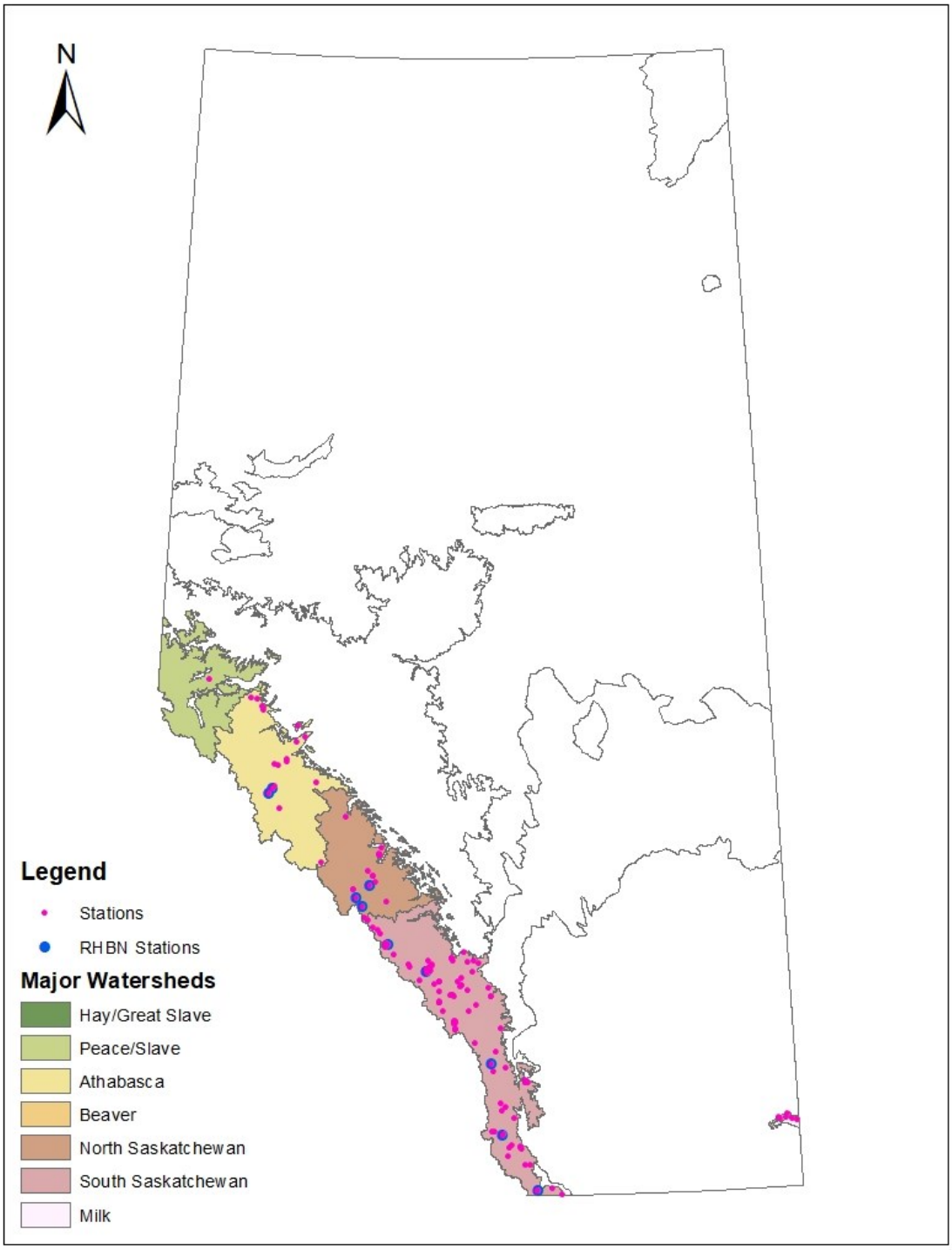

Figure 5: Water Survey of Canada stream gauge locations across the Rocky Mountain Natural Region. The region is comprised of four of the major watersheds: Peace/Slave, Athabasca, North Saskatchewan, and South Saskatchewan River Basins.

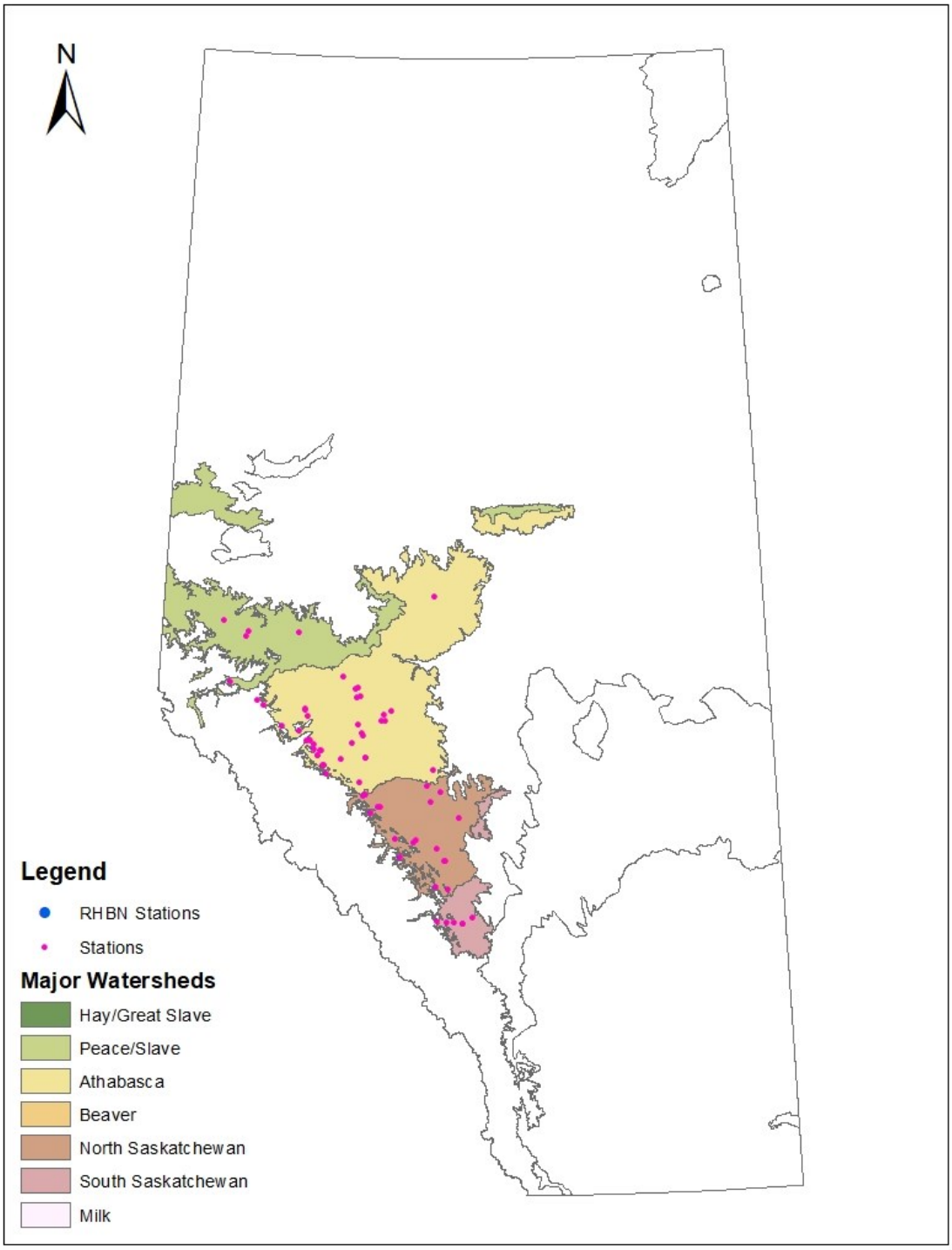

Figure 6: Water Survey of Canada stream gauge locations across the Foothills Natural Region. The region is comprised of four of the major watersheds: Peace/Slave, Athabasca, North Saskatchewan, and South Saskatchewan River Basins.

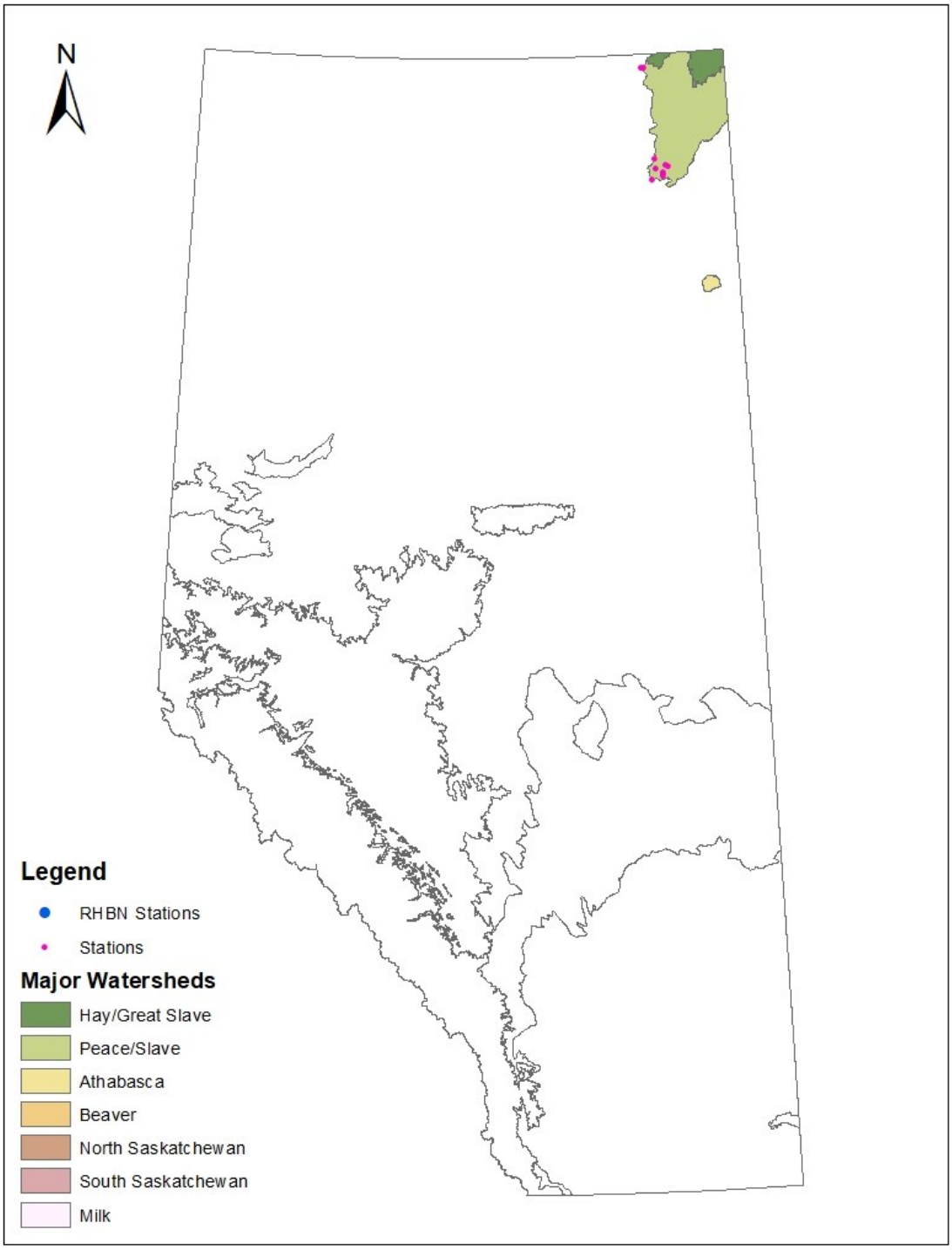

Figure 7: Water Survey of Canada stream gauge locations across the Canadian Shield Natural Region. The region is comprised of two of the major watersheds: Peace/Slave, and Athabasca River Basins.

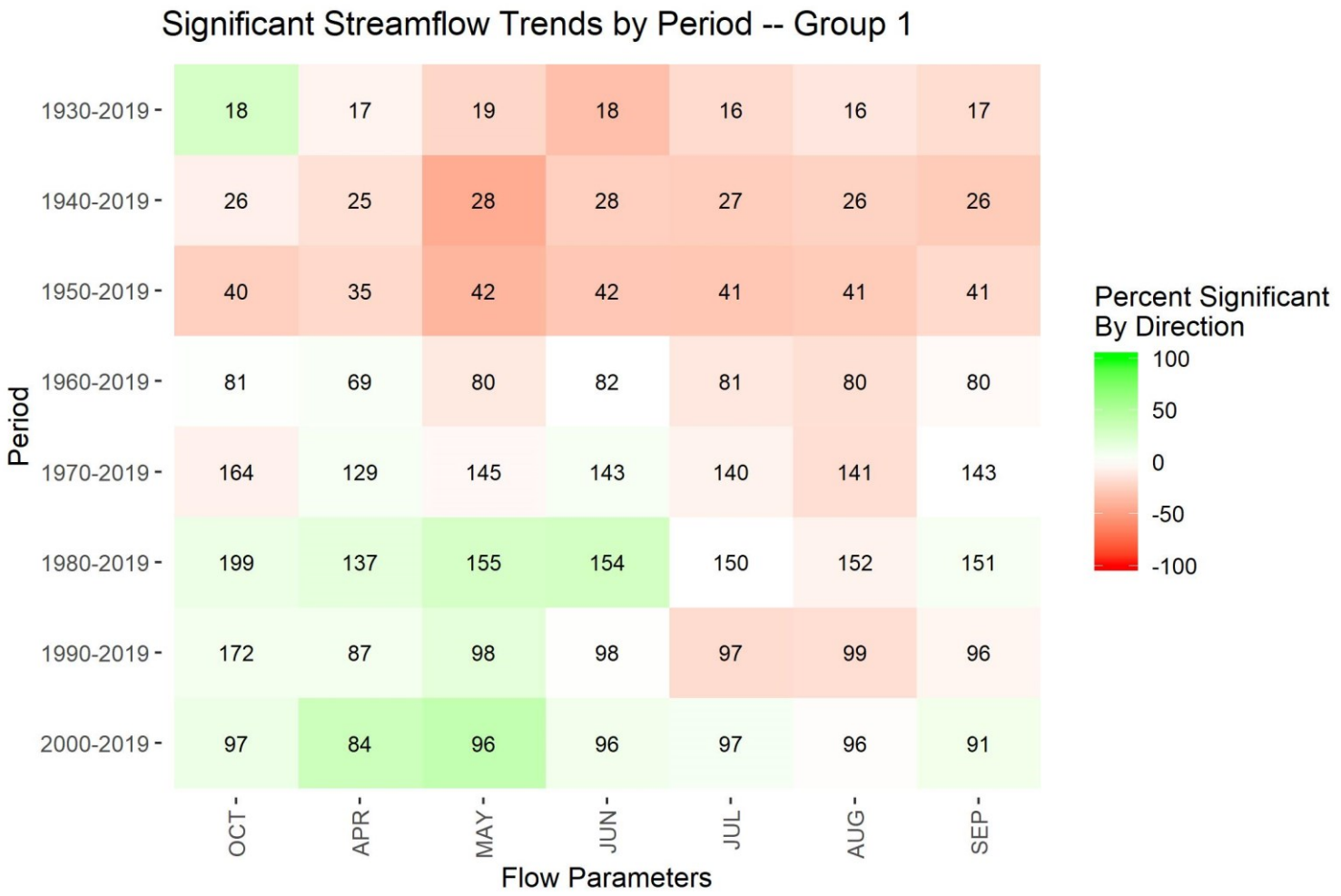

Figure 8: Streamflow trend analysis results by period of analysis for monthly magnitude variables (Group 1). The numbers indicate the total number of stations available for a given analysis across Alberta within each period.

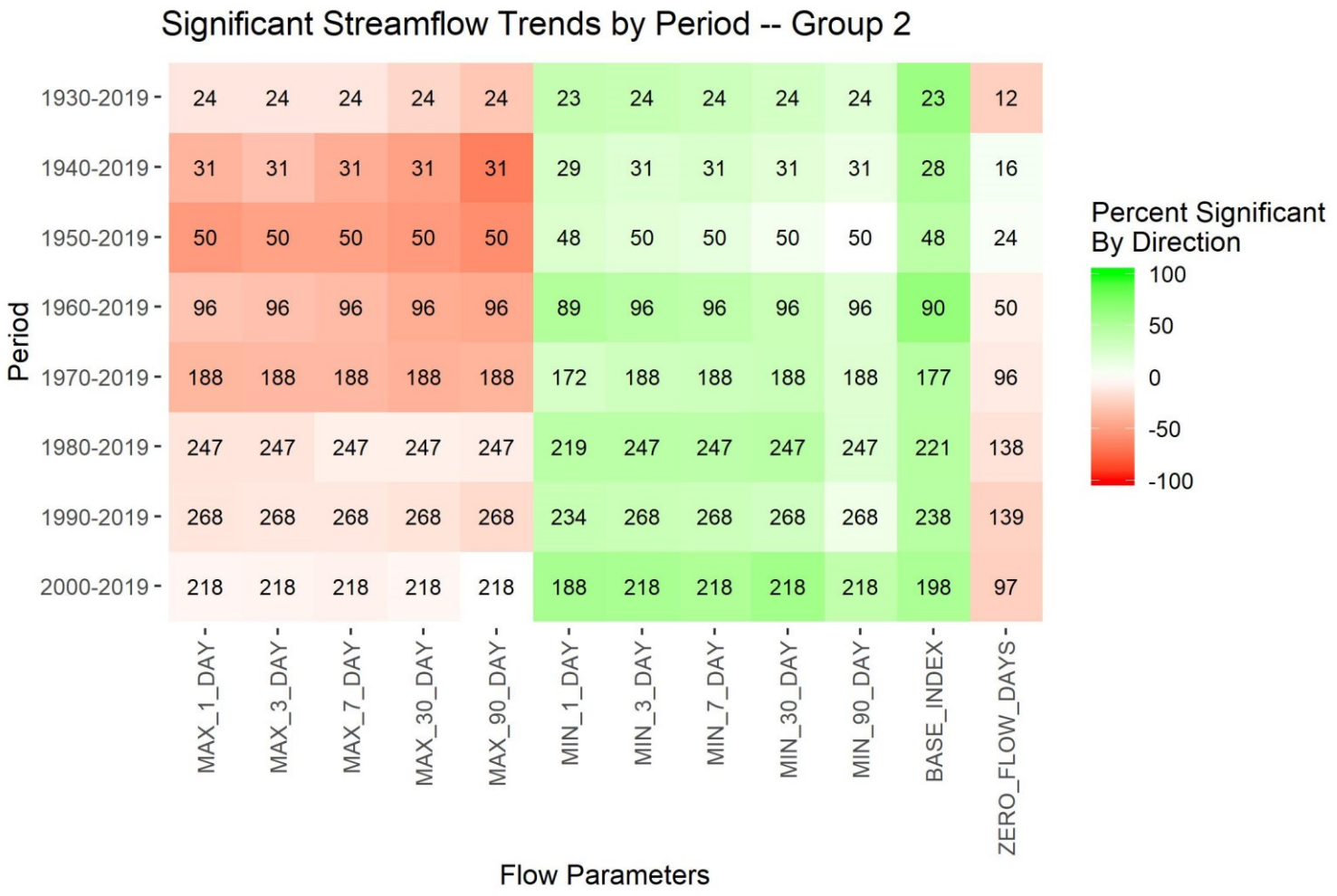

Figure 9: Streamflow trend analysis results by period of analysis for Annual extreme condition variables (Group 2). The numbers indicate the total number of stations available for a given analysis across Alberta within each period.

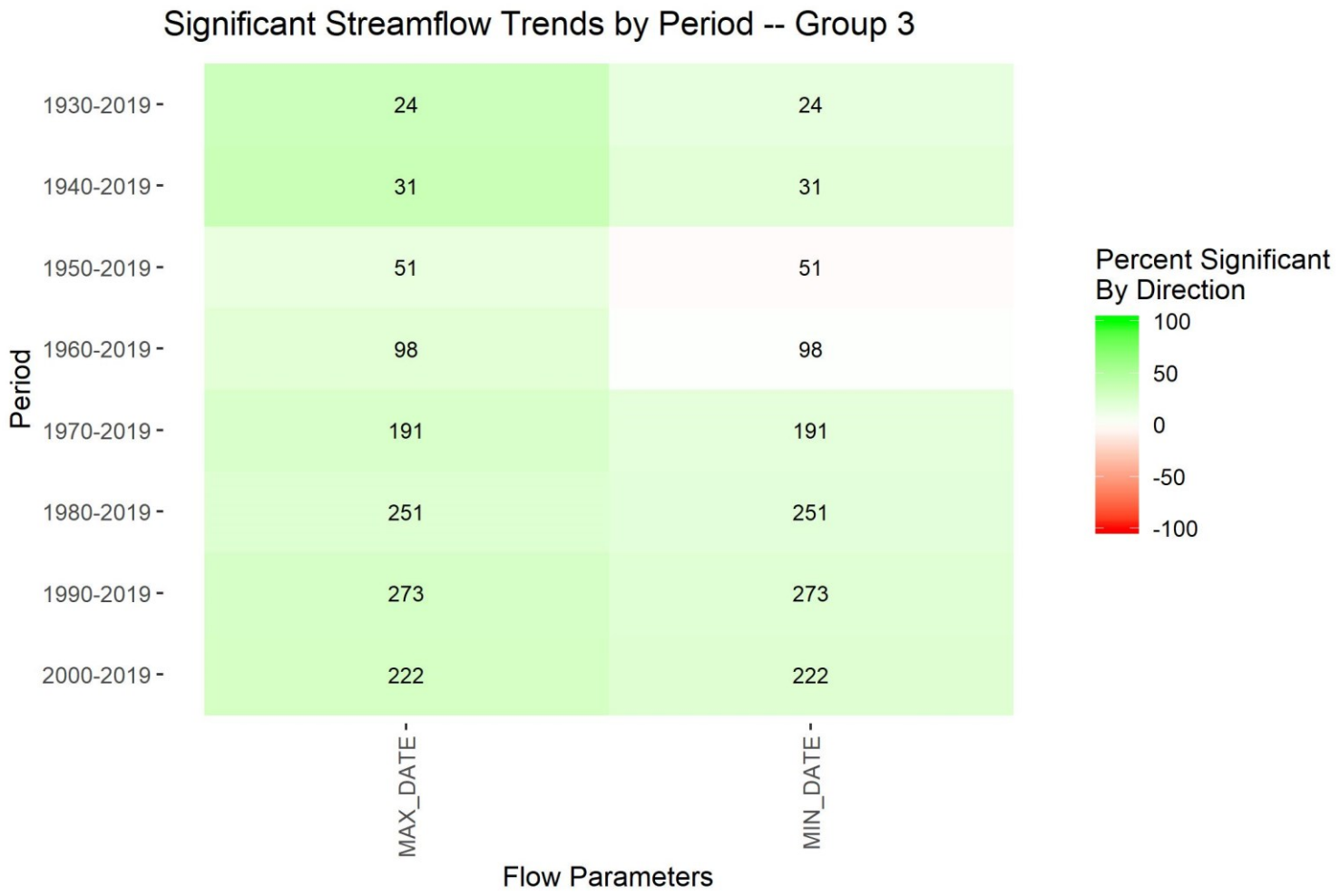

Figure 10: Streamflow trend analysis results by period of analysis for timing variables (Group 3). The numbers indicate the total number of stations available for a given analysis across Alberta within each period.

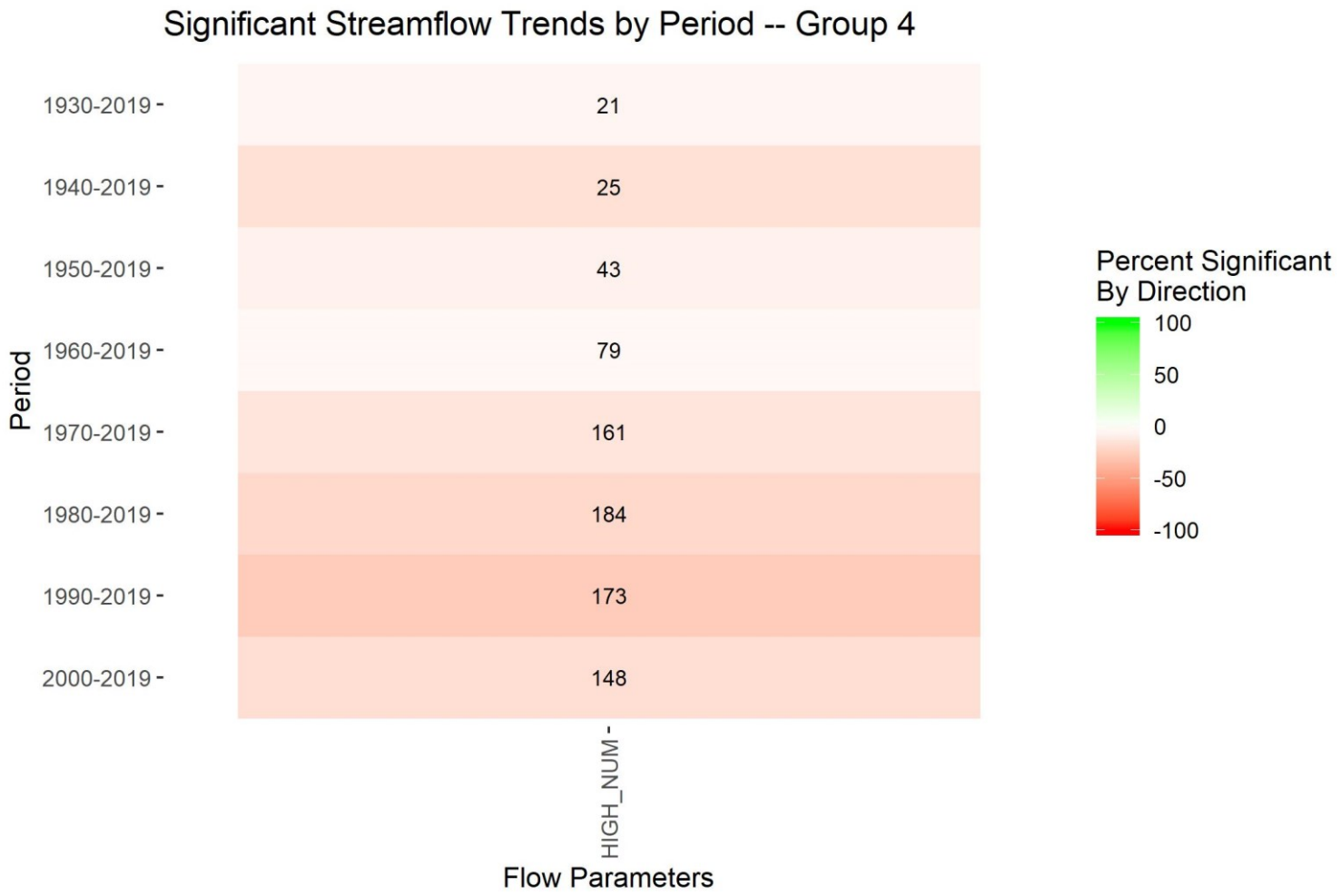

Figure 11: Streamflow trend analysis results by period of analysis for frequency of pulse variables (Group 4). The numbers indicate the total number of stations available for a given analysis across Alberta within each period.

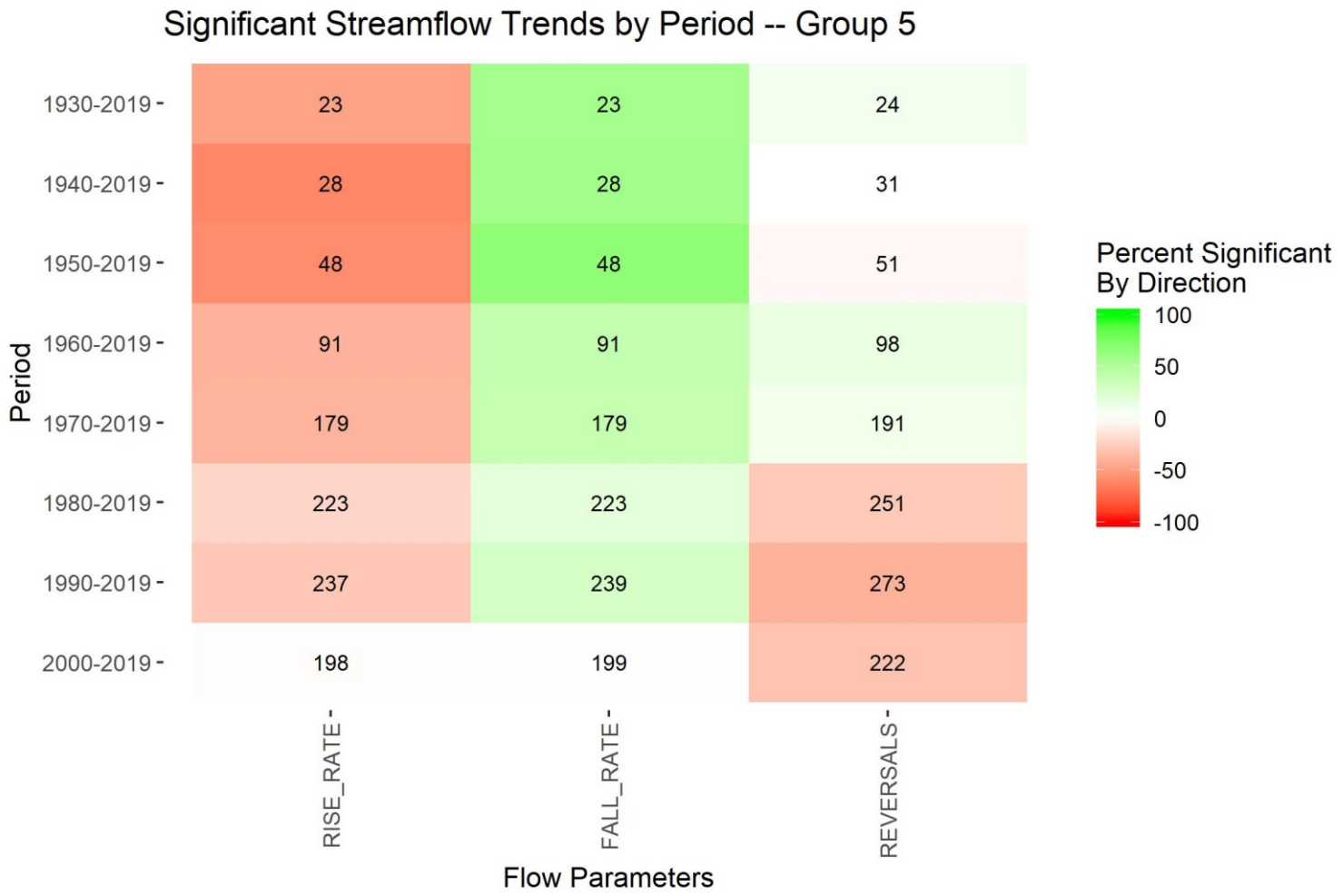

Figure 12: Streamflow trend analysis results by period of analysis for frequency and rate of change variables (Group 5). The numbers indicate the total number of stations available for a given analysis across Alberta within each period. Note that the analysis considered fall rate as a negative value; in other words, an increase in the fall rate indicates a decrease in the absolute value of the fall rate.

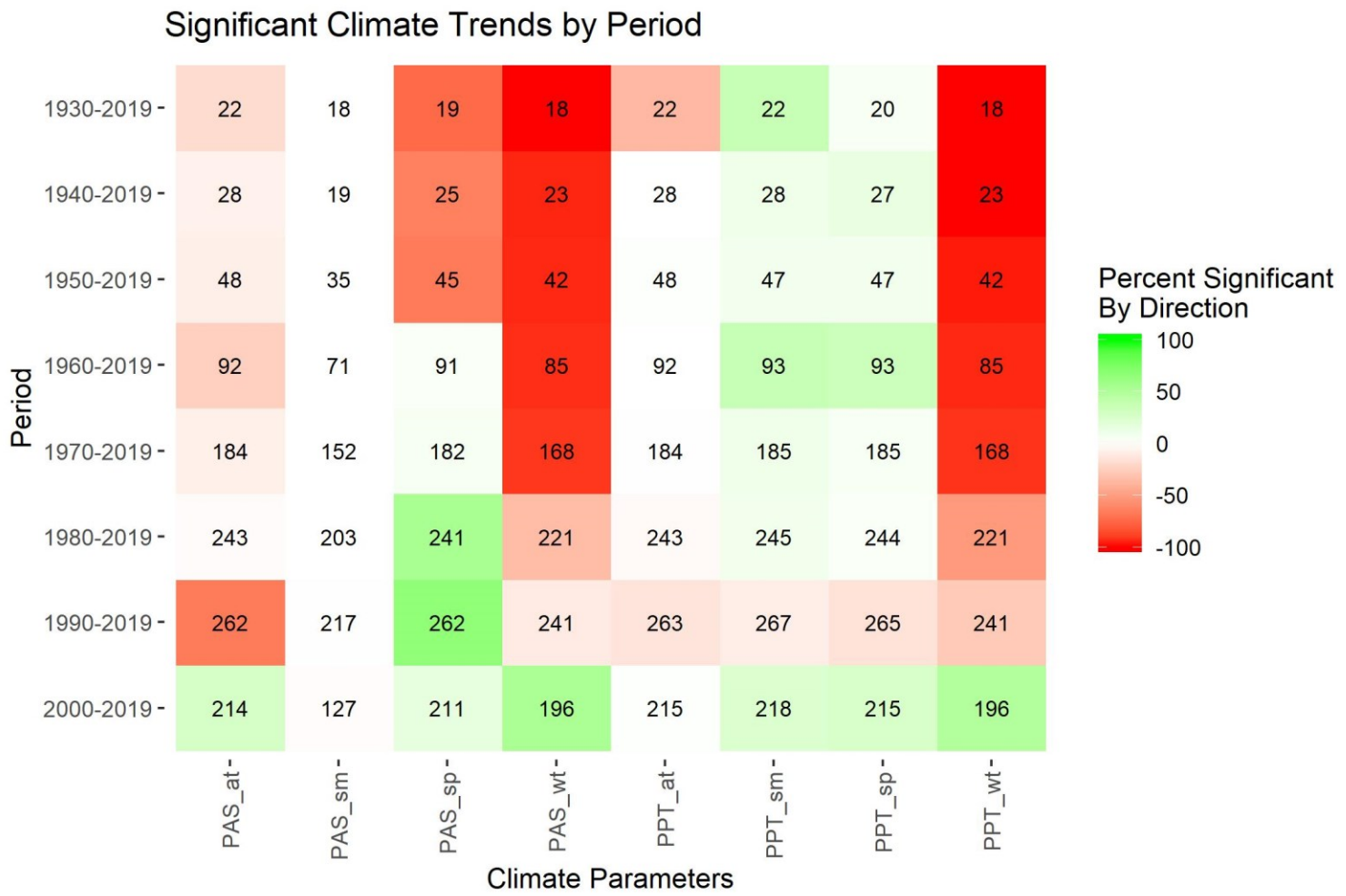

Figure 13: Seasonal climate trend analysis results by period of analysis for precipitation variables. The numbers indicate the total number of stations available for a given analysis.

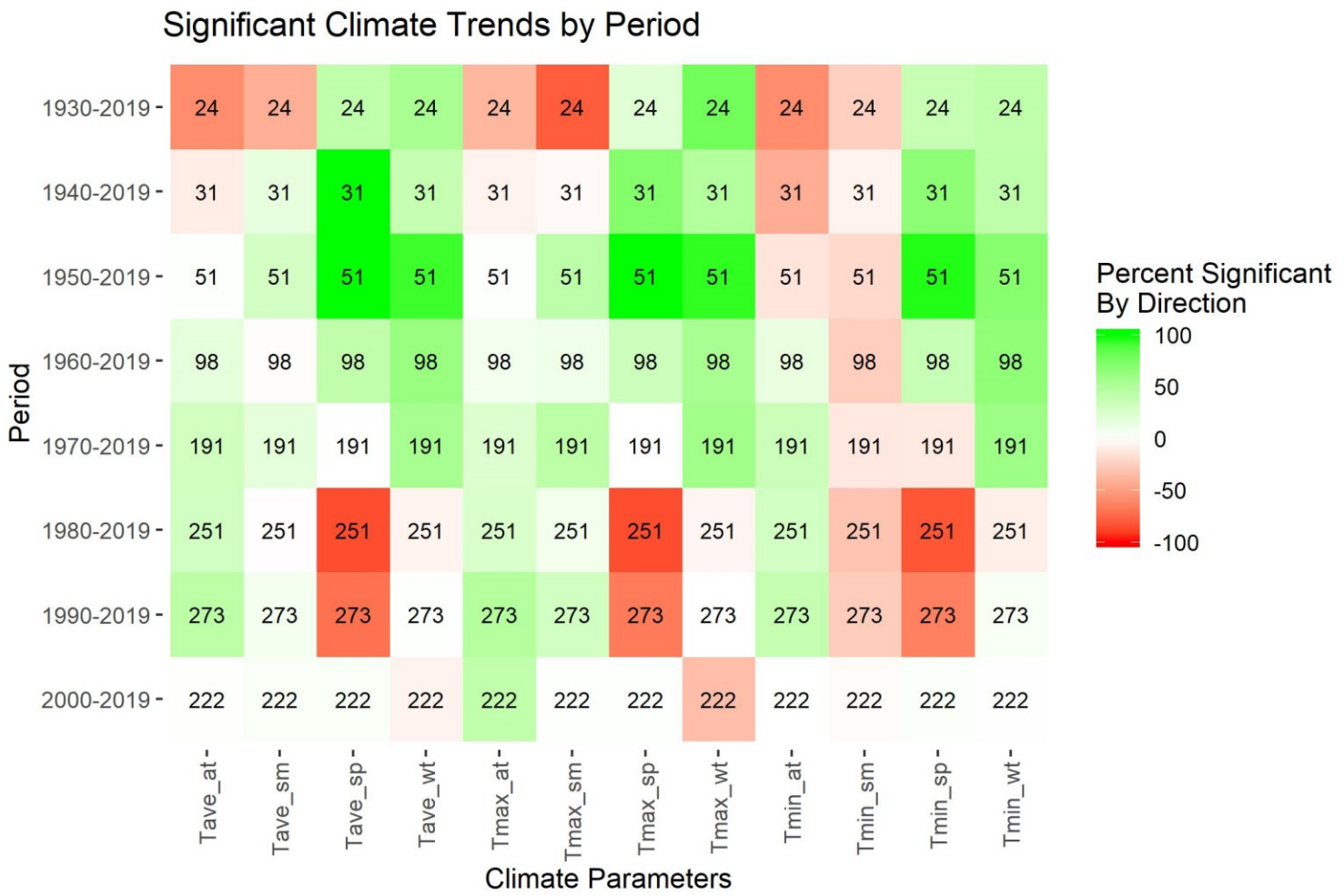

Figure 14: Seasonal climate trend analysis results by period of analysis for temperature variables. The numbers indicate the total number of stations available for a given analysis.

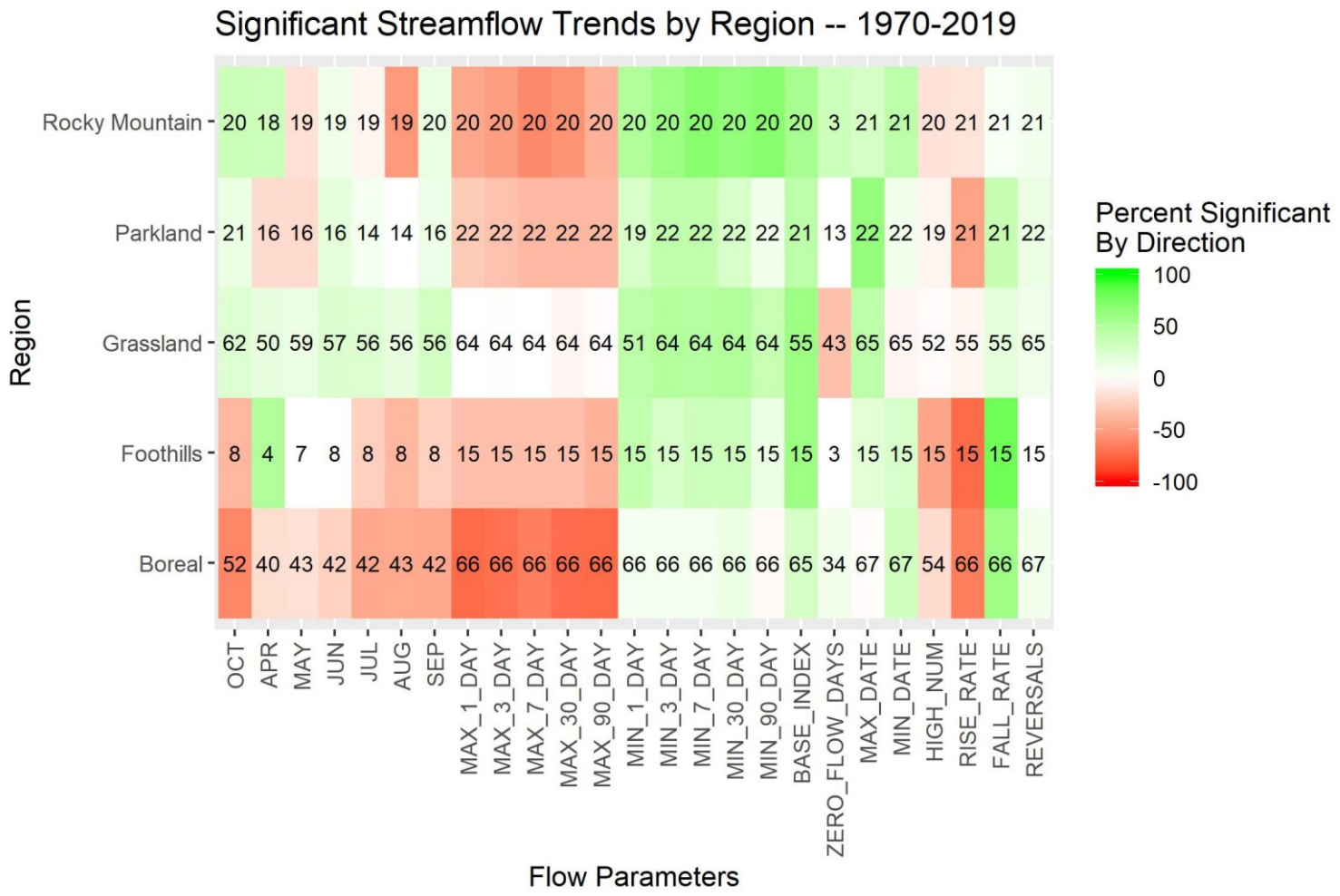

Figure 15: Streamflow trend analysis results by region for the 1970-2019 period. The numbers indicate the total number of stations available for a given analysis. Note that the analysis considered fall rate as a negative value; in other words, an increase in the fall rate indicates a decrease in the absolute value of the fall rate.

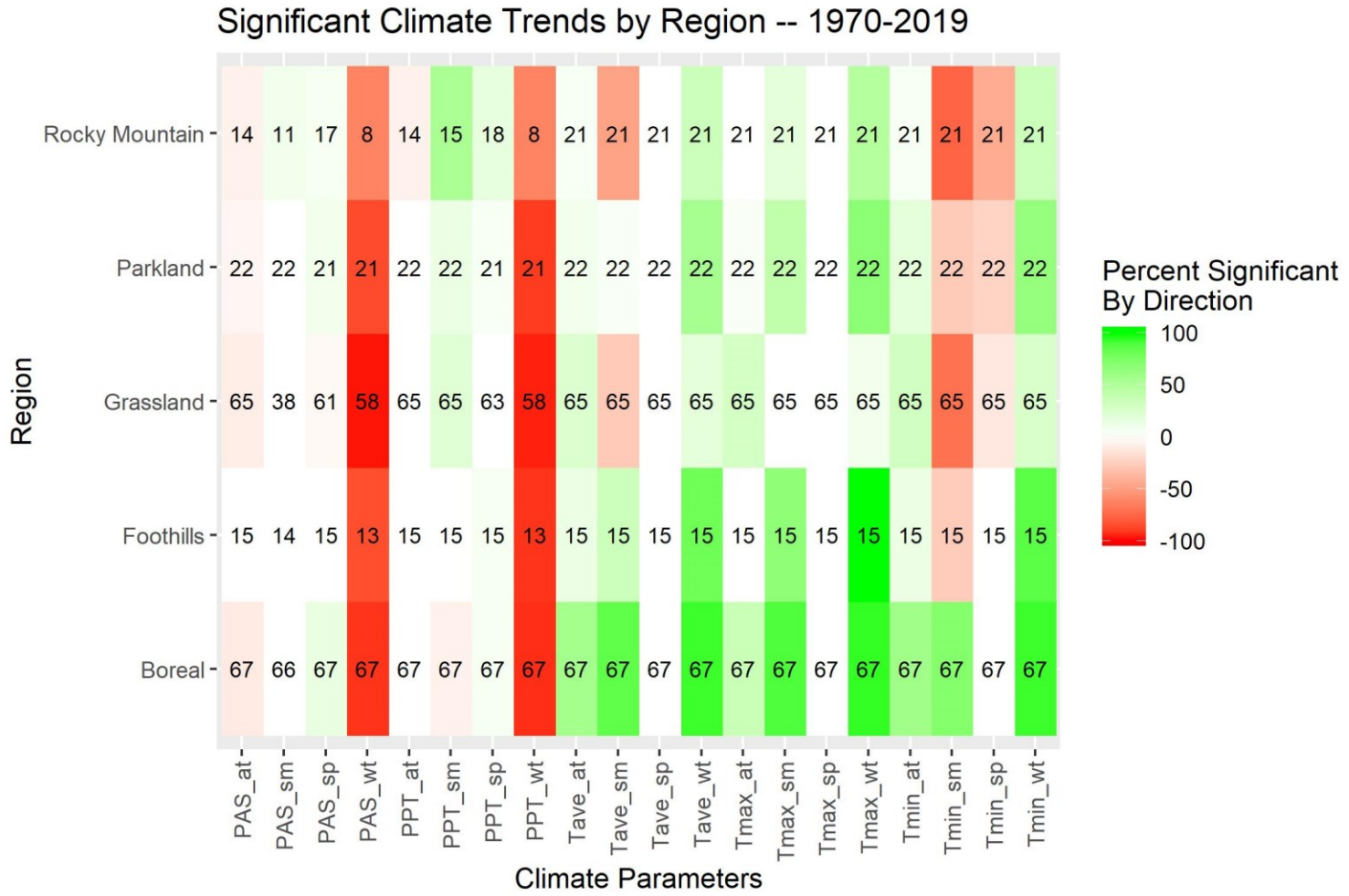

Figure 16: Seasonal climate trend analysis results by region for the 1970-2019 period. The numbers indicate the total number of stations available for a given analysis.

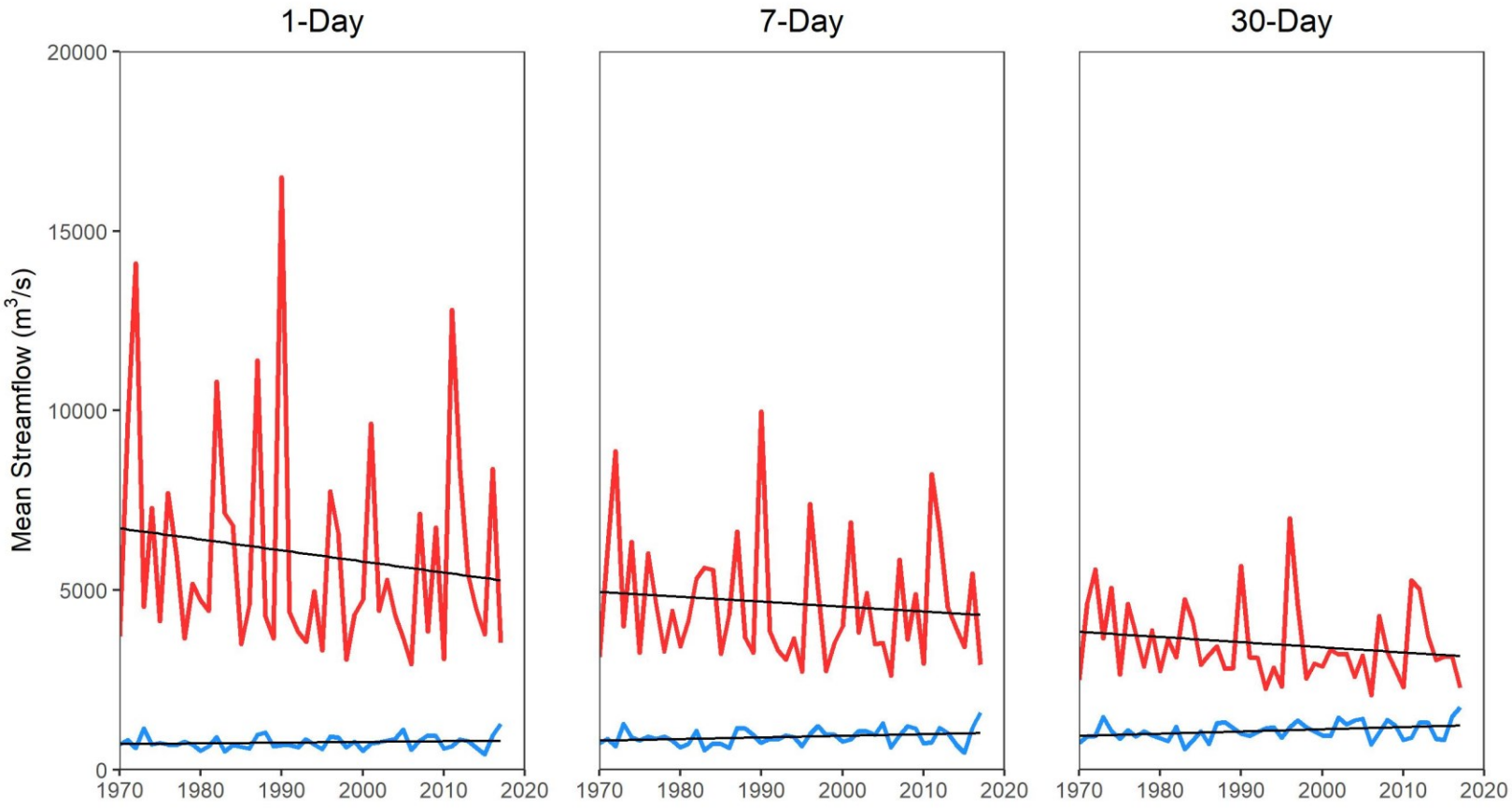

Figure 17: Minimum (blue) and maximum (red) annual streamflow events for 1-, 7-, and 30-day periods for the Peace River at Peace River Water Survey of Canada station (WSC 07HA001). The maximum mean streamflow for each period is decreasing, while the minimum mean streamflow is increasing for the same periods. This "narrowing" of the river's extreme flow conditions limit its natural variability.

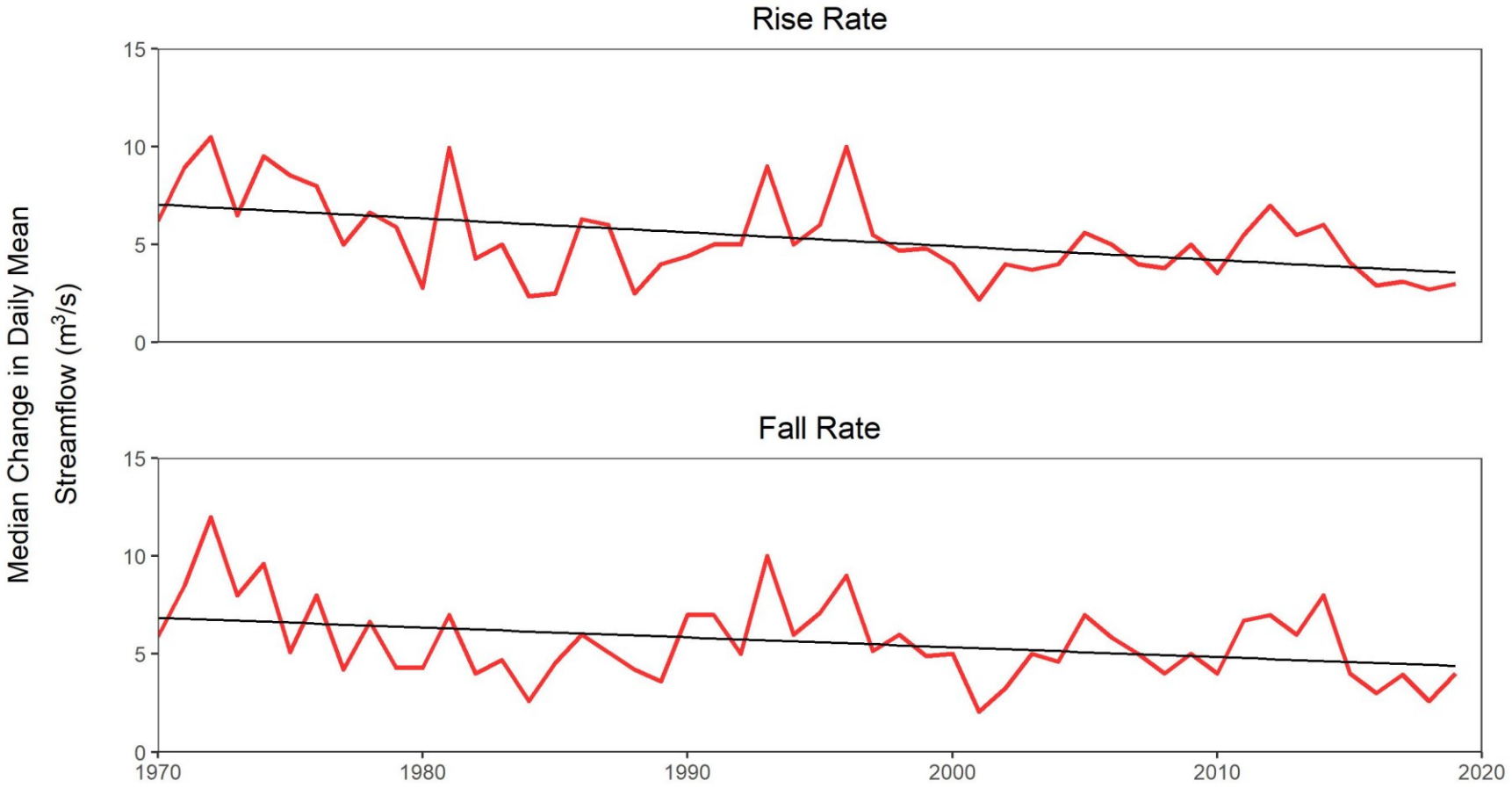

Figure 18: Median increase (rise rate) and decrease (fall rate) in daily mean streamflow for the South Saskatchewan River at Medicine Hat Water Survey of Canada station (WSC 05AJ001). The decrease in both parameters illustrates a change in the variability of the hydrograph.

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Appendices

Appendix A – List of Water Survey of Canada (WSC) hydrometric stations in Alberta

Table A1: Water Survey of Canada stations, including the WSC station number, WSC station name, geographic location (latitude and longitude in decimal degrees), watershed, natural region, and Reference Hydrometric Basin Network (RHBN) status.

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AA001	Oldman River Near Cowley	49.6	-114.04	South Saskatchewan River	Grassland	-
05AA002	Crowsnest River Near Lundbreck	49.59	-114.17	South Saskatchewan River	Grassland	-
05AA003	Castle River Near Cowley	49.53	-114.03	South Saskatchewan River	Grassland	-
05AA004	Pincher Creek at Pincher Creek	49.48	-113.94	South Saskatchewan River	Grassland	-
05AA005	Cow Creek Near Cowley	49.65	-114.15	South Saskatchewan River	Grassland	-
05AA006	Todd Creek at Elton's Ranch	49.65	-114.12	South Saskatchewan River	Grassland	-
05AA007	Connelly Creek Near Lundbreck	49.59	-114.13	South Saskatchewan River	Grassland	-
05AA008	Crowsnest River at Frank	49.59	-114.41	South Saskatchewan River	Rocky Mountain	X
05AA009	Crowsnest River Near Coleman	49.63	-114.56	South Saskatchewan River	Rocky Mountain	-
05AA010	Beaver Mines Creek Near Beaver Mines	49.47	-114.15	South Saskatchewan River	Rocky Mountain	-
05AA011	Mill Creek Near the Mouth	49.46	-114.13	South Saskatchewan River	Rocky Mountain	-
05AA013	McGillivray Creek Near Coleman	49.63	-114.52	South Saskatchewan River	Rocky Mountain	-
05AA014	Elton Ditch Below Todd Creek	49.66	-114.13	South Saskatchewan River	Grassland	-
05AA015	Castle River at McDonald’s Ranch	49.5	-114.27	South Saskatchewan River	Rocky Mountain	-
05AA016	Carbondale Creek at Evan’s Ranch	49.47	-114.31	South Saskatchewan River	Rocky Mountain	-
05AA021	Oldman River at The Gap	49.86	-114.35	South Saskatchewan River	Rocky Mountain	-
05AA022	Castle River Near Beaver Mines	49.48	-114.14	South Saskatchewan River	Rocky Mountain	-
05AA023	Oldman River Near Waldron’s Corner	49.81	-114.18	South Saskatchewan River	Grassland	X
05AA024	Oldman River Near Brocket	49.55	-113.82	South Saskatchewan River	Grassland	-
05AA025	Snowfence Creek at Plateau Mountain	50.21	-114.54	South Saskatchewan River	Rocky Mountain	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AA026	Dutch Creek Near the Mouth	49.9	-114.43	South Saskatchewan River	Rocky Mountain	-
05AA027	Racehorse Creek Near the Mouth	49.83	-114.42	South Saskatchewan River	Rocky Mountain	-
05AA028	Castle River at Ranger Station	49.39	-114.33	South Saskatchewan River	Rocky Mountain	-
05AA029	Callum Creek at Waldron's Ranch	49.82	-114.13	South Saskatchewan River	Grassland	-
05AA030	Gold Creek Near Frank	49.6	-114.4	South Saskatchewan River	Rocky Mountain	-
05AA032	Oldman Reservoir Near Pincher Creek	49.61	-114.05	South Saskatchewan River	Grassland	-
05AA033	Kettles Creek at Pincher Creek	49.49	-113.92	South Saskatchewan River	Grassland	-
05AA034	Pincher Creek at Front Range Road	49.3	-114.07	South Saskatchewan River	Rocky Mountain	-
05AA035	Oldman River at Range Road No. 13A	49.72	-114.08	South Saskatchewan River	Grassland	-
05AA909	Todd Creek Near Highway No.22	49.76	-114.23	South Saskatchewan River	Rocky Mountain	-
05AB002	Willow Creek Near Nolan	49.79	-113.53	South Saskatchewan River	Grassland	-
05AB005	Trout Creek Near Granum	49.97	-113.68	South Saskatchewan River	Grassland	-
05AB006	Meadow Creek at Hart's Ranch	49.93	-113.75	South Saskatchewan River	Grassland	-
05AB007	Oldman River Near Fort Macleod	49.71	-113.45	South Saskatchewan River	Grassland	-
05AB011	Mud Lake Near Fort Macleod	49.74	-113.53	South Saskatchewan River	Grassland	-
05AB013	Beaver Creek Near Brocket	49.63	-113.79	South Saskatchewan River	Grassland	-
05AB014	Five Mile Creek Near Spring Point	49.73	-113.85	South Saskatchewan River	Grassland	-
05AB015	Willow Creek Near Granum	49.88	-113.55	South Saskatchewan River	Grassland	-
05AB016	Lethbridge Northern Irrigation District Canal at Menzaghies Bridge	49.72	-113.55	South Saskatchewan River	Grassland	-
05AB017	Lethbridge Northern Irrigation District Mud Lake Canal Near Macleod	49.73	-113.54	South Saskatchewan River	Grassland	-
05AB018	Lethbridge Northern Irrigation District Canal at Syphon Spillway	49.68	-113.61	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AB019	Lethbridge Northern Irrigation District Canal Above Oldman Flume	49.68	-113.57	South Saskatchewan River	Grassland	-
05AB020	Lethbridge Northern Irrigation District Canal Below Oldman Flume	49.69	-113.56	South Saskatchewan River	Grassland	-
05AB021	Willow Creek Near Claresholm	50.01	-113.71	South Saskatchewan River	Grassland	-
05AB022	West Streeter Creek Near Nanton	50.1	-114.06	South Saskatchewan River	Rocky Mountain	-
05AB023	Middle Streeter Creek Near Nanton	50.1	-114.05	South Saskatchewan River	Rocky Mountain	-
05AB024	East Streeter Creek Near Nanton	50.1	-114.04	South Saskatchewan River	Rocky Mountain	-
05AB025	West Streeter Spring No. 1 Near Nanton	50.1	-114.06	South Saskatchewan River	Rocky Mountain	-
05AB026	Middle Streeter Spring No. 1 Near Nanton	50.1	-114.05	South Saskatchewan River	Rocky Mountain	-
05AB027	East Streeter Spring No. 1 Near Nanton	50.1	-114.04	South Saskatchewan River	Rocky Mountain	-
05AB028	Willow Creek Above Chain Lakes	50.19	-114.21	South Saskatchewan River	Parkland	-
05AB029	Meadow Creek Near the Mouth	49.95	-113.66	South Saskatchewan River	Grassland	-
05AB030	Streeter Creek (Main Stem) Near Nanton	50.12	-114.05	South Saskatchewan River	Rocky Mountain	-
05AB031	Lethbridge Northern Irrigation District Canal Near Willow Creek Flume	49.78	-113.51	South Saskatchewan River	Grassland	-
05AB032	Lethbridge Northern Irrigation District Canal at Headgates	49.66	-113.6	South Saskatchewan River	Grassland	-
05AB035	Middle Streeter Spring No. 2 Near Nanton	50.1	-114.05	South Saskatchewan River	Rocky Mountain	-
05AB036	Mcintosh Spring No. 1 Near Nanton	50.1	-114.03	South Saskatchewan River	Rocky Mountain	-
05AB037	Chain Lakes Reservoir Near Nanton	50.2	-114.19	South Saskatchewan River	Parkland	-
05AB038	Kyiskap Creek Near Granum	49.81	-113.59	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AB039	Willow Creek Below Lane Creek	50.14	-113.93	South Saskatchewan River	Grassland	-
05AB040	Willow Creek at Secondary No. 532	50.24	-114.35	South Saskatchewan River	Rocky Mountain	-
05AB041	Willow Creek at Oxly Ranch	50.12	-113.84	South Saskatchewan River	Grassland	-
05AB042	Pine Coulee Diversion Canal Below Head Gates	50.12	-113.78	South Saskatchewan River	Grassland	-
05AB044	Pine Coulee Reservoir Near Stavely	50.12	-113.74	South Saskatchewan River	Grassland	-
05AB045	Pine Coulee Outflow Below Reservoir	50.12	-113.75	South Saskatchewan River	Grassland	-
05AB046	Willow Creek at Highway No. 811	49.75	-113.4	South Saskatchewan River	Grassland	-
05AC001	Mosquito Creek Near Nanton	50.37	-113.82	South Saskatchewan River	Grassland	-
05AC002	Nanton Creek Near Nanton	50.35	-113.82	South Saskatchewan River	Grassland	-
05AC003	Little Bow River at Carmangay	50.12	-113.11	South Saskatchewan River	Grassland	-
05AC004	Bow River Development Main Canal	50.74	-113.02	South Saskatchewan River	Grassland	-
05AC005	Frank Lake Near High River	50.57	-113.7	South Saskatchewan River	Grassland	-
05AC006	Keho Lake Reservoir Near Albion Ridge	49.95	-112.95	South Saskatchewan River	Grassland	-
05AC009	Lethbridge Northern Irrigation District Canal at Inlet to Keho Lake	51.64	-115.01	South Saskatchewan River	Foothills	-
05AC010	Lethbridge Northern Irrigation District - Turin Branch Canal	49.95	-112.95	South Saskatchewan River	Grassland	-
05AC011	Lethbridge Northern Irrigation District - Monarch Branch Canal	49.88	-113.2	South Saskatchewan River	Grassland	-
05AC012	Little Bow River Below Travers Dam	50.17	-112.72	South Saskatchewan River	Grassland	-
05AC013	Bow River Development Western Block Lateral A Near Headgate	50.19	-112.58	South Saskatchewan River	Grassland	-
05AC014	Bow River Development Western Block Lateral A2 Near Headgate	50.18	-112.57	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AC015	Bow River Development Western Block Lateral B Near Headgate	50.15	-112.49	South Saskatchewan River	Grassland	-
05AC016	Bow River Development Western Block Lateral C Near Headgate	50.12	-112.41	South Saskatchewan River	Grassland	-
05AC017	Lomond Lateral Near Headgate	50.21	-112.66	South Saskatchewan River	Grassland	-
05AC022	Lake McGregor At South Dam	50.27	-112.82	South Saskatchewan River	Grassland	-
05AC023	Little Bow River Near the Mouth	49.89	-112.5	South Saskatchewan River	Grassland	-
05AC024	McGregor Lake Inflow Near Milo	50.58	-112.92	South Saskatchewan River	Grassland	-
05AC025	McGregor Travers Canal Near Champion	50.25	-112.81	South Saskatchewan River	Grassland	-
05AC026	Lethbridge Northern Irrigation District Canal Below Keho Outflow	49.95	-112.93	South Saskatchewan River	Grassland	-
05AC027	Bow River Development Main Canal Below Little Bow Reservoir	50.2	-112.62	South Saskatchewan River	Grassland	-
05AC028	L.N.I.D. - Monarch Branch Canal Below Monarch Headgates	49.88	-113.18	South Saskatchewan River	Grassland	-
05AC029	Lethbridge Northern Irrigation District Canal Below Monarch Headgates	49.9	-113.18	South Saskatchewan River	Grassland	-
05AC030	Snake Creek Near Vulcan	50.47	-112.91	South Saskatchewan River	Grassland	-
05AC031	Mosquito Creek Near the Mouth	50.25	-113.55	South Saskatchewan River	Grassland	-
05AC032	Clear Lake Near Stavely	50.13	-113.41	South Saskatchewan River	Grassland	-
05AC033	Clear Brook Near Stavely	50.15	-113.45	South Saskatchewan River	Grassland	-
05AC034	Little Bow River Above Travers Reservoir	50.2	-112.97	South Saskatchewan River	Grassland	-
05AC901	Clear Lake Near Stavely	50.13	-113.41	South Saskatchewan River	Grassland	-
05AC902	Bow River Development Main Canal at Drop No. 3	50.15	-112.53	South Saskatchewan River	Grassland	-
05AC909	Womans Coulee At 690 Ave Near Mosquito Creek	50.42	-113.96	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AC911	Little Bow River Below Frank Lake	50.46	-113.62	South Saskatchewan River	Grassland	-
05AC917	Squaw Coulee Diversion Below Squaw Coulee Dam	50.52	-113.92	South Saskatchewan River	Grassland	-
05AC918	L.N.I.D. Canal at Drop No. 6	49.97	-113.1	South Saskatchewan River	Grassland	-
05AC919	Keho Lake Near Nobleford	49.95	-112.95	South Saskatchewan River	Grassland	-
05AC921	Travers Reservoir Near Enchant	50.17	-112.68	South Saskatchewan River	Grassland	-
05AC922	Little Bow Reservoir Near Enchant	50.2	-112.66	South Saskatchewan River	Grassland	-
05AC924	Mosquito Creek at Highway No. 534	50.39	-113.98	South Saskatchewan River	Grassland	-
05AC926	Mosquito Creek Upstream Nanton At Hwy No. 2	50.37	-113.79	South Saskatchewan River	Grassland	-
05AC927	Nanton Creek at Highway No. 2	50.35	-113.78	South Saskatchewan River	Grassland	-
05AC928	Little Bow River at Highway No. 2	50.54	-113.82	South Saskatchewan River	Grassland	-
05AC929	Frank Lake Basin 3 Outlet At 594 Ave.	50.51	-113.68	South Saskatchewan River	Grassland	-
05AC930	Little Bow River at Highway No. 533	50.35	-113.54	South Saskatchewan River	Grassland	-
05AC937	Mosquito Creek Below Clear Lake Diversion	50.23	-113.47	South Saskatchewan River	Grassland	-
05AC938	Clear Lake Diversion Canal Below Headgate	50.23	-113.47	South Saskatchewan River	Grassland	-
05AC939	Clear Lake Diversion Headpond Above Headgate	50.23	-113.48	South Saskatchewan River	Grassland	-
05AC940	Twin Valley Reservoir at Highway No. 529	56.23	-113.4	Peace River	Boreal	-
05AC941	Little Bow River Below Twin Valley Reservoir	50.22	-113.39	South Saskatchewan River	Grassland	-
05AD001	Mami Creek at Mountain View	49.13	-113.58	South Saskatchewan River	Grassland	-
05AD002	Belly River Near Stand Off	49.47	-113.3	South Saskatchewan River	Grassland	-
05AD003	Waterton River Near Waterton Park	49.11	-113.83	South Saskatchewan River	Parkland	X
05AD004	Crooked Creek Near Waterton Park	49.12	-113.81	South Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AD005	Belly River Near Mountain View	49.09	-113.69	South Saskatchewan River	Parkland	X
05AD006	Cameron Creek at Waterton Park	49.05	-113.91	South Saskatchewan River	Rocky Mountain	-
05AD007	Oldman River Near Lethbridge	49.7	-112.86	South Saskatchewan River	Grassland	-
05AD008	Waterton River Near Stand Off	49.5	-113.32	South Saskatchewan River	Grassland	-
05AD010	Drywood Creek Near the Mouth	49.29	-113.79	South Saskatchewan River	Grassland	-
05AD012	Cottonwood Creek Near Twin Butte	49.13	-113.85	South Saskatchewan River	Parkland	-
05AD013	United Irrigation District Canal Near Hill Spring	49.21	-113.63	South Saskatchewan River	Grassland	-
05AD014	Spring Creek Near Waterton Park	49.11	-113.84	South Saskatchewan River	Parkland	-
05AD015	Waterton Lake (Lower) Near Waterton Park	49.11	-113.83	South Saskatchewan River	Parkland	-
05AD016	Drywood Creek Near Twin Butte	49.3	-114	South Saskatchewan River	Rocky Mountain	-
05AD017	Mountain View Irrigation District Canal	49.07	-113.68	South Saskatchewan River	Rocky Mountain	-
05AD018	Bullhorn Coulee Near Cardston	49.24	-113.41	South Saskatchewan River	Grassland	-
05AD019	Oldman River Near Monarch	49.79	-113.12	South Saskatchewan River	Grassland	-
05AD020	Six Mile Coulee Spillway Near Lethbridge	49.66	-112.82	South Saskatchewan River	Grassland	-
05AD021	Belly - St. Mary Diversion Canal	49.33	-113.55	South Saskatchewan River	Grassland	-
05AD022	Leavitt - Aetna Canal Near Headgate	49.11	-113.61	South Saskatchewan River	Parkland	-
05AD023	Mountain View Canal Below Mami Creek	49.1	-113.62	South Saskatchewan River	Parkland	-
05AD024	Mami Creek Below Leavitt-Aetna Diversion	49.11	-113.61	South Saskatchewan River	Parkland	-
05AD025	Waterton Lake at Waterton Park	49.05	-113.9	South Saskatchewan River	Rocky Mountain	X
05AD026	Waterton Reservoir	49.32	-113.68	South Saskatchewan River	Grassland	-
05AD027	Waterton - Belly Diversion Canal	49.32	-113.63	South Saskatchewan River	Grassland	-
05AD028	Waterton River Near Glenwood	49.43	-113.48	South Saskatchewan River	Grassland	-
05AD034	Nolan Coulee Near Coaldale	49.85	-112.58	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AD035	Prairie Blood Coulee Near Lethbridge	49.56	-112.95	South Saskatchewan River	Grassland	-
05AD036	Drywood Creek Below South Drywood Creek	49.29	-113.97	South Saskatchewan River	Parkland	-
05AD037	Piyami Drain Near Picture Butte	49.83	-112.76	South Saskatchewan River	Grassland	-
05AD038	Battersea Drain Near the Mouth	49.87	-112.6	South Saskatchewan River	Grassland	-
05AD039	Lonesome Lake at Waterton Park	49.07	-113.89	South Saskatchewan River	Parkland	-
05AD040	Drain L-5 Near Diamond City	49.78	-112.85	South Saskatchewan River	Grassland	-
05AD041	Belly River Near Glenwood	49.35	-113.48	South Saskatchewan River	Grassland	-
05AD042	Yarrow Creek at Spread Eagle Road	49.23	-113.96	South Saskatchewan River	Parkland	-
05AD901	Foothills Creek Near Pincher Creek	49.4	-113.68	South Saskatchewan River	Grassland	-
05AD903	Cottonwood Creek Near Twin Butte	49.14	-113.84	South Saskatchewan River	Parkland	-
05AD904	Galwey Brook Near Waterton Park	49.14	-113.85	South Saskatchewan River	Parkland	-
05AD933	United Irrigation District Canal Near Highway No. 800	49.23	-113.62	South Saskatchewan River	Grassland	-
05AD934	Belly River Near Moon River Road	49.72	-113.12	South Saskatchewan River	Grassland	-
05AD940	Payne Lake Reservoir Near Mountain View	49.1	-113.63	South Saskatchewan River	Parkland	-
05AE002	Lee Creek at Cardston	49.19	-113.29	South Saskatchewan River	Grassland	-
05AE003	Alberta Railway and Irrigation Co. Canal Near Kimball	49.13	-113.14	South Saskatchewan River	Grassland	-
05AE004	Canadian St. Mary Canal at Kimball	49.07	-113.21	South Saskatchewan River	Grassland	-
05AE005	Rolph Creek Near Kimball	49.12	-113.14	South Saskatchewan River	Grassland	-
05AE006	St. Mary River Near Lethbridge	49.57	-112.84	South Saskatchewan River	Grassland	-
05AE007	Boundary Creek at Hillmer's Ranch	49.05	-113.44	South Saskatchewan River	Grassland	-
05AE008	Lee Creek at Layton’s Ranch	49.14	-113.38	South Saskatchewan River	Grassland	-
05AE009	Pinepound Creek Near Spring Coulee	49.33	-113.06	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AE010	Alberta Railway and Irrigation Co. Canal at Spring Coulee	49.33	-113.04	South Saskatchewan River	Grassland	-
05AE011	Pothole Creek Near Magrath	49.37	-112.88	South Saskatchewan River	Grassland	-
05AE012	Pothole Creek Near Magrath (Lower Station)	49.44	-112.83	South Saskatchewan River	Grassland	-
05AE014	Magrath Irrigation District Canal Near Magrath	49.37	-112.89	South Saskatchewan River	Grassland	-
05AE015	Canadian St. Mary Canal Near Magrath	49.43	-112.82	South Saskatchewan River	Grassland	-
05AE016	Pothole Creek at Russell's Ranch	49.56	-112.82	South Saskatchewan River	Grassland	-
05AE017	Rolph Creek at Vaughn Ranch	49	-113.15	South Saskatchewan River	Grassland	-
05AE020	Rolph Creek Near Taylorville	49.04	-113.11	South Saskatchewan River	Grassland	-
05AE021	Magrath Irrigation District Canal Near Spring Coulee	49.34	-113.05	South Saskatchewan River	Grassland	-
05AE022	Raymond Irrigation District Canal Near Welling	49.44	-112.78	South Saskatchewan River	Grassland	-
05AE023	Lee Creek Near Beazer	49.06	-113.51	South Saskatchewan River	Parkland	-
05AE024	Pothole Coulee Reservoir Near Magrath	49.33	-112.9	South Saskatchewan River	Grassland	-
05AE025	St. Mary Reservoir Near Spring Coulee	49.36	-113.11	South Saskatchewan River	Grassland	-
05AE026	Canadian St. Mary Canal Near Spring Coulee	49.34	-113.04	South Saskatchewan River	Grassland	-
05AE027	St. Mary River at International Boundary	49.01	-113.29	South Saskatchewan River	Grassland	-
05AE037	Lee Creek at Beazer	49.11	-113.48	South Saskatchewan River	Grassland	-
05AE038	Pothole Turnout Near Magrath	49.37	-112.89	South Saskatchewan River	Grassland	-
05AE039	Tough Creek Near Beazer	49.06	-113.53	South Saskatchewan River	Parkland	-
05AE040	Lee Creek (East Branch) Near Beazer	49.01	-113.53	South Saskatchewan River	Rocky Mountain	-
05AE041	Dry Coulee Near Magrath	49.49	-112.93	South Saskatchewan River	Grassland	-
05AE042	Nine Mile Coulee Near Lethbridge	49.55	-112.77	South Saskatchewan River	Grassland	-
05AE043	St. Mary River at Highway No. 501	49.09	-113.22	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AE904	Lee Creek Below Confluence of East Fork	49.02	-113.54	South Saskatchewan River	Parkland	-
05AE912	Aetna Creek at Highway No. 501	49.13	-113.25	South Saskatchewan River	Grassland	-
05AF004	Etzikom Coulee Near Stirling	49.53	-112.5	Milk River	Grassland	-
05AF006	Etzikom Coulee Near Goddard	49.36	-111.86	Milk River	Grassland	-
05AF007	Ketchum Creek Near Orion	49.33	-110.83	Milk River	Grassland	-
05AF008	Irrigation Creek Near Orion	49.42	-110.83	Milk River	Grassland	-
05AF009	Canal Creek Near Manyberries	49.23	-110.75	Milk River	Grassland	-
05AF010	Manyberries Creek at Brodin's Farm	49.31	-110.74	Milk River	Grassland	-
05AF011	Erickson Coulee at E.C. Bennett's Farm	49.36	-110.86	Milk River	Grassland	-
05AF015	Pakowki Lake Near Young's Ranch	49.39	-111.01	Milk River	Grassland	-
05AF020	Pakowki Lake Near Etzikom	49.36	-111.03	Milk River	Grassland	-
05AF021	Coal Creek Near Orion	49.26	-110.85	Milk River	Grassland	-
05AF022	Grayback Coulee Near Orion	49.23	-110.87	Milk River	Grassland	-
05AF024	Raymond Coulee Near Raymond	49.41	-112.67	Milk River	Grassland	-
05AF026	Tyrrell Lake Near Warner	49.38	-112.25	Milk River	Grassland	-
05AF027	Etzikom Coulee Near Nemiscam	49.44	-111.26	Milk River	Grassland	-
05AF028	Canadian St. Mary Canal at Drop No. 1	49.43	-112.69	Milk River	Grassland	-
05AF029	Stirling Lake Outflow Near Stirling	49.53	-112.51	Milk River	Grassland	-
05AF030	Milk River Ridge Reservoir	49.38	-112.59	Milk River	Grassland	-
05AF031	Rush Lake Drain Near New Dayton	49.43	-112.17	Milk River	Grassland	-
05AF032	Canadian St. Mary Canal Above Raymond Chute	49.4	-112.61	Milk River	Grassland	-
05AF903	Tyrrell Lake Near Warner	49.4	-112.3	Milk River	Grassland	-
05AF905	Etzikom Coulee Near Nemiskam	49.44	-111.26	Milk River	Grassland	-
05AG001	Taber Irrigation District Canal Near Chin	49.77	-112.45	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AG002	New West Irrigation District Canal Near Vauxhall	50.13	-112.18	South Saskatchewan River	Grassland	-
05AG003	Expanse Coulee Near the Mouth	49.98	-112.08	South Saskatchewan River	Grassland	-
05AG004	Bow River Development Drain A Near Hays	49.98	-111.72	South Saskatchewan River	Grassland	-
05AG005	Bow River Development Drain T Near Hays	49.91	-111.72	South Saskatchewan River	Grassland	-
05AG006	Oldman River Near the Mouth	49.91	-111.8	South Saskatchewan River	Grassland	-
05AG007	Lateral 10 Spillway Near Chin	49.84	-112.42	South Saskatchewan River	Grassland	-
05AG008	Bountiful Coulee Near Cranford	49.78	-112.33	South Saskatchewan River	Grassland	-
05AG009	Chin Reservoir Outflow to Bountiful Coulee	49.77	-112.45	South Saskatchewan River	Grassland	-
05AG011	Cameron Lateral Spill to Chin Reservoir	49.77	-112.46	South Saskatchewan River	Grassland	-
05AG012	Taber Irrigation District Canal Near Cranford	49.74	-112.35	South Saskatchewan River	Grassland	-
05AG013	Readymade Main Inflow Canal	49.66	-112.44	South Saskatchewan River	Grassland	-
05AG015	Readymade Mini Inflow B	49.69	-112.44	South Saskatchewan River	Grassland	-
05AG016	Readymade Drain A	49.7	-112.43	South Saskatchewan River	Grassland	-
05AG017	Readymade Drain B	49.7	-112.42	South Saskatchewan River	Grassland	-
05AG022	Readymade Drain G	49.69	-112.39	South Saskatchewan River	Grassland	-
05AG023	Drain T-2 Near Taber	49.8	-112.17	South Saskatchewan River	Grassland	-
05AG024	Natural Flow D Near Chin	49.85	-112.44	South Saskatchewan River	Grassland	-
05AG025	Drain T-11 Near Fincastle	49.88	-112.01	South Saskatchewan River	Grassland	-
05AG026	Bountiful Coulee Inflow Near Cranford	49.78	-112.31	South Saskatchewan River	Grassland	-
05AG027	Drain T-1 Near Taber	49.8	-112.23	South Saskatchewan River	Grassland	-
05AH002	Mackay Creek at Walsh	49.94	-110.04	South Saskatchewan River	Grassland	-
05AH003	Ross Creek Near Irvine	49.97	-110.36	South Saskatchewan River	Grassland	-
05AH005	Seven Persons Creek at Medicine Hat	50.02	-110.68	South Saskatchewan River	Grassland	-
05AH006	Mackay Creek at Grant’s Ranch	49.86	-110.01	South Saskatchewan River	Grassland	-
05AH007	McAlpine Creek at Schnell's Ranch	49.85	-110.06	South Saskatchewan River	Grassland	-
05AH009	Gros Ventre Creek at Tothill's Ranch	49.75	-110.46	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AH010	Bullshead Creek at Clark's Ranch	49.73	-110.6	South Saskatchewan River	Grassland	-
05AH011	Stark and Burton’s Ditch Near Medicine Hat	49.9	-110.63	South Saskatchewan River	Grassland	-
05AH012	Bullshead Creek at Burton’s Ranch	49.92	-110.65	South Saskatchewan River	Grassland	-
05AH013	Bullshead Creek Near Woolchester	49.87	-110.63	South Saskatchewan River	Grassland	-
05AH025	Elkwater Lake at Elkwater	49.66	-110.28	South Saskatchewan River	Rocky Mountain	-
05AH032	Ross Creek Near Pashley	49.98	-110.46	South Saskatchewan River	Grassland	-
05AH033	Seven Persons Creek Near Seven Persons	49.83	-110.9	South Saskatchewan River	Grassland	-
05AH036	Ross Creek at Koenig’s Ranch	49.77	-110.28	South Saskatchewan River	Grassland	-
05AH037	Gros Ventre Creek Near Dunmore	49.88	-110.5	South Saskatchewan River	Grassland	-
05AH038	Paradise Creek Near Seven Persons	49.83	-110.85	South Saskatchewan River	Grassland	-
05AH039	Seven Persons Creek Near Whitla	49.76	-111.05	South Saskatchewan River	Grassland	-
05AH040	Mackay Creek Near Walsh	49.96	-110.05	South Saskatchewan River	Grassland	-
05AH041	Peigan Creek Near Pakowki Road	49.58	-110.94	South Saskatchewan River	Grassland	-
05AH042	Mackay Creek Near Graburn Gap	49.74	-110.04	South Saskatchewan River	Grassland	-
05AH043	East McAlpine Creek Near Elkwater Lake	49.79	-110.18	South Saskatchewan River	Grassland	-
05AH044	Cavan Lake Diversion Near Dunmore	49.89	-110.48	South Saskatchewan River	Grassland	-
05AH045	Ross Creek Diversion Canal Near Irvine	49.95	-110.34	South Saskatchewan River	Grassland	-
05AH046	Ross Creek at Outlet of Elkwater Lake	49.67	-110.29	South Saskatchewan River	Rocky Mountain	-
05AH047	Sam Lake Tributary Near Schuler	50.16	-110.25	South Saskatchewan River	Grassland	-
05AH048	Cavan Lake Near Dunmore	49.94	-110.4	South Saskatchewan River	Grassland	-
05AH049	Ross Creek at Medicine Hat	50.02	-110.64	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05AH052	Ross Creek at Highway No. 41	50	-110.53	South Saskatchewan River	Grassland	-
05AH053	Bullshead Creek at Black and White Trail	49.91	-110.64	South Saskatchewan River	Grassland	-
05AH054	Cypress View Reservoir Near Elkwater	49.8	-110.12	South Saskatchewan River	Grassland	-
05AH055	McAlpine Creek Reservoir Near Elkwater	49.7	-110.16	South Saskatchewan River	Rocky Mountain	-
05AH056	Mackay Creek Reservoir Near Elkwater	49.71	-110.12	South Saskatchewan River	Grassland	-
05AH057	Bullshead Reservoir Near Elkwater	49.67	-110.51	South Saskatchewan River	Grassland	-
05AH058	Spruce Coulee Reservoir Near Elkwater	49.67	-110.18	South Saskatchewan River	Rocky Mountain	-
05AJ001	South Saskatchewan River at Medicine Hat	50.04	-110.67	South Saskatchewan River	Grassland	-
05AJ002	Drain S-4 Near Grassy Lake	49.89	-111.66	South Saskatchewan River	Grassland	-
05AJ003	Drain S-10 Near Bow Island	49.92	-111.41	South Saskatchewan River	Grassland	-
05AJ004	Drain S-6 Near Bow Island	49.9	-111.47	South Saskatchewan River	Grassland	-
05AK001	South Saskatchewan River at Highway No. 41	50.73	-110.09	South Saskatchewan River	Grassland	-
05BA001	Bow River at Lake Louise	51.42	-116.18	South Saskatchewan River	Rocky Mountain	-
05BA002	Pipestone River Near Lake Louise	51.43	-116.17	South Saskatchewan River	Rocky Mountain	X
05BA003	Bath Creek Near Lake Louise	51.44	-116.2	South Saskatchewan River	Rocky Mountain	-
05BA004	Louise Creek Near Lake Louise	51.41	-116.2	South Saskatchewan River	Rocky Mountain	-
05BA005	Bow River Above Bath Creek	51.44	-116.21	South Saskatchewan River	Rocky Mountain	-
05BA006	Johnston Creek Near the Mouth	51.24	-115.84	South Saskatchewan River	Rocky Mountain	-
05BA007	Baker Creek Near the Mouth	51.34	-116.06	South Saskatchewan River	Rocky Mountain	-
05BA008	Bow River Below Hector Lake	51.54	-116.29	South Saskatchewan River	Rocky Mountain	-
05BA009	Bow Glacier Outflow	51.66	-116.48	South Saskatchewan River	Rocky Mountain	-
05BA010	Bow River Above Hector Lake	51.57	-116.32	South Saskatchewan River	Rocky Mountain	-
05BA011	Balfour Creek Near the Mouth	51.59	-116.4	South Saskatchewan River	Rocky Mountain	-
05BB001	Bow River at Banff	51.17	-115.57	South Saskatchewan River	Rocky Mountain	X
05BB003	Forty Mile Creek Near Banff	51.2	-115.58	South Saskatchewan River	Rocky Mountain	-
05BB004	Brewster Creek Near Banff	51.09	-115.66	South Saskatchewan River	Rocky Mountain	-
05BB005	Redearth Creek Near the Mouth	51.22	-115.81	South Saskatchewan River	Rocky Mountain	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05BC001	Spray River at Banff	51.16	-115.55	South Saskatchewan River	Rocky Mountain	-
05BC002	Spray River Near Spray Lakes	50.88	-115.36	South Saskatchewan River	Rocky Mountain	-
05BC003	Spray Creek at Spray Lakes	50.88	-115.36	South Saskatchewan River	Rocky Mountain	-
05BC004	Spray Lake at Spray Lakes	50.88	-115.36	South Saskatchewan River	Rocky Mountain	-
05BC005	Spray River at Canyon Near Spray Lakes	50.88	-115.36	South Saskatchewan River	Rocky Mountain	-
05BC006	Spray Reservoir at Three Sisters Dam	50.98	-115.36	South Saskatchewan River	Rocky Mountain	-
05BC007	Spray Reservoir Spillway Near Canyon Dam	50.89	-115.37	South Saskatchewan River	Rocky Mountain	-
05BC008	Goat Creek at Banff Park Boundary	51.05	-115.43	South Saskatchewan River	Rocky Mountain	-
05BD001	Devil’s Creek Near Bankhead	51.25	-115.48	South Saskatchewan River	Rocky Mountain	-
05BD002	Cascade River Near Banff	51.22	-115.51	South Saskatchewan River	Rocky Mountain	-
05BD003	Lake Minnewanka Near Banff	51.23	-115.48	South Saskatchewan River	Rocky Mountain	-
05BD004	Cascade Power Diversion Near Banff	51.19	-115.5	South Saskatchewan River	Rocky Mountain	-
05BD005	Cascade River Above Lake Minnewanka	51.28	-115.53	South Saskatchewan River	Rocky Mountain	-
05BE001	Bow River Near Morley	51.17	-114.85	South Saskatchewan River	Rocky Mountain	-
05BE003	Bow River Near Kananaskis	51.08	-115.08	South Saskatchewan River	Rocky Mountain	-
05BE004	Bow River Near Seebe	51.11	-115.03	South Saskatchewan River	Rocky Mountain	-
05BE005	Ghost Lake Near Cochrane	51.21	-114.71	South Saskatchewan River	Parkland	-
05BE006	Bow River Below Ghost Dam	51.21	-114.61	South Saskatchewan River	Parkland	-
05BE007	Spray Power Diversion at Canmore	51.08	-115.37	South Saskatchewan River	Rocky Mountain	-
05BE008	Bow River at Canmore	51.08	-115.36	South Saskatchewan River	Rocky Mountain	-
05BE009	Policeman Creek at Canmore	51.08	-115.36	South Saskatchewan River	Rocky Mountain	-
05BE999	Ghost Tailrace	51.22	-114.7	South Saskatchewan River	Parkland	-
05BF001	Kananaskis River Near Seebe	51.04	-115.02	South Saskatchewan River	Rocky Mountain	-
05BF002	Kananaskis River Above Lower Lake	50.62	-115.12	South Saskatchewan River	Rocky Mountain	-
05BF003	Kananaskis River Above Pocaterra Creek	50.7	-115.11	South Saskatchewan River	Rocky Mountain	-
05BF004	Pocaterra Creek Near Mouth	50.69	-115.11	South Saskatchewan River	Rocky Mountain	-
05BF005	Upper Kananaskis Lake	50.61	-115.11	South Saskatchewan River	Rocky Mountain	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05BF008	Smith-Dorrien Creek Near Mouth	50.68	-115.14	South Saskatchewan River	Rocky Mountain	-
05BF009	Lower Kananaskis Lake	50.68	-115.12	South Saskatchewan River	Rocky Mountain	-
05BF010	Kananaskis River at Outlet of Lower Lake	50.67	-115.13	South Saskatchewan River	Rocky Mountain	-
05BF011	Boulton Creek Near Mouth	50.63	-115.12	South Saskatchewan River	Rocky Mountain	-
05BF013	Mud Lake Diversion Canal	50.79	-115.3	South Saskatchewan River	Rocky Mountain	-
05BF015	Marmot Creek Near the Mouth	50.94	-115.14	South Saskatchewan River	Rocky Mountain	-
05BF016	Marmot Creek Main Stem Near Seebe	50.95	-115.15	South Saskatchewan River	Rocky Mountain	-
05BF017	Middle Fork Creek Near Seebe	50.95	-115.17	South Saskatchewan River	Rocky Mountain	-
05BF018	Twin Creek Near Seebe	50.95	-115.17	South Saskatchewan River	Rocky Mountain	-
05BF019	Cabin Creek Near Seebe	50.95	-115.16	South Saskatchewan River	Rocky Mountain	-
05BF020	Middle Fork Creek in Cirque Near Seebe	50.95	-115.19	South Saskatchewan River	Rocky Mountain	-
05BF021	Kananaskis River in Canal Below Upper Dam Site	50.61	-115.12	South Saskatchewan River	Rocky Mountain	-
05BF022	Kananaskis River at Canyon Above Lower Falls	50.7	-115.13	South Saskatchewan River	Rocky Mountain	-
05BF024	Barrier Lake Near Seebe	51.03	-115.04	South Saskatchewan River	Rocky Mountain	-
05BF025	Kananaskis River Below Barrier Dam	51.04	-115.03	South Saskatchewan River	Rocky Mountain	-
05BG001	Ghost River Near Cochrane	51.26	-114.76	South Saskatchewan River	Rocky Mountain	-
05BG002	Ghost River Near Black Rock Mountain	51.3	-115.18	South Saskatchewan River	Rocky Mountain	-
05BG003	Ghost River Diversion to Lake Minnewanka	51.28	-115.16	South Saskatchewan River	Rocky Mountain	-
05BG004	Ghost River Diversion Canal Near Black Rock Mountain	51.3	-115.18	South Saskatchewan River	Rocky Mountain	-
05BG005	Ghost River Overflow Near Black Rock Mountain	51.3	-115.18	South Saskatchewan River	Rocky Mountain	-
05BG006	Waiparous Creek Near the Mouth	51.28	-114.83	South Saskatchewan River	Rocky Mountain	-
05BG009	Waiparous Creek Below Meadow Creek	51.36	-114.99	South Saskatchewan River	Rocky Mountain	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05BG010	Ghost River Above Waiparous Creek	51.27	-114.92	South Saskatchewan River	Rocky Mountain	-
05BH002	Bow River at Cushing Bridge Near Calgary	51.03	-114.01	South Saskatchewan River	Grassland	-
05BH003	Nose Creek at Calgary	51.12	-114.04	South Saskatchewan River	Grassland	-
05BH004	Bow River at Calgary	51.05	-114.05	South Saskatchewan River	Grassland	-
05BH005	Bow River Near Cochrane	51.17	-114.46	South Saskatchewan River	Parkland	-
05BH006	Jumpingpound Creek Near Jumping Pound	51.06	-114.54	South Saskatchewan River	Parkland	-
05BH008	Bow River Below Bearspaw Dam	51.09	-114.22	South Saskatchewan River	Parkland	-
05BH009	Jumpingpound Creek Near the Mouth	51.15	-114.52	South Saskatchewan River	Parkland	-
05BH011	Jumpingpound Creek at Bateman’s Ranch	51.02	-114.61	South Saskatchewan River	Rocky Mountain	-
05BH013	Jumpingpound Creek Near Cox Hill	51	-114.93	South Saskatchewan River	Rocky Mountain	-
05BH014	Nose Creek Above Airdrie	51.31	-114.02	South Saskatchewan River	Grassland	-
05BH015	Jumpingpound Creek at Township Road No. 252	51.12	-114.56	South Saskatchewan River	Parkland	-
05BH901	Nose Creek Near the Mouth	51.05	-114.01	South Saskatchewan River	Grassland	-
05BH904	Beddington Creek Near Calgary	51.2	-114.16	South Saskatchewan River	Parkland	-
05BJ001	Elbow River Below Glenmore Dam	51.01	-114.09	South Saskatchewan River	Grassland	-
05BJ003	Elbow River at Fullerton’s Ranch	50.94	-114.57	South Saskatchewan River	Rocky Mountain	-
05BJ004	Elbow River at Bragg Creek	50.94	-114.57	South Saskatchewan River	Rocky Mountain	-
05BJ005	Elbow River Above Glenmore Dam	51	-114.1	South Saskatchewan River	Grassland	-
05BJ006	Elbow River Above Elbow Falls	50.85	-114.79	South Saskatchewan River	Rocky Mountain	-
05BJ008	Glenmore Reservoir at Calgary	51	-114.09	South Saskatchewan River	Grassland	-
05BJ009	Little Elbow River Above Nihahi Creek	50.79	-114.91	South Saskatchewan River	Rocky Mountain	-
05BJ010	Elbow River at Sarcee Bridge	50.99	-114.16	South Saskatchewan River	Parkland	-
05BJ011	Elbow River at Clem Gardiner Bridge	51.04	-114.46	South Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05BK001	Fish Creek Near Priddis	50.88	-114.32	South Saskatchewan River	Parkland	-
05BK002	Fish Creek Near Midnapore	50.92	-114.06	South Saskatchewan River	Grassland	-
05BK003	Fish Creek at Bow Bottom Trail	50.9	-114.01	South Saskatchewan River	Grassland	-
05BL003	Highwood River at High River	50.58	-113.87	South Saskatchewan River	Grassland	-
05BL004	Highwood River Below Little Bow Canal	50.58	-113.86	South Saskatchewan River	Grassland	-
05BL006	Pekisko Creek at Pekisko	50.42	-114.22	South Saskatchewan River	Grassland	-
05BL007	Stimson Creek Near Pekisko	50.43	-114.16	South Saskatchewan River	Grassland	-
05BL008	Highwood River at Brown's Ranch	50.52	-114.23	South Saskatchewan River	Grassland	-
05BL009	Highwood River Near Aldersyde	50.69	-113.85	South Saskatchewan River	Grassland	-
05BL012	Sheep River at Okotoks	50.72	-113.97	South Saskatchewan River	Parkland	-
05BL013	Threepoint Creek Near Millarville	50.77	-114.27	South Saskatchewan River	Parkland	-
05BL014	Sheep River at Black Diamond	50.68	-114.24	South Saskatchewan River	Parkland	-
05BL015	Little Bow Canal at High River	50.58	-113.86	South Saskatchewan River	Grassland	-
05BL016	Tongueflag Creek Near High River	50.61	-113.88	South Saskatchewan River	Grassland	-
05BL017	Highwood River Diversion Canal	50.53	-113.96	South Saskatchewan River	Grassland	-
05BL018	Sheep River at Buck Ranch	50.62	-114.42	South Saskatchewan River	Rocky Mountain	-
05BL019	Highwood River at Diebel's Ranch	50.4	-114.5	South Saskatchewan River	Rocky Mountain	-
05BL020	Sheep River Near Aldersyde	50.71	-113.88	South Saskatchewan River	Grassland	-
05BL021	Highwood River Below Picklejar Creek	50.49	-114.81	South Saskatchewan River	Rocky Mountain	-
05BL022	Cataract Creek Near Forestry Road	50.28	-114.58	South Saskatchewan River	Rocky Mountain	X
05BL023	Pekisko Creek Near Longview	50.47	-114.2	South Saskatchewan River	Grassland	-
05BL024	Highwood River Near the Mouth	50.78	-113.82	South Saskatchewan River	Grassland	-
05BL025	Highwood Diversion Canal Near Headgates	50.55	-113.98	South Saskatchewan River	Grassland	-
05BL027	Trap Creek Near Longview	50.47	-114.42	South Saskatchewan River	Parkland	-
05BM002	Bow River Below Carseland Dam	50.82	-113.44	South Saskatchewan River	Grassland	-
05BM003	Western Irrigation District Canal Near Chestermere Lake	51.01	-113.84	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05BM004	Bow River Below Bassano Dam	50.75	-112.54	South Saskatchewan River	Grassland	-
05BM005	Hammer Hill Spillway Near Gleichen	50.85	-113.13	South Saskatchewan River	Grassland	-
05BM006	Canada Land and Irrigation Co. Canal Near Intake	50.81	-113.44	South Saskatchewan River	Grassland	-
05BM007	Parflesh Creek Near Chancellor	50.99	-112.84	South Saskatchewan River	Grassland	-
05BM008	Crowfoot Creek Near Cluny	50.83	-112.76	South Saskatchewan River	Grassland	-
05BM009	Twelve Mile Coulee Spillway Near Carseland	50.84	-113.57	South Saskatchewan River	Grassland	-
05BM010	Cairn Hill Spillway Near Strangmuir	50.9	-113.4	South Saskatchewan River	Grassland	-
05BM011	Hammer Hill Spillway Near Stobart	50.9	-113.15	South Saskatchewan River	Grassland	-
05BM012	Cairn Hill Spillway Near the Mouth	50.85	-113.35	South Saskatchewan River	Grassland	-
05BM013	Cluny Spillway Near Cluny	50.81	-112.9	South Saskatchewan River	Grassland	-
05BM014	West Arrowwood Creek Near Arrowwood	50.76	-113.23	South Saskatchewan River	Grassland	X
05BM015	Western Irrigation District Canal Near Headgates	51.04	-114	South Saskatchewan River	Grassland	-
05BM016	Western Irrigation District Canal ""A"" Near Headgate	51	-113.79	South Saskatchewan River	Grassland	-
05BM017	Western Irrigation District Canal ""B"" Near Headgate	51.06	-113.81	South Saskatchewan River	Grassland	-
05BM018	West Arrowwood Creek Near Ensign	50.51	-113.34	South Saskatchewan River	Grassland	-
05BM020	Eastern Irrigation District Main Branch Canal Near Headgate	50.74	-112.51	South Saskatchewan River	Grassland	-
05BM021	Bow River Development Main Canal Below Headgates	50.82	-113.43	South Saskatchewan River	Grassland	-
05BM904	Chestermere Lake at South Outlet	51.01	-113.81	South Saskatchewan River	Grassland	-
05BN001	Eastern Irrigation District Main Bantry Canal Above Aqueduct	50.52	-111.87	South Saskatchewan River	Grassland	-
05BN002	Twelve Mile Creek Near Cecil	50.14	-111.66	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05BN003	Eastern Irrigation District West Bantry Canal Near Headgate	50.53	-111.81	South Saskatchewan River	Grassland	-
05BN004	Eastern Irrigation District Rolling Hills Canal Near Headgate	50.37	-111.88	South Saskatchewan River	Grassland	-
05BN005	Eastern Irrigation District Bow Slope Canal Near Headgate	50.5	-112.14	South Saskatchewan River	Grassland	-
05BN006	New West Coulee Near the Mouth	50.21	-112.1	South Saskatchewan River	Grassland	-
05BN007	Ronalane Wasteway Near Hays	50.04	-111.58	South Saskatchewan River	Grassland	-
05BN008	Bow River Development Drain D Near Vauxhall	50.19	-112.04	South Saskatchewan River	Grassland	-
05BN009	Bow River Development Drain K Near Vauxhall	50.29	-112.18	South Saskatchewan River	Grassland	-
05BN010	Antelope Coulee Spillway	50.45	-112.16	South Saskatchewan River	Grassland	-
05BN011	Eastern Irrigation District East Branch Canal Above Antelope Crossing	50.53	-112.18	South Saskatchewan River	Grassland	-
05BN012	Bow River Near the Mouth	50.04	-111.59	South Saskatchewan River	Grassland	-
05BN013	Eastern Irrigation District East Branch Canal Below Bow Slope Canal	50.51	-112.14	South Saskatchewan River	Grassland	-
05BN014	Coal Creek at Bow City	50.43	-112.22	South Saskatchewan River	Grassland	-
05BN015	Rolling Hills Canal No. 1 Spill	50.16	-111.81	South Saskatchewan River	Grassland	-
05BN016	West Sauki Drain Near Rolling Hills	50.22	-112	South Saskatchewan River	Grassland	-
05BN017	Onetree Creek Spillway Near Aqueduct	50.52	-111.86	South Saskatchewan River	Grassland	-
05BN019	Rolling Hills Canal No. 2 Spill	50.14	-111.68	South Saskatchewan River	Grassland	-
05BN023	Bow River Development Drain E Near Vauxhall	50.19	-112.08	South Saskatchewan River	Grassland	-
05BN024	Natural Flow C Near Bow City	50.37	-112.24	South Saskatchewan River	Grassland	-
05CA001	Red Deer River Near Sundre	51.7	-114.85	South Saskatchewan River	Foothills	-
05CA002	James River Near Sundre	51.92	-114.68	South Saskatchewan River	Boreal	-
05CA003	Deer Creek (Main Stem) Near Sundre	51.65	-115.13	South Saskatchewan River	Foothills	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05CA004	Red Deer River Above Panther River	51.66	-115.41	South Saskatchewan River	Foothills	-
05CA008	Red Deer River at Forestry Road	51.65	-115.26	South Saskatchewan River	Foothills	-
05CA009	Red Deer River Below Burnt Timber Creek	51.64	-115.01	South Saskatchewan River	Foothills	-
05CA010	Red Deer River at Sundre	51.79	-114.63	South Saskatchewan River	Boreal	-
05CA011	Bearberry Creek Near Sundre	51.8	-114.66	South Saskatchewan River	Boreal	-
05CA012	Fallentimber Creek Near Sundre	51.73	-114.65	South Saskatchewan River	Boreal	-
05CB001	Little Red Deer River Near the Mouth	52.02	-114.14	South Saskatchewan River	Parkland	-
05CB002	Little Red Deer River Near Water Valley	51.51	-114.67	South Saskatchewan River	Parkland	-
05CB004	Raven River Near Raven	52.08	-114.47	South Saskatchewan River	Boreal	-
05CB005	Beaverdam Creek Near Cochrane	51.36	-114.43	South Saskatchewan River	Parkland	-
05CB006	Gleniffer Reservoir Near Dickson	52.04	-114.22	South Saskatchewan River	Parkland	-
05CB007	Dickson Dam Tunnel Outlet	52.05	-114.21	South Saskatchewan River	Parkland	-
05CC001	Blindman River Near Blackfalds	52.35	-113.79	South Saskatchewan River	Parkland	-
05CC002	Red Deer River at Red Deer	52.27	-113.81	South Saskatchewan River	Parkland	-
05CC003	Sylvan Lake at Sylvan Lake	52.31	-114.1	South Saskatchewan River	Parkland	-
05CC004	Sylvan Creek Near Sylvan Lake	52.31	-114.06	South Saskatchewan River	Parkland	-
05CC006	Gull Lake at RV Heaven Marina	52.59	-114.05	South Saskatchewan River	Parkland	-
05CC007	Medicine River Near Eckville	52.31	-114.34	South Saskatchewan River	Parkland	-
05CC008	Blindman River Near Bluffton	52.75	-114.28	South Saskatchewan River	Boreal	-
05CC009	Lloyd Creek Near Bluffton	52.74	-114.14	South Saskatchewan River	Boreal	-
05CC010	Block Creek Near Leedale	52.57	-114.57	South Saskatchewan River	Boreal	-
05CC011	Waskasoo Creek at Red Deer	52.26	-113.79	South Saskatchewan River	Parkland	-
05CC012	Tindastoll Creek Near Markerville	52.11	-114.11	South Saskatchewan River	Parkland	-
05CC013	Lasthill Creek Near Eckville	52.36	-114.45	South Saskatchewan River	Boreal	-
05CC901	Cygnet Lake Near Sylvan Lake	52.27	-113.96	South Saskatchewan River	Parkland	-
05CD001	Upper Chain Lake Outlet Near Ponoka	52.6	-113.46	South Saskatchewan River	Parkland	-
05CD003	Upper Chain Lake Near Ponoka	52.61	-113.46	South Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05CD004	Red Deer River Near Nevis	52.3	-113.06	South Saskatchewan River	Parkland	-
05CD005	Buffalo Lake Near Erskine	52.46	-112.88	South Saskatchewan River	Parkland	-
05CD006	Haynes Creek Near Haynes	52.33	-113.36	South Saskatchewan River	Parkland	-
05CD007	Parlby Creek at Alix	52.4	-113.19	South Saskatchewan River	Parkland	-
05CD902	Parlby Creek Near Mirror	52.49	-113.1	South Saskatchewan River	Parkland	-
05CD903	Spotted Lake Near Mirror	52.49	-113.1	South Saskatchewan River	Parkland	-
05CD905	Mirror Backflood at Highway No. 50	52.46	-113.13	South Saskatchewan River	Parkland	-
05CD913	Haynes Creek (M1) Near Joffre	52.41	-113.53	South Saskatchewan River	Parkland	-
05CE001	Red Deer River at Drumheller	51.46	-112.71	South Saskatchewan River	Grassland	-
05CE002	Kneehills Creek Near Drumheller	51.46	-112.97	South Saskatchewan River	Grassland	-
05CE003	Rosebud River at Beynon	51.33	-112.78	South Saskatchewan River	Grassland	-
05CE004	Rosebud River Near Crossfield	51.47	-113.8	South Saskatchewan River	Grassland	-
05CE005	Rosebud River at Redland	51.29	-113.01	South Saskatchewan River	Grassland	-
05CE006	Rosebud River Below Carstairs Creek	51.41	-113.72	South Saskatchewan River	Grassland	-
05CE007	Threehills Creek Near Carbon	51.56	-113.07	South Saskatchewan River	Grassland	-
05CE008	Atusis Creek Near Redland	51.33	-113.05	South Saskatchewan River	Grassland	-
05CE009	Severn Creek Near Rosebud	51.26	-112.94	South Saskatchewan River	Grassland	-
05CE010	Ray Creek Near Innisfail	52	-113.59	South Saskatchewan River	Parkland	-
05CE011	Renwick Creek Near Three Hills	51.71	-113.36	South Saskatchewan River	Parkland	-
05CE012	Ghostpine Creek Near Huxley	51.89	-113.24	South Saskatchewan River	Parkland	-
05CE013	Lonepine Creek Near Linden	51.57	-113.52	South Saskatchewan River	Grassland	-
05CE015	Threehills Creek Near Trochu	51.85	-113.42	South Saskatchewan River	Parkland	-
05CE016	Kneehills Creek Near Linden	51.59	-113.51	South Saskatchewan River	Grassland	-
05CE018	Threehills Creek Below Ray Creek	51.99	-113.56	South Saskatchewan River	Parkland	-
05CE019	Sheep Coulee Near Carstairs	51.56	-114.03	South Saskatchewan River	Parkland	-
05CE020	Michichi Creek at Drumheller	51.47	-112.71	South Saskatchewan River	Grassland	-
05CE901	Bigelow Reservoir Near Wimborne	51.88	-113.46	South Saskatchewan River	Parkland	-
05CF001	Sullivan Lake Near Sullivan Lake	52.04	-111.91	South Saskatchewan River	Grassland	-
05CF002	Dowling Lake Near Dowling	51.76	-111.99	South Saskatchewan River	Grassland	-
05CG001	Bullpound Creek Near Hutton	51.12	-111.9	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05CG002	Bullpound Creek Near Hanna	51.65	-112	South Saskatchewan River	Grassland	-
05CG003	Bullpound Creek Near the Mouth	51.09	-111.93	South Saskatchewan River	Grassland	-
05CG004	Bullpound Creek Near Watts	51.66	-112.08	South Saskatchewan River	Grassland	-
05CG005	Atlas Mine Coulee at Western Monarch	51.32	-112.47	South Saskatchewan River	Grassland	-
05CG006	Fish Creek Above Little Fish Lake	51.39	-112.2	South Saskatchewan River	Grassland	-
05CG007	Alberta Power Limited Cooling Pond Outlet	51.42	-111.8	South Saskatchewan River	Grassland	-
05CH001	Berry Creek at Forster's Ranch	50.96	-111.75	South Saskatchewan River	Grassland	-
05CH002	Berry Creek Near Wardlow	50.9	-111.56	South Saskatchewan River	Grassland	-
05CH003	Berry Creek (East Branch) Near Wardlow	50.9	-111.55	South Saskatchewan River	Grassland	-
05CH005	Dead Fish Creek Near Hutton	51.01	-111.8	South Saskatchewan River	Grassland	-
05CH007	Berry Creek Near the Mouth	50.85	-111.59	South Saskatchewan River	Grassland	-
05CH008	Berry Creek Near Rose Lynn	51.41	-111.49	South Saskatchewan River	Grassland	-
05CH009	Natural Flow A Near Pollockville	51.14	-111.79	South Saskatchewan River	Grassland	-
05CH010	Berry Creek Near Pollockville	51.09	-111.68	South Saskatchewan River	Grassland	-
05CH011	Berry Creek Reservoir Outlet	51.23	-111.63	South Saskatchewan River	Grassland	-
05CH012	Deadfish Inflow Canal Near Cessford	51.01	-111.81	South Saskatchewan River	Grassland	-
05CH013	Forster Reservoir Near Cessford	50.98	-111.76	South Saskatchewan River	Grassland	-
05CH014	Berry Creek Reservoir Near Sunnynook	51.25	-111.64	South Saskatchewan River	Grassland	-
05CH016	Berry Creek Below Deadfish Creek	50.93	-111.76	South Saskatchewan River	Grassland	-
05CJ001	Eastern Irrigation District North Branch Canal Near Bassano	50.75	-112.41	South Saskatchewan River	Grassland	-
05CJ002	C. P. R. Co. East Branch Canal Near Bassano	50.75	-112.41	South Saskatchewan River	Grassland	-
05CJ003	Eastern Irrigation District East Branch Canal Near Lathom	50.71	-112.34	South Saskatchewan River	Grassland	-
05CJ004	Eastern Irrigation District Springhill Canal Near Lathom	50.72	-112.33	South Saskatchewan River	Grassland	-
05CJ005	Matzhiwin Creek Near Duchess	50.81	-111.82	South Saskatchewan River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05CJ006	Onetree Creek Near Patricia	50.73	-111.68	South Saskatchewan River	Grassland	-
05CJ007	Matzhiwin Creek Above Ware Coulee	50.84	-111.92	South Saskatchewan River	Grassland	-
05CJ008	Ware Coulee Above Matzhiwin Creek	50.79	-111.78	South Saskatchewan River	Grassland	-
05CJ009	Red Deer River Near Jenner	50.84	-111.15	South Saskatchewan River	Grassland	-
05CJ010	Spring Creek Near Verger	50.95	-111.95	South Saskatchewan River	Grassland	-
05CJ011	Natural Flow B Near Princess	50.63	-111.5	South Saskatchewan River	Grassland	-
05CJ012	Matzhiwin Creek Below Ware Coulee	50.82	-111.82	South Saskatchewan River	Grassland	-
05CK001	Blood Indian Creek Near the Mouth	50.95	-111.06	South Saskatchewan River	Grassland	-
05CK002	Red Deer River Near Empress	50.96	-110.02	South Saskatchewan River	Grassland	-
05CK003	Blood Indian Creek at Hogarth's Ranch	51.03	-111.23	South Saskatchewan River	Grassland	-
05CK004	Red Deer River Near Bindloss	50.9	-110.29	South Saskatchewan River	Grassland	-
05CK005	Alkali Creek Near the Mouth	50.89	-110.5	South Saskatchewan River	Grassland	-
05CK006	Kennedy Coulee Near Acadia Valley	51.09	-110.25	South Saskatchewan River	Grassland	-
05CK007	Blood Indian Creek Near Cabin Lake	51.09	-111.24	South Saskatchewan River	Grassland	-
05DA001	Whiterabbit Creek Near Wilson's Ranch	52.1	-116.41	North Saskatchewan River	Rocky Mountain	-
05DA002	Siffleur River Near the Mouth	52.04	-116.38	North Saskatchewan River	Rocky Mountain	-
05DA003	North Saskatchewan River at Wilson's Ranch	52.09	-116.41	North Saskatchewan River	Rocky Mountain	-
05DA004	Cline River Near the Mouth	52.14	-116.5	North Saskatchewan River	Rocky Mountain	-
05DA005	Mistaya River Near the Mouth	51.96	-116.71	North Saskatchewan River	Rocky Mountain	-
05DA006	North Saskatchewan River at Saskatchewan Crossing	51.96	-116.72	North Saskatchewan River	Rocky Mountain	-
05DA007	Mistaya River Near Saskatchewan Crossing	51.88	-116.68	North Saskatchewan River	Rocky Mountain	X
05DA008	Peyto Creek at Peyto Glacier	51.69	-116.53	North Saskatchewan River	Rocky Mountain	-
05DA009	North Saskatchewan River at Whirlpool Point	52	-116.47	North Saskatchewan River	Rocky Mountain	X

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05DA010	Silverhorn Creek Near the Mouth	51.79	-116.58	North Saskatchewan River	Rocky Mountain	X
05DB001	Clearwater River Near Rocky Mountain House	52.34	-114.93	North Saskatchewan River	Boreal	-
05DB002	Prairie Creek Near Rocky Mountain House	52.27	-114.92	North Saskatchewan River	Boreal	-
05DB003	Clearwater River Above Limestone Creek	51.99	-115.43	North Saskatchewan River	Foothills	-
05DB004	Prairie Creek Near Ranger Station	52.24	-115.3	North Saskatchewan River	Foothills	-
05DB005	Prairie Creek Below Lick Creek	52.25	-115.28	North Saskatchewan River	Foothills	-
05DB006	Clearwater River Near Dovercourt	52.25	-114.85	North Saskatchewan River	Boreal	-
05DB007	Clearwater River at Forestry Road	51.97	-115.23	North Saskatchewan River	Foothills	-
05DC001	North Saskatchewan River Near Rocky Mountain House	52.37	-114.94	North Saskatchewan River	Boreal	-
05DC002	North Saskatchewan River at Saunders	52.45	-115.75	North Saskatchewan River	Foothills	-
05DC003	Martin Creek Near Nordegg	52.46	-116.07	North Saskatchewan River	Foothills	-
05DC004	Shunda Creek Near Saunders	52.42	-115.78	North Saskatchewan River	Foothills	-
05DC005	Bighorn River Near the Mouth	52.37	-116.29	North Saskatchewan River	Rocky Mountain	-
05DC006	Ram River Near the Mouth	52.36	-115.42	North Saskatchewan River	Foothills	-
05DC007	North Saskatchewan River Below Tershishner Creek	52.3	-116.31	North Saskatchewan River	Rocky Mountain	-
05DC008	Ram River at Ram Glacier	51.85	-116.19	North Saskatchewan River	Rocky Mountain	-
05DC009	Lake Abraham Near Nordegg	52.3	-116.32	North Saskatchewan River	Rocky Mountain	-
05DC010	North Saskatchewan River Below Bighorn Plant	52.31	-116.32	North Saskatchewan River	Rocky Mountain	-
05DC011	North Ram River at Forestry Road	52.28	-115.99	North Saskatchewan River	Foothills	-
05DC012	Baptiste River Near the Mouth	52.66	-115.07	North Saskatchewan River	Foothills	-
05DD001	Southesk River Near Forestry Ford	52.66	-116.87	North Saskatchewan River	Rocky Mountain	-
05DD002	Blackstone River Near Grass Mountain	52.76	-116.31	North Saskatchewan River	Foothills	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05DD003	Chungo Creek Near the Mouth	52.7	-116.48	North Saskatchewan River	Foothills	-
05DD004	Brown Creek at Forestry Road	52.76	-116.36	North Saskatchewan River	Foothills	-
05DD005	Brazeau River Below Brazeau Plant	52.91	-115.36	North Saskatchewan River	Foothills	-
05DD006	Brazeau Reservoir	52.97	-115.58	North Saskatchewan River	Foothills	-
05DD007	Brazeau River Below Cardinal River	52.88	-116.55	North Saskatchewan River	Foothills	-
05DD008	Cardinal River Near the Mouth	52.86	-116.59	North Saskatchewan River	Foothills	-
05DD009	Nordegg River at Sunchild Road	52.81	-115.52	North Saskatchewan River	Foothills	-
05DE001	North Saskatchewan River at Rocky Rapids	53.21	-114.93	North Saskatchewan River	Boreal	-
05DE002	Wabamun Lake at Wabamun	53.55	-114.46	North Saskatchewan River	Boreal	-
05DE003	Wabamun Creek Near Duffield	53.46	-114.36	North Saskatchewan River	Boreal	-
05DE004	Wabamun Lake at Seba Beach	53.55	-114.73	North Saskatchewan River	Boreal	-
05DE006	North Saskatchewan River Near Lodgepole	53.05	-115.21	North Saskatchewan River	Boreal	-
05DE007	Rose Creek Near Alder Flats	52.92	-115.01	North Saskatchewan River	Boreal	X
05DE008	Modeste Creek Near Breton	53.1	-114.5	North Saskatchewan River	Boreal	-
05DE009	Tomahawk Creek Near Tomahawk	53.4	-114.76	North Saskatchewan River	Boreal	-
05DE010	North Saskatchewan River at Highway No. 759	53.31	-114.75	North Saskatchewan River	Boreal	-
05DE911	Modeste Creek Near Lindale	53.24	-114.7	North Saskatchewan River	Boreal	-
05DF001	North Saskatchewan River at Edmonton	53.53	-113.48	North Saskatchewan River	Parkland	-
05DF002	Conjuring Creek Near Wizard Lake	53.1	-113.82	North Saskatchewan River	Parkland	-
05DF003	Blackmud Creek Near Ellerslie	53.41	-113.51	North Saskatchewan River	Parkland	-
05DF004	Strawberry Creek Near the Mouth	53.31	-114.05	North Saskatchewan River	Boreal	-
05DF006	Whitemud Creek Near Ellerslie	53.41	-113.59	North Saskatchewan River	Parkland	-
05DF007	West Whitemud Creek Near Ireton	53.22	-113.69	North Saskatchewan River	Parkland	-
05DF008	Weed Creek at Thorsby	53.23	-114.05	North Saskatchewan River	Boreal	-
05EA001	Sturgeon River Near Fort Saskatchewan	53.83	-113.28	North Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05EA002	Sturgeon River at St. Albert	53.63	-113.62	North Saskatchewan River	Parkland	-
05EA003	Sturgeon River Near Darwell	53.66	-114.61	North Saskatchewan River	Boreal	-
05EA004	Sturgeon River Near Onoway	53.73	-114.27	North Saskatchewan River	Boreal	-
05EA005	Sturgeon River Near Villeneuve	53.65	-113.76	North Saskatchewan River	Parkland	-
05EA006	Lac Ste. Anne At Alberta Beach	53.67	-114.35	North Saskatchewan River	Boreal	-
05EA008	Isle Lake at Eureka Beach	53.62	-114.68	North Saskatchewan River	Boreal	-
05EA009	Atim Creek Near Spruce Grove	53.57	-113.93	North Saskatchewan River	Parkland	-
05EA010	Sturgeon River Near Magnolia Bridge	53.59	-114.85	North Saskatchewan River	Boreal	-
05EA011	Carrot Creek Near the Mouth	53.62	-113.69	North Saskatchewan River	Parkland	-
05EA012	Atim Creek at Century Road	53.59	-113.88	North Saskatchewan River	Parkland	-
05EB001	Hastings Creek Near Lindbrook	53.4	-112.82	North Saskatchewan River	Boreal	-
05EB002	Beaverhill Creek Near Mundare	53.56	-112.5	North Saskatchewan River	Parkland	-
05EB003	Beaverhill Lake Near Mundare	53.55	-112.5	North Saskatchewan River	Parkland	-
05EB004	Hastings Lake Near North Cooking Lake	53.41	-112.94	North Saskatchewan River	Boreal	-
05EB005	Sisib Lake Near North Cooking Lake	53.4	-112.96	North Saskatchewan River	Boreal	-
05EB006	Cooking Lake Creek Near North Cooking Lake	53.44	-112.93	North Saskatchewan River	Boreal	-
05EB007	Cooking Lake Near North Cooking Lake	53.46	-113	North Saskatchewan River	Boreal	-
05EB008	Beaverhill Lake Near Tofield	53.36	-112.56	North Saskatchewan River	Parkland	-
05EB009	Stove Lake Near Tofield	53.33	-112.91	North Saskatchewan River	Boreal	-
05EB011	Hastings Lake Near Deville	53.42	-112.9	North Saskatchewan River	Boreal	-
05EB012	Cooking Lake at Cooking Lake	53.41	-113.12	North Saskatchewan River	Boreal	-
05EB013	Ministik Lake Near New Sarepta	53.32	-113.05	North Saskatchewan River	Boreal	-
05EB014	Miquelon Lake at Provincial Park	53.24	-112.9	North Saskatchewan River	Boreal	-
05EB015	Beaverhill Creek Near the Mouth	53.88	-112.94	North Saskatchewan River	Boreal	-
05EB016	Amisk Creek Near Shonts	53.3	-112.55	North Saskatchewan River	Parkland	-
05EB902	Pointe-Aux-Pins Creek Near Ardrossan	53.59	-113.16	North Saskatchewan River	Parkland	-
05EB909	Pointe-Aux-Pins Tributary No. 1 Near Ardrossan	53.57	-113.14	North Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05EB910	Pointe-Aux-Pins Tributary No. 2 Near Ardrossan	53.59	-113.14	North Saskatchewan River	Parkland	-
05EB911	Pointe-Aux-Pins Tributary No. 3 Near Ardrossan	53.59	-113.14	North Saskatchewan River	Parkland	-
05EC001	Smoky Lake Near Warspite	54.1	-112.58	North Saskatchewan River	Boreal	-
05EC002	Waskatenau Creek Near Waskatenau	54.12	-112.78	North Saskatchewan River	Boreal	-
05EC003	Redwater River Near Redwater	53.94	-113.05	North Saskatchewan River	Boreal	-
05EC004	Namepi Creek Near the Mouth	54.02	-112.84	North Saskatchewan River	Boreal	-
05EC005	Redwater River Near the Mouth	53.89	-112.99	North Saskatchewan River	Boreal	-
05EC006	White Earth Creek Near Smoky Lake	54.11	-112.3	North Saskatchewan River	Boreal	-
05EC007	Redwater River Near Vimy	54.09	-113.56	North Saskatchewan River	Parkland	-
05ED001	Stony Creek Near Saddle Lake	54.02	-111.69	North Saskatchewan River	Boreal	-
05ED002	Atimoswe Creek Near Elk Point	53.88	-110.92	North Saskatchewan River	Boreal	-
05ED003	Moosehills Creek Near Elk Point	53.93	-110.77	North Saskatchewan River	Boreal	-
05EE001	Vermilion River Near Mannville	53.37	-111.17	North Saskatchewan River	Parkland	-
05EE002	Vermilion River at Lea Park	53.65	-110.33	North Saskatchewan River	Parkland	-
05EE003	Vermilion River Near Vegreville	53.46	-112.06	North Saskatchewan River	Parkland	-
05EE004	Vermilion River Near Hazeldine	53.62	-110.42	North Saskatchewan River	Parkland	-
05EE005	Stretton Creek Near Marwayne	53.44	-110.32	North Saskatchewan River	Parkland	-
05EE006	Vermilion River Tributary Near Bruce	53.29	-112.04	North Saskatchewan River	Parkland	-
05EE007	Vermilion River Near Marwayne	53.49	-110.39	North Saskatchewan River	Parkland	-
05EE008	Vermilion Park Lake Near Vermilion	53.36	-110.86	North Saskatchewan River	Parkland	-
05EE009	Vermilion River at Vegreville	53.49	-112.03	North Saskatchewan River	Parkland	-
05EE010	Vermilion River at Range Road No. 105	53.61	-111.45	North Saskatchewan River	Boreal	-
05EE011	Vermilion Lakes Near Morecambe	53.64	-111.47	North Saskatchewan River	Boreal	-
05EE913	Vermilion River Drainage Near Holden	53.13	-112.4	North Saskatchewan River	Parkland	-
05EE915	Vermilion River Drainage Near Bruce	53.17	-112.06	North Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05EE930	Vermilion River Near Beauvallon	53.59	-111.4	North Saskatchewan River	Boreal	-
05EF003	North Saskatchewan River at Lea Park	53.65	-110.33	North Saskatchewan River	Parkland	-
05FA001	Battle River Near Ponoka	52.66	-113.58	North Saskatchewan River	Parkland	-
05FA002	Pigeon Lake Creek Near Westerose	52.95	-113.96	North Saskatchewan River	Parkland	-
05FA003	Bittern Lake at Bittern Lake	53.01	-113.03	North Saskatchewan River	Parkland	-
05FA004	Big Hay Lake Near Millet	53.15	-113.16	North Saskatchewan River	Parkland	-
05FA006	Driedmeat Lake Near Edberg	52.85	-112.75	North Saskatchewan River	Parkland	-
05FA007	Pipestone Creek Near Millet	53.08	-113.46	North Saskatchewan River	Parkland	-
05FA008	Bigstone Creek Near Bigstone	53.03	-113.43	North Saskatchewan River	Parkland	-
05FA009	Pigeon Lake Near Westerose	52.95	-113.96	North Saskatchewan River	Parkland	-
05FA010	Camrose Creek at Camrose	53.01	-112.83	North Saskatchewan River	Parkland	-
05FA011	Battle River at Duhamel	52.94	-112.96	North Saskatchewan River	Parkland	-
05FA012	Pipestone Creek Near Wetaskiwin	53.03	-113.32	North Saskatchewan River	Parkland	-
05FA013	Pigeon Lake at Pigeon Lake Provincial Park	53.02	-114.12	North Saskatchewan River	Boreal	-
05FA014	Maskwa Creek No. 1 Above Bearhills Lake	52.78	-113.62	North Saskatchewan River	Parkland	-
05FA015	Maskwa Creek No. 2 Above Bearhills Lake	52.81	-113.61	North Saskatchewan River	Parkland	-
05FA016	Coal Lake Reservoir Near Wetaskiwin	53	-113.21	North Saskatchewan River	Parkland	-
05FA017	Pigeon Lake Creek Near the Mouth	52.85	-113.89	North Saskatchewan River	Parkland	-
05FA018	Driedmeat Creek Near the Mouth	52.88	-112.63	North Saskatchewan River	Parkland	-
05FA019	Pigeon Lake Creek Near Usona	52.86	-113.89	North Saskatchewan River	Parkland	-
05FA020	Driedmeat Lake at Outflow	52.78	-112.71	North Saskatchewan River	Parkland	-
05FA021	Battle River Below Pipestone Creek	52.96	-113.07	North Saskatchewan River	Parkland	-
05FA022	Pipestone Creek Below Bigstone Creek	53.04	-113.36	North Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05FA023	Battle River Above Pipestone Creek	52.95	-113.17	North Saskatchewan River	Parkland	-
05FA024	Weiller Creek Near Wetaskiwin	52.95	-113.28	North Saskatchewan River	Parkland	-
05FA025	Camrose Creek Near Camrose	53.04	-112.82	North Saskatchewan River	Parkland	-
05FA026	Wolf Creek at Township Road No. 410	52.49	-113.69	North Saskatchewan River	Parkland	-
05FA912	Muskeg Creek Near Westerose	52.86	-113.95	North Saskatchewan River	Parkland	-
05FB001	Thomas Lake Near Viking	53.1	-111.71	North Saskatchewan River	Parkland	-
05FB002	Iron Creek Near Hardisty	52.7	-111.31	North Saskatchewan River	Parkland	X
05FB003	Iron Creek Near Viking	53.01	-111.9	North Saskatchewan River	Parkland	-
05FC001	Battle River Near Forestburg	52.57	-112.34	North Saskatchewan River	Parkland	-
05FC002	Bigknife Creek Near Gadsby	52.51	-112.35	North Saskatchewan River	Parkland	-
05FC003	Meeting Creek Near the Mouth	52.55	-112.41	North Saskatchewan River	Parkland	-
05FC004	Paintearth Creek Near Halkirk	52.38	-112.13	North Saskatchewan River	Parkland	-
05FC005	Redwillow Creek Near Red Willow	52.52	-112.38	North Saskatchewan River	Parkland	-
05FC006	Meeting Creek Near Donalda	52.58	-112.53	North Saskatchewan River	Parkland	-
05FC007	Young Creek Near Castor	52.25	-111.73	North Saskatchewan River	Grassland	-
05FC008	Battle River at Highway No. 872	52.4	-111.41	North Saskatchewan River	Parkland	-
05FC904	Redwillow Creek Near Red Willow	52.51	-112.38	North Saskatchewan River	Parkland	-
05FD001	Ribstone Creek Near Edgerton	52.75	-110.48	North Saskatchewan River	Parkland	-
05FD002	Ribstone Lake Near Heath	52.76	-110.63	North Saskatchewan River	Parkland	-
05FD003	Ribstone Creek Near Ribstone	52.72	-110.26	North Saskatchewan River	Parkland	-
05FD005	Ribstone Creek Near Czar	52.48	-110.73	North Saskatchewan River	Parkland	-
05FD006	Copper Creek Near Coronation	52.17	-111.23	North Saskatchewan River	Grassland	-
05FD007	Shorncliffe Lake Near Czar	52.47	-110.86	North Saskatchewan River	Parkland	-
05FE002	Buffalo Creek at Highway No. 41	53	-110.86	North Saskatchewan River	Parkland	-
05FE003	Battle River at Highway No. 41	52.99	-110.85	North Saskatchewan River	Parkland	-
05FE004	Battle River Near the Saskatchewan Boundary	52.85	-110.01	North Saskatchewan River	Parkland	-
05FE005	Blackfoot Creek Near the Saskatchewan Boundary	52.95	-110	North Saskatchewan River	Parkland	-
05GA003	Monitor Creek Near Monitor	51.96	-110.57	North Saskatchewan River	Grassland	-
05GA004	Sounding Lake Near Monitor	52.15	-110.56	North Saskatchewan River	Parkland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
05GA005	Gooseberry Lake Near Consort	52.11	-110.76	North Saskatchewan River	Grassland	-
05GA008	Sounding Creek Near Oyen	51.56	-110.47	North Saskatchewan River	Grassland	-
05GA009	Kirkpatrick Lake Tributary Near Spondin	51.97	-111.47	North Saskatchewan River	Grassland	-
05GA010	Killarney Lake Tributary Near Chauvin	52.56	-110.14	North Saskatchewan River	Parkland	-
05GA011	Monitor Creek Near Consort	51.87	-110.76	North Saskatchewan River	Grassland	-
05GA012	Sounding Creek Near Chinook	51.54	-110.91	North Saskatchewan River	Grassland	-
05GA013	Loyalist Creek Near Consort	52	-110.76	North Saskatchewan River	Grassland	-
06AA001	Beaver River Near Goodridge	54.43	-111.36	Beaver River	Boreal	-
06AA002	Amisk River at Highway No. 36	54.47	-112.01	Beaver River	Boreal	-
06AA003	Beaver Lake at Ranger Station	54.76	-111.9	Beaver River	Boreal	-
06AA004	Columbine Creek Near the Mouth	54.35	-111.13	Beaver River	Boreal	-
06AA901	Columbine Creek Near Glendon	54.35	-111.14	Beaver River	Boreal	-
06AB001	Sand River Near the Mouth	54.46	-111.18	Beaver River	Boreal	-
06AB002	Wolf River at Outlet of Wolf Lake	54.71	-111	Beaver River	Boreal	X
06AB003	Punk Creek Near the Mouth	54.53	-111.22	Beaver River	Boreal	-
06AB004	Wolf Lake at Outlet	54.71	-111	Beaver River	Boreal	-
06AC001	Jackfish Creek Near La Corey	54.44	-110.68	Beaver River	Boreal	-
06AC002	Moore Lake Near Cold Lake	54.5	-110.56	Beaver River	Boreal	-
06AC003	Hilda Lake Near Cold Lake	54.52	-110.41	Beaver River	Boreal	-
06AC004	Ethel Lake Near Cold Lake	54.54	-110.33	Beaver River	Boreal	-
06AC005	Marie Lake Near Cold Lake	54.59	-110.3	Beaver River	Boreal	-
06AC006	Mooselake River Near Franchere	54.32	-110.96	Beaver River	Boreal	-
06AC007	Muriel Lake at Gurneyville	54.15	-110.74	Beaver River	Boreal	-
06AC009	Manatokan Creek Near Iron River	54.44	-110.93	Beaver River	Boreal	-
06AC901	Marie Creek Below Ethel Lake	54.52	-110.32	Beaver River	Boreal	-
06AD006	Beaver River at Cold Lake Reserve	54.35	-110.21	Beaver River	Boreal	-
06AD013	Reita Creek Near Outlet of Angling Lake	54.22	-110.32	Beaver River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
06AF001	Cold River at Outlet of Cold Lake	54.56	-109.84	Beaver River	Boreal	-
06AF002	Cold Lake at Cold Lake	54.46	-110.17	Beaver River	Boreal	-
06AF003	Primrose Lake at R.C.A.F. Testing Station	54.77	-110.06	Beaver River	Boreal	-
06AF008	Martineau River Above Cold Lake	54.68	-110.02	Beaver River	Boreal	-
07AA001	Miette River Near Jasper	52.86	-118.1	Athabasca River	Rocky Mountain	-
07AA002	Athabasca River Near Jasper	52.91	-118.05	Athabasca River	Rocky Mountain	X
07AA003	Rocky River at Hawes	53.14	-117.97	Athabasca River	Rocky Mountain	-
07AA004	Maligne River Near Jasper	52.93	-118.02	Athabasca River	Rocky Mountain	-
07AA007	Sunwapta River at Athabasca Glacier	52.21	-117.23	Athabasca River	Rocky Mountain	-
07AA008	Fiddle River at Highway No. 16	53.2	-117.84	Athabasca River	Rocky Mountain	-
07AA009	Whirlpool River Near the Mouth	52.72	-117.92	Athabasca River	Rocky Mountain	-
07AA010	Fiddle River Above Morris Creek	53.17	-117.83	Athabasca River	Rocky Mountain	-
07AB002	Snake Indian River Near the Mouth	53.15	-118.03	Athabasca River	Rocky Mountain	-
07AC001	Wildhay River Near Hinton	53.52	-117.94	Athabasca River	Foothills	-
07AC002	North Fox Creek Near Muskeg	53.71	-118.26	Athabasca River	Foothills	-
07AC003	East Cabin Creek Near Muskeg	53.76	-118.36	Athabasca River	Foothills	-
07AC004	Hendrickson Creek Near the Mouth	53.77	-118.36	Athabasca River	Rocky Mountain	-
07AC005	Vogel Creek Near the Mouth	53.78	-118.45	Athabasca River	Rocky Mountain	-
07AC006	Hinton Study Basin No.14	53.7	-118.27	Athabasca River	Rocky Mountain	-
07AC007	Berland River Near the Mouth	54.01	-116.96	Athabasca River	Foothills	-
07AC008	Little Berland River at Highway No. 40	53.67	-118.24	Athabasca River	Rocky Mountain	-
07AD001	Athabasca River at Entrance	53.37	-117.69	Athabasca River	Rocky Mountain	-
07AD002	Athabasca River at Hinton	53.42	-117.56	Athabasca River	Rocky Mountain	-
07AD003	Cache Percotte Creek Near Hinton	53.4	-117.5	Athabasca River	Foothills	-
07AD004	Whiskeyjack Creek Near Hinton	53.38	-117.53	Athabasca River	Foothills	-
07AD005	Fish Creek Near Hinton	53.48	-117.65	Athabasca River	Foothills	-
07AD006	Oldman Creek Near Hinton	53.53	-117.68	Athabasca River	Rocky Mountain	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07AD007	Cache Percotte Creek (North Fork) Near Hinton	53.39	-117.48	Athabasca River	Foothills	-
07AD008	Hinton Study Basin No.1	53.69	-117.56	Athabasca River	Foothills	-
07AD009	Hinton Study Basin No.2	53.68	-117.56	Athabasca River	Foothills	-
07AD010	Hinton Study Basin No.5	53.62	-117.52	Athabasca River	Foothills	-
07AE001	Athabasca River Near Windfall	54.2	-116.06	Athabasca River	Boreal	-
07AE002	Hinton Study Basin No.6	53.91	-116.72	Athabasca River	Foothills	-
07AE003	Hinton Study Basin No.7	53.9	-116.76	Athabasca River	Foothills	-
07AF001	Embarras River Near Mcleod River	53.45	-116.61	Athabasca River	Foothills	-
07AF002	Mcleod River Above Embarras River	53.47	-116.63	Athabasca River	Foothills	-
07AF003	Wampus Creek Near Hinton	53.15	-117.26	Athabasca River	Foothills	-
07AF004	Deerlick Creek Near Hinton	53.15	-117.24	Athabasca River	Foothills	-
07AF005	Eunice Creek Near Hinton	53.15	-117.23	Athabasca River	Foothills	-
07AF008	Quigley Creek Near Hinton	53.35	-117.4	Athabasca River	Foothills	-
07AF009	North Anderson Creek Near Hinton	53.31	-117.4	Athabasca River	Foothills	-
07AF010	Sundance Creek Near Bickerdike	53.56	-116.7	Athabasca River	Foothills	-
07AF011	Hinton Study Basin No.15	53.3	-117.3	Athabasca River	Foothills	-
07AF012	Hinton Study Basin No.16	53.3	-117.28	Athabasca River	Foothills	-
07AF013	Mcleod River Near Cadomin	53.07	-117.19	Athabasca River	Foothills	-
07AF014	Embarras River Near Weald	53.37	-116.8	Athabasca River	Foothills	-
07AF015	Gregg River Near the Mouth	53.25	-117.35	Athabasca River	Foothills	-
07AF016	Erith River Below Hanlan Creek	53.23	-116.56	Athabasca River	Foothills	-
07AF906	Gregg River Near Hinton	53.25	-117.35	Athabasca River	Foothills	-
07AF907	Erith River Below Hanlan Creek	53.23	-116.56	Athabasca River	Foothills	-
07AF909	Embarras River at Robb	53.22	-116.96	Athabasca River	Foothills	-
07AF910	Whitehorse Creek Near Cadomin	52.98	-117.34	Athabasca River	Rocky Mountain	-
07AG001	Mcleod River Near Wolf Creek	53.65	-116.28	Athabasca River	Foothills	-
07AG002	Mcleod River Near Edson	53.6	-116.33	Athabasca River	Foothills	-
07AG003	Wolf Creek at Highway No. 16A	53.59	-116.27	Athabasca River	Foothills	-
07AG004	Mcleod River Near Whitecourt	54.01	-115.83	Athabasca River	Boreal	-
07AG005	Hinton Study Basin No.8	53.81	-116.74	Athabasca River	Foothills	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07AG006	Hinton Study Basin No.9	53.83	-116.68	Athabasca River	Foothills	-
07AG007	Mcleod River Near Rosevear	53.69	-116.16	Athabasca River	Foothills	-
07AG008	Groat Creek Near Whitecourt	54.03	-115.84	Athabasca River	Boreal	-
07AH001	Freeman River Near Fort Assiniboine	54.36	-114.9	Athabasca River	Boreal	-
07AH002	Christmas Creek Near Blue Ridge	54.22	-115.33	Athabasca River	Boreal	X
07AH003	Sakwatamau River Near Whitecourt	54.2	-115.77	Athabasca River	Boreal	-
07BA001	Pembina River Below Paddy Creek	53.12	-115.32	Athabasca River	Boreal	-
07BA002	Rat Creek Near Cynthia	53.13	-115.48	Athabasca River	Foothills	-
07BA003	Lovett River Near the Mouth	52.99	-116.65	Athabasca River	Foothills	-
07BB001	Lobstick River Near Entwistle	53.61	-115.01	Athabasca River	Boreal	-
07BB002	Pembina River Near Entwistle	53.6	-115	Athabasca River	Boreal	-
07BB003	Lobstick River Near Styal	53.61	-115.1	Athabasca River	Boreal	-
07BB004	Paddle River Near Rochfort Bridge	53.89	-115.04	Athabasca River	Boreal	-
07BB005	Little Paddle River Near Mayerthorpe	53.94	-115.02	Athabasca River	Boreal	-
07BB006	Paddle River at Barrhead	54.11	-114.4	Athabasca River	Boreal	-
07BB007	Lac La Nonne at Lac La Nonne	53.91	-114.28	Athabasca River	Boreal	-
07BB008	Chip Lake Near Northville	53.63	-115.39	Athabasca River	Boreal	-
07BB009	Connor Creek Near Sangudo	54.02	-114.94	Athabasca River	Boreal	-
07BB010	Connor Creek Near Rochfort Bridge	54.04	-115.04	Athabasca River	Boreal	-
07BB011	Paddle River Near Anselmo	53.85	-115.36	Athabasca River	Boreal	-
07BB012	Paddle River Near Sangudo	53.95	-114.89	Athabasca River	Boreal	-
07BB013	Paddle River at Highway No. 764	54.04	-114.67	Athabasca River	Boreal	-
07BB014	Coyote Creek Near Cherhill	53.87	-114.67	Athabasca River	Boreal	-
07BB903	Romeo Creek Above Romeo Lake	54.07	-114.9	Athabasca River	Boreal	-
07BB914	Paddle River Reservoir Near Rochfort Bridge	53.89	-115.06	Athabasca River	Boreal	-
07BC001	Pembina River Near Dapp	54.35	-114.01	Athabasca River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07BC002	Pembina River at Jarvie	54.45	-113.99	Athabasca River	Boreal	-
07BC003	Wabash Creek Near Westlock	54.19	-113.92	Athabasca River	Boreal	-
07BC004	Shoal Creek Near Linaria	54.31	-114.2	Athabasca River	Boreal	-
07BC005	Steele Lake Near Jarvie	54.64	-113.81	Athabasca River	Boreal	-
07BC006	Dapp Creek at Highway No. 44	54.3	-113.84	Athabasca River	Boreal	-
07BC007	Wabash Creek Near Pibroch	54.22	-113.92	Athabasca River	Boreal	-
07BE001	Athabasca River at Athabasca	54.72	-113.28	Athabasca River	Boreal	-
07BE002	Baptiste Lake Near Athabasca	54.73	-113.53	Athabasca River	Boreal	-
07BE003	Porter Creek Above Baptiste Lake	54.72	-113.58	Athabasca River	Boreal	-
07BE004	Stony Creek Near Tawatinaw	54.29	-113.46	Athabasca River	Boreal	-
07BF001	East Prairie River Near Enilda	55.41	-116.34	Athabasca River	Boreal	-
07BF002	West Prairie River Near High Prairie	55.44	-116.49	Athabasca River	Boreal	-
07BF004	South Heart River Near High Prairie	55.53	-116.48	Athabasca River	Boreal	-
07BF006	Winagami Lake at Provincial Park	55.62	-116.68	Athabasca River	Boreal	-
07BF007	Bridge Creek Near Enilda	55.43	-116.28	Athabasca River	Boreal	-
07BF008	South Heart Reservoir Near Mclennan	55.68	-116.59	Athabasca River	Boreal	-
07BF009	Salt Creek Near Grouard	55.6	-116.1	Athabasca River	Boreal	-
07BF010	South Heart River Near Peavine	55.81	-116.38	Athabasca River	Boreal	-
07BF901	South Heart River Below West Prairie River	55.52	-116.45	Athabasca River	Boreal	-
07BF905	South Heart River Near Big Prairie Settlement	55.57	-116.29	Athabasca River	Boreal	-
07BF910	Buffalo Bay Outlet at Grouard (Causeway)	55.51	-116.16	Athabasca River	Boreal	-
07BG004	Lily Creek Near Slave Lake	55.41	-114.81	Athabasca River	Boreal	-
07BH001	Arcadia Creek Near Arcadia	55.39	-116.12	Athabasca River	Boreal	-
07BH003	Driftpile River Near Driftpile	55.34	-115.79	Athabasca River	Boreal	-
07BJ001	Swan River Near Kinuso	55.31	-115.41	Athabasca River	Boreal	-
07BJ002	Lesser Slave Lake at Faust	55.32	-115.64	Athabasca River	Boreal	-
07BJ003	Swan River Near Swan Hills	54.8	-115.47	Athabasca River	Foothills	-
07BJ004	Adams Creek Near Kinuso	55.21	-115.33	Athabasca River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07BJ005	Lesser Slave Lake at Dog Island	55.31	-114.81	Athabasca River	Boreal	-
07BJ006	Lesser Slave Lake at Slave Lake	55.3	-115.77	Athabasca River	Boreal	-
07BK001	Lesser Slave River at Slave Lake	55.3	-114.75	Athabasca River	Boreal	-
07BK002	Lesser Slave River Above Otauwau River	55.27	-114.4	Athabasca River	Boreal	-
07BK003	Lesser Slave River at Saulteaux Landing	55.26	-114.31	Athabasca River	Boreal	-
07BK004	Otauwau River Near Slave Lake	55.27	-114.4	Athabasca River	Boreal	-
07BK005	Saulteaux River Near Spurfield	55.15	-114.23	Athabasca River	Boreal	-
07BK006	Lesser Slave River at Highway No. 2A	55.29	-114.59	Athabasca River	Boreal	-
07BK007	Driftwood River Near the Mouth	55.25	-114.23	Athabasca River	Boreal	-
07BK008	Fawcett Lake Near Smith	55.31	-114.05	Athabasca River	Boreal	-
07BK009	Sawridge Creek Near Slave Lake	55.27	-114.77	Athabasca River	Boreal	-
07BK010	Lesser Slave Lake at Sawridge	55.3	-114.76	Athabasca River	Boreal	-
07BK012	Fawcett River at Outlet of Fawcett Lake	55.31	-114.05	Athabasca River	Boreal	-
07CA001	Flat Creek Near Donatville	54.75	-112.87	Athabasca River	Boreal	-
07CA002	Flat Lake Near Stocks	54.63	-112.94	Athabasca River	Boreal	-
07CA003	Flat Creek Near Boyle	54.58	-112.9	Athabasca River	Boreal	-
07CA004	Lac La Biche at Lac La Biche	54.77	-111.98	Athabasca River	Boreal	-
07CA005	Pine Creek Near Grassland	54.82	-112.77	Athabasca River	Boreal	-
07CA006	Wandering River Near Wandering River	55.19	-112.46	Athabasca River	Boreal	-
07CA008	Babette Creek Near Colinton	54.65	-113.07	Athabasca River	Boreal	-
07CA010	Piche River Near Imperial Mills	55	-111.71	Athabasca River	Boreal	-
07CA011	La Biche River at Highway No. 63	54.93	-112.5	Athabasca River	Boreal	-
07CA012	Logan River Near the Mouth	55.17	-111.72	Athabasca River	Boreal	-
07CA013	Owl River Below Piche River	55.01	-111.85	Athabasca River	Boreal	-
07CA901	Pine Creek Near Colinton	54.61	-113.01	Athabasca River	Boreal	-
07CB001	Calling Lake at Ranger Station	55.21	-113.19	Athabasca River	Boreal	-
07CB002	House River at Highway No. 63	55.64	-112.15	Athabasca River	Boreal	-
07CC001	Horse River at Abasands Park	56.7	-111.39	Athabasca River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07CC002	Athabasca River at McMurray	56.73	-111.37	Athabasca River	Boreal	-
07CD001	Clearwater River at Draper	56.68	-111.25	Athabasca River	Boreal	X
07CD002	Clearwater River Below Waterways	56.71	-111.34	Athabasca River	Boreal	-
07CD003	Clearwater River at Upper Wingdam	56.7	-111.33	Athabasca River	Boreal	-
07CD004	Hangingstone River at Fort McMurray	56.7	-111.35	Athabasca River	Boreal	-
07CD005	Clearwater River Above Christina River	56.66	-110.92	Athabasca River	Boreal	-
07CE001	Gregoire Lake Near Fort McMurray	56.48	-111.18	Athabasca River	Boreal	-
07CE002	Christina River Near Chard	55.83	-110.86	Athabasca River	Boreal	-
07CE003	Pony Creek Near Chard	55.86	-110.91	Athabasca River	Boreal	-
07CE004	Robert Creek Near Anzac	56.38	-111.02	Athabasca River	Boreal	-
07CE005	Jackfish River Below Christina Lake	55.67	-111.1	Athabasca River	Boreal	-
07CE006	Birch Creek Near Conklin	55.61	-111.08	Athabasca River	Boreal	-
07CE906	Christina Lake Near Winefred Lake	55.62	-110.77	Athabasca River	Boreal	-
07DA001	Athabasca River Below McMurray	56.78	-111.4	Athabasca River	Boreal	-
07DA002	Athabasca River Near Mildred Lake	57.03	-111.48	Athabasca River	Boreal	-
07DA003	Athabasca River Near Fort Mackay	57.19	-111.6	Athabasca River	Boreal	-
07DA004	Athabasca River at Shott Island	57.71	-111.39	Athabasca River	Boreal	-
07DA005	Beaver River Near Fort Mackay	57.1	-111.63	Athabasca River	Boreal	-
07DA006	Steepbank River Near Fort McMurray	56.99	-111.4	Athabasca River	Boreal	-
07DA007	Poplar Creek Near Fort McMurray	56.91	-111.45	Athabasca River	Boreal	-
07DA008	Muskeg River Near Fort Mackay	57.19	-111.57	Athabasca River	Boreal	-
07DA009	Hartley Creek Near Fort Mackay	57.25	-111.46	Athabasca River	Boreal	-
07DA010	Ells River Below Gardiner Lakes	57.37	-112.56	Athabasca River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07DA011	Unnamed Creek Near Fort Mackay	57.66	-111.51	Athabasca River	Boreal	-
07DA012	Asphalt Creek Near Fort Mackay	57.53	-111.67	Athabasca River	Boreal	-
07DA013	Pierre River Near Fort Mackay	57.46	-111.65	Athabasca River	Boreal	-
07DA014	Calumet River Near Fort Mackay	57.4	-111.68	Athabasca River	Boreal	-
07DA015	Tar River Near Fort Mackay	57.35	-111.75	Athabasca River	Boreal	-
07DA016	Joslyn Creek Near Fort Mackay	57.27	-111.74	Athabasca River	Boreal	-
07DA017	Ells River Near the Mouth	57.26	-111.71	Athabasca River	Boreal	-
07DA018	Beaver River Above Syncrude	56.94	-111.56	Athabasca River	Boreal	-
07DA019	Tar River Near Fort Mackay (Upper Station)	57.48	-112.01	Athabasca River	Boreal	-
07DA020	Gardiner Lake (Upper) In Birch Mountains	57.54	-112.47	Athabasca River	Boreal	-
07DA021	Namur Lake at Birch Mountains Lodge	57.36	-112.75	Athabasca River	Boreal	-
07DA022	Eaglenest Lake Near the Outlet	57.75	-112.16	Athabasca River	Boreal	-
07DB001	Mackay River Near Fort Mackay	57.21	-111.69	Athabasca River	Boreal	-
07DB002	Dover River Near the Mouth	57.17	-111.79	Athabasca River	Boreal	-
07DB003	Dunkirk River Near Fort Mackay	56.85	-112.71	Athabasca River	Boreal	-
07DB004	Thickwood Creek Near Fort Mackay	56.89	-112.17	Athabasca River	Boreal	-
07DB005	Mackay River Above Dunkirk River	56.75	-112.61	Athabasca River	Boreal	-
07DC001	Firebag River Near the Mouth	57.65	-111.2	Athabasca River	Boreal	-
07DC002	Lost Creek Near the Mouth	57.28	-110.46	Athabasca River	Boreal	-
07DD001	Athabasca River at Embarras Airport	58.31	-111.51	Athabasca River	Boreal	-
07DD002	Richardson River Near the Mouth	58.36	-111.24	Athabasca River	Boreal	X
07DD003	Embarras River Below Divergence	58.42	-111.55	Athabasca River	Boreal	-
07DD004	Fletcher Channel Below Divergence	58.46	-111.07	Athabasca River	Boreal	-
07DD005	Goose Island Channel Below Divergence	58.47	-110.85	Athabasca River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07DD006	Big Point Channel Below Divergence	58.48	-110.8	Athabasca River	Boreal	-
07DD007	Athabasca River Above Jackfish Creek	58.41	-110.91	Athabasca River	Boreal	-
07DD008	Richardson Lake at The Outlet	58.39	-110.97	Athabasca River	Boreal	-
07DD009	Jackfish Creek Above Athabasca River	58.4	-110.92	Athabasca River	Boreal	-
07DD010	Athabasca River Above Fletcher Channel	58.45	-111.06	Athabasca River	Boreal	-
07DD011	Athabasca River Near Old Fort	58.37	-111.52	Athabasca River	Boreal	-
07FD003	Peace River at Dunvegan Bridge	55.91	-118.6	Peace/Slave River	Boreal	-
07FD006	Saddle River Near Woking	55.64	-118.7	Peace/Slave River	Boreal	-
07FD008	Hines Creek Near Fairview	56.06	-118.65	Peace/Slave River	Parkland	-
07FD009	Clear River Near Bear Canyon	56.3	-119.68	Peace/Slave River	Boreal	-
07FD011	Hines Creek Above Gerry Lake	56.33	-118.26	Peace/Slave River	Boreal	-
07FD012	Montagneuse River Near Hines Creek	56.38	-118.71	Peace/Slave River	Boreal	-
07FD013	Eureka River Near Worsley	56.45	-119.13	Peace/Slave River	Boreal	-
07FD014	Wainscott Coulee Near Brownvale	56.02	-117.93	Peace/Slave River	Parkland	-
07FD020	Spirit River Near Spirit River	55.74	-118.83	Peace/Slave River	Boreal	-
07FD901	Peace River Above Smoky River Confluence	56.15	-117.44	Peace/Slave River	Parkland	-
07FD908	Grimshaw Drainage Near Grimshaw	56.16	-117.6	Peace/Slave River	Parkland	-
07FD910	Rycroft Survey No. 3 Near Rycroft	55.75	-118.58	Peace/Slave River	Parkland	-
07FD912	Whitburn Drainage Project Near Spirit River	55.85	-119.13	Peace/Slave River	Boreal	-
07FD913	Young Drainage Project Near Spirit River	55.81	-118.79	Peace/Slave River	Parkland	-
07FD921	Vixen Creek Near Belloy	55.8	-118.15	Peace/Slave River	Boreal	-
07FD934	Peace River Near Elk Island Park	55.91	-117.98	Peace/Slave River	Boreal	-
07GA001	Smoky River Above Hells Creek	53.94	-119.16	Peace/Slave River	Rocky Mountain	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07GA002	Muskeg River Near Grande Cache	53.92	-118.81	Peace/Slave River	Foothills	-
07GB001	Cutbank River Near Grande Prairie	54.51	-118.96	Peace/Slave River	Foothills	-
07GB002	Kakwa River Near Grande Prairie	54.37	-118.59	Peace/Slave River	Foothills	-
07GB003	Kakwa River at Highway No. 40	54.42	-118.55	Peace/Slave River	Foothills	-
07GC002	Pinto Creek Near Grande Prairie	54.84	-119.39	Peace/Slave River	Boreal	-
07GD001	Beaverlodge River Near Beaverlodge	55.18	-119.43	Peace/Slave River	Boreal	-
07GD002	Beavertail Creek Near Hythe	55.31	-119.64	Peace/Slave River	Boreal	-
07GD003	Redwillow River Near Beaverlodge	55.08	-119.52	Peace/Slave River	Boreal	-
07GD004	Redwillow River Near Rio Grande	55.07	-119.7	Peace/Slave River	Boreal	-
07GE001	Wapiti River Near Grande Prairie	55.07	-118.8	Peace/Slave River	Boreal	-
07GE002	Kleskun Hills Main Drain Near Grande Prairie	55.22	-118.46	Peace/Slave River	Parkland	-
07GE003	Grande Prairie Creek Near Sexsmith	55.37	-118.91	Peace/Slave River	Parkland	-
07GE004	Bear Lake Near Clairmont	55.23	-118.95	Peace/Slave River	Parkland	-
07GE005	Bear River Near Grande Prairie	55.2	-118.83	Peace/Slave River	Parkland	-
07GE006	Colquhoun Creek Near Grande Prairie	55.28	-119.14	Peace/Slave River	Boreal	-
07GE007	Bear River Near Valhalla Centre	55.4	-119.38	Peace/Slave River	Boreal	-
07GF001	Simonette River Near Goodwin	55.14	-118.18	Peace/Slave River	Boreal	-
07GF002	Spring Creek Near Valleyview	54.91	-117.84	Peace/Slave River	Boreal	-
07GF003	Wolverine Creek Near Valleyview	54.92	-117.8	Peace/Slave River	Boreal	-
07GF004	Spring Creek (Upper) Near Valleyview	54.92	-117.7	Peace/Slave River	Boreal	-
07GF005	Bridlebit Creek Near Valleyview	54.93	-117.73	Peace/Slave River	Boreal	-
07GF006	Rocky Creek Near Valleyview	54.93	-117.77	Peace/Slave River	Boreal	-
07GF007	Horse Creek Near Valleyview	54.92	-117.81	Peace/Slave River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07GF008	Deep Valley Creek Near Valleyview	54.43	-117.72	Peace/Slave River	Foothills	-
07GG001	Waskahigan River Near the Mouth	54.75	-117.2	Peace/Slave River	Boreal	X
07GG002	Little Smoky River at Little Smoky	54.73	-117.17	Peace/Slave River	Boreal	-
07GG003	Iosegun River Near Little Smoky	54.74	-117.15	Peace/Slave River	Boreal	-
07GH001	Little Smoky River Near Triangle	55.37	-116.92	Peace/Slave River	Boreal	-
07GH002	Little Smoky River Near Guy	55.45	-117.16	Peace/Slave River	Boreal	-
07GH003	Sturgeon Lake Near Valleyview	55.11	-117.55	Peace/Slave River	Boreal	-
07GH004	Peavine Creek Near Falher	55.62	-117.25	Peace/Slave River	Boreal	-
07GH005	Wabatanisk Creek at Highway No. 676	55.42	-117.35	Peace/Slave River	Boreal	-
07GH906	Peavine Creek Near Falher	55.63	-117.23	Peace/Slave River	Boreal	-
07GJ001	Smoky River at Watino	55.71	-117.62	Peace/Slave River	Boreal	-
07GJ004	Bad Heart River Near Heart Valley	55.53	-118.39	Peace/Slave River	Boreal	-
07GJ005	Lalby Creek Near Girouxville	55.79	-117.33	Peace/Slave River	Boreal	-
07HA001	Peace River at Peace River	56.24	-117.31	Peace/Slave River	Boreal	-
07HA002	Heart River at Peace River	56.23	-117.28	Peace/Slave River	Boreal	-
07HA003	Heart River Near Nampa	56.05	-117.12	Peace/Slave River	Boreal	-
07HA005	Whitemud River Near Dixonville	56.51	-117.66	Peace/Slave River	Boreal	-
07HA902	Krawchuk Drainage Near Mclennan	55.95	-117.03	Peace/Slave River	Boreal	-
07HA914	Nampa (South) Drainage Near Nampa	56.01	-117.14	Peace/Slave River	Boreal	-
07HB001	Cadotte River at Outlet Cadotte Lake	56.48	-116.43	Peace/Slave River	Boreal	-
07HB002	Elder Creek at Highway No. 686	56.46	-116.83	Peace/Slave River	Boreal	-
07HC001	Notikewin River at Manning	56.92	-117.61	Peace/Slave River	Boreal	-
07HC002	Buchanan Creek Near Manning	56.89	-117.48	Peace/Slave River	Boreal	-
07HC907	North Star Drainage Near North Star	56.82	-117.56	Peace/Slave River	Boreal	-
07HD001	Peace River Near Carcajou	57.74	-117.03	Peace/Slave River	Boreal	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07HF001	Peace River at Fort Vermilion	58.38	-116.02	Peace/Slave River	Boreal	-
07HF002	Keg River at Highway No. 35	57.74	-117.62	Peace/Slave River	Boreal	-
07JA001	Utikuma Lake Near Nipisi	55.91	-115.17	Peace/Slave River	Boreal	-
07JA002	South Wabasca Lake Near Desmarais	55.93	-113.8	Peace/Slave River	Boreal	-
07JA003	Willow River Near Wabasca	55.91	-113.92	Peace/Slave River	Boreal	-
07JB001	Peerless Lake Near Peerless Lake	56.63	-114.6	Peace/Slave River	Boreal	-
07JB002	Wabasca River Below Trout River	56.32	-113.78	Peace/Slave River	Boreal	-
07JC001	Lafond Creek Near Red Earth Creek	57.07	-115.09	Peace/Slave River	Boreal	X
07JC002	Redearth Creek Near Red Earth Creek	56.54	-115.24	Peace/Slave River	Boreal	-
07JC003	Loon River Near the Mouth	57.07	-115.07	Peace/Slave River	Boreal	-
07JD001	Wabasca River Above Peace River	58.29	-115.38	Peace/Slave River	Boreal	-
07JD002	Wabasca River at Highway No. 88	57.87	-115.38	Peace/Slave River	Boreal	-
07JD003	Jackpine Creek at Highway No. 88	58.19	-115.74	Peace/Slave River	Boreal	-
07JD004	Teepee Creek Near La Crete	58.13	-116.25	Peace/Slave River	Boreal	-
07JF002	Boyer River Near Fort Vermilion	58.44	-116.26	Peace/Slave River	Boreal	-
07JF003	Ponton River Above Boyer River	58.46	-116.25	Peace/Slave River	Boreal	-
07JF004	Boyer River Near Paddle Prairie	57.9	-117.61	Peace/Slave River	Boreal	-
07JF005	Boyer River at Paddle Prairie	57.94	-117.48	Peace/Slave River	Boreal	-
07KA002	Peace River at Fifth Meridian	58.65	-114.02	Peace/Slave River	Boreal	-
07KC001	Peace River at Peace Point (Alberta)	59.11	-112.43	Peace/Slave River	Boreal	-
07KC003	Peace River at Carlson Landing	58.97	-111.81	Peace/Slave River	Boreal	-
07KC004	Peace River at Sweetgrass Landing	58.92	-111.91	Peace/Slave River	Boreal	-
07KC005	Peace River Below Chenal Des Quatre Fourches	58.9	-111.58	Peace/Slave River	Boreal	-
07KE001	Birch River Below Alice Creek	58.32	-113.06	Peace/Slave River	Boreal	X

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07KF001	Chenal Des Quatre Fourches At Quatre Fourches	58.64	-111.28	Peace/Slave River	Boreal	-
07KF002	Lake Claire Near Outlet to Prairie River	58.63	-111.69	Peace/Slave River	Boreal	-
07KF003	Mamawi Lake Channel at Old Dog Camp	58.63	-111.33	Peace/Slave River	Boreal	-
07KF004	Chenal Des Quatre Fourches Above Peace River	58.87	-111.6	Peace/Slave River	Boreal	-
07KF005	Baril Lake at Centre Of Lake	58.78	-111.68	Peace/Slave River	Boreal	-
07KF006	Chenal Des Quatre Fourches Below Four Forks	58.65	-111.29	Peace/Slave River	Boreal	-
07KF007	Chenal Des Quatre Fourches At Ranger’s Cabin	58.79	-111.47	Peace/Slave River	Canadian Shield	-
07KF008	Chenal Des Quatre Fourches At High Rock Tower	58.81	-111.55	Peace/Slave River	Boreal	-
07KF010	Mamawi Lake Channel at Dog Camp	58.64	-111.31	Peace/Slave River	Boreal	-
07KF013	Prairie River at Fish Study Camp	58.62	-111.63	Peace/Slave River	Boreal	-
07KF014	Prairie River Near Lake Claire	58.62	-111.68	Peace/Slave River	Boreal	-
07KF015	Embarras River Breakthrough to Mamawi Lake	58.48	-111.44	Athabasca River	Boreal	-
07MD001	Lake Athabasca At Fort Chipewyan	58.71	-111.14	Peace/Slave River	Boreal	-
07MD002	Lake Athabasca At Bustard Island	58.78	-110.77	Peace/Slave River	Boreal	-
07NA001	Riviere Des Rochers Above Slave River	58.99	-111.4	Peace/Slave River	Canadian Shield	-
07NA002	Riviere Des Rochers At Ben Houle’s Cabin	58.81	-111.27	Peace/Slave River	Canadian Shield	-
07NA003	Riviere Des Rochers Above Revillon Coupe	58.84	-111.26	Peace/Slave River	Canadian Shield	-
07NA004	Revillon Coupe Below Riviere Des Rochers	58.85	-111.26	Peace/Slave River	Canadian Shield	-
07NA005	Revillon Coupe at Ranger’s Cabin	58.89	-111.4	Peace/Slave River	Canadian Shield	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
07NA007	Riviere Des Rochers East of Little Rapids	58.91	-111.17	Peace/Slave River	Canadian Shield	-
07NA008	Riviere Des Rochers West of Little Rapids	58.92	-111.2	Peace/Slave River	Canadian Shield	-
07NB001	Slave River at Fitzgerald (Alberta)	59.87	-111.58	Peace/Slave River	Canadian Shield	-
07NB004	Slave River Above Mountain Rapids	59.96	-111.75	Peace/Slave River	Boreal	-
07NB005	Slave River Below Mountain Rapids	59.96	-111.75	Peace/Slave River	Boreal	-
07NB006	Bench Mark Creek Near Fort Smith	59.81	-111.96	Peace/Slave River	Boreal	-
07NB007	Salt River Below Peace Point Highway	59.83	-111.96	Peace/Slave River	Boreal	-
07NB008	Dog River Near Fitzgerald	59.87	-111.52	Peace/Slave River	Canadian Shield	-
07OA001	Sousa Creek Near High Level	58.59	-118.49	Hay River	Boreal	-
07OB003	Hay River Near Meander River	59.14	-117.63	Hay River	Boreal	x
07OB004	Steen River Near Steen River	59.58	-117.19	Hay River	Boreal	-
07OB005	Meander River at Outlet Hutch Lake	58.77	-117.38	Hay River	Boreal	-
07OB006	Lutose Creek Near Steen River	59.4	-117.28	Hay River	Boreal	-
07OB007	Hutch Lake Tributary Near High Level	58.71	-117.24	Hay River	Boreal	-
07OC001	Chinchaga River Near High Level	58.59	-118.33	Hay River	Boreal	-
11AA001	North Milk River Near International Boundary	49.02	-112.97	Milk River	Grassland	-
11AA002	North Milk River at Knight’s Ranch	49.13	-112.66	Milk River	Grassland	-
11AA003	North Branch of Milk River Near Mackie’s Ranch	49.13	-112.4	Milk River	Grassland	-
11AA004	Milk River at Mackie’s Ranch	49.08	-112.4	Milk River	Grassland	-
11AA005	Milk River at Milk River	49.14	-112.08	Milk River	Grassland	-
11AA006	Milk River at Writing-On-Stone Police Detachment	49.08	-111.65	Milk River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
11AA007	Milk River at Pendant D'Oreille Police Detachment	49.13	-111.03	Milk River	Grassland	-
11AA009	Sage Creek at Bjordals Near Wild Horse	49.01	-110.2	Milk River	Grassland	-
11AA010	Deer Creek at Dickinson’s Ranch	49.03	-111.54	Milk River	Grassland	-
11AA011	Deer Creek at Deer Creek Cattle Co.’s Ranch	49.08	-111.5	Milk River	Grassland	-
11AA012	Deer Creek Cattle Co. West Ditch	49.08	-111.5	Milk River	Grassland	-
11AA013	Deer Creek Cattle Co. East Ditch	49.08	-111.5	Milk River	Grassland	-
11AA022	Deer Creek Cattle Co. Ditch	49.08	-111.5	Milk River	Grassland	-
11AA023	Lindsay Coulee Near Onefour Post Office	49.06	-110.42	Milk River	Grassland	-
11AA024	Maynard Coulee Near Onefour Post Office	49.06	-110.44	Milk River	Grassland	-
11AA025	Milk River at Western Crossing of International Boundary	49	-112.54	Milk River	Grassland	-
11AA026	Sage Creek at Q Ranch Near Wildhorse	49.1	-110.22	Milk River	Grassland	X
11AA027	Sage Creek Near International Boundary	49	-110.19	Milk River	Grassland	-
11AA028	Bear Creek Near International Boundary	49.02	-111.21	Milk River	Grassland	-
11AA029	Miners Coulee Near International Boundary	49.01	-111.4	Milk River	Grassland	-
11AA034	Milk River Near Writing-On-Stone Park	49.08	-111.53	Milk River	Grassland	-
11AA035	Milk River Near Pendant D'Oreille	49.12	-110.87	Milk River	Grassland	-
11AA036	Milk River at Highway No. 880	49.14	-111.3	Milk River	Grassland	-
11AA037	Red Creek at Highway No. 4	49.04	-111.99	Milk River	Grassland	-
11AA038	Verdigris Coulee Near the Mouth	49.11	-111.75	Milk River	Grassland	-

Station Number	Station Name	Latitude	Longitude	Watershed	Natural Region	RHBN
11AA039	Verdigris Lake Tributary Near Milk River	49.22	-112.09	Milk River	Grassland	-
11AA040	Breed Creek Near International Boundary	49.02	-111.28	Milk River	Grassland	-
11AB007	Lodge Creek at Hartt's Ranch	49.45	-110.33	Milk River	Grassland	-
11AB009	Middle Creek Near the Saskatchewan Boundary	49.42	-110.05	Milk River	Grassland	-
11AB021	English Ditch Near Thelma	49.54	-110.29	Milk River	Grassland	-
11AB023	Lodge Creek at Hester’s Ranch	49.24	-110.01	Milk River	Grassland	-
11AB063	Thelma Creek at English’s Ranch	49.53	-110.28	Milk River	Grassland	-
11AB086	Walburger Coulee Below Diversions	49.29	-110.02	Milk River	Grassland	-
11AB090	Reesor Reservoir Near Elkwater	49.66	-110.09	Milk River	Rocky Mountain	-
11AB091	Michel Reservoir Near Elkwater	49.52	-110.36	Milk River	Grassland	-
11AB092	Greasewood Reservoir Near Elkwater	49.48	-110.4	Milk River	Grassland	-
11AB093	Yeast Reservoir Near Elkwater	49.43	-110.29	Milk River	Grassland	-
11AB094	Bare Creek Reservoir Near Elkwater	49.43	-110.39	Milk River	Grassland	-
11AB097	Cressday Reservoir Near Cressday	49.23	-110.26	Milk River	Grassland	-
11AB098	Jaydot Reservoir Near Jaydot	49.17	-110.01	Milk River	Grassland	-
11AB099	Mitchell Reservoir Near Elkwater	49.47	-110.09	Milk River	Grassland	-
11AB104	Massy Reservoir Near Elkwater	49.46	-110.37	Milk River	Grassland	-
11AB111	Graburn Creek Near the Mouth	49.64	-110.02	Milk River	Rocky Mountain	-
11AB902	Lodge Creek at Highway No. 41	49.41	-110.25	Milk River	Grassland	-

Appendix B – Mann-Kendal Test Results using the Yue Procedure

As discussed in Section 1.2.4, the Yue Procedure was performed on the IHA parameters and climate data to complete the Mann-Kendall Test, while accounting for potential concerns with serial correlation. Tables B1 to B6 summarize the results for each station for each variable for the 50-year period.

Table B1: Mann-Kendall Test results for monthly magnitude variables (Group 1). A "+" indicates a positive significant trend, "-" indicates a negative significant trend, "NS" indicates the trend was not significant, and "NA" indicates the Mann-Kendall Test could not be performed for that station.

Station Number	October	April	May	June	July	August	September
05AA004	NS	NS	NS	NS	NS	NS	NS
05AA008	+	+	NS	NS	NS	NS	NS
05AA022	NS	+	-	NS	NS	NS	NS
05AA024	+	NS	-	NA	NA	NA	NA
05AA027	NS	NS	NS	NS	-	NS	NS
05AA028	NS	NS	NS	NS	-	-	-
05AB013	+	NS	NS	+	+	+	+
05AB021	+	NS	NS	NS	+	+	+
05AB029	+	NS	NS	+	+	+	+
05AC003	+	NS	+	+	+	+	+
05AC012	+	+	+	+	+	+	+
05AC017	NS	NA	+	NS	+	+	+
05AC023	+	NA	+	+	+	+	+
05AD003	NS	+	-	NS	NS	-	-
05AD005	+	+	NS	NS	NS	NS	NS
05AD007	+	NS	-	NS	NS	+	+
05AD010	NS	NS	-	NS	NS	NS	NS
05AD013	NS	NS	NS	NS	+	NS	-
05AD017	-	-	-	NS	NS	-	-
05AD021	NS	NS	+	+	+	+	+
05AD027	NS	NS	+	+	+	+	+
05AD028	NS	NS	-	-	NS	NS	+
05AD035	+	+	+	+	+	NS	NS
05AD037	-	NA	NS	-	-	-	-

Station Number	October	April	May	June	July	August	September
05AE002	NS	NS	NS	NS	NS	NS	NS
05AE005	NS	NS	NS	+	NS	NS	NS
05AE006	+	+	NS	+	+	+	+
05AE016	NS	NA	NS	+	+	+	NS
05AE021	NS	NS	+	NS	NS	NS	+
05AE026	-	NS	+	NS	NS	NS	+
05AE027	NS	+	-	NS	NS	-	-
05AG003	-	NA	NS	-	-	-	-
05AH002	NS	NS	NS	NS	NS	NS	NS
05AH005	-	NA	+	-	-	-	+
05AH037	NS	NS	NS	NS	NS	NS	NS
05AH041	NS	NA	NA	NA	NA	NA	NA
05AJ001	+	NS	-	NS	NS	NS	+
05BA001	+	NA	NS	NA	NA	NA	+
05BB001	+	+	NS	NS	-	-	NS
05BC001	+	+	NS	NS	NS	-	NS
05BD004	NS	NS	NS	NS	NS	-	NS
05BF016	NS	NA	NA	NS	NS	-	NS
05BG006	+	NS	NS	+	+	NS	+
05BH004	NS	+	NS	NS	NS	-	-
05BJ001	+	+	+	+	+	+	+
05BJ004	+	NS	NS	+	+	NS	+
05BK001	+	NS	NS	+	+	+	+
05BL007	+	NS	NS	+	+	+	+
05BL013	+	-	NS	+	+	NS	+
05BL014	+	NS	NS	+	NA	NS	+
05BL015	+	+	+	+	+	NS	+
05BL019	NS	NS	-	NS	NS	NS	NS
05BL022	NS	NS	NS	NS	NS	NS	NS
05BL023	NS	NS	-	+	+	NS	NS
05BL024	+	NS	-	NS	NS	NS	NS
05BM002	+	NS	NS	NS	NS	NS	+
05BM004	+	NA	-	NS	NS	+	+
05BM007	NA	NA	NA	NA	NA	NA	NA
05BM008	NS	NS	+	+	+	+	+
05BM014	+	NS	+	+	+	+	+

Station Number	October	April	May	June	July	August	September
05BN002	-	NA	+	NS	-	-	+
05BN006	-	NS	+	-	-	-	-
05BN008	-	NA	-	-	-	-	-
05BN012	+	-	NS	+	NS	NS	+
05CA002	NS	-	NS	+	NS	+	NS
05CA004	+	NA	NS	NS	NS	NS	+
05CB001	+	-	NS	+	NS	+	+
05CB002	+	-	NS	+	+	+	+
05CB004	NS	NS	NS	NS	NS	NS	NS
05CC001	NS	NS	NS	NS	NS	NS	NS
05CC002	+	NS	NS	NS	NS	-	NS
05CC007	NS	NS	NS	NS	NS	NS	NS
05CC008	NS	NA	NA	NA	NA	NA	NA
05CC009	-	NA	NA	NA	NA	NA	NA
05CE001	NS	NS	NS	NS	NS	NS	NS
05CE002	+	NS	NS	+	NA	NA	NA
05CE005	-	NS	+	+	+	+	NS
05CE006	+	NS	+	+	+	+	+
05CE007	+	NS	+	NS	+	+	+
05CE018	NA	NA	NA	NA	NA	NA	NA
05CH007	+	+	+	+	+	+	+
05CH008	NS	NA	NA	NA	NA	NA	NA
05CJ006	-	NS	NS	-	-	-	-
05CK001	NA	-	-	NA	NA	NS	NS
05CK004	NS	NS	NS	NS	NS	-	NS
05CK005	NS	-	-	NS	NS	NA	NA
05DA007	+	+	NS	NS	NS	-	NS
05DA009	+	NS	NS	NS	NS	NS	+
05DA010	NS	NS	NS	NS	NS	-	NS
05DB002	NS	NS	NS	NS	NS	NS	NS
05DB005	NA	NA	NA	NA	NA	NA	NA
05DC001	+	NA	NS	NS	NS	+	NS
05DC006	NS	NS	NS	NS	NS	NS	NS
05DD004	NA	NA	NA	NA	NA	NA	NA
05DD005	NS	+	NS	NS	NS	-	NS
05DD007	NA	NA	NA	NA	NA	NA	NA

Station Number	October	April	May	June	July	August	September
05DD009	NA	NA	NA	NA	NA	NA	NA
05DE007	NA	NA	NA	NA	NA	NA	NA
05DF001	NS	+	NS	NS	NS	NS	NS
05DF004	NA	NA	NA	NA	NA	NA	NA
05DF006	NS	-	NS	NS	-	NA	NS
05EA001	-	-	-	-	NA	NA	-
05EA005	-	-	-	-	-	-	-
05EC002	NS	-	-	-	-	-	-
05FA001	NS	NA	NA	NA	NA	NA	NA
05FB002	NS	NA	NA	NA	NA	NA	NA
05FC001	-	NA	NA	NA	NA	NA	NA
05FC002	NS	NA	NA	NA	NA	NA	NA
05FD001	-	NA	NA	NA	NA	NA	NA
05GA003	NS	NA	NA	NA	NA	NA	NA
05GA008	NA	NA	NA	NA	NA	NA	NA
06AA001	-	-	-	-	-	-	-
06AA002	-	-	-	NS	-	-	-
06AB001	-	-	NS	NS	NS	NS	NS
06AB002	-	NS	NS	NS	NA	NS	NS
06AC001	NA	NA	NA	NA	NA	NA	NA
06AD006	NS	-	NS	NS	NS	NS	NS
07AA001	NA	NA	NA	NA	NA	NA	NA
07AA002	NS	+	NS	NS	NS	NS	NS
07AC001	NS	NA	NS	NS	NS	NS	NS
07AD002	NS	+	NS	NS	NS	-	NS
07AE001	NS	NS	NS	NS	-	-	-
07AF002	-	NS	NS	NS	NS	NS	NS
07AF003	-	+	NS	NS	-	NS	-
07AF010	NA	NA	NA	NA	NA	NA	NA
07AG003	NA	NA	NA	NA	NA	NA	NA
07AG004	-	NS	NS	NS	NS	NS	NS
07AH001	-	NS	NS	NS	-	-	-
07AH002	NA	NA	NA	NA	NA	NA	NA
07AH003	NA	NA	NA	NA	NA	NA	NA
07BA002	NA	NA	NA	NA	NA	NA	NA
07BB002	-	NS	NS	NS	NS	NS	NS

Station Number	October	April	May	June	July	August	September
07BB004	NA	NA	NA	NA	NA	NA	NA
07BB005	NA	-	-	-	-	-	-
07BB006	NA	NA	NA	NA	NA	NA	NA
07BC002	-	NS	-	NS	-	-	-
07BC006	NA	NA	NA	NA	NA	NA	NA
07BE001	-	-	NS	NS	-	-	-
07BF001	-	NS	NS	-	-	NS	-
07BF002	-	NA	NA	NA	NA	NA	NA
07BJ001	-	NS	NS	NS	-	-	-
07BJ003	-	NA	NA	NS	-	-	-
07BK005	-	NA	NA	NA	NA	NA	NA
07BK007	-	NS	NS	NS	-	-	-
07CA005	NA	NA	NA	NA	NA	NA	NA
07CA006	-	NS	NS	NA	-	-	-
07CD001	NS	NS	NS	NS	NS	NS	NS
07CD004	-	-	NS	NS	NS	-	NS
07CD005	-	NA	NS	NS	NS	-	NS
07DA001	-	-	NS	NS	-	-	-
07DA006	NS	NA	NS	NS	+	NS	NA
07DA008	NA	NA	NA	NA	NA	NA	NA
07DB001	NS	NS	NS	NS	NS	NS	NS
07DC001	NS	NS	NS	NS	NS	NS	NS
07DD002	NS	NS	NS	NS	NS	NS	+
07FD006	-	NA	NA	NA	NA	NA	NA
07FD009	NA	NA	NA	NA	NA	NA	NA
07GA001	NS	NS	NS	NS	NS	-	+
07GB001	-	NA	NS	NS	NS	-	-
07GD001	NS	NS	-	-	-	NS	NS
07GE001	-	NA	NA	NA	NA	NA	NA
07GE002	NS	NS	NS	NS	NS	NS	NS
07GE003	NS	NS	NS	NS	NS	NS	NS
07GF001	-	NS	NS	-	NS	-	-
07GG001	-	NA	NA	NA	NA	NA	NA
07GG002	NS	NA	NA	NA	NA	NA	NA
07GG003	-	NS	NS	NS	-	-	-
07GH002	-	NA	NA	NA	NA	NA	NA

Station Number	October	April	May	June	July	August	September
07GJ001	-	NS	NS	NS	-	-	-
07HA001	-	NS	NS	-	-	NS	NS
07HA003	-	NA	NA	NA	NA	NA	NA
07HA005	-	-	NS	-	-	-	-
07HC001	-	NS	NS	NS	NS	-	-
07HF002	NA	NA	NA	NA	NA	NA	NA
07JD002	-	NS	-	-	-	-	-
07JD003	NA	NA	NA	NA	NA	NA	NA
07JF002	-	+	NS	NS	NS	NS	NS
07JF003	+	+	NS	-	NS	NS	NS
07KC001	-	+	NS	-	-	-	-
07KE001	-	NS	NS	NS	NS	NS	NS
07NB001	-	+	NS	-	-	-	-
07OA001	NS	+	NS	NS	NS	NS	NS
07OB003	NA	NA	NA	NA	NA	NA	NA
07OC001	NS	NS	NS	NS	NS	NS	NS
11AA001	NS	+	NS	-	-	-	-
11AA005	NS	+	NS	NS	-	-	-
11AA025	NS	NS	NS	NS	NS	NS	-
11AA026	NS	NA	NA	NA	NA	NA	NA
11AA028	NS	+	NS	NS	NS	NS	NS
11AA029	NS	NS	NS	NS	NS	NS	NS
11AB009	NS	NS	NS	NS	-	NS	NS

Table B2: Mann-Kendall Test results for annual extreme condition variables (Group 2). A "+" indicates a positive significant trend, "-" indicates a negative significant trend, "NS" indicates the trend was not significant, and "NA" indicates the Mann-Kendall Test could not be performed for that station.

Station Number	1-Day Minimum	3-Day Minimum	7-Day Minimum	30-Day Minimum	90-Day Minimum	1-Day Maximum	3-Day Maximum	7-Day Maximum	30-Day Maximum	90-Day Maximum
05AA004	+	+	+	+	NS	NS	NS	NS	NS	NS
05AA008	NS	NS	NS	NS	+	NS	NS	NS	NS	NS
05AA022	+	+	+	+	+	NS	-	-	-	NS
05AA024	+	+	+	+	+	NS	NS	NS	-	-
05AA027	NS	NS	NS	+	+	NS	NS	-	-	NS
05AA028	+	+	+	NS	NS	NS	NS	NS	NS	NS
05AB013	+	+	+	+	NS	NS	NS	NS	NS	NS
05AB021	+	+	+	+	+	NS	NS	NS	NS	NS
05AB029	NS	+	+	+	+	NS	NS	NS	NS	NS
05AC003	+	+	+	+	+	-	NS	NS	NS	+
05AC012	+	+	+	+	+	+	+	+	+	+
05AC017	NA	NS	NS	NS	NS	+	+	+	+	NS
05AC023	+	+	+	+	+	+	+	+	+	+
05AD003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05AD005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05AD007	+	+	+	+	+	NS	NS	NS	NS	NS
05AD010	-	-	NS	NS	NS	NS	NS	NS	NS	NS
05AD013	NA	NS	-	NS	-	+	+	+	+	NS
05AD017	NS	NS	-	-	-	-	-	-	-	-
05AD021	NA	NS	NS	+	+	+	+	+	+	+
05AD027	NA	NS	+	NS	+	+	+	+	+	+
05AD028	+	+	+	+	+	-	-	-	-	-
05AD035	NS	+	+	+	+	NS	NS	NS	NS	NS
05AD037	NS	NS	NS	NS	NS	NS	NS	NS	-	-
05AE002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05AE005	NS	+	+	+	NS	NS	NS	NS	NS	NS
05AE006	+	+	+	+	+	NS	NS	NS	NS	NS
05AE016	NS	+	+	+	+	-	-	-	-	NS
05AE021	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
05AE026	NA	NS	-	-	-	+	+	+	NS	NS
05AE027	NS	NS	NS	NS	+	NS	NS	NS	NS	NS

Station Number	1-Day Minimum	3-Day Minimum	7-Day Minimum	30-Day Minimum	90-Day Minimum	1-Day Maximum	3-Day Maximum	7-Day Maximum	30-Day Maximum	90-Day Maximum
05AG003	+	+	+	+	NS	-	-	-	-	-
05AH002	NA	NS	NS	NS	NS	-	-	-	-	NS
05AH005	-	-	-	-	-	NS	NS	NS	-	NS
05AH037	NA	+	NS	NS	NS	NS	NS	NS	NS	NS
05AH041	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
05AJ001	+	+	+	+	+	NS	NS	NS	NS	NS
05BA001	+	+	+	+	+	NS	NS	NS	NS	NS
05BB001	+	+	+	+	+	-	-	-	-	-
05BC001	+	+	+	+	+	NS	NS	NS	NS	-
05BD004	+	+	+	NS	NS	-	-	-	-	-
05BF016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
05BG006	NS	+	+	+	+	NS	NS	NS	NS	NS
05BH004	+	+	+	+	+	NS	NS	NS	NS	NS
05BJ001	+	+	+	+	+	+	NS	NS	NS	NS
05BJ004	+	+	+	+	+	NS	NS	NS	NS	NS
05BK001	+	+	+	+	+	NS	NS	NS	NS	NS
05BL007	+	+	+	+	+	NS	NS	NS	NS	NS
05BL013	+	+	+	+	NS	NS	NS	NS	NS	NS
05BL014	NS	NS	NS	NS	+	NS	NS	NS	NS	NS
05BL015	+	+	+	+	+	+	+	+	+	+
05BL019	NS	NS	+	+	+	NS	NS	-	-	-
05BL022	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05BL023	+	+	+	+	NS	NS	NS	NS	NS	NS
05BL024	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05BM002	+	+	+	+	+	NS	NS	NS	NS	NS
05BM004	+	+	+	+	NS	NS	NS	NS	NS	NS
05BM007	NS	NS	NS	NS	NS	NS	NS	NS	+	+
05BM008	NS	NS	NS	+	+	NS	+	+	+	+
05BM014	NS	+	+	+	+	NS	NS	NS	NS	NS
05BN002	+	NS	NS	+	NS	-	-	-	-	-
05BN006	NS	NS	NS	NS	NS	-	-	-	-	-
05BN008	NS	NS	-	-	-	-	-	-	-	-
05BN012	+	+	+	NS	NS	NS	NS	NS	NS	NS
05CA002	+	+	+	+	+	NS	NS	NS	NS	NS
05CA004	+	+	+	+	+	-	-	-	NS	NS
05CB001	+	+	+	+	+	+	+	+	+	+

Station Number	1-Day Minimum	3-Day Minimum	7-Day Minimum	30-Day Minimum	90-Day Minimum	1-Day Maximum	3-Day Maximum	7-Day Maximum	30-Day Maximum	90-Day Maximum
05CB002	+	+	+	+	+	NS	NS	NS	NS	NS
05CB004	-	-	-	NS	NS	NS	NS	NS	+	+
05CC001	+	+	+	+	+	-	-	-	-	-
05CC002	+	+	+	+	+	NS	NS	NS	NS	NS
05CC007	+	+	+	+	+	NS	NS	NS	NS	NS
05CC008	NS	NS	NS	+	-	NS	NS	NS	-	-
05CC009	+	+	+	+	-	NS	NS	NS	NS	-
05CE001	+	+	+	+	+	NS	NS	NS	NS	NS
05CE002	NS	+	+	+	+	NS	NS	NS	NS	NS
05CE005	NS	NS	NS	+	+	NS	NS	NS	NS	NS
05CE006	NS	+	+	+	+	NS	NS	NS	NS	NS
05CE007	NS	+	+	+	NS	NS	NS	NS	NS	NS
05CE018	NS	+	+	+	+	NS	NS	NS	NS	+
05CH007	+	+	+	+	+	+	+	+	+	+
05CH008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05CJ006	NS	NS	+	NS	NS	-	-	-	-	-
05CK001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05CK004	+	+	+	+	+	NS	NS	NS	NS	NS
05CK005	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
05DA007	NS	+	+	+	+	NS	-	-	-	NS
05DA009	NS	NS	+	+	+	-	-	-	-	NS
05DA010	NS	NS	NS	NS	NS	-	-	-	-	-
05DB002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05DB005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05DC001	+	+	+	+	NS	NS	NS	NS	NS	NS
05DC006	+	+	+	+	NS	NS	NS	NS	NS	NS
05DD004	NS	NS	NS	NS	NS	+	NS	NS	NS	NS
05DD005	+	+	+	+	+	-	NS	NS	NS	NS
05DD007	+	NS	NS	NS	NS	NS	NS	NS	NS	NS
05DD009	NS	NS	NS	NS	+	NS	NS	NS	NS	NS
05DE007	-	-	-	NS	-	NS	NS	NS	NS	NS
05DF001	+	+	+	+	+	NS	NS	NS	NS	NS
05DF004	NS	NS	NS	NS	-	-	-	-	-	-
05DF006	NS	+	+	NS	-	-	-	-	-	-
05EA001	-	NS	NS	-	-	-	-	-	-	-
05EA005	-	-	-	-	-	-	-	-	-	-

Station Number	1-Day Minimum	3-Day Minimum	7-Day Minimum	30-Day Minimum	90-Day Minimum	1-Day Maximum	3-Day Maximum	7-Day Maximum	30-Day Maximum	90-Day Maximum
05EC002	NS	NS	NS	-	-	-	-	-	-	-
05FA001	-	NS	NS	NS	NS	NS	NS	-	NS	-
05FB002	NS	NS	NS	NS	NS	-	-	-	-	-
05FC001	NS	NS	NS	NS	-	NS	-	-	-	-
05FC002	NA	NS	NS	NS	-	-	-	-	-	-
05FD001	NS	NS	NS	-	-	-	-	-	-	-
05GA003	NS	+	+	+	NS	NS	NS	NS	-	NS
05GA008	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
06AA001	-	-	-	-	-	-	-	-	-	-
06AA002	-	-	-	-	-	-	-	-	-	-
06AB001	NS	NS	NS	NS	NS	-	-	-	-	-
06AB002	NS	NS	NS	NS	+	NS	NS	NS	NS	NS
06AC001	NS	NS	NS	NS	+	-	NS	NS	NS	NS
06AD006	-	-	-	NS	NS	-	-	-	-	-
07AA001	+	+	+	+	+	-	-	-	NS	NS
07AA002	+	+	+	+	+	-	-	-	-	-
07AC001	+	+	+	+	NS	NS	NS	NS	NS	-
07AD002	+	+	+	+	+	-	-	-	-	NS
07AE001	NS	NS	NS	NS	+	-	-	-	-	-
07AF002	+	+	+	+	+	NS	NS	NS	-	-
07AF003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
07AF010	NS	NS	NS	NS	-	-	-	-	-	-
07AG003	NS	NS	NS	NS	NS	-	-	-	-	-
07AG004	+	+	+	+	NS	-	-	-	-	-
07AH001	NS	NS	NS	+	NS	-	NS	NS	NS	NS
07AH002	NS	NS	NS	-	-	NS	NS	NS	NS	NS
07AH003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
07BA002	NS	NS	NS	NS	NS	NS	NS	-	-	-
07BB002	+	NS	+	+	NS	-	-	-	-	-
07BB004	+	+	+	NS	-	-	-	-	-	-
07BB005	-	-	-	-	-	-	-	-	-	-
07BB006	-	-	-	-	-	-	-	-	-	-
07BC002	NS	NS	NS	NS	NS	-	-	-	-	-
07BC006	NS	-	-	-	-	-	-	-	-	-
07BE001	-	-	-	NS	NS	-	-	-	-	-
07BF001	NS	NS	NS	NS	NS	-	-	-	-	-

Station Number	1-Day Minimum	3-Day Minimum	7-Day Minimum	30-Day Minimum	90-Day Minimum	1-Day Maximum	3-Day Maximum	7-Day Maximum	30-Day Maximum	90-Day Maximum
07BF002	NS	NS	NS	NS	NS	-	-	-	-	-
07BJ001	NS	NS	NS	NS	NS	-	-	-	-	-
07BJ003	+	NS	+	+	NS	-	-	NS	NS	NS
07BK005	NS	NS	NS	NS	-	-	-	NS	-	-
07BK007	+	+	+	+	NS	-	-	-	-	-
07CA005	-	-	-	-	-	-	-	-	-	-
07CA006	NS	NS	NS	NS	+	-	-	-	-	-
07CD001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
07CD004	NS	NS	NS	NS	+	-	-	-	-	-
07CD005	NS	-	-	-	NS	-	-	-	-	-
07DA001	-	-	-	-	-	-	-	-	-	-
07DA006	NS	NS	NS	NS	+	NS	NS	NS	NS	NS
07DA008	NS	NS	NS	NS	+	-	-	NS	-	-
07DB001	+	+	+	+	+	-	-	-	-	-
07DC001	+	+	+	+	+	NS	NS	NS	NS	NS
07DD002	+	+	+	+	+	NS	NS	NS	NS	NS
07FD006	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
07FD009	NS	NS	NS	NS	-	NS	NS	NS	-	-
07GA001	NS	NS	+	+	+	-	NS	NS	NS	-
07GB001	-	-	-	-	-	-	-	-	-	-
07GD001	NS	+	NS	NS	NS	NS	NS	NS	-	-
07GE001	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
07GE002	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
07GE003	NA	NS	NS	NS	-	NS	NS	NS	-	-
07GF001	+	+	+	+	+	-	-	-	-	-
07GG001	NS	NS	NS	NS	NS	-	-	NS	-	-
07GG002	+	+	+	+	NS	-	-	NS	-	-
07GG003	NS	NS	NS	NS	-	-	-	-	NS	-
07GH002	NS	NS	NS	NS	NS	-	-	-	-	-
07GJ001	NS	NS	NS	NS	NS	-	-	-	-	-
07HA001	NS	+	+	+	+	-	-	-	-	-
07HA003	NS	NS	NS	NS	-	-	-	-	-	-
07HA005	-	-	-	NS	+	-	-	-	-	-
07HC001	NS	NS	NS	NS	NS	-	-	-	-	-
07HF002	+	+	+	+	+	-	-	-	-	-
07JD002	-	-	-	-	-	-	-	-	-	-

Station Number	1-Day Minimum	3-Day Minimum	7-Day Minimum	30-Day Minimum	90-Day Minimum	1-Day Maximum	3-Day Maximum	7-Day Maximum	30-Day Maximum	90-Day Maximum
07JD003	NS	NS	NS	NS	-	-	-	-	-	-
07JF002	NS	NS	NS	NS	NS	-	-	-	-	-
07JF003	+	+	+	+	+	-	-	-	-	-
07KC001	NS	NS	NS	NS	NS	-	-	-	-	-
07KE001	+	+	+	+	+	-	-	-	-	-
07NB001	NS	NS	NS	+	+	-	-	-	-	-
07OA001	NS	+	+	+	NS	-	-	-	-	NS
07OB003	+	+	+	+	NS	-	-	-	-	NS
07OC001	+	+	+	+	+	-	-	-	-	-
11AA001	NS	NS	NS	NS	NS	-	-	-	-	-
11AA005	NS	NS	NS	NS	+	NS	NS	-	NS	NS
11AA025	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
11AA026	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
11AA028	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
11AA029	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
11AB009	NS	NS	NS	NS	-	NS	NS	NS	NS	NS

Table B3: Mann-Kendall Test results for the remaining annual extreme condition variables (Group 2), timing, frequency, and rate of change variables (Groups 3, 4, and 5). A "+" indicates a positive significant trend, "-" indicates a negative significant trend, "NS" indicates the trend was not significant, and "NA" indicates the Mann-Kendall Test could not be performed for that station. Note that the analysis considered fall rate as a negative value; in other words, an increase in the fall rate indicates a decrease in the absolute value of the fall rate.

Station Number	Base Index	Zero Flow Days	Date of Minimum Flow	Date of Maximum Flow	High Pulse Number	Rise Rate	Fall Rate	Reversals
05AA004	+	NA	NS	+	NS	NS	NS	-
05AA008	+	NA	NS	+	NS	NS	NS	NS
05AA022	+	NA	NS	+	NS	NS	-	NS
05AA024	+	NA	NS	+	NS	-	+	+
05AA027	NS	NA	+	NS	NS	+	NS	-
05AA028	+	NA	NS	+	NS	NS	NS	-
05AB013	+	NS	NS	+	NS	NS	NS	NS
05AB021	+	NS	NS	+	+	NS	NS	-
05AB029	+	-	-	+	NS	NS	NS	NS
05AC003	+	NS	+	+	+	NS	-	+
05AC012	NS	NS	+	NS	NA	NS	NS	-
05AC017	+	+	-	+	+	+	-	+
05AC023	+	NA	NS	NS	+	+	-	NS
05AD003	NS	NA	NS	+	NS	NS	+	-
05AD005	NS	NA	NS	+	NS	NS	NS	NS
05AD007	+	NA	NS	+	NS	-	NS	NS
05AD010	NS	NA	+	+	NS	NS	NS	NS
05AD013	-	+	-	NS	NS	+	NS	-
05AD017	-	+	-	NS	NS	+	NS	-
05AD021	NS	-	-	NS	NS	NS	-	NS
05AD027	+	-	-	-	NS	+	NS	+
05AD028	+	NA	-	+	NS	-	NS	+
05AD035	NA	-	NS	+	NA	NA	NA	+
05AD037	+	-	+	NS	-	NS	+	-
05AE002	NS	NA	NS	+	NS	NS	NS	+
05AE005	+	NS	NS	+	-	NS	NS	-
05AE006	+	NA	NS	NS	-	NS	NS	+

Station Number	Base Index	Zero Flow Days	Date of Minimum Flow	Date of Maximum Flow	High Pulse Number	Rise Rate	Fall Rate	Reversals
05AE016	+	NA	NS	NS	NS	+	NS	NS
05AE021	NS	-	-	NS	NS	-	+	NS
05AE026	NS	+	-	NS	NS	+	NS	-
05AE027	NS	NA	+	NS	NS	NS	NS	NS
05AG003	+	NS	NS	NS	-	+	-	+
05AH002	NA	-	NS	NS	NA	NA	NA	+
05AH005	-	NS	-	NS	+	-	+	+
05AH037	NS	NS	NS	+	NA	-	NS	NS
05AH041	NA	-	NS	+	NA	NA	NA	+
05AJ001	+	NA	NS	NS	NS	-	+	-
05BA001	+	NA	+	NS	NS	+	-	-
05BB001	+	NA	+	NS	NS	NS	+	NS
05BC001	+	NA	NS	NS	NS	NS	NS	+
05BD004	+	NS	NS	NS	-	-	+	+
05BF016	NA	NA	+	+	NS	NS	NS	-
05BG006	NS	NA	+	NS	-	NS	NS	+
05BH004	+	NA	NS	NS	-	-	+	+
05BJ001	+	NA	NS	+	+	+	NS	+
05BJ004	+	NA	NS	+	-	NS	NS	+
05BK001	+	NS	NS	+	+	NS	-	+
05BL007	+	NS	NS	NS	+	NS	NS	NS
05BL013	+	NS	NS	+	NS	NS	NS	-
05BL014	NS	NA	NS	+	NS	+	NS	-
05BL015	+	NS	-	NS	NS	NS	NS	+
05BL019	+	NA	+	NS	NS	NS	+	-
05BL022	NS	NS	+	NS	NS	NS	NS	-
05BL023	+	NS	NS	NS	+	NS	NS	-
05BL024	NS	NA	+	NS	-	NS	NS	NS
05BM002	+	NA	-	+	NS	-	+	-
05BM004	+	NA	NS	NS	-	-	+	-
05BM007	NA	-	NS	NS	NA	NA	NA	NS
05BM008	NS	NS	NS	+	+	+	-	-
05BM014	+	-	NS	+	NS	NS	NS	+
05BN002	+	NS	NS	-	NS	NS	NS	NS
05BN006	NS	NS	-	-	NS	NS	+	+

Station Number	Base Index	Zero Flow Days	Date of Minimum Flow	Date of Maximum Flow	High Pulse Number	Rise Rate	Fall Rate	Reversals
05BN008	NS	+	NS	NS	-	-	+	-
05BN012	+	NA	NS	NS	-	-	+	+
05CA002	NS	NA	NS	NS	NS	-	NS	-
05CA004	NS	NA	NS	NS	-	-	NS	-
05CB001	+	NS	-	NS	NS	-	NS	+
05CB002	NS	NA	NS	+	NS	NS	-	NS
05CB004	-	NA	NS	NS	-	-	+	+
05CC001	+	NA	NS	+	NS	-	NS	+
05CC002	+	NA	NS	NS	NS	NS	NS	+
05CC007	+	NA	NS	+	NS	-	+	+
05CC008	+	NS	NS	+	NA	-	+	+
05CC009	+	NS	NS	+	NA	-	+	NS
05CE001	+	NA	NS	NS	-	NS	+	+
05CE002	+	-	NS	+	NS	NS	NS	-
05CE005	NS	NS	+	+	NS	NS	NS	-
05CE006	+	-	-	+	+	+	NS	NS
05CE007	+	-	+	+	NS	NS	NS	-
05CE018	+	-	NS	+	NA	NS	NS	+
05CH007	+	-	-	NS	+	+	-	+
05CH008	NA	NS	NS	+	NA	NA	NA	NS
05CJ006	+	NS	NS	NS	-	-	+	+
05CK001	NS	NS	NS	+	NS	NS	NS	+
05CK004	+	NA	+	NS	-	NS	+	+
05CK005	NA	-	NS	NS	NA	NA	NA	NS
05DA007	+	NA	NS	+	NS	-	+	+
05DA009	NS	NA	+	NS	NS	-	NS	+
05DA010	NS	NA	NS	NS	NS	-	NS	+
05DB002	NS	NA	-	+	NS	-	+	+
05DB005	NS	NA	+	NS	-	-	+	NS
05DC001	+	NA	-	NS	NA	NS	NS	+
05DC006	+	NA	-	+	NS	-	+	+
05DD004	NS	NA	+	+	NS	NS	NS	-
05DD005	+	NS	+	NS	-	-	+	+
05DD007	+	NA	NS	NS	NS	-	+	NS
05DD009	NS	NA	+	NS	-	-	+	+

Station Number	Base Index	Zero Flow Days	Date of Minimum Flow	Date of Maximum Flow	High Pulse Number	Rise Rate	Fall Rate	Reversals
05DE007	NS	NA	NS	+	NA	-	+	-
05DF001	+	NA	NS	NS	NS	-	+	-
05DF004	NS	NS	NS	NS	NS	-	+	+
05DF006	+	-	NS	+	NS	-	NS	+
05EA001	NS	NS	+	+	-	-	+	-
05EA005	-	NS	+	NS	-	-	+	+
05EC002	NA	+	NS	NS	NA	NA	NA	-
05FA001	NS	NA	+	+	NS	-	+	+
05FB002	+	NS	NS	+	NS	-	+	+
05FC001	NS	NS	NS	NS	NA	-	+	NS
05FC002	NA	NS	NS	NS	NA	NA	NA	-
05FD001	NS	+	NS	NS	-	-	+	-
05GA003	NS	-	NS	+	NA	-	+	NS
05GA008	NA	NA	NS	+	NA	NA	NA	+
06AA001	-	NS	+	NS	NS	-	+	NS
06AA002	-	NS	+	NS	NS	-	+	NS
06AB001	NS	NA	NS	NS	NS	NS	NS	NS
06AB002	-	NS	+	NS	NS	NS	NS	-
06AC001	NS	NS	NS	+	NA	NS	NS	NS
06AD006	NS	NA	-	NS	NS	-	+	+
07AA001	+	NA	+	NS	NA	-	NS	+
07AA002	+	NA	NS	NS	NS	-	NS	+
07AC001	+	NA	+	NS	-	NS	+	-
07AD002	+	NA	NS	NS	NS	-	NS	NS
07AE001	-	NA	NS	NS	NS	+	NS	NS
07AF002	+	NA	NS	NS	NS	-	+	NS
07AF003	+	NA	+	+	NS	NS	NS	NS
07AF010	+	NA	NS	NS	NS	NS	+	-
07AG003	NS	NA	NS	+	-	-	+	NS
07AG004	+	NA	NS	NS	NS	-	+	NS
07AH001	+	NS	+	-	NS	-	+	-
07AH002	NS	NS	+	NS	-	-	+	-
07AH003	NS	NA	+	-	-	-	+	NS
07BA002	+	NA	NS	NS	NS	-	+	+
07BB002	+	NA	NS	NS	-	-	+	+

Station Number	Base Index	Zero Flow Days	Date of Minimum Flow	Date of Maximum Flow	High Pulse Number	Rise Rate	Fall Rate	Reversals
07BB004	+	NS	NS	+	NA	-	+	NS
07BB005	-	+	+	NS	-	-	+	-
07BB006	NS	NA	+	NS	NA	-	+	NS
07BC002	NS	NA	NS	NS	NS	-	+	+
07BC006	-	+	NS	NS	-	-	+	NS
07BE001	NS	NA	NS	NS	NS	-	+	+
07BF001	+	NS	NS	NS	NS	-	+	+
07BF002	NS	NS	+	NS	NS	-	NS	+
07BJ001	+	NA	NS	-	-	-	+	NS
07BJ003	+	NS	NS	-	-	-	+	-
07BK005	NS	NS	NS	-	NA	-	+	NS
07BK007	+	NS	+	-	NS	-	+	NS
07CA005	-	+	+	-	-	-	+	-
07CA006	NS	NS	+	NS	NS	-	-	-
07CD001	NA	NA	NS	NS	NS	-	+	NS
07CD004	NS	NS	+	+	NS	-	NS	NS
07CD005	-	NA	-	NS	NS	-	+	+
07DA001	NS	NA	-	-	NS	-	+	+
07DA006	NS	NA	NS	NS	NS	NS	NS	+
07DA008	NS	NA	NS	NS	NS	-	NS	+
07DB001	+	NA	NS	+	NS	NS	NS	NS
07DC001	NS	NA	NS	NS	NS	NS	NS	+
07DD002	NS	NA	NS	+	NS	NS	NS	-
07FD006	NS	NS	+	NS	NA	NS	NS	-
07FD009	NS	NS	+	NS	NA	-	+	-
07GA001	-	NA	+	NS	NS	+	-	NS
07GB001	NS	NS	-	NS	NS	-	+	+
07GD001	NS	NS	+	+	NS	NS	NS	NS
07GE001	+	NA	+	NS	NS	-	+	NS
07GE002	NS	NS	NS	NS	+	NS	+	+
07GE003	NS	+	NS	+	NS	NS	NS	-
07GF001	+	NA	+	NS	-	+	NS	-
07GG001	NS	NS	NS	NS	NS	NS	+	+
07GG002	+	NA	+	NS	-	-	+	-
07GG003	NS	NS	+	NS	NS	-	+	+

Station Number	Base Index	Zero Flow Days	Date of Minimum Flow	Date of Maximum Flow	High Pulse Number	Rise Rate	Fall Rate	Reversals
07GH002	+	NA	NS	NS	NS	-	+	NS
07GJ001	+	NA	NS	NS	NS	-	+	+
07HA001	+	NA	+	NS	NS	NS	NS	+
07HA003	+	NS	NS	-	NS	-	+	NS
07HA005	NS	NS	NS	NS	NS	NS	-	-
07HC001	NS	NS	+	-	NS	-	+	-
07HF002	+	NS	+	NS	NA	NS	NS	NS
07JD002	+	NA	+	NS	NS	-	+	NS
07JD003	+	NS	NS	NS	NA	-	+	NS
07JF002	+	NS	NS	-	NS	NS	NS	NS
07JF003	+	NS	+	NS	NS	-	+	NS
07KC001	NS	NA	+	-	NS	+	NS	+
07KE001	+	NA	-	NS	NS	-	-	NS
07NB001	+	NA	+	NS	NS	+	-	+
07OA001	+	-	+	NS	NS	-	NS	+
07OB003	+	NA	NS	NS	NS	NS	+	NS
07OC001	+	NS	NS	NS	NS	NS	+	NS
11AA001	NS	NA	NS	+	NS	NS	NS	-
11AA005	+	NA	NS	+	NS	NS	+	+
11AA025	NS	NS	+	+	NS	NS	+	NS
11AA026	NA	-	NS	NS	NA	NA	NA	NS
11AA028	NA	-	NS	+	NA	NA	NA	NS
11AA029	NA	NS	NS	NS	NA	NA	NA	NS
11AB009	NS	NS	+	NS	NS	NS	NS	-

Table B4: Mann-Kendall Test results for seasonal precipitation variables. A "+" indicates a positive significant trend, "-" indicates a negative significant trend, "NS" indicates the trend was not significant, and "NA" indicates the Mann-Kendall Test could not be performed for that station.

Station Number	PAS_at	PAS_wt	PAS_sp	PAS_sm	PPT_at	PPT_wt	PPT_sp	PPT_sm
05AA004	NS	NA	NS	NA	NS	NA	NS	+
05AA008	NS	-	NS	NA	NS	-	NS	+
05AA022	NS	NA	NS	NA	NS	NA	NS	+
05AA024	NS	-	NS	NS	NS	-	NS	+
05AA027	NS	NA	NS	NS	NS	NA	NS	+
05AA028	NS	NA	NS	NS	NS	NA	NS	NS
05AB013	NS	-	NS	NA	NS	-	NS	+
05AB021	NS	-	NS	NA	NS	-	NS	+
05AB029	NS	-	NS	NA	NS	-	NS	+
05AC003	NS	-	NS	NS	NS	-	NS	NS
05AC012	NS	-	NS	NA	NS	-	NS	NS
05AC017	NS	-	NS	NA	NS	-	NS	NS
05AC023	NS	-	NS	NS	NS	-	NS	NS
05AD003	NS	NS	NS	NS	NS	-	-	NS
05AD005	NS	NA	NA	NS	NS	NA	NA	+
05AD007	NS	-	NS	NS	NS	-	NS	NS
05AD010	NS	NA	NA	NA	NS	NA	NS	+
05AD013	NS	-	NA	NA	NS	-	NS	+
05AD017	NS	NA	NS	NS	NS	NA	NS	+
05AD021	NS	NA	NS	NA	NS	NA	NS	+
05AD027	NS	NA	NS	NS	NS	NA	NS	+
05AD028	NS	-	NS	NA	NS	-	NS	+
05AD035	NS	-	-	NS	NS	-	NS	NS
05AD037	NS	-	NS	NS	NS	-	NS	NS
05AE002	NS	-	NS	NA	NS	-	NS	+
05AE005	NS	-	NS	NA	NS	-	NS	NS
05AE006	NS	-	NS	NS	NS	-	NS	NS
05AE016	NS	-	NS	NS	NS	-	NS	NS
05AE021	NS	-	NS	NA	NS	-	NS	+
05AE026	NS	-	NS	NA	NS	-	NS	+
05AE027	NS	-	NS	NS	NS	-	NS	NS

Station Number	PAS_at	PAS_wt	PAS_sp	PAS_sm	PPT_at	PPT_wt	PPT_sp	PPT_sm
05AG003	NS	-	NS	NS	NS	-	NS	NS
05AH002	NS	-	NS	NS	NS	NS	NS	NS
05AH005	NS	-	NS	NS	NS	-	NS	NS
05AH037	NS	-	-	NA	NS	-	NS	NS
05AH041	NS	-	NS	NA	NS	-	NS	NS
05AJ001	NS	-	NS	NS	NS	-	NS	NS
05BA001	NA	NA	NA	NA	NA	NA	NA	NA
05BB001	NA	NA	NA	NA	NA	NA	NA	NA
05BC001	NA	NA	NA	NA	NA	NA	NA	NA
05BD004	NA	NA	NS	NA	NA	NA	+	NA
05BF016	NA	NA	NS	NA	NA	NA	NS	NS
05BG006	NS	-	NS	NS	NS	-	NS	+
05BH004	NS	-	NS	NS	NS	-	NS	+
05BJ001	NS	-	NS	NA	NS	-	NS	NS
05BJ004	NS	-	NA	NS	NS	-	NS	+
05BK001	NS	NS	NS	NS	NS	NS	NS	NS
05BL007	NS	NA	NA	NS	NS	NA	NA	NS
05BL013	NS	-	NS	NS	NS	-	NS	NS
05BL014	NS	-	NS	NS	NS	-	NS	NS
05BL015	NS	-	NS	NS	NS	-	NS	NS
05BL019	NS	NA	NS	NS	NS	NA	NS	NS
05BL022	NS	NA	NS	+	NS	NA	NS	+
05BL023	NS	NA	NA	NA	NS	NA	NA	NS
05BL024	NS	-	NS	NS	NS	-	NS	NS
05BM002	NS	-	NS	NA	NS	-	NS	NS
05BM004	NS	-	NS	NS	NS	-	NS	NS
05BM007	-	-	NS	NS	NS	-	NS	NS
05BM008	NS	-	NS	NA	NS	-	NS	NS
05BM014	NS	-	NS	NA	NS	-	NS	NS
05BN002	NS	-	NS	NS	NS	-	NS	NS
05BN006	NS	-	NS	NS	NS	-	NS	NS
05BN008	NS	-	NS	NS	NS	-	NS	NS
05BN012	-	-	NS	NS	NS	-	NS	NS
05CA002	NS	-	NS	NS	NS	-	NS	+
05CA004	NS	NA	NS	NA	NS	NA	NS	NS
05CB001	NS	-	NS	NS	NS	-	NS	+

Station Number	PAS_at	PAS_wt	PAS_sp	PAS_sm	PPT_at	PPT_wt	PPT_sp	PPT_sm
05CB002	NS	-	NS	NS	NS	-	NS	+
05CB004	NS	-	NS	NS	NS	-	NS	NS
05CC001	NS	-	NS	NS	NS	-	NS	NS
05CC002	NS	-	+	NS	NS	-	NS	NS
05CC007	NS	-	NS	NS	NS	-	NS	NS
05CC008	NS	-	NS	NS	NS	-	NS	NS
05CC009	NS	-	NS	NS	NS	-	NS	NS
05CE001	NS	-	NS	NS	NS	-	NS	NS
05CE002	NS	-	NS	NS	NS	-	NS	NS
05CE005	-	-	NS	NS	NS	-	NS	NS
05CE006	NS	-	NS	NS	NS	-	NS	NS
05CE007	-	-	NS	NS	NS	-	NS	NS
05CE018	NS	-	NS	NS	NS	-	NS	NS
05CH007	-	-	NS	NS	NS	-	NS	NS
05CH008	NS	-	NS	NS	NS	-	NS	NS
05CJ006	-	-	NS	NA	NS	-	NS	NS
05CK001	NS	-	NS	NS	NS	-	NS	NS
05CK004	NS	-	NS	NA	NS	-	NS	NS
05CK005	NS	-	NS	NS	NS	-	NS	NS
05DA007	-	-	NS	NA	-	-	NS	NA
05DA009	NS	NA	NS	NS	NS	NA	NS	NS
05DA010	NS	-	+	+	NS	-	NS	+
05DB002	NS	-	NS	NS	NS	-	NS	NS
05DB005	NS	-	NS	NS	NS	-	NS	NS
05DC001	NS	-	NS	NS	NS	-	NS	NS
05DC006	NS	-	NS	NS	NS	-	NS	NS
05DD004	NS	-	NS	NS	NS	-	NS	NS
05DD005	NS	-	NS	NS	NS	-	NS	NS
05DD007	NS	NA	NS	NS	NS	NA	NS	NS
05DD009	NS	-	NS	NS	NS	-	NS	NS
05DE007	NS	-	NS	NS	NS	-	NS	NS
05DF001	-	-	NS	NS	NS	-	NS	NS
05DF004	NS	-	NS	NS	NS	-	NS	NS
05DF006	NS	-	NS	NS	NS	-	NS	NS
05EA001	NS	-	NS	NS	NS	-	NS	NS
05EA005	NS	-	NS	NS	NS	-	NS	NS

Station Number	PAS_at	PAS_wt	PAS_sp	PAS_sm	PPT_at	PPT_wt	PPT_sp	PPT_sm
05EC002	NS	NS	NS	NS	NS	NS	NS	NS
05FA001	NS	-	NS	NS	NS	-	NS	NS
05FB002	NS	-	NS	NS	NS	-	NS	NS
05FC001	NS	-	NS	NS	NS	-	NS	NS
05FC002	NS	-	NS	NS	NS	-	NS	NS
05FD001	NS	-	NS	NS	NS	-	NS	NS
05GA003	NS	-	NS	NS	NS	-	NS	NS
05GA008	NS	-	NS	NS	NS	-	NS	NS
06AA001	-	-	NS	NS	NS	-	NS	NS
06AA002	NS	-	NS	NA	NS	-	NS	NS
06AB001	NS	-	NS	NS	NS	-	NS	NS
06AB002	-	-	NS	NS	NS	-	NS	NS
06AC001	-	-	NS	NS	NS	-	NS	NS
06AD006	-	-	NS	NS	NS	-	NS	NS
07AA001	NS	NS	NS	NA	NS	NS	+	NS
07AA002	NA	NA	NS	NA	NA	NA	NS	NA
07AC001	NS	NS	NS	NS	NS	NS	NS	NS
07AD002	NA	NS	NS	NS	NA	NS	NS	NS
07AE001	NS	-	NS	NS	NS	-	NS	-
07AF002	NS	-	NS	NS	NS	-	NS	NS
07AF003	NS	NS	NS	NS	NS	-	NS	NS
07AF010	NS	-	NS	NS	NS	-	NS	NS
07AG003	NS	-	NS	NS	NS	-	NS	NS
07AG004	NS	-	NS	NS	NS	-	NS	-
07AH001	NS	-	NS	NS	NS	-	NS	NS
07AH002	NS	-	NS	NS	NS	-	NS	-
07AH003	NS	-	NS	NS	NS	-	NS	-
07BA002	NS	-	NS	NS	NS	-	NS	NS
07BB002	NS	-	NS	NS	NS	-	NS	NS
07BB004	NS	-	NS	NS	NS	-	NS	NS
07BB005	NS	-	NS	NS	NS	-	NS	NS
07BB006	NS	-	NS	NS	NS	-	NS	NS
07BC002	NS	-	NS	NS	NS	-	NS	NS
07BC006	NS	-	NS	NS	NS	-	NS	NS
07BE001	NS	-	NS	NS	NS	-	NS	NS
07BF001	NS	NS	NS	NS	NS	NS	NS	NS

Station Number	PAS_at	PAS_wt	PAS_sp	PAS_sm	PPT_at	PPT_wt	PPT_sp	PPT_sm
07BF002	NS	NS	NS	NS	NS	NS	NS	NS
07BJ001	NS	-	NS	NS	NS	-	NS	NS
07BJ003	NS	-	NS	NS	NS	-	NS	NS
07BK005	NS	-	NS	NS	NS	-	NS	NS
07BK007	NS	-	NS	NS	NS	-	NS	NS
07CA005	NS	-	NS	NS	NS	-	NS	NS
07CA006	NS	-	NS	NS	NS	-	NS	NS
07CD001	NS	-	NS	NS	NS	-	NS	NS
07CD004	NS	-	NS	NS	NS	-	NS	NS
07CD005	NS	-	NS	NS	NS	-	NS	NS
07DA001	NS	-	NS	NS	NS	-	NS	NS
07DA006	NS	-	NS	NS	NS	-	NS	NS
07DA008	NS	-	NS	NS	NS	-	NS	NS
07DB001	NS	-	NS	NS	NS	-	NS	NS
07DC001	-	-	NS	NS	NS	-	NS	NS
07DD002	NS	NS	NS	NS	NS	-	NS	NS
07FD006	NS	-	+	NS	NS	-	+	NS
07FD009	-	NS	+	NS	NS	NS	+	NS
07GA001	NS	NS	NS	-	NS	NS	+	NS
07GB001	NS	-	NS	NS	NS	-	+	NS
07GD001	NS	-	+	NS	NS	-	+	NS
07GE001	NS	-	+	NS	NS	-	+	NS
07GE002	NS	-	+	NS	NS	-	+	NS
07GE003	NS	NS	NS	NS	NS	NS	+	NS
07GF001	NS	-	+	NS	NS	-	NS	NS
07GG001	NS	-	NS	NS	NS	-	NS	-
07GG002	NS	-	+	NS	NS	-	NS	NS
07GG003	NS	-	+	NS	NS	-	NS	-
07GH002	NS	-	+	NS	NS	-	NS	NS
07GJ001	NS	-	+	NS	NS	-	NS	NS
07HA001	NS	-	NS	NS	NS	-	NS	NS
07HA003	NS	-	NS	NS	NS	-	NS	NS
07HA005	NS	-	+	NS	NS	-	NS	NS
07HC001	NS	-	NS	NS	NS	-	NS	NS
07HF002	NS	-	NS	NS	NS	-	NS	NS
07JD002	NS	-	NS	NS	NS	-	NS	NS

Station Number	PAS_at	PAS_wt	PAS_sp	PAS_sm	PPT_at	PPT_wt	PPT_sp	PPT_sm
07JD003	NS	-	NS	NS	NS	-	NS	NS
07JF002	NS	-	NS	NS	NS	-	NS	NS
07JF003	NS	-	NS	NS	NS	-	NS	NS
07KC001	NS	-	NS	NS	NS	-	NS	NS
07KE001	-	-	NS	NS	NS	-	NS	NS
07NB001	NS	-	NS	NS	NS	-	NS	NS
07OA001	NS	-	NS	NS	NS	-	NS	NS
07OB003	NS	-	NS	NS	NS	-	NS	NS
07OC001	NS	-	NS	NS	NS	-	NS	NS
11AA001	NS	-	NS	NS	NS	-	NS	NS
11AA005	NS	-	NS	NS	NS	-	NS	NS
11AA025	NS	-	NS	NS	NS	-	NS	NS
11AA026	NS	NA	NS	NA	NS	NA	NS	NS
11AA028	NS	-	NS	NA	NS	-	NS	NS
11AA029	NS	-	NS	NA	NS	-	NS	NS
11AB009	NS	NS	NS	NA	NS	NS	NS	NS

Table B5: Mann-Kendall Test results for seasonal temperature variables. A "+" indicates a positive significant trend, "-" indicates a negative significant trend, "NS" indicates the trend was not significant, and "NA" indicates the Mann-Kendall Test could not be performed for that station.

Station Number	Average Temperature				Maximum Temperature				Minimum Temperature			
	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
05AA004	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AA008	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AA022	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AA024	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AA027	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AA028	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AB013	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AB021	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AB029	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05AC003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AC012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AC017	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AC023	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AD003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
05AD005	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AD007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AD010	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AD013	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AD017	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AD021	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AD027	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AD028	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AD035	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AD037	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AE002	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AE005	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AE006	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AE016	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AE021	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AE026	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05AE027	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-

Station Number	Average Temperature				Maximum Temperature				Minimum Temperature			
	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
05AG003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05AH002	+	+	NS	NS	+	NS	NS	NS	+	+	NS	NS
05AH005	+	+	NS	NS	+	NS	NS	NS	+	+	NS	NS
05AH037	+	+	NS	NS	+	NS	NS	NS	+	+	NS	NS
05AH041	+	NS	NS	NS	+	NS	NS	NS	+	+	NS	NS
05AJ001	+	+	NS	NS	+	NS	NS	NS	+	+	NS	NS
05BA001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05BB001	NS	NS	NS	-	NS	+	NS	NS	NS	NS	NS	-
05BC001	NS	NS	NS	-	NS	+	NS	NS	NS	NS	NS	-
05BD004	NS	NS	NS	-	NS	+	NS	NS	NS	NS	-	-
05BF016	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BG006	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BH004	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05BJ001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05BJ004	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BK001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
05BL007	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BL013	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BL014	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
05BL015	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
05BL019	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05BL022	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BL023	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05BL024	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
05BM002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05BM004	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05BM007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05BM008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05BM014	NS	NS	NS	NS	NS	NS	NS	NS	NS	+	NS	-
05BN002	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS	NS
05BN006	NS	NS	NS	NS	NS	NS	NS	NS	+	NS	NS	-
05BN008	NS	NS	NS	NS	+	NS	NS	NS	NS	NS	NS	-
05BN012	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS	-
05CA002	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
05CA004	NS	NS	NS	-	NS	+	NS	NS	NS	NS	NS	-
05CB001	NS	NS	NS	NS	NS	+	NS	NS	NS	NS	NS	-

Station Number	Average Temperature				Maximum Temperature				Minimum Temperature			
	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
05CB002	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	-	-
05CB004	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05CC001	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS
05CC002	NS	NS	NS	NS	NS	NS	NS	NS	NS	+	NS	NS
05CC007	NS	NS	NS	NS	NS	+	NS	NS	NS	NS	NS	-
05CC008	NS	+	NS	NS	NS	NS	NS	NS	NS	+	NS	NS
05CC009	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS
05CE001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05CE002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
05CE005	NS	+	NS	NS	NS	NS	NS	NS	NS	+	NS	NS
05CE006	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
05CE007	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS
05CE018	NS	NS	NS	NS	NS	+	NS	NS	NS	+	NS	NS
05CH007	NS	NS	NS	NS	+	NS	NS	NS	+	NS	NS	-
05CH008	NS	+	NS	NS	+	+	NS	NS	+	+	NS	NS
05CJ006	NS	NS	NS	NS	+	NS	NS	NS	+	+	NS	NS
05CK001	+	NS	NS	NS	+	NS	NS	NS	+	+	NS	NS
05CK004	+	+	NS	NS	+	NS	NS	NS	+	+	NS	NS
05CK005	+	+	NS	NS	+	+	NS	NS	+	+	NS	NS
05DA007	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DA009	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DA010	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DB002	NS	NS	NS	NS	NS	+	NS	NS	NS	NS	NS	-
05DB005	NS	NS	NS	NS	NS	+	NS	NS	NS	NS	NS	-
05DC001	NS	NS	NS	NS	NS	+	NS	NS	NS	NS	NS	-
05DC006	NS	NS	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DD004	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	-
05DD005	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DD007	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
05DD009	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DE007	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	-
05DF001	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
05DF004	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
05DF006	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
05EA001	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
05EA005	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS

Station Number	Average Temperature				Maximum Temperature				Minimum Temperature			
	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
05EC002	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
05FA001	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
05FB002	+	+	NS	NS	NS	+	NS	+	+	+	NS	NS
05FC001	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS
05FC002	NS	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS
05FD001	+	+	NS	+	+	+	NS	+	+	+	NS	NS
05GA003	+	+	NS	+	+	+	NS	NS	+	+	NS	NS
05GA008	+	+	NS	NS	+	+	NS	NS	+	+	NS	NS
06AA001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
06AA002	+	+	NS	+	NS	+	NS	+	+	+	NS	+
06AB001	+	+	NS	+	+	+	NS	+	+	+	NS	+
06AB002	+	+	NS	+	+	+	NS	+	+	+	NS	+
06AC001	+	+	NS	+	+	+	NS	+	+	+	NS	+
06AD006	+	+	NS	+	+	+	NS	+	+	+	NS	+
07AA001	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
07AA002	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
07AC001	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AD002	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AE001	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07AF002	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AF003	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
07AF010	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AG003	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AG004	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AH001	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07AH002	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07AH003	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07BA002	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
07BB002	NS	+	NS	NS	NS	+	NS	+	NS	+	NS	NS
07BB004	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07BB005	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07BB006	NS	+	NS	+	NS	+	NS	+	NS	+	NS	NS
07BC002	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07BC006	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07BE001	+	+	NS	+	+	+	NS	+	+	+	NS	+
07BF001	+	+	NS	+	NS	+	NS	+	+	+	NS	+

Station Number	Average Temperature				Maximum Temperature				Minimum Temperature			
	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
07BF002	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07BJ001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07BJ003	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07BK005	+	+	NS	+	+	+	NS	+	+	+	NS	+
07BK007	+	+	NS	+	+	+	NS	+	+	+	NS	+
07CA005	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07CA006	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07CD001	+	+	NS	+	+	+	NS	+	+	+	NS	+
07CD004	+	+	NS	+	+	+	NS	+	+	+	NS	+
07CD005	+	+	NS	+	+	+	NS	+	+	+	NS	+
07DA001	NS	+	NS	+	+	+	NS	+	NS	+	NS	+
07DA006	+	+	NS	+	+	+	NS	+	NS	+	NS	+
07DA008	+	+	NS	+	+	+	NS	+	+	+	NS	+
07DB001	+	+	NS	+	+	+	NS	+	+	+	NS	+
07DC001	+	+	NS	+	+	+	NS	+	+	+	NS	+
07DD002	+	+	NS	+	+	+	NS	+	+	+	NS	+
07FD006	NS	+	NS	+	NS	+	NS	+	+	+	NS	+
07FD009	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07GA001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07GB001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07GD001	+	+	NS	+	NS	+	NS	+	NS	+	NS	+
07GE001	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07GE002	NS	+	NS	+	NS	+	NS	+	+	+	NS	+
07GE003	NS	+	NS	+	NS	+	NS	+	+	+	NS	+
07GF001	NS	+	NS	+	NS	+	NS	+	+	+	NS	+
07GG001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07GG002	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07GG003	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07GH002	+	+	NS	+	+	+	NS	+	+	+	NS	+
07GJ001	NS	+	NS	+	NS	+	NS	+	+	+	NS	+
07HA001	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07HA003	+	+	NS	+	NS	+	NS	+	NS	+	NS	+
07HA005	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07HC001	NS	+	NS	+	NS	+	NS	+	+	+	NS	+
07HF002	NS	+	NS	+	NS	+	NS	+	NS	+	NS	+
07JD002	+	+	NS	+	+	+	NS	+	+	+	NS	+

Station Number	Average Temperature				Maximum Temperature				Minimum Temperature			
	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
07JD003	+	+	NS	+	+	+	NS	+	+	+	NS	+
07JF002	+	+	NS	+	+	+	NS	+	+	+	NS	+
07JF003	+	+	NS	+	+	+	NS	+	+	+	NS	+
07KC001	+	+	NS	+	+	+	NS	+	+	+	NS	+
07KE001	+	+	NS	+	+	+	NS	+	+	+	NS	+
07NB001	+	+	NS	+	+	+	NS	+	+	+	+	+
07OA001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
07OB003	+	+	NS	+	+	+	NS	+	+	+	NS	+
07OC001	+	+	NS	+	NS	+	NS	+	+	+	NS	+
11AA001	NS	NS	NS	-	NS	NS	NS	NS	NS	NS	NS	-
11AA005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
11AA025	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
11AA026	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS	-
11AA028	+	NS	NS	NS	NS	NS	NS	NS	+	NS	NS	-
11AA029	+	NS	NS	NS	+	NS	NS	NS	+	+	NS	-
11AB009	+	NS	NS	NS	+	NS	NS	NS	+	NS	NS	NS

Appendix C – Spatial Visualization of Mann-Kendal Test Results

The Mann-Kendall Test trend results for each IHA and climate parameter are illustrated spatially in the Figures A1 to A32.

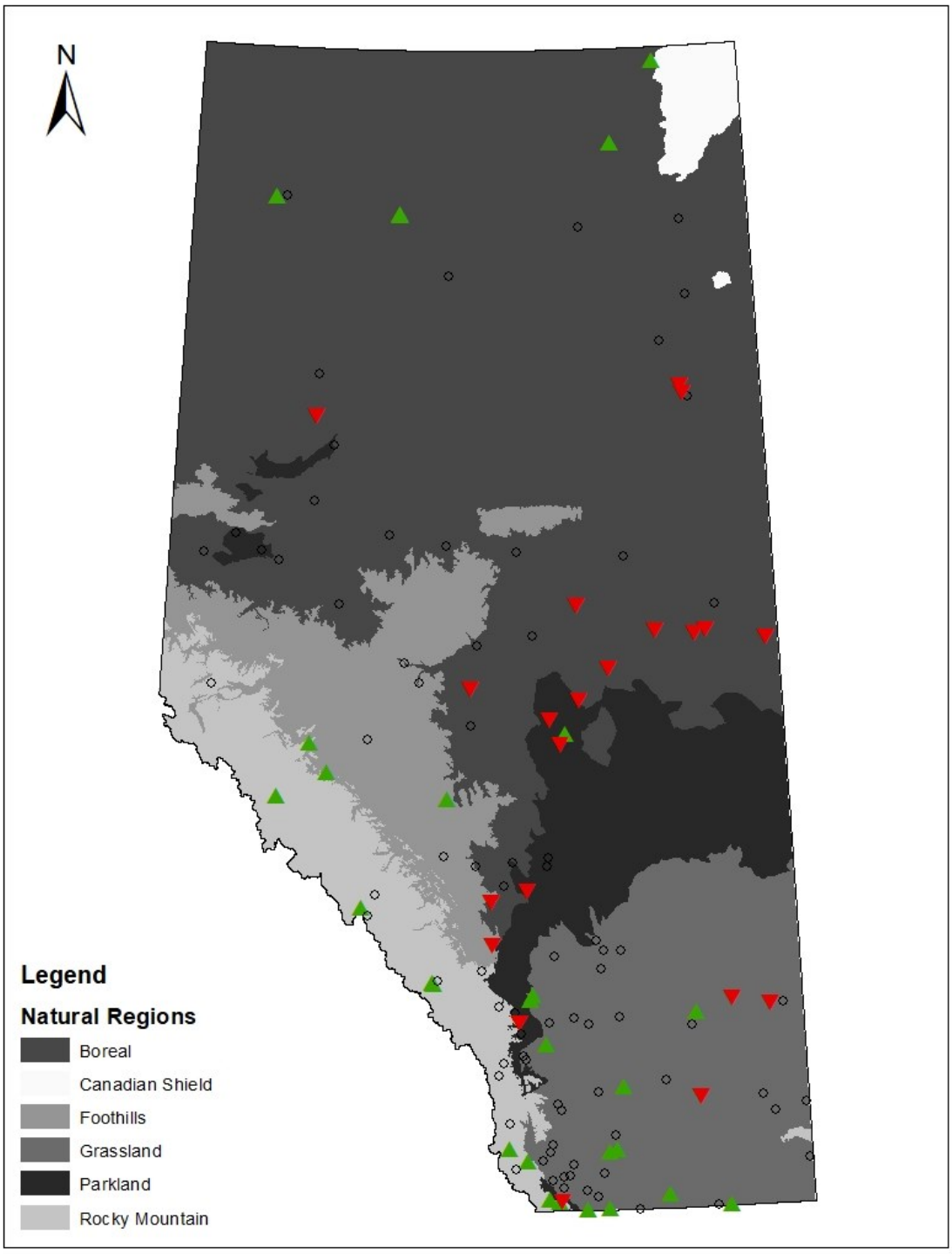

Figure C1: Trend results for April median magnitude at stations across Alberta.

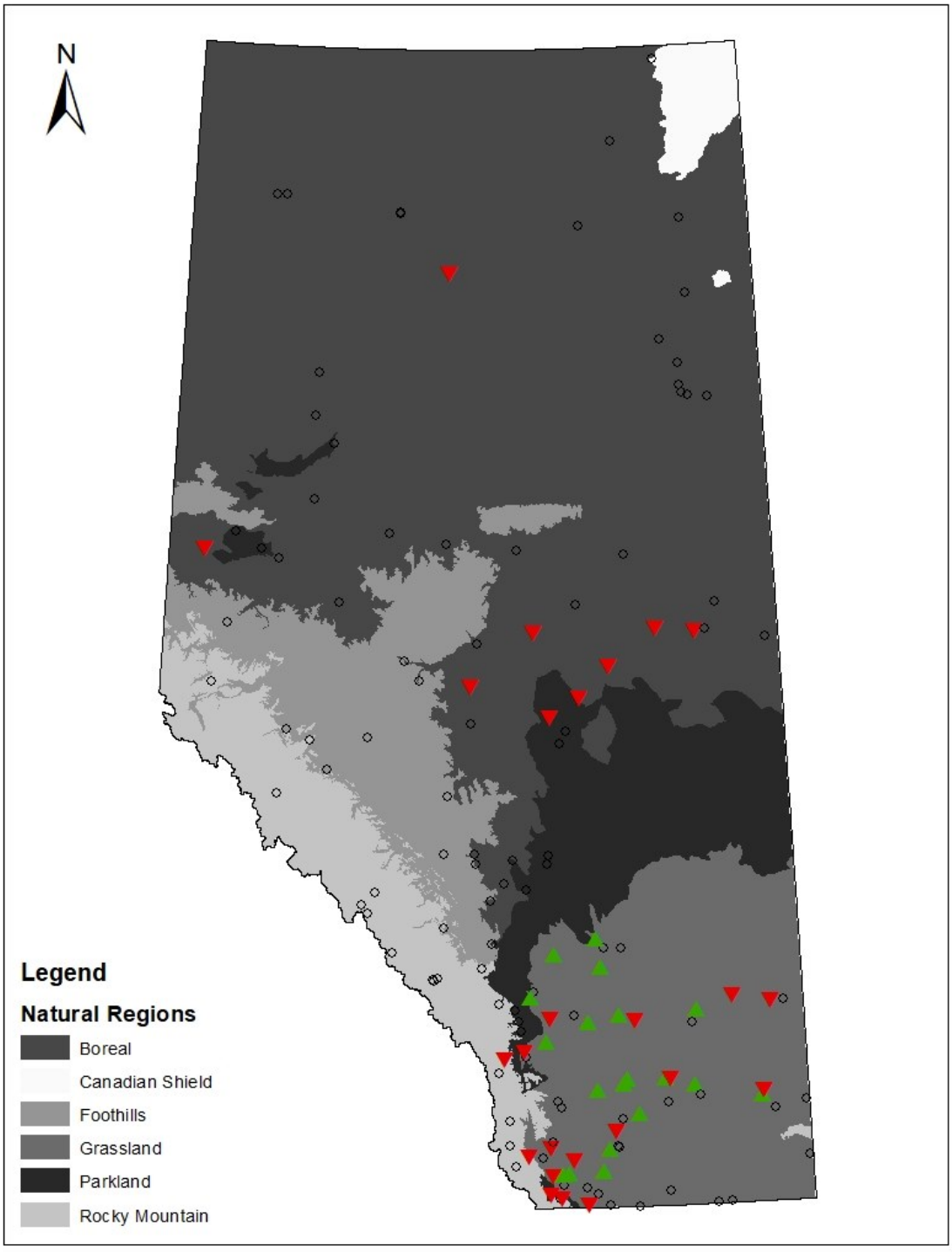

Figure C2: Trend results for May median magnitude at stations across Alberta.

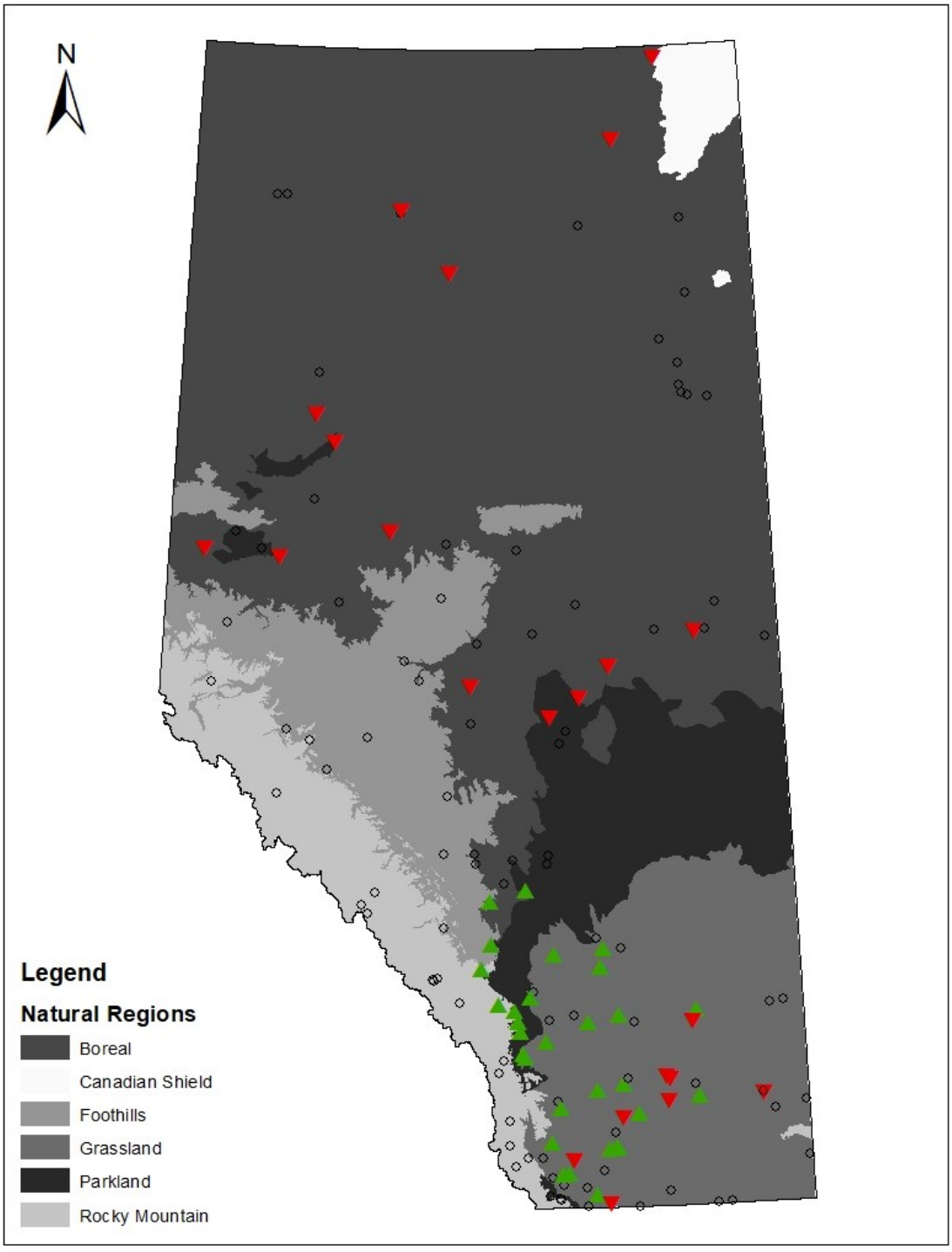

Figure C3: Trend results for June median magnitude at stations across Alberta.

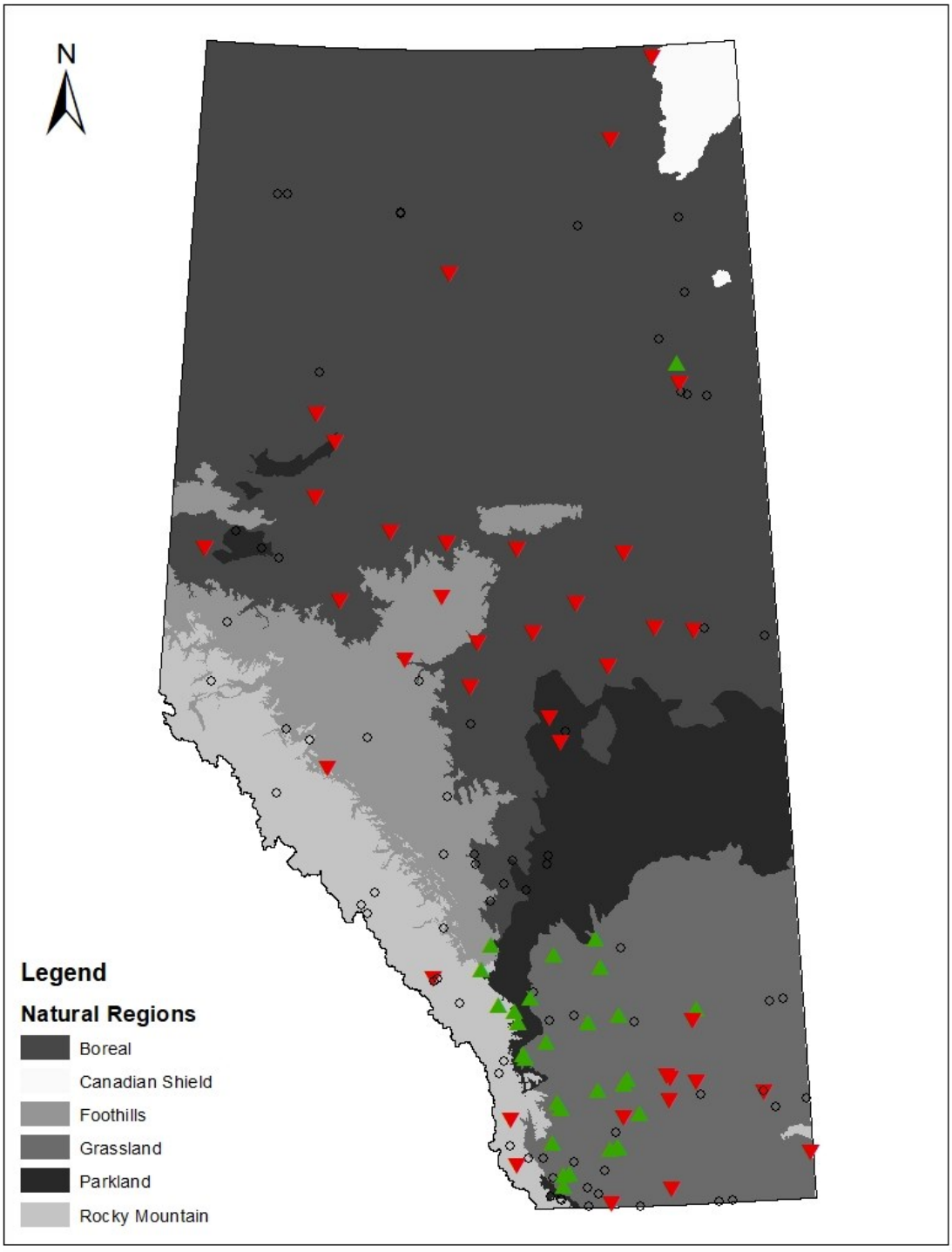

Figure C4: Trend results for July median magnitude at stations across Alberta.

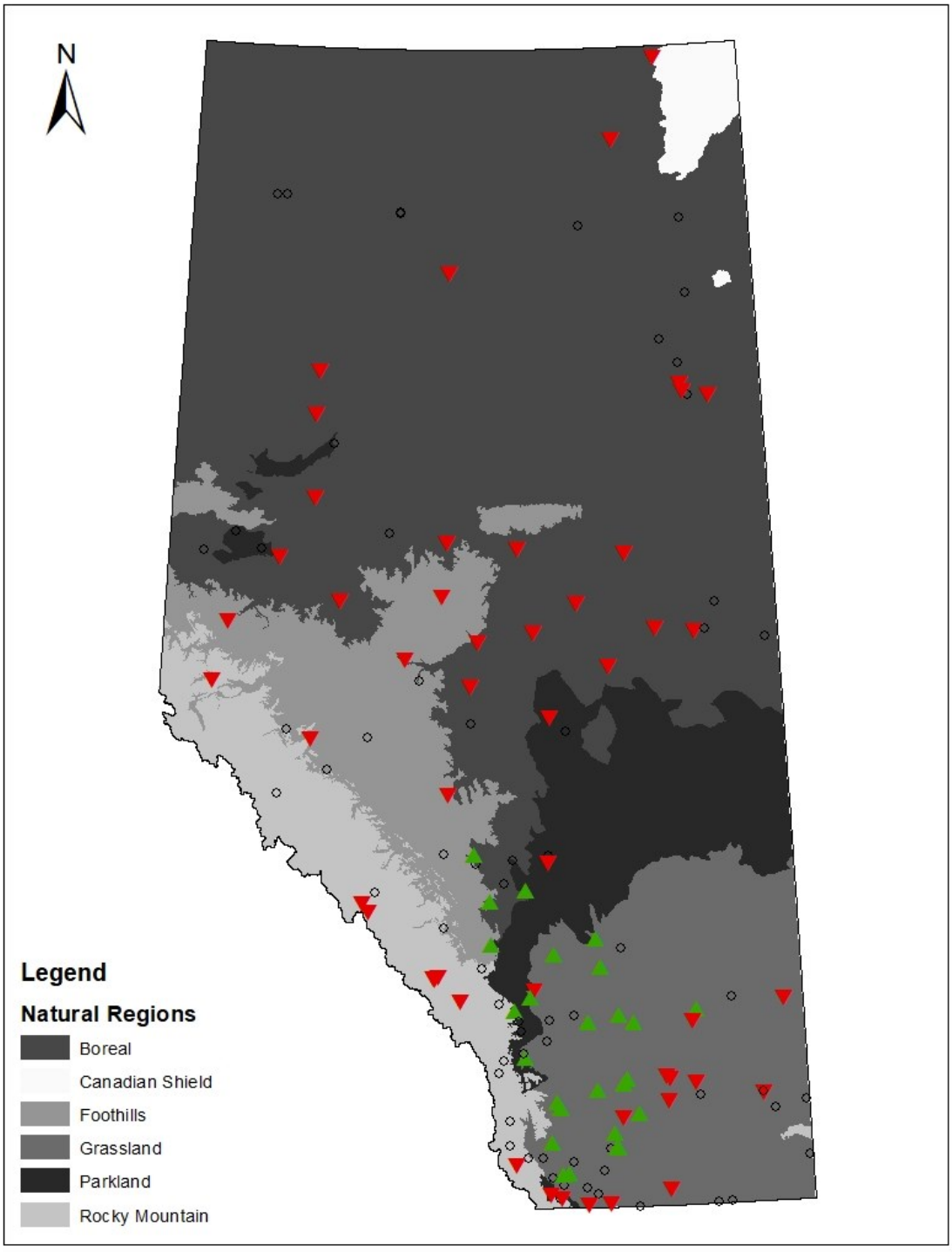

Figure C5: Trend results for August median magnitude at stations across Alberta.

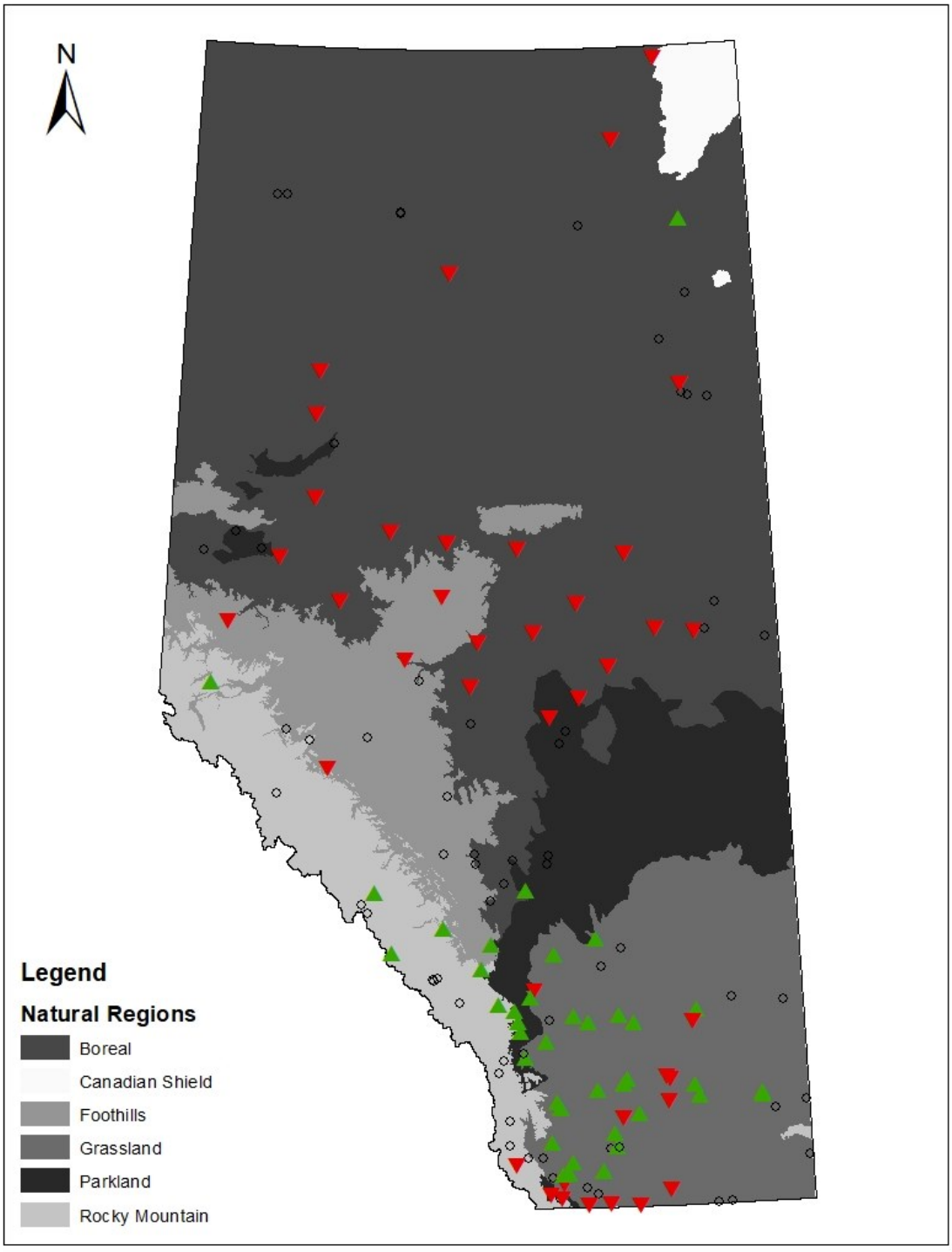

Figure C6: Trend results for September median magnitude at stations across Alberta.

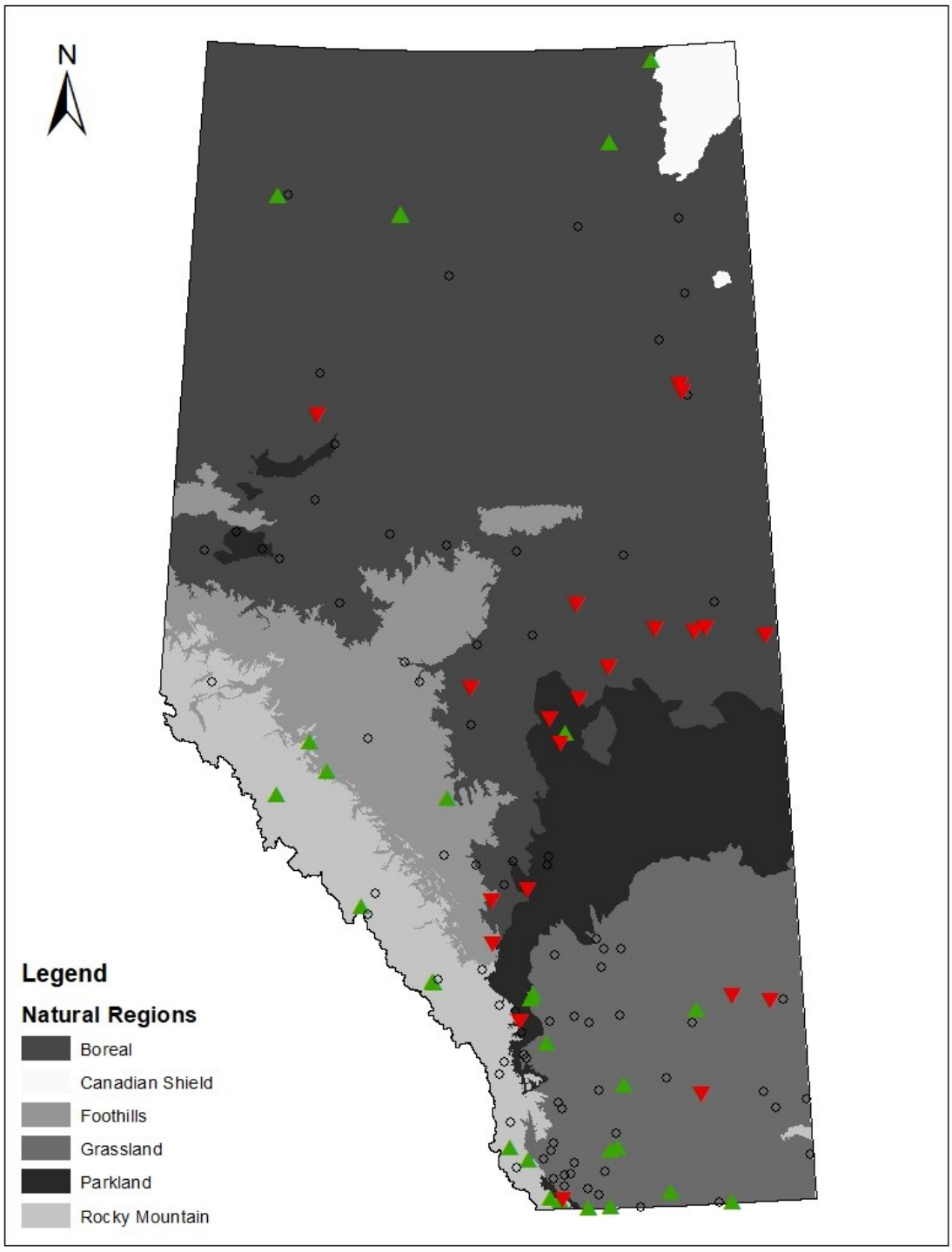

Figure C7: Trend results for October median magnitude at stations across Alberta.

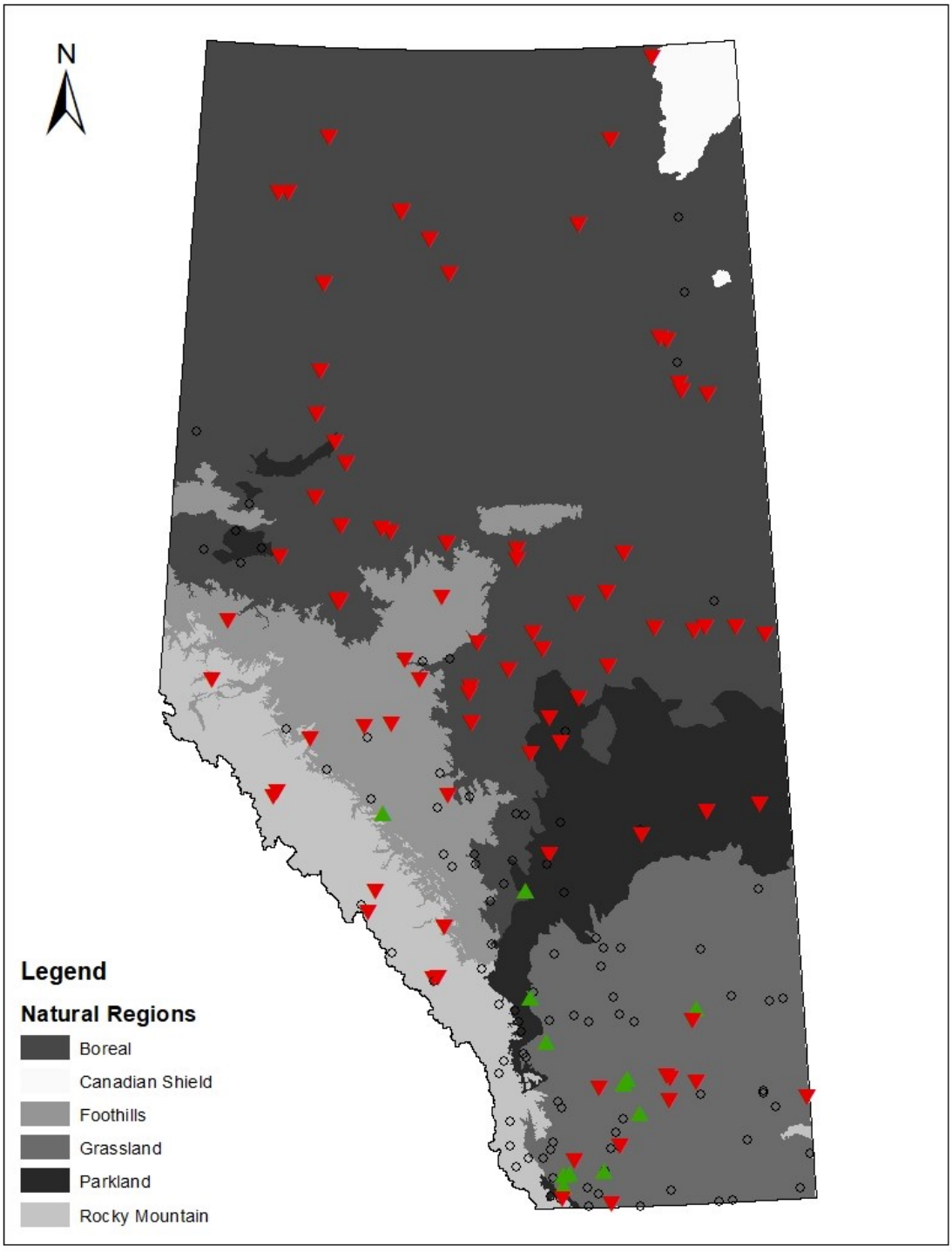

Figure C8: Trend results for annual maximum 1-day mean streamflow at stations across Alberta.

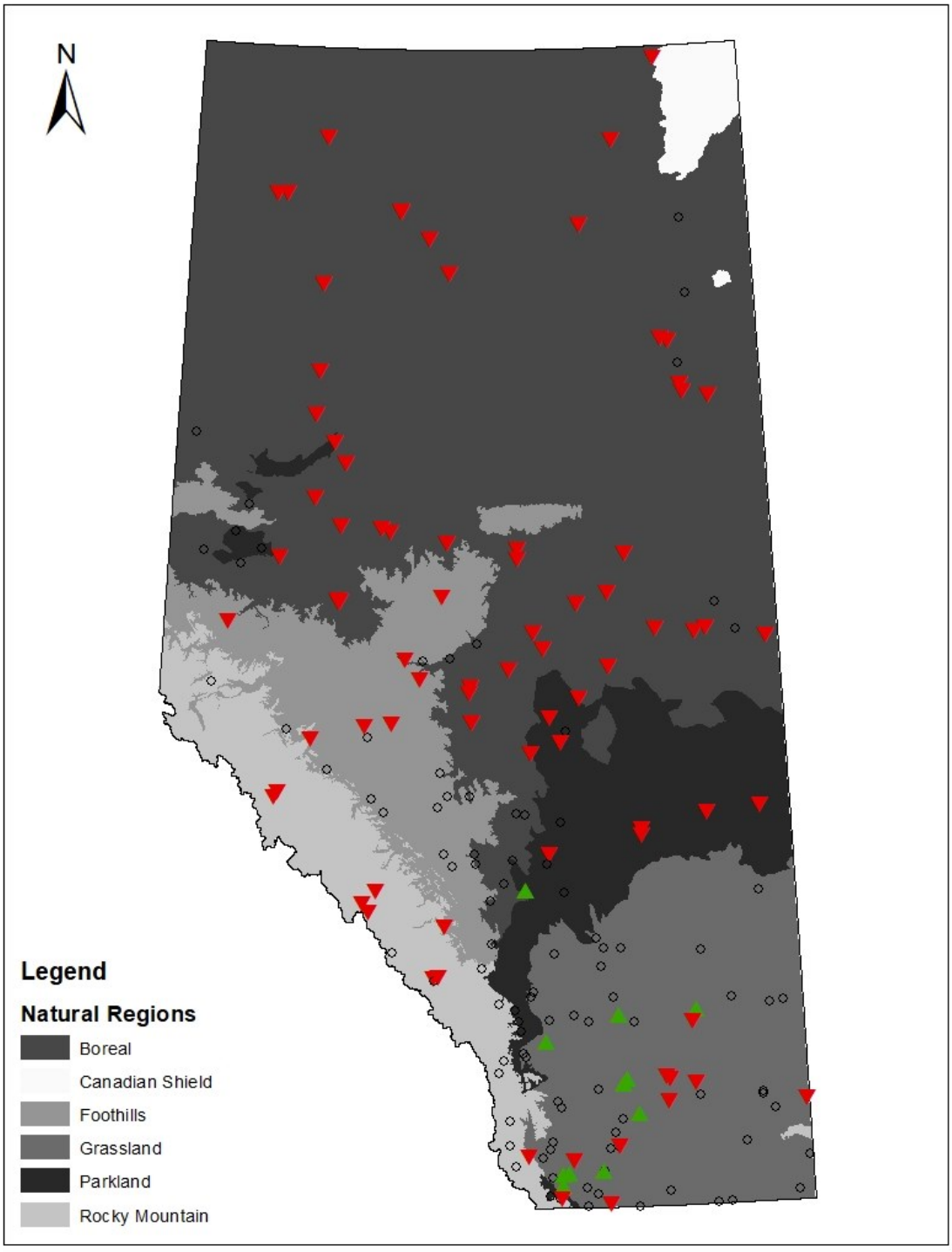

Figure C9: Trend results for annual maximum 3-day mean streamflow at stations across Alberta.

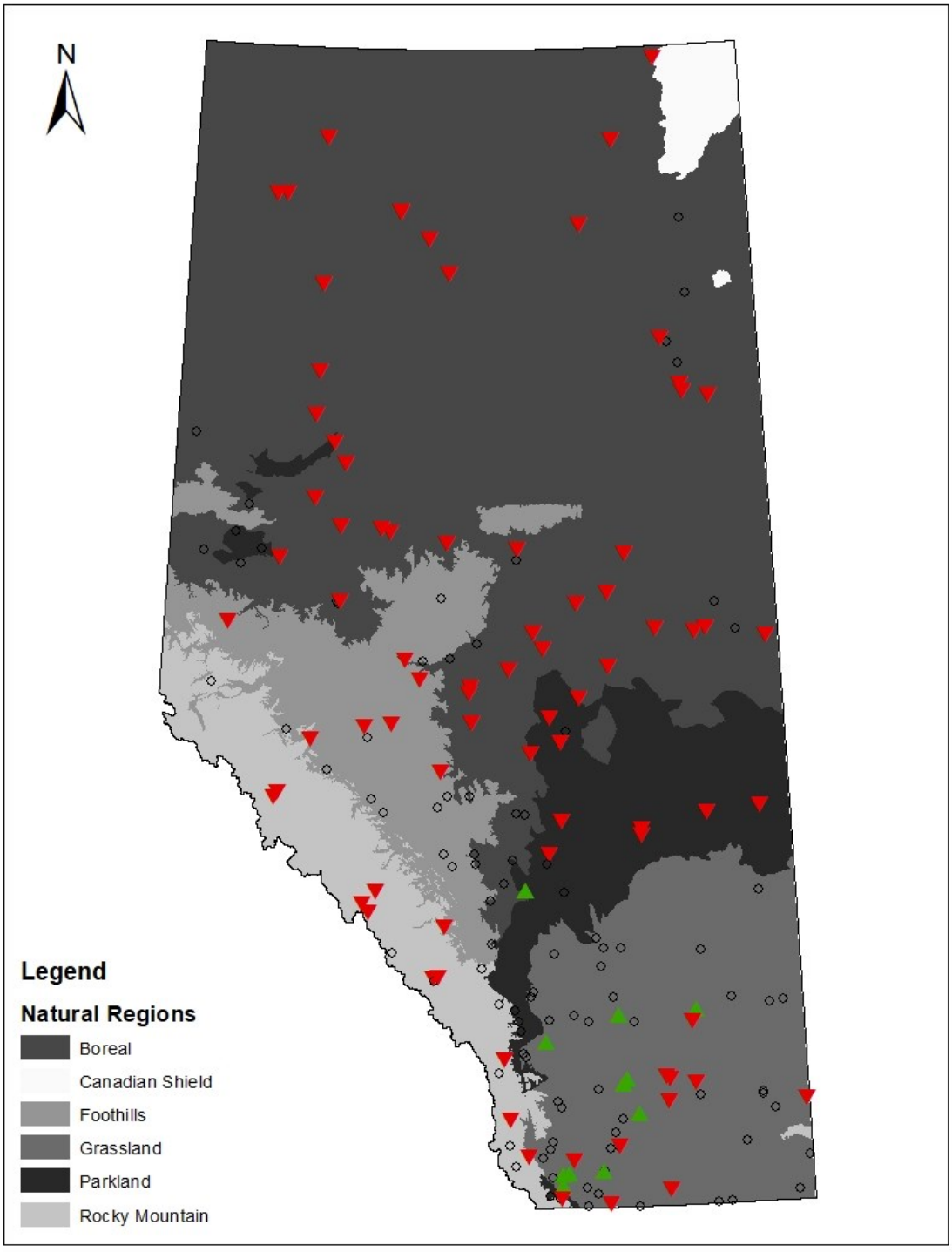

Figure C10: Trend results for annual maximum 7-day mean streamflow at stations across Alberta.

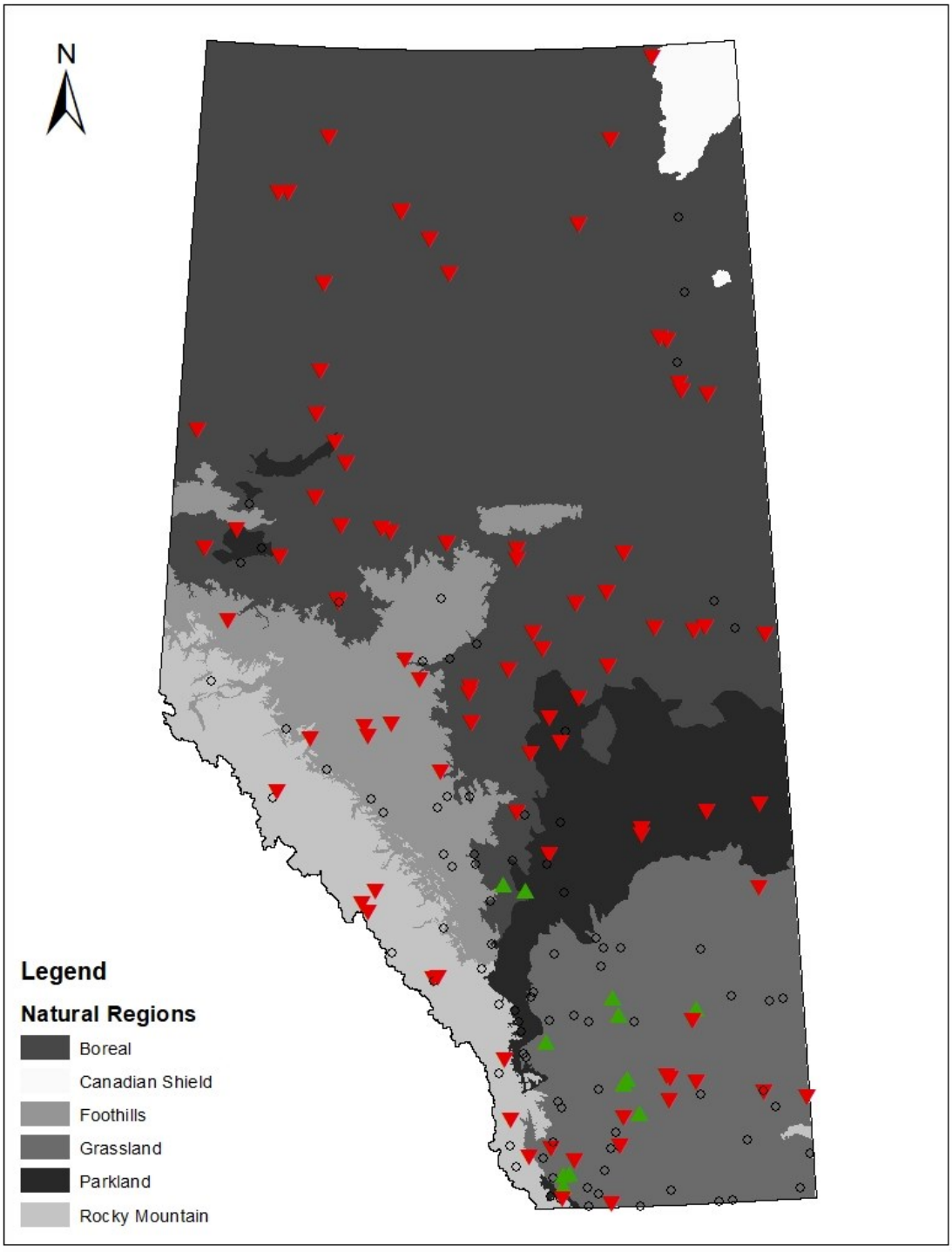

Figure C11: Trend results for annual maximum 30-day mean streamflow at stations across Alberta.

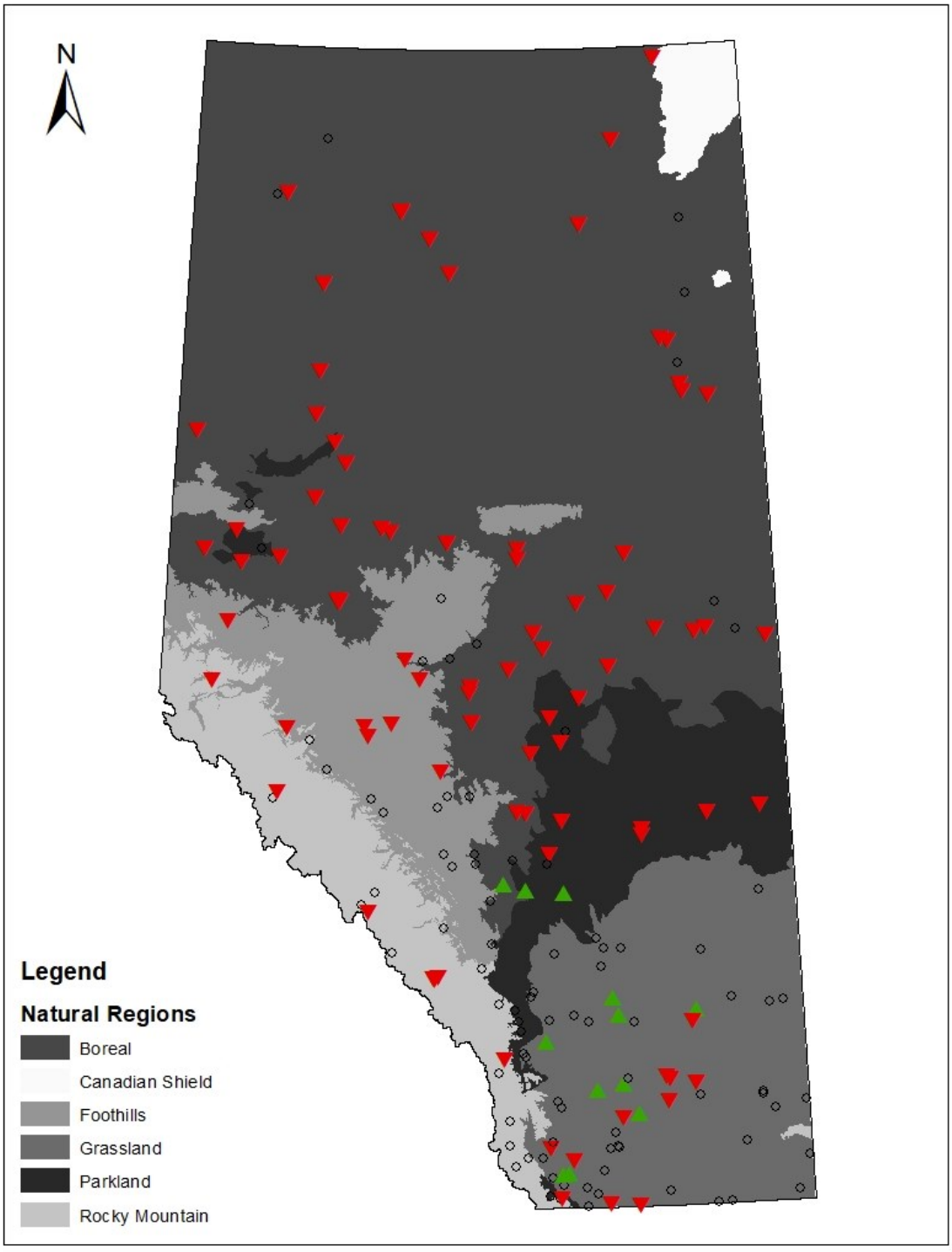

Figure C12: Trend results for annual maximum 90-day mean streamflow at stations across Alberta.

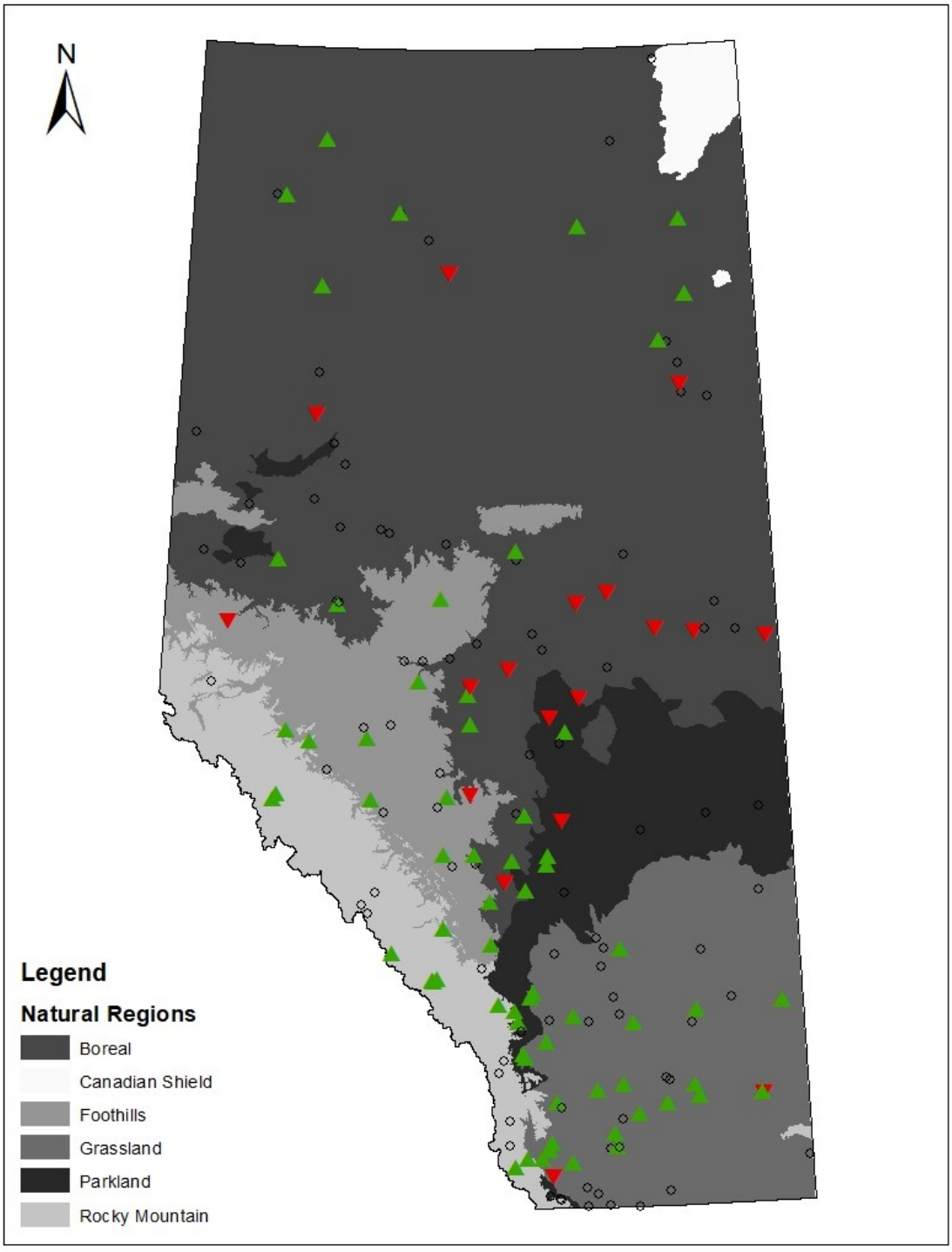

Figure C13: Trend results for annual minimum 1-day mean streamflow at stations across Alberta.

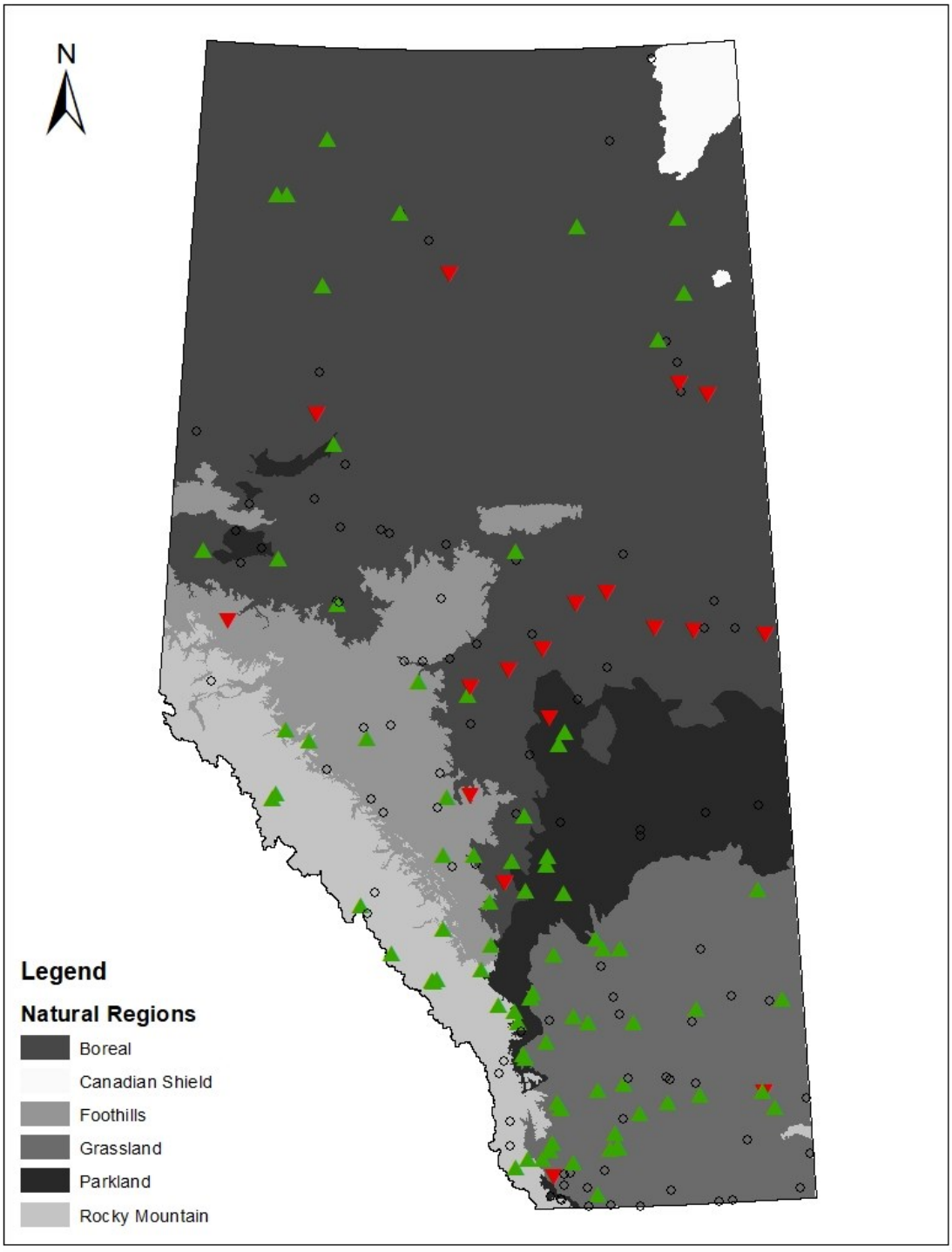

Figure C14: Trend results for annual minimum 3-day mean streamflow at stations across Alberta.

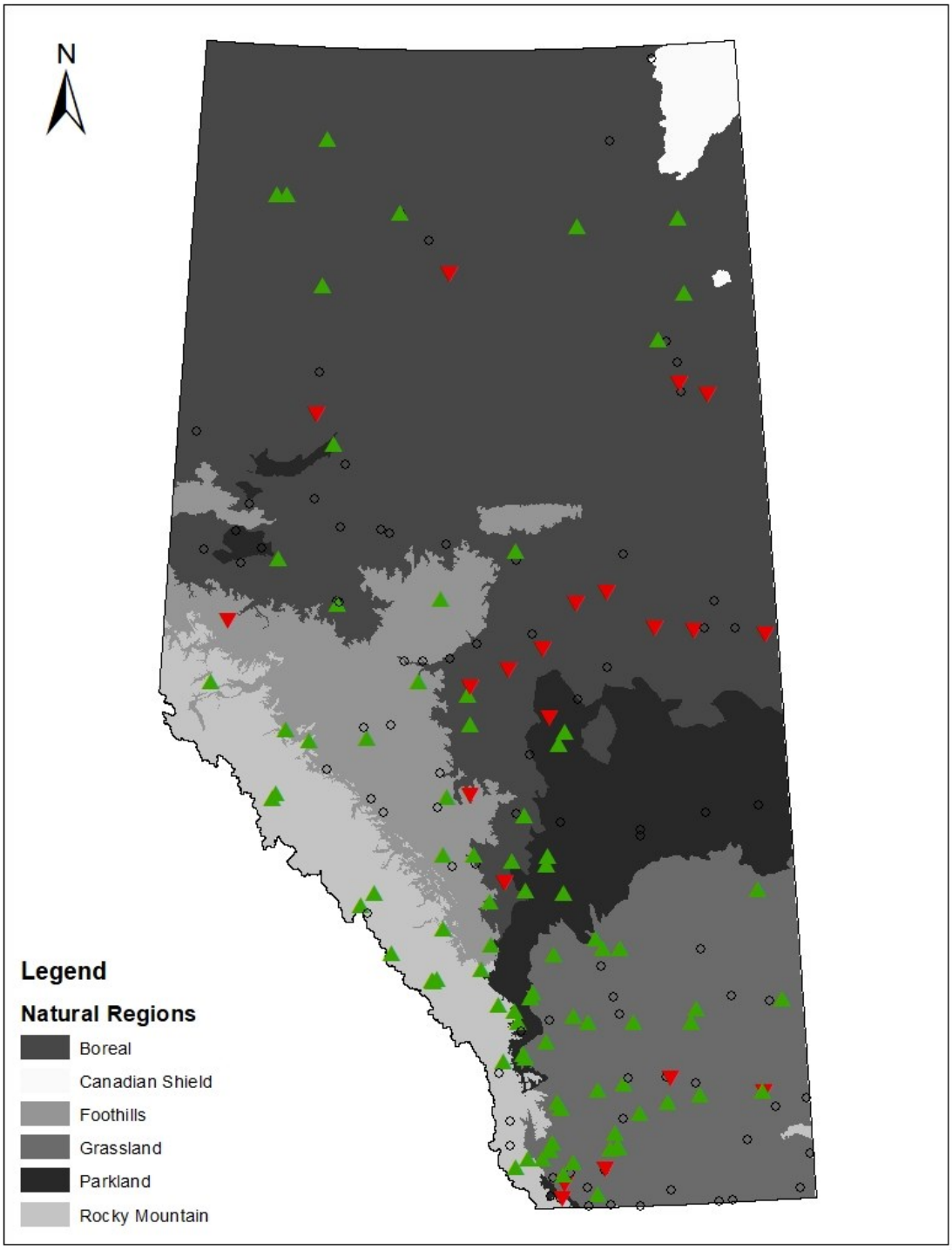

Figure C15: Trend results for annual minimum 7-day mean streamflow at stations across Alberta.

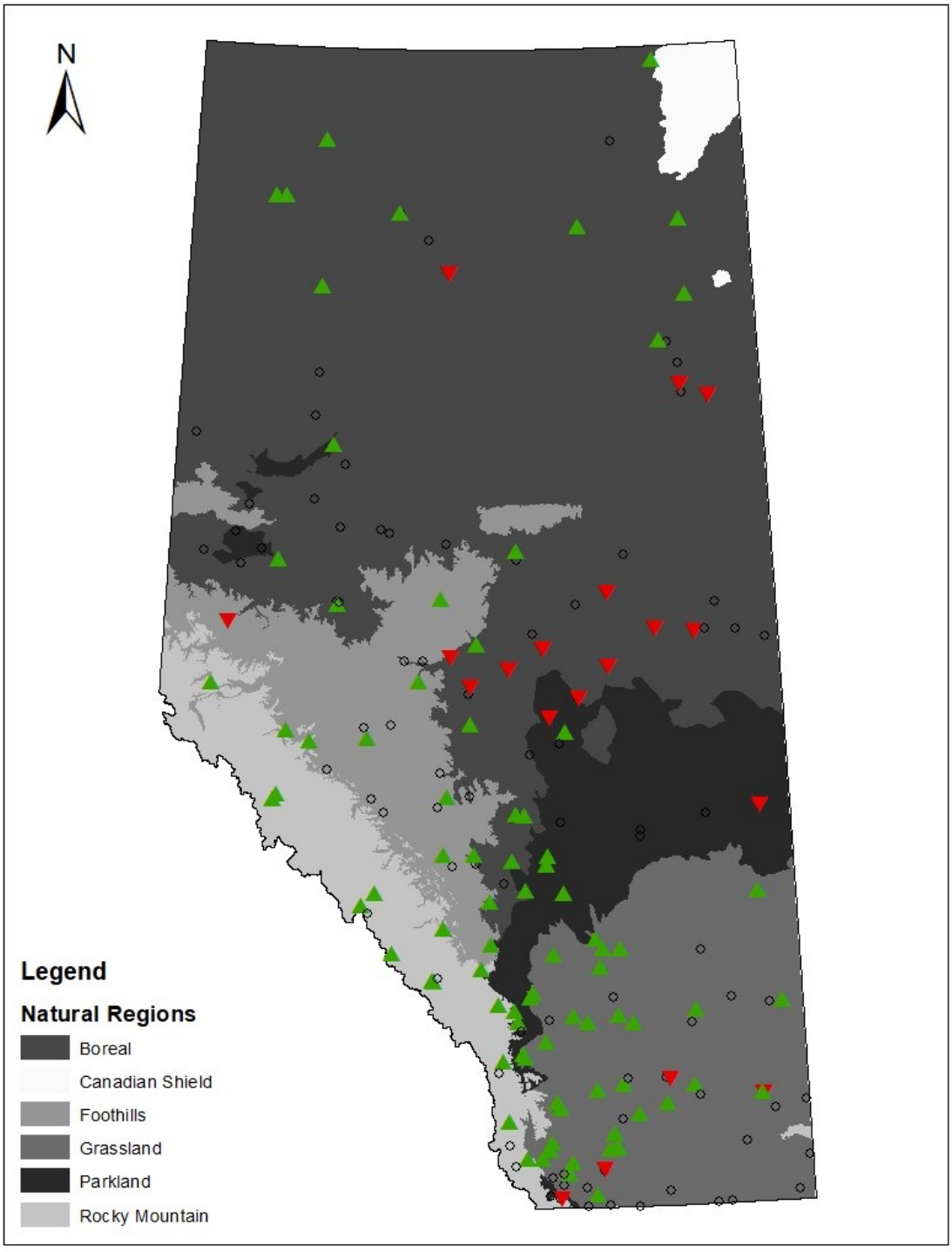

Figure C16: Trend results for annual minimum 30-day mean streamflow at stations across Alberta.

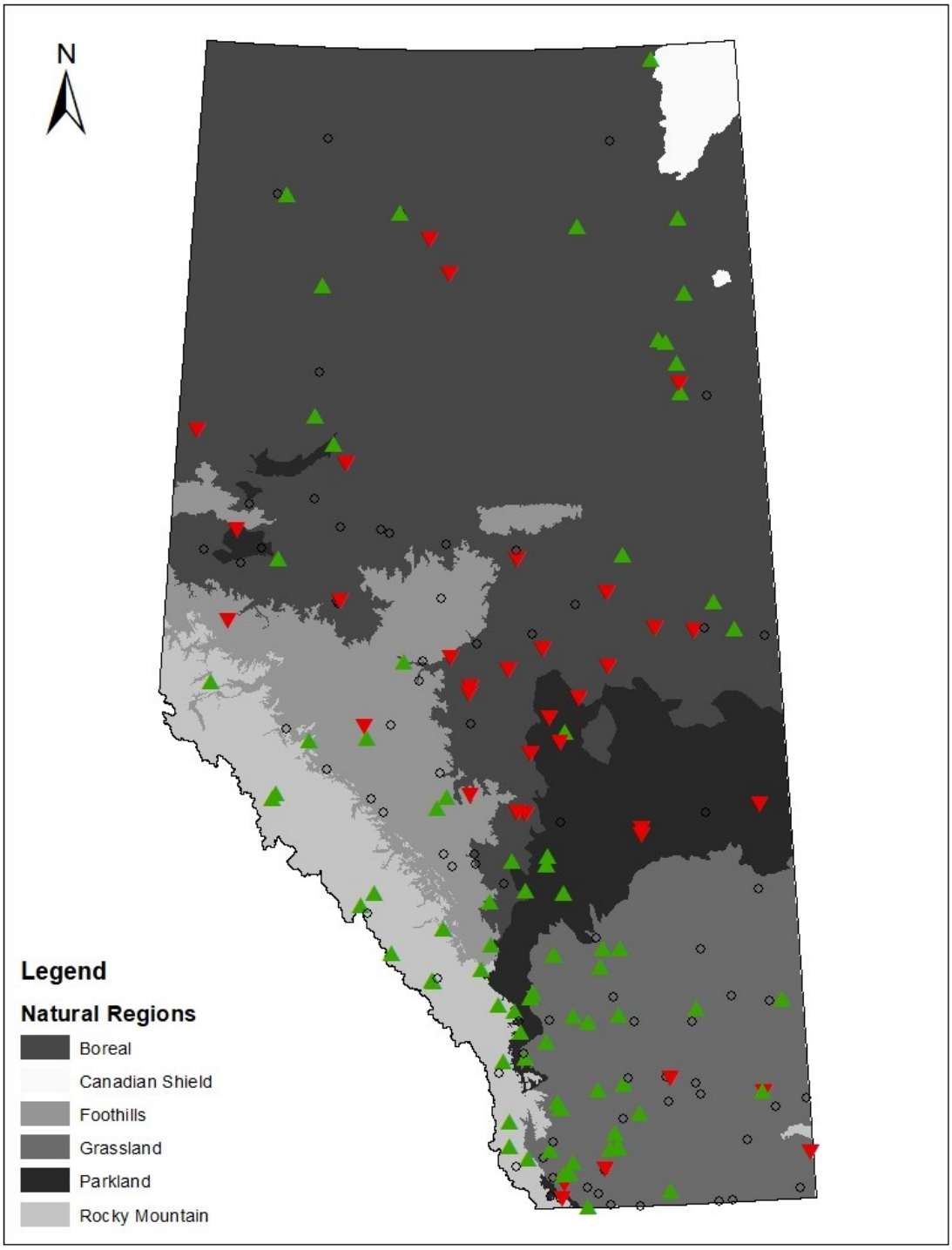

Figure C17: Trend results for annual minimum 90-day mean streamflow at stations across Alberta.

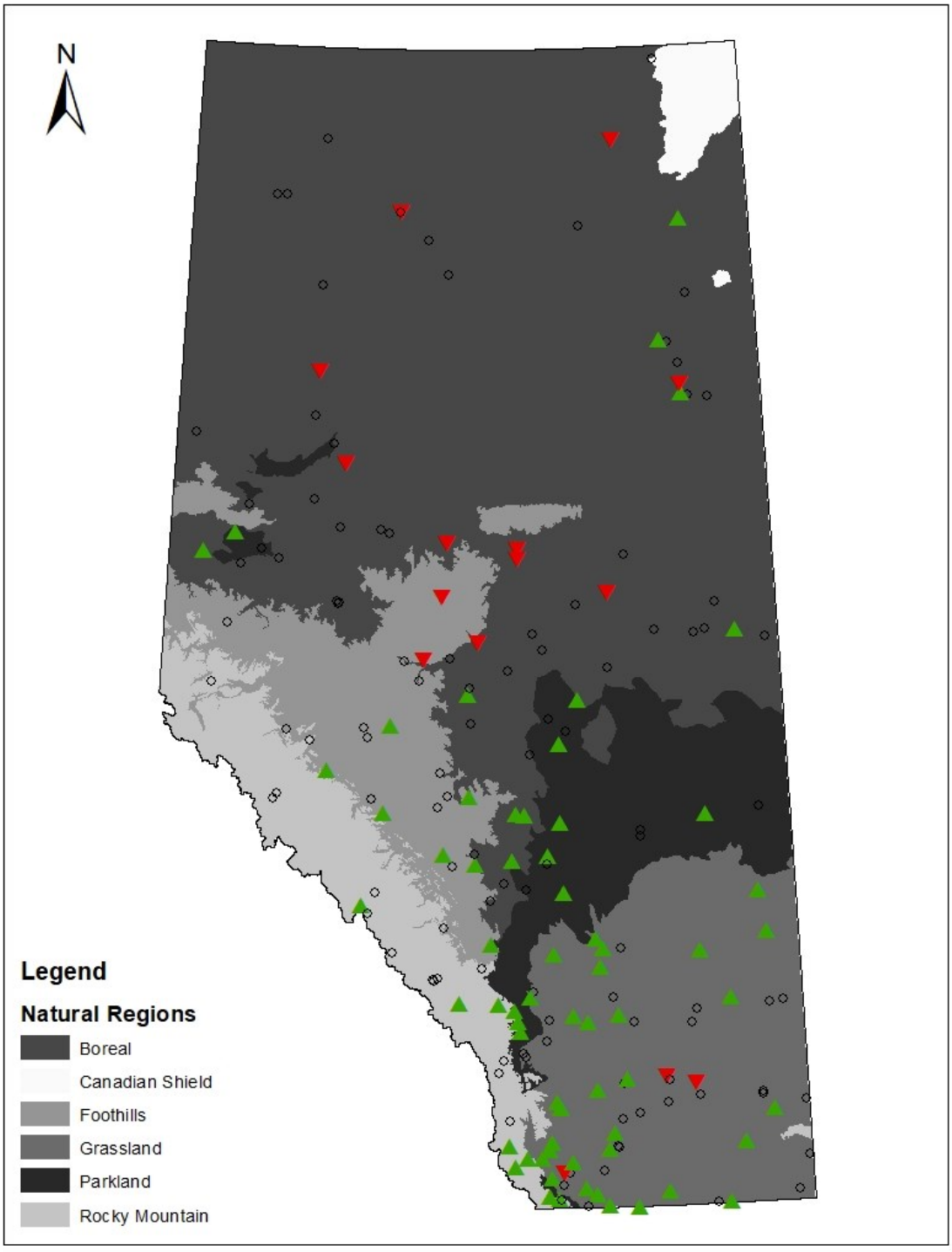

Figure C18: Trend results for the Julian date of the annual maximum daily streamflow at stations across Alberta.

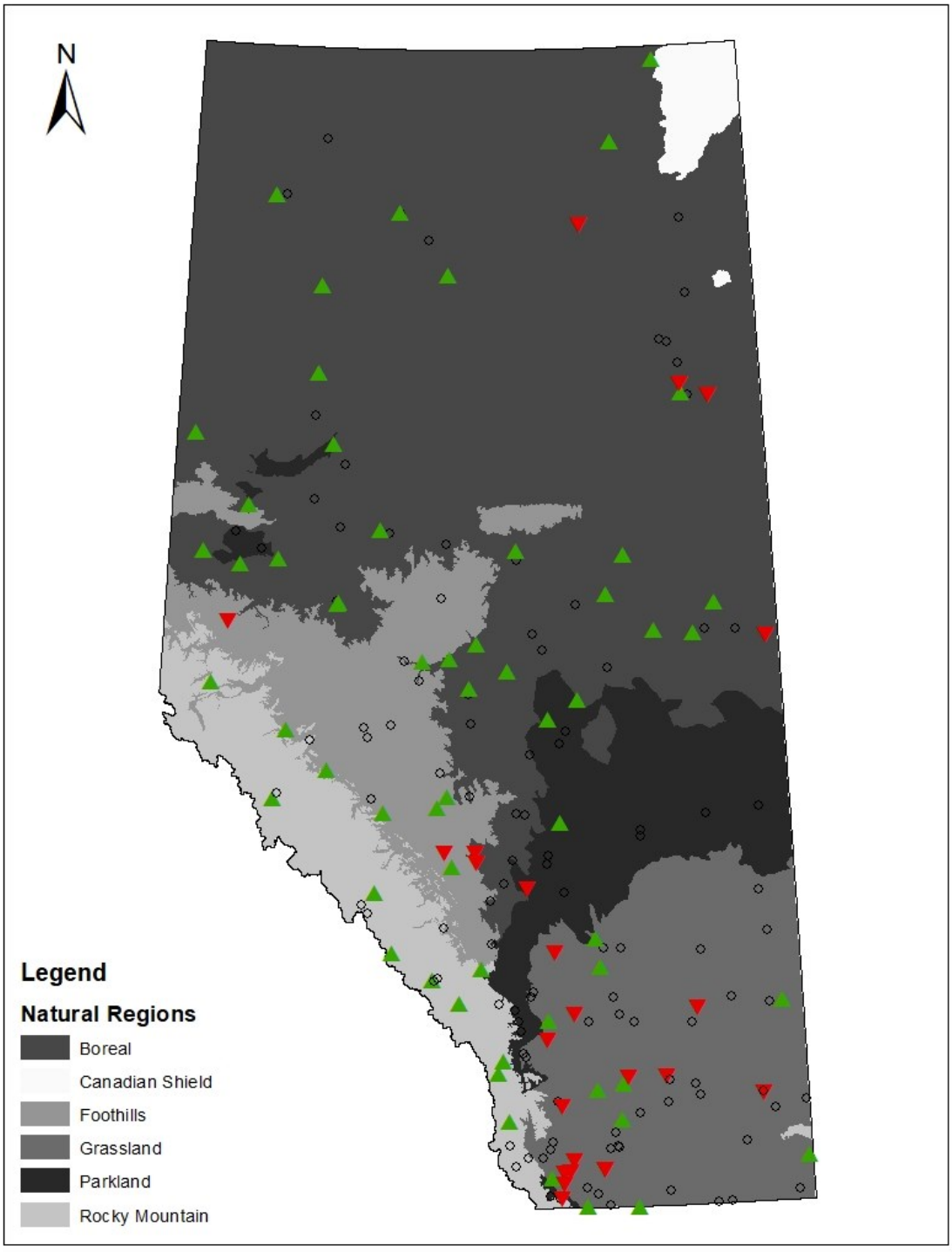

Figure C19: Trend results for the Julian date of the annual minimum daily streamflow at stations across Alberta.

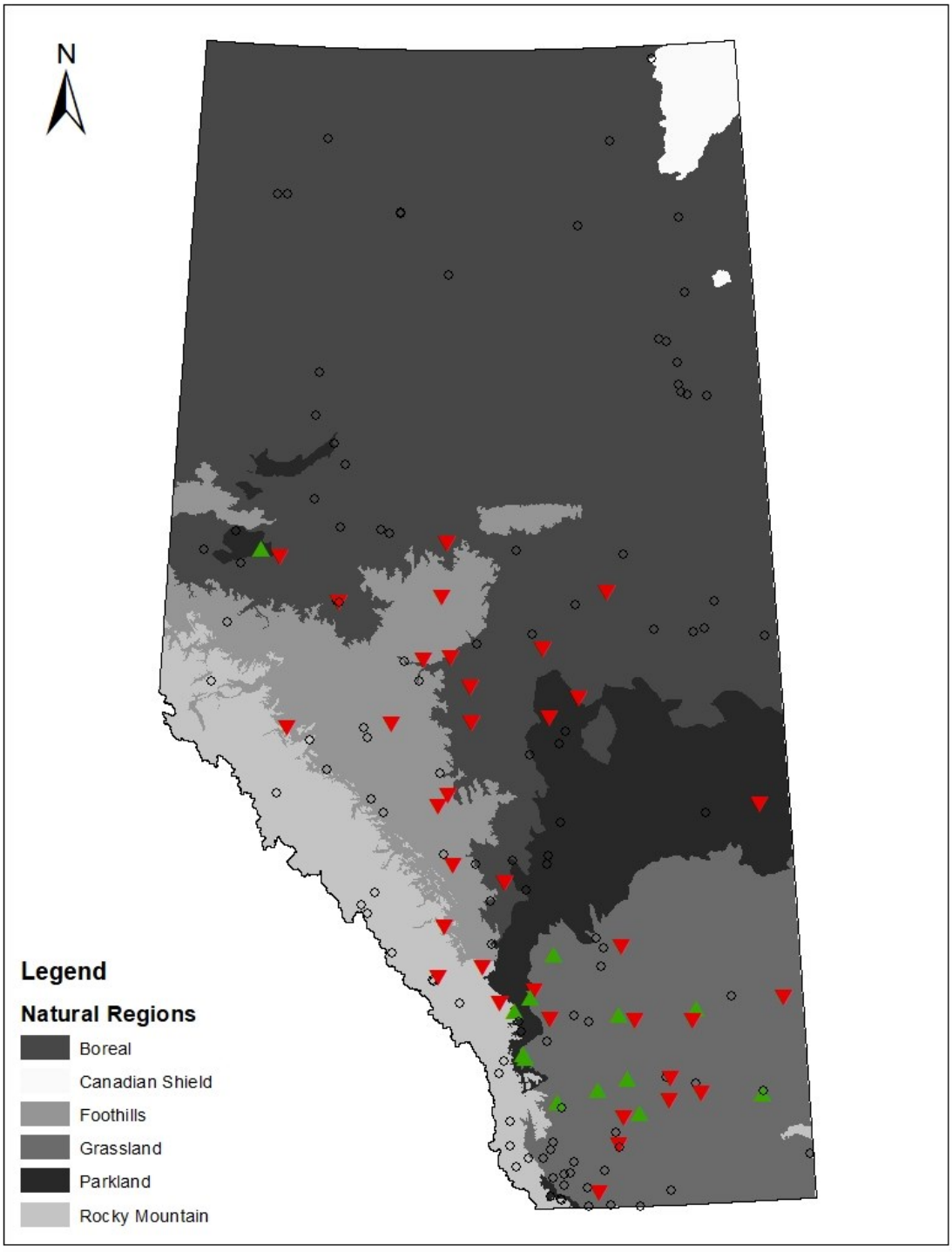

Figure C20: Trend results for the number of high pulses at stations across Alberta.

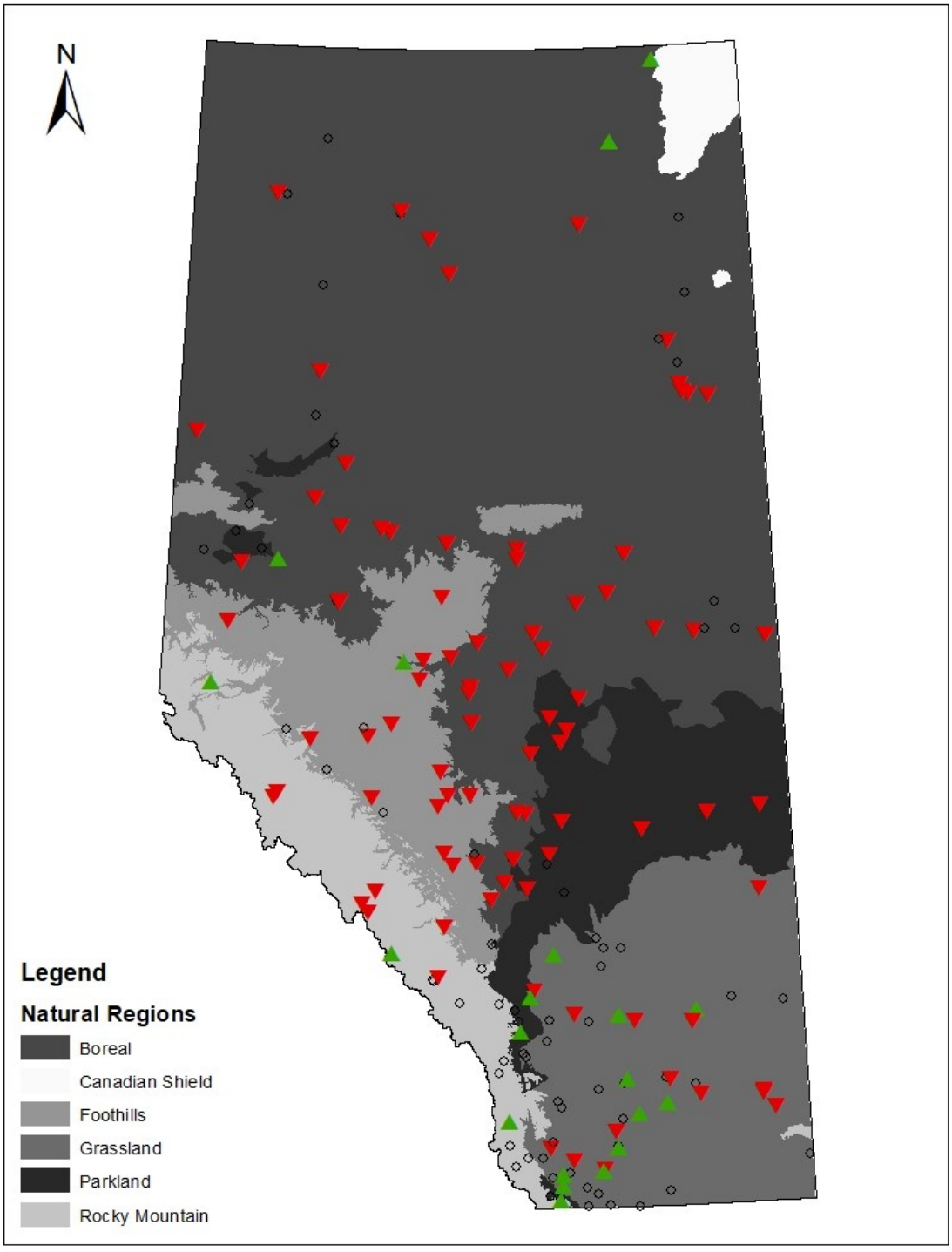

Figure C21: Trend results for the rise rate at stations across Alberta.

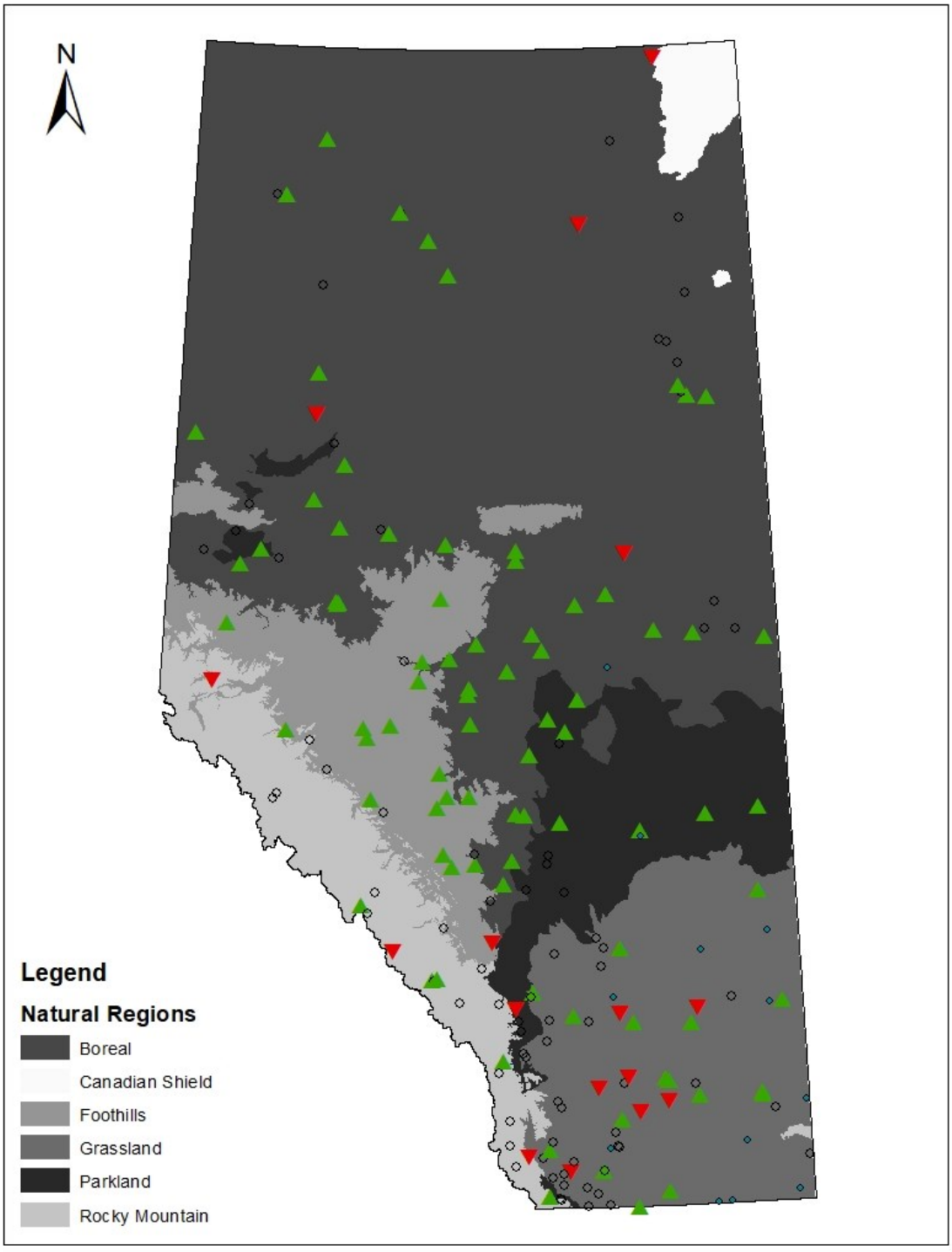

Figure C22: Trend results for the fall rate at stations across Alberta. Note that the analysis considered fall rate as a negative value; in other words, an increase in the fall rate indicates a decrease in the absolute value of the fall rate.

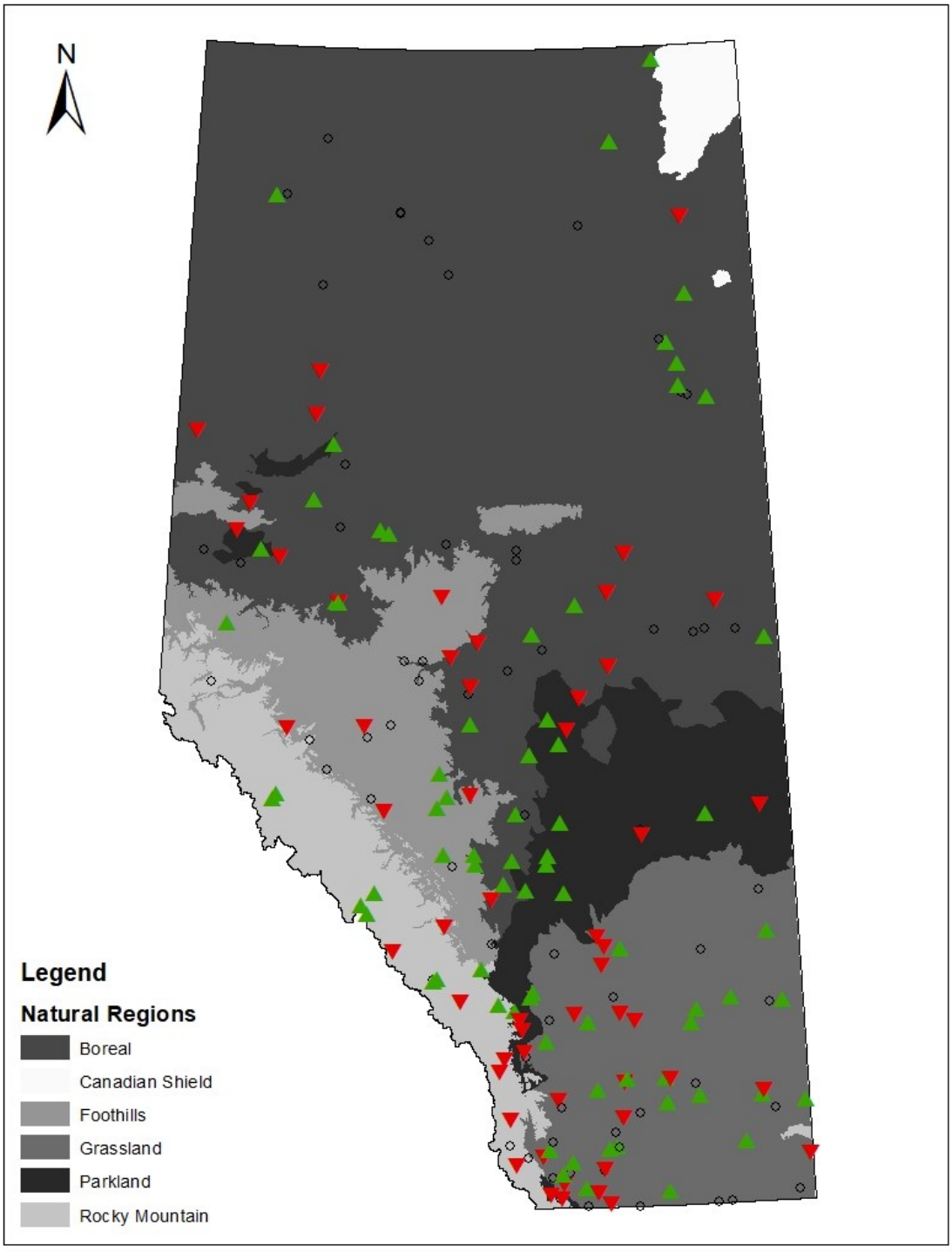

Figure C23: Trend results for the number of reversals at stations across Alberta.

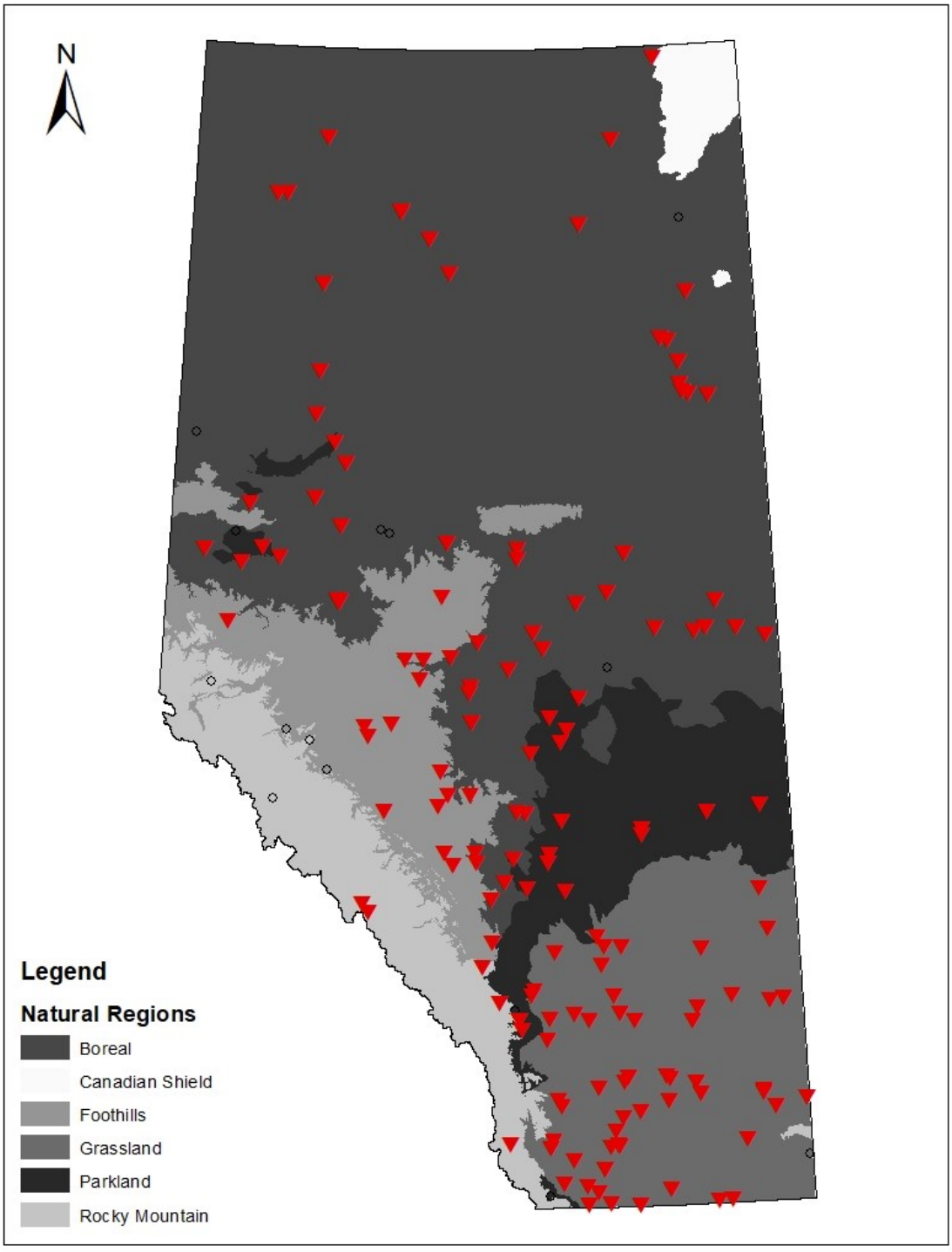

Figure C24: Trend results for precipitation as snow (PAS) during the winter at stations across Alberta.

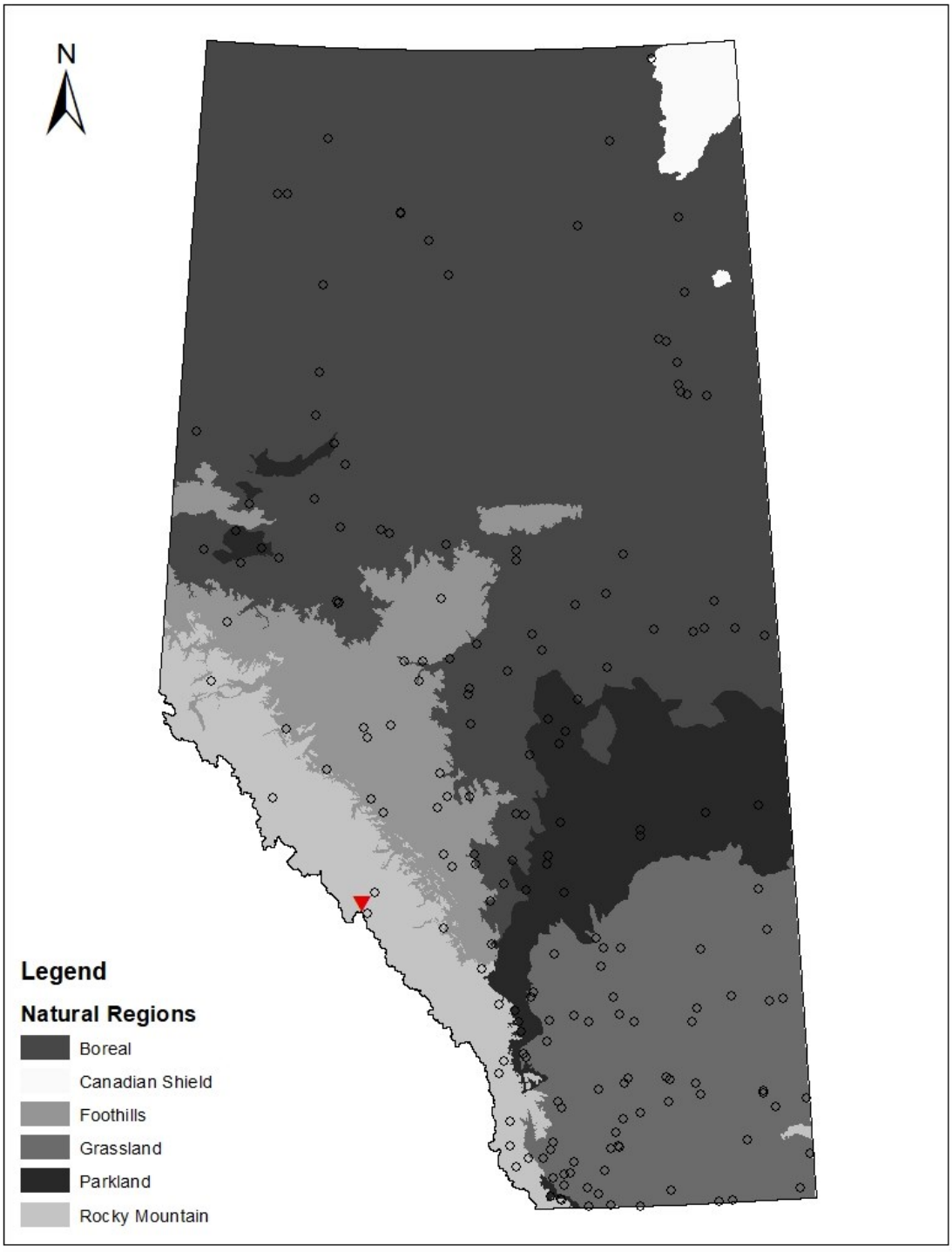

Figure C25: Trend results for fall precipitation at stations across Alberta.

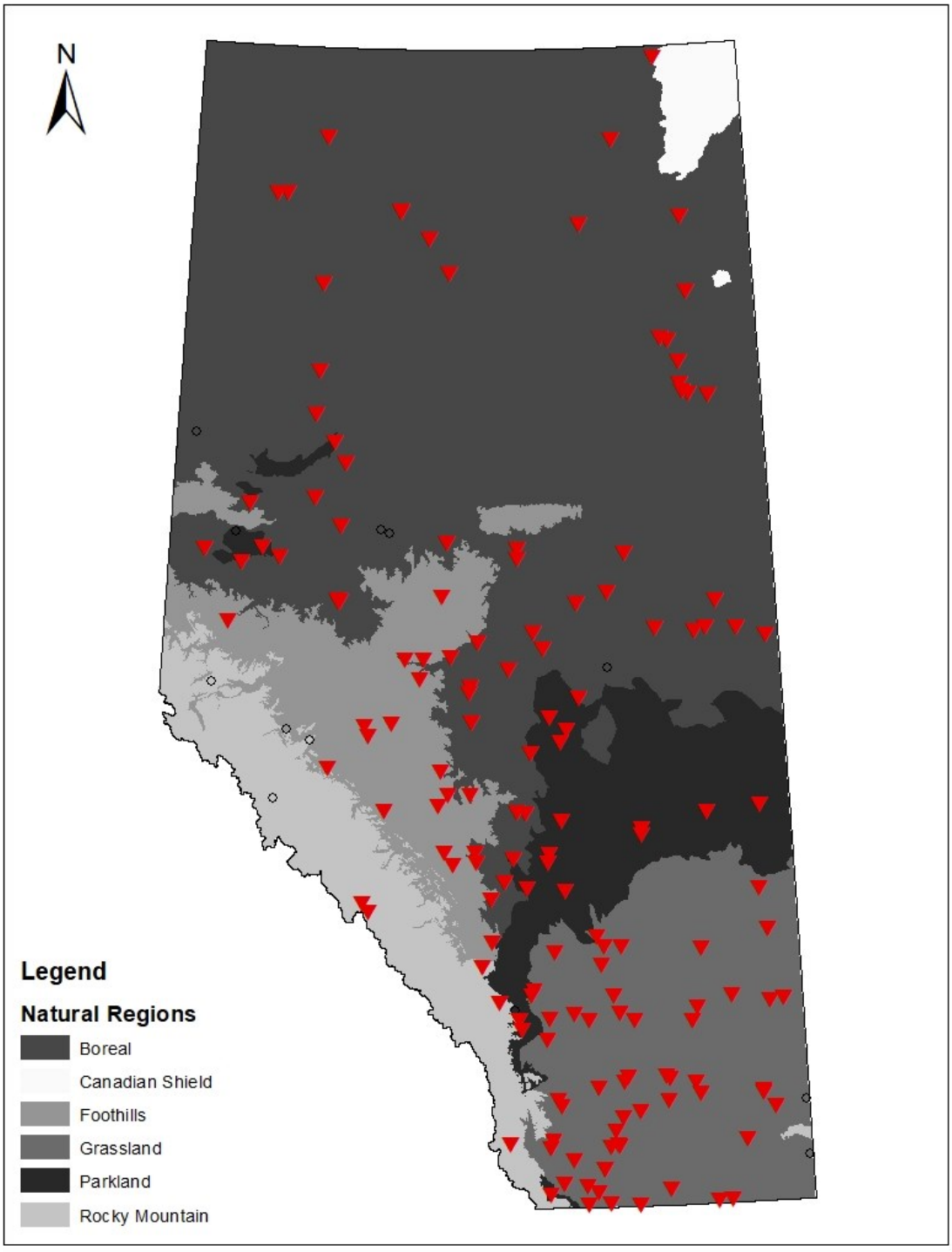

Figure C26: Trend results for winter precipitation at stations across Alberta.

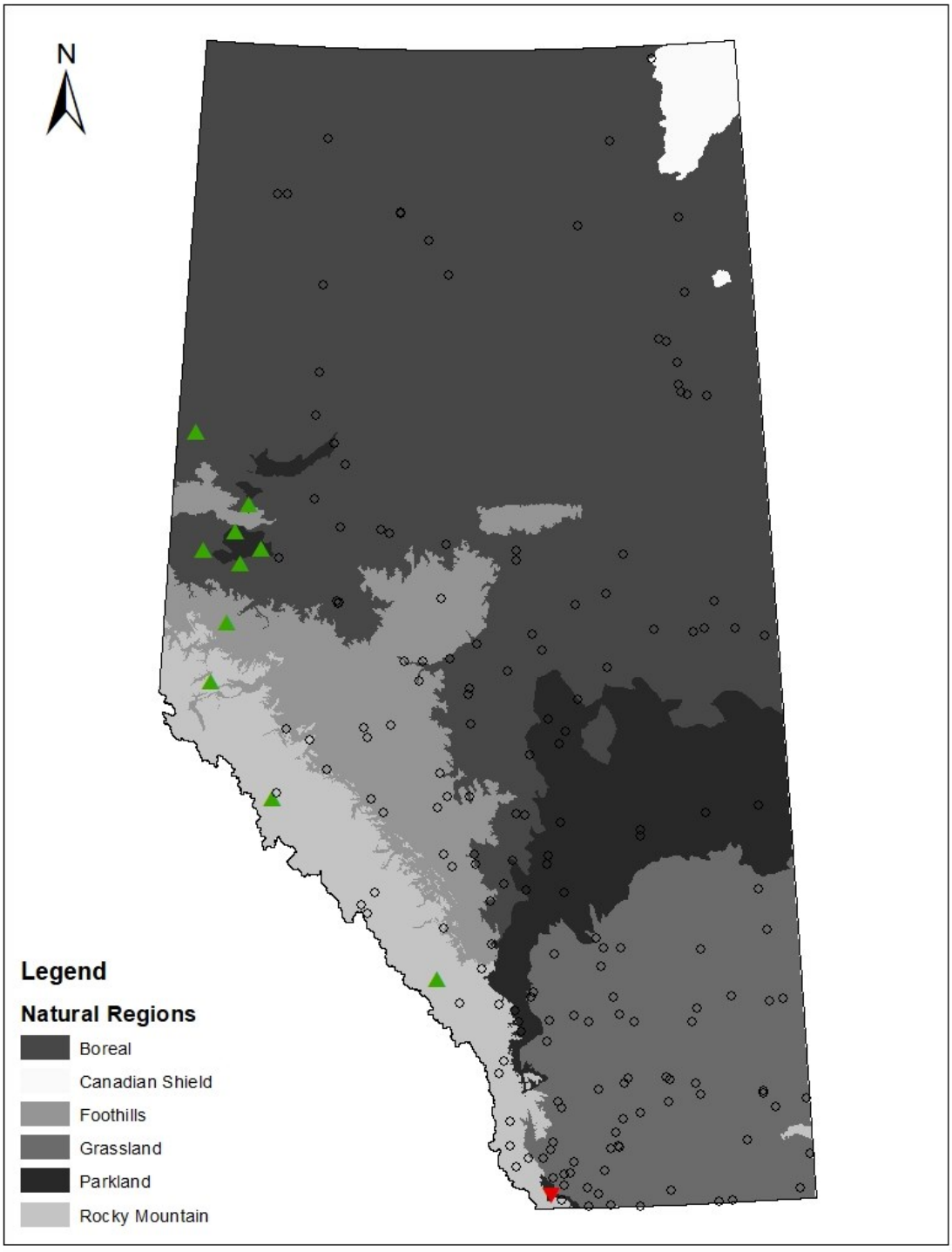

Figure C27: Trend results for spring precipitation at stations across Alberta.

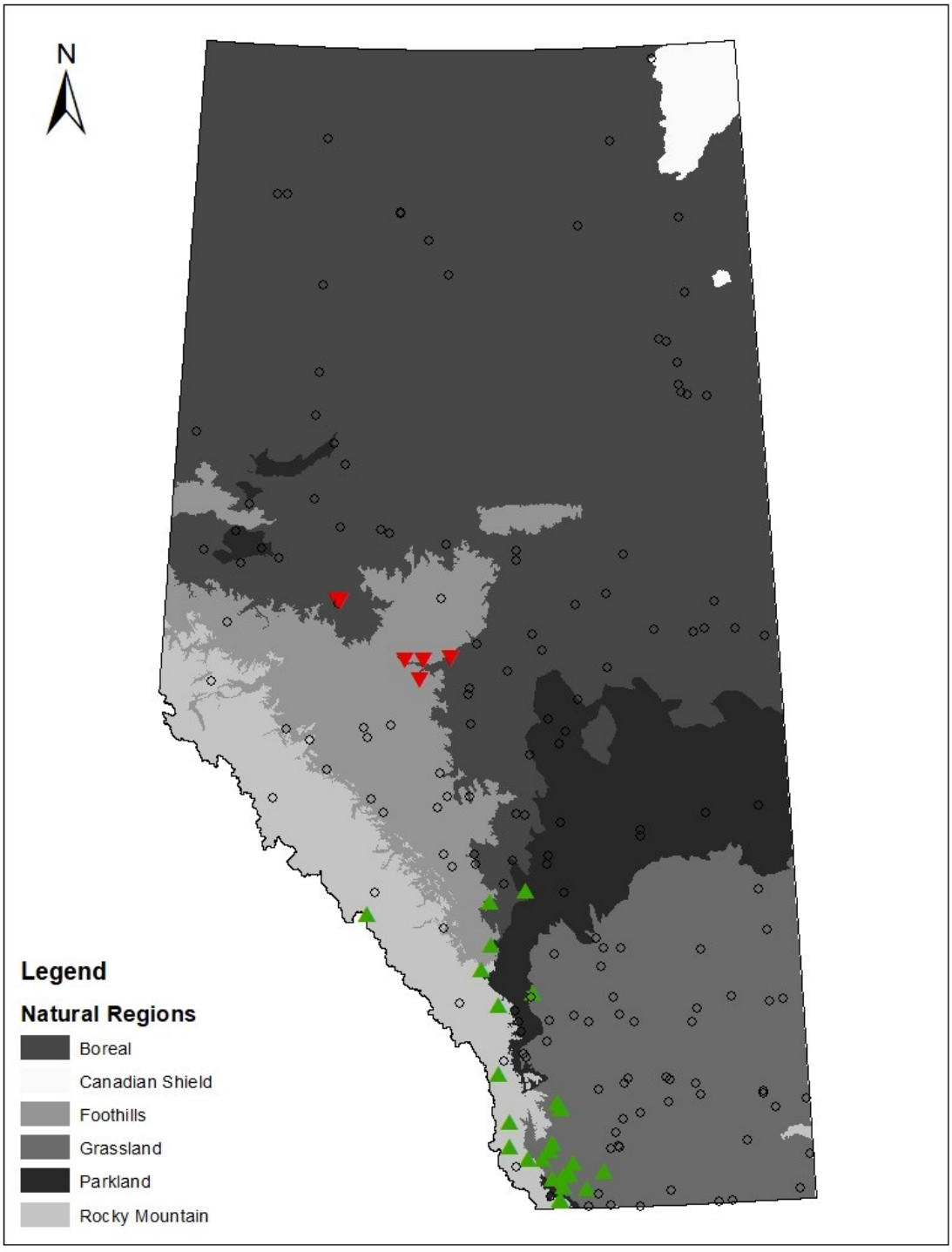

Figure C28: Trend results for summer precipitation at stations across Alberta.

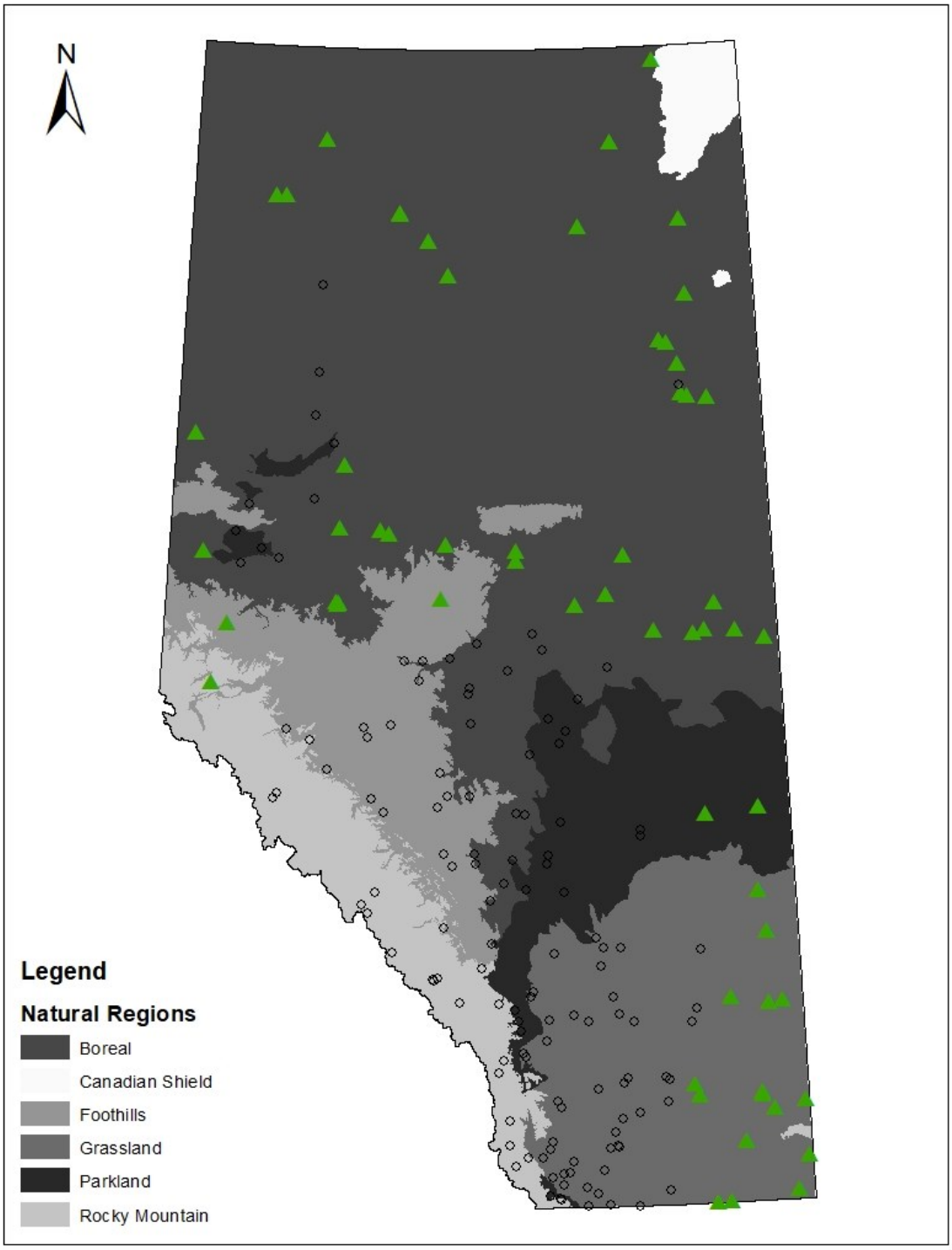

Figure C29: Trend results for fall average temperature at stations across Alberta.

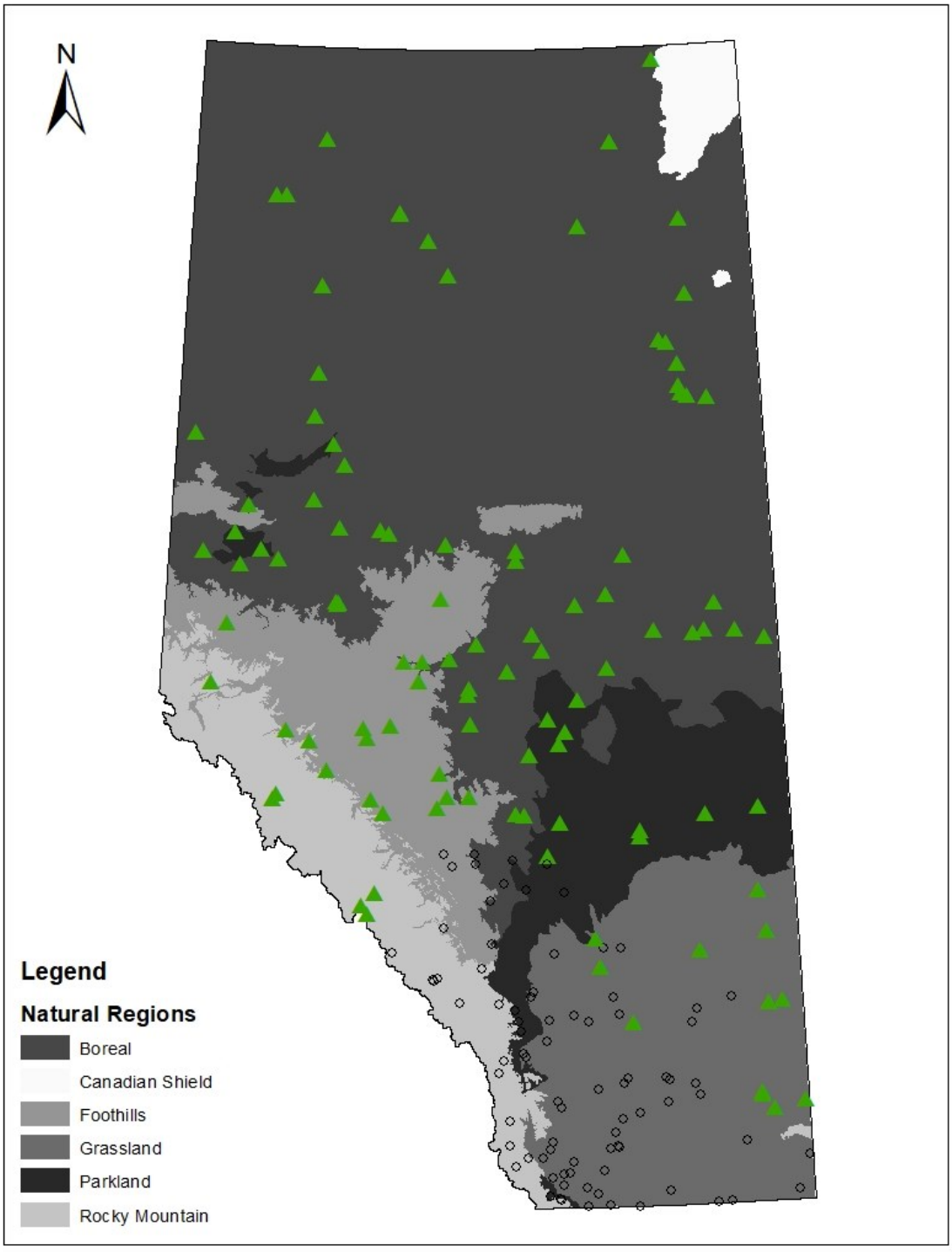

Figure C30: Trend results for winter average temperature at stations across Alberta.

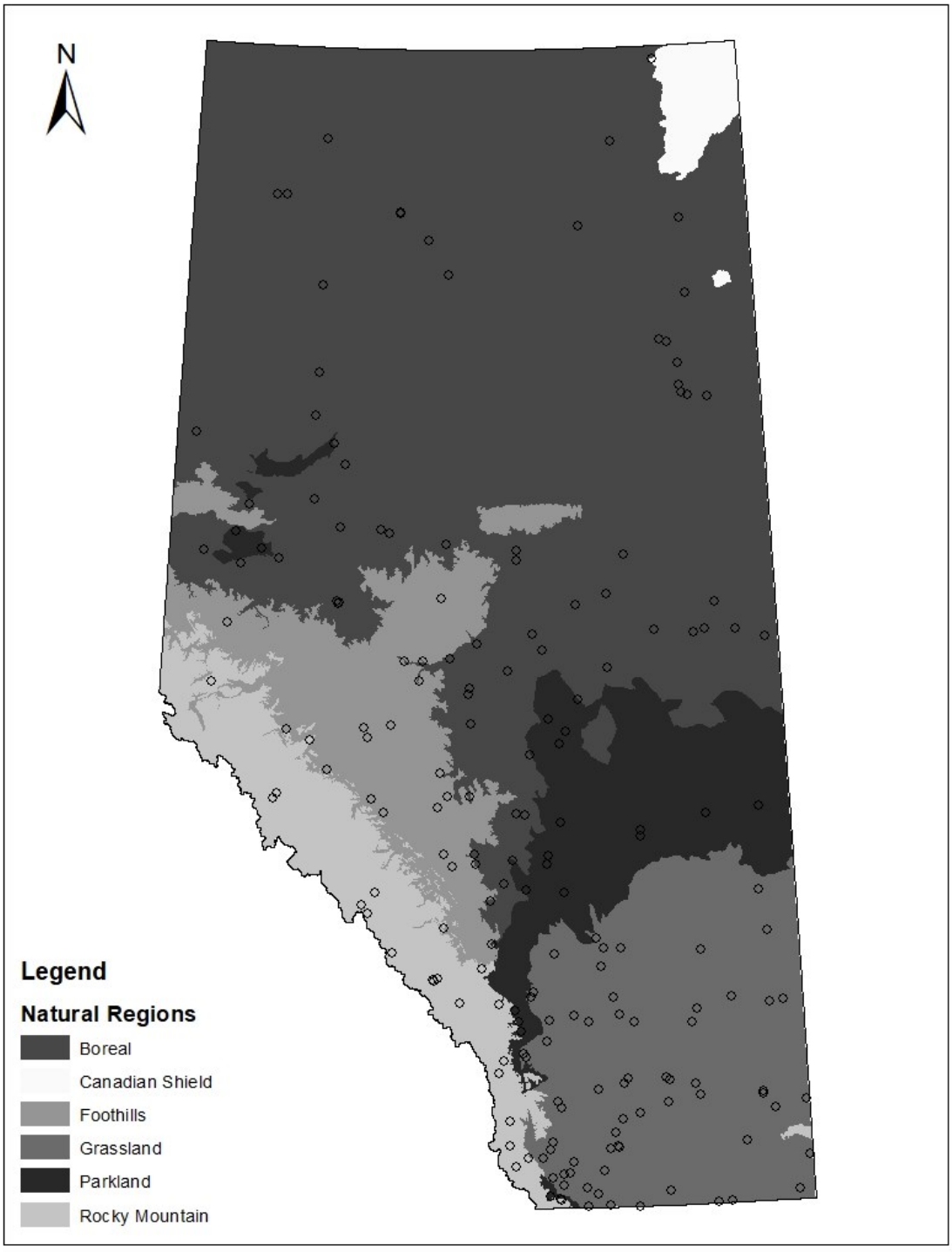

Figure C31: Trend results for spring average temperature at stations across Alberta.

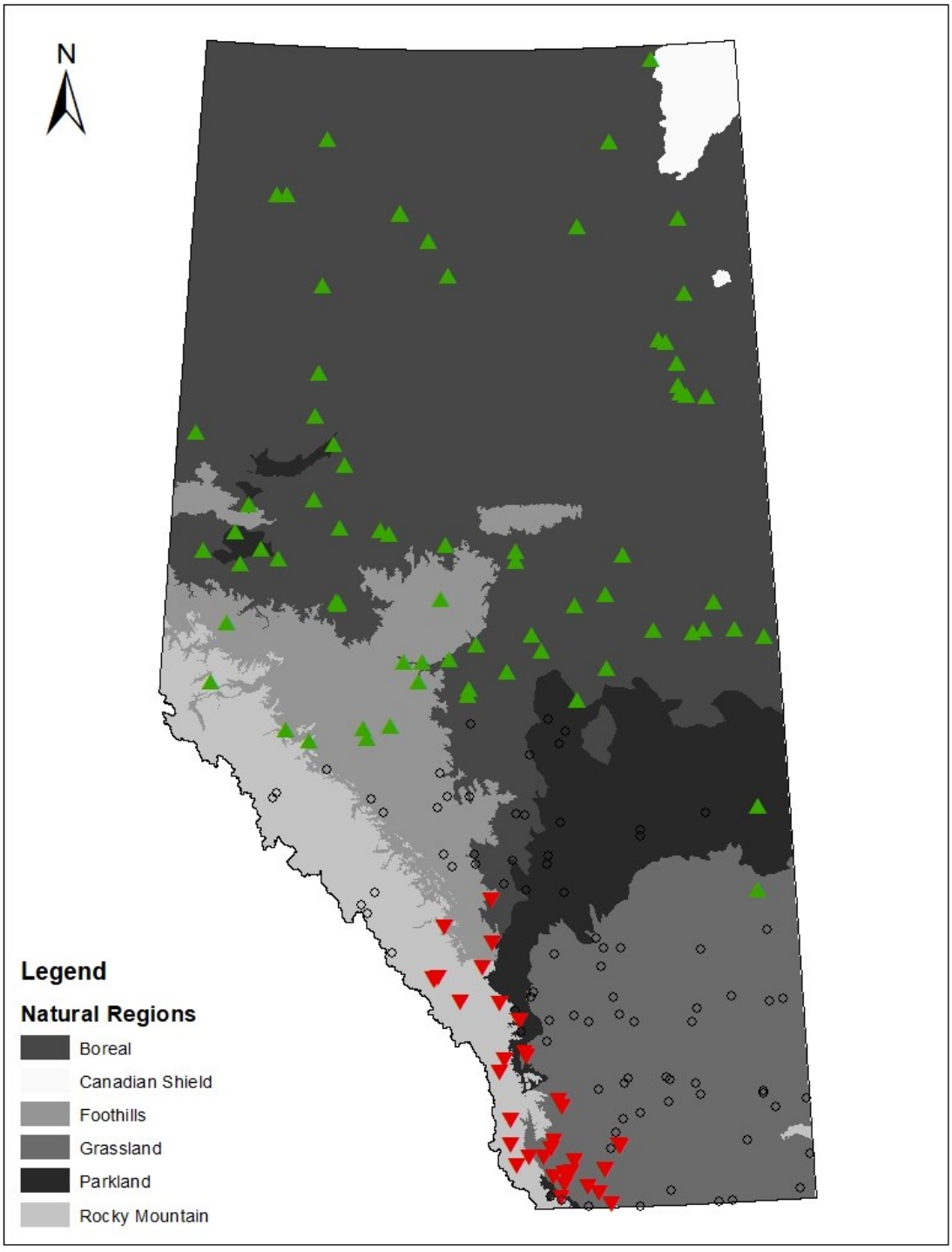

Figure C32: Trend results for summer average temperature at stations across Alberta.