January 31, 2022

Dr. Chelsea Morris
Permit Writer, Water Quality Program
Washington State Department of Ecology
300 Desmond Drive SE
Lacey, WA 98503

RE: Request for Comments
Concentrated Animal Feeding Operation (CAFO) General Permit
2022 Permit Reissuance

Dear Dr. Morris:

Inland Earth Sciences Corporation (IES) and Agrimanagement, Inc. (Agrimanagement), in cooperation with the Washington State Dairy Federation (WSDF) provide this letter (the "Letter") presenting comments regarding the Washington State Department of Ecology (Ecology) Water Quality General Permit (the "Permit") for Concentrated Animal Feeding Operations (CAFO). Comments regarding the Permit were solicited by Ecology as part of the permit reissuance process. These comments pertain to both the State Waste Discharge General Permit covering groundwater discharge and the Combined National Pollutant Discharge Elimination System and State Waste Discharge General Permit covering both surface water and groundwater discharge. We focus our comments on eight specific areas of the Permit, (1) land application of manure, (2) field soil sampling, (3) adaptive management actions, (4) composting, (5) lagoons, (6) groundwater, (7) DNMP-MPPP harmonization and (8) climate change.

LAND APPLICATION OF MANURE

Permittees apply manure solids and/or liquids to agricultural fields for the beneficial purpose of providing crop nutrient. Crop production in Washington State differs greatly by geographic location; the most significant difference being between agricultural practices west and east of the Cascade Range. The Permit requirements regarding land application of manure were designed for implementation by all permittees in the State, with little regard for geographic location. We contend that this approach does not adequately consider regional agricultural and climatic conditions existing east of the Cascade Range and ask that Ecology consider a revised approach for permittees located in eastern Washington. Section S4.J.3.d of the Permit (*Land Application – Application Restrictions*) currently states:

> *d. No land application of manure, litter, process wastewater, or other organic byproducts may occur:*
>
> > *i. To fields with a frozen surface crust (2 inches) or deeper, or if the soil is at or below zero degrees Celsius (32 degrees Fahrenheit).*
> >
> > *ii. To fields that are snow covered.*
> >
> > *iii. To fields with saturated soil.*

> iv. *If the water table is within 12 inches or less of the surface.*
>
> v. *If precipitation is forecast in the next 24 hours for the facility location that will cause a discharge from the Permittee's land application fields.*
>
> vi. *After October 1 and prior to T-SUM 200 unless the manure, litter, process wastewater, or other organic by-products are applied in accordance with special condition S4.J.4.*
>
> vii. *To fields that are bare (no perennial crop) unless the Permittee is preparing the bare field for the current year's annual crop (planting within 30 days of land application). Special condition S4.M applies to fields that are being prepared for a crop.*

Sections S4.J.3.d.vi and S4.J.3.d.vii significantly restrict the ability of Permittees east of the Cascade Range to actively manage their crops in relation to eastern Washington climatic conditions. We would ask that Ecology consider the following proposed modifications to the Permit for Permittees located within eastern Washington:

- Delay the requirement that Permittees located within eastern Washington to apply nutrient in accordance with special condition S4.J.4 until November 15th;
- Replace the T-SUM 200 requirement for Permittees located within eastern Washington with T-SUM 100 and continue with NRCS guidance that prohibits applications to:
    - Fields with frozen surface crust (2 inches) or deeper, or if the soil is at or below zero degrees Celsius (32 degrees Fahrenheit).
    - To fields that are snow covered.
    - To fields with saturated soil.
    - If the water table is within 12 inches or less of the surface.

    At the time of application, records of the current conditions would yet be required.

Our reasoning for this request is presented in the following Sections of this letter.

Climate of Washington

The information in this section is excerpted from the *Climate of Washington*, Western Regional Climate Center, 2021. Web. April 30,2021. https://wrcc.dri.edu/Climate/narrative_wa.php. This section is intended to provide a general background into the Washington's climate and the significant difference between the western and eastern portions of the state, as delineated by the Cascade Range.

Topographic Features

The location of the State of Washington on the windward coast in mid-latitudes is such that the climatic elements combine to produce a predominantly marine-type climate west of the Cascade Mountains, while east of the Cascades, the climate possesses both continental and marine characteristics. Considering its northerly latitude, 46° to 49°, Washington's climate is mild.

There are several climatic controls which have a definite influence on the climate, namely; (a) terrain, (b) Pacific Ocean, and (c) semi-permanent high and low pressure regions located over the North Pacific

Ocean. The effect of these various controls combine to produce entirely different conditions within short distances.

Washington's western boundary is formed by the Pacific Ocean. The seasonal change in the temperature of the ocean is less than the seasonal change in the temperature of the land, thus the ocean is warmer in winter and cooler in summer than the adjoining land surfaces. The average temperature of the water along the coast and in the Strait of Juan de Fuca ranges from 45° in January to 53° F in July; however, during the summer, some of the shallow bays and protected coves are five to ten degrees warmer.

There are two ranges of mountains parallel to the coast and athwart to the prevailing direction of moist air moving inland from over the ocean. The first orographic lifting and major release of moisture occurs along the western slope of the Coastal Range. The second area of heavy orographic precipitation is along the windward slopes of the Cascade Range. The Cascade Mountains, 90 to 125 miles inland and 4,000 to 10,000 feet in elevation, are a topographic and climatic barrier separating the state into eastern and western Washington. The higher, wider, and more rugged sections are in the northern part of the state. Some of the highest isolated volcanic peaks are Mt. Rainier (14,408 ft.), Mt Adams (12,307 ft.) and Mt. Baker (10,730 ft.). These and other high peaks are snowcapped throughout the year. The only break in the Cascade Range is the narrow and scenic Columbia River gorge.

Climatic Features

Warming and drying of air as it descends along the lee (eastern) slopes of the Cascade Range results in near desert conditions in the lowest section of the Columbia Basin. Another orographic lifting of the air occurs as it flows eastward from the lowest elevations of the Inland Basin toward the Rocky Mountains. This lifting of air results in a gradual increase in precipitation from the lowest section of the basin to the higher elevations along the eastern border of the state.

The location and intensity of the semi-permanent high and low-pressure areas over the North Pacific Ocean have a definite influence on the climate. Air circulates in a clockwise direction around the semi-permanent high-pressure cell and in a counter-clockwise direction around the semi-permanent low-pressure cell. During the spring and summer, the low-pressure cell becomes weak and moves north of the Aleutian Islands. At the same time, the high-pressure area spreads over most of the North Pacific Ocean. A circulation of air around the high-pressure center brings a prevailing westerly and northwesterly flow of comparatively dry, cool, and stable air into the Pacific Northwest. As the air moves inland, it becomes warmer and drier which results in a dry season beginning in the late spring and reaching a peak in mid-summer.

In the fall and winter, the Aleutian low-pressure center intensifies and moves southward reaching a maximum intensity in midwinter. At the same time, the high-pressure area becomes weaker and moves southward. A circulation of air around these two pressure centers over the ocean brings a prevailing southwesterly and westerly flow of air into the Pacific Northwest. This air from over the ocean is moist and near the temperature of the water. Condensation occurs as the air moves inland over the cooler land and rises along the windward slopes of the mountains. This results in a wet season beginning in October, reaching a peak in winter, then gradually decreasing in the spring.

Eastern Washington

This section of the state is part of the large inland basin between the Cascade and Rocky Mountains. In an easterly and northerly direction, the Rocky Mountains shield the inland basin from the winter season's cold air masses traveling southward across Canada. In a westerly direction, the Cascade Range forms a barrier to the easterly movement of moist and comparatively mild air in winter and cool air in summer. Some of the air from each of these source regions reaches this section of the state and produces a climate which has some of the characteristics of both continental and marine types. Most of the air masses and weather systems crossing eastern Washington are traveling under the influence of the prevailing westerly winds. Infrequently, dry continental air masses enter the inland basin from the north or east. In the summer season this air from over the continent results in low relative humidity and high temperatures, while in winter clear, cold weather prevails. Extremes in both summer and winter temperatures generally occur when the inland basin is under the influence of air from over the continent.

East of the Cascades, summers are warmer, winters are colder and precipitation is less than in western Washington.

The average number of clear or only partly cloudy days each month varies from five to 10 in winter, 12 to 18 in spring and fall, and 20 to 28 in summer. The percent of possible sunshine received each month is from 20 to 30 percent in winter, 50 to 60 percent in spring and fall and 80 to 85 percent in summer. The number of hours of sunshine possible on a clear day ranges from approximately eight in December to 16 in June. In the driest areas, rainfall is recorded on 70 days each year and on 120 days or more in the higher elevations near the eastern border and along the eastern slope of the Cascades.

Annual precipitation ranges from seven to nine inches near the confluence of the Snake and Columbia Rivers, 15 to 30 inches along the eastern border and 75 to 90 inches near the summit of the Cascade Mountains. During July and August, it is not unusual for four to eight weeks to pass with only a few scattered showers. Thunderstorms can be expected on one to three days each month from April through September. Most thunderstorms in the warmest months occur as isolated cells covering only a few square miles. A few damaging hailstorms are reported each summer. Maximum rainfall intensities to expect in one out of ten years are 0.6-inch in one hour; 1.0 inch in three hours; 1.0 to 1.5 inches in six hours; and 1.2 to 2.0 inches in 12 hours.

During the coldest months, a loss of heat by radiation at night and moist air crossing the Cascades and mixing with the colder air in the inland basin results in cloudiness, for and occasional freezing drizzle. A "chinook" wind which produces a rapid rise in temperature occurs a few times each winter. Frost penetration in the soil depends to some extent on the vegetative cover, snow cover and the duration of low temperatures. In an average winter, frost in the soil can be expected to reach a depth of 10 to 20 inches. During a few of the colder winters with little or no snow cover, frost has reached a depth of 25 to 35 inches.

During most of the year, the prevailing direction of the wind is from the southwest or west. The frequency of northeasterly winds is greatest in the fall and winter. Wind velocities ranging from four to 12 miles per hour (mph) can be expected 60 to 70 percent of the time; 13 to 24 mph, 15 to 24 percent of the time; and 25 mph or higher, one to two percent of the time. The highest wind velocities are from the southwest or west and are frequently associated with rapidly moving weather systems. Extreme wind velocities at 30 feet above the ground can be expected to reach 50 m.p.h. at least once in two years; 60 to 70mph. once in 50 years and 80 mph once in 100 years.

During the growing season, April through September, the average evaporation from a Class A evaporation pan is from 35 to 52 inches. Monthly evaporation is midsummer ranges from nine to 12 inches. Annual evaporation from lakes and reservoirs is estimated at 26 inches in the mountains and 34 to 42 inches in other localities. The average relative humidity in January is approximately 85 percent at 4 a.m. and 75 percent humidity at 4 p.m. and in July, 65 percent at 4 a.m. and 27 percent at 4 p.m.

Central Basin

The Central Basin includes the Ellensburg valley, the central plains area in the Columbia basin south from the Waterville Plateau to the Oregon border and east to near the Palouse River. The elevation increases from approximately 400 feet at the confluence of the Snake and Columbia Rivers to 1,300 feet near the Waterville Plateau and 1,800 feet along the eastern edge of the area. This is the lowest and driest section in eastern Washington. Annual precipitation ranges from seven inches in the drier localities along the southern slopes of the Saddle Mountains, Frenchman Hills and east of Rattlesnake Mountains, to 15 inches in the vicinity of the Blue Mountains. Summer precipitation is usually associated with thunderstorms. During July and August, it is not unusual for four to six weeks to pass without measurable rainfall.

The winter season snowfall is from 10 to 35 inches. Snow can be expected after the first of December and to remain on the ground for periods varying from a few days to two months between mid-December and the last of February. Other than in the Ellensburg valley, snow depths seldom exceed eight to 15 inches. The Central Basin is subject to "chinook" winds which produce a rapid rise in temperature. A few damaging hailstorms are reported in the agricultural areas each summer.

The average January maximum temperature is near 30° F in the colder localities in the Columbia Basin and 40°F in the lower Yakima valley, and minimum temperatures are between 15° to 25°F. Minimum temperatures between 0° to -10°F are recorded almost every winter and temperatures from -15°F to -30°F have been recorded.

In July the average maximum temperature is in the lower 90's, and the minimum temperature is in the upper 50's. The documented high temperature for the state, 118°F, was recorded on July 24, 1928, at Wahluke, located along the southern slope of the Saddle Mountains and again on August 5, 1961, at Ice Harbor Dam on the Snake River. Maximum temperatures reach 100° to 105°F on a few afternoons each summer. The last freezing temperature in the spring occurs during the latter half of April in the Yakima valley and the latter half of May in the colder localities of the Columbia Basin. The first freezing temperature in the fall is usually recorded between mid-September and mid-October.

Agricultural Climate Analysis

To evaluate the effect of weather conditions on the ability of crops to utilize nutrients applied under the conditions defined in Sections S4.J.3.d.vi and S4.J.3.d.vii of the Permit, we reviewed a 50-year (1971 to 2020) period of daily temperature (minimum and maximum), precipitation, snowfall, and snow depth measurements collected from the lower Yakima Valley. We utilized measurements collected from the National Oceanic and Atmospheric Administration (NOAA) Global Historical Climatology Network – Daily (GHCND) station **USC00458207, SUNNYSIDE** located at the Sunnyside WA Post Office within the City of Sunnyside (46.3236°, -120.0103°) and GHCND station **USC00458211, SUNNYSIDE NUMBER 2**, located at a rural residence outside of the City of Sunnyside (46.3450°, -120.0289°) The SUNNYSIDE station period of record extends from 1894 to 2013 (https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USC00458207/detail) , while the SUNNYSIDE NUMBER 2 station period of record extends from 2013 to 2021 (https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USC00458211/detail). Both stations recorded or record daily measurements of minimum and maximum temperature, precipitation, snowfall, and snow depth. This information is provided to Ecology as an electronic file in Microsoft Excel ".xlsx" format (Attachment A).

Evaluation of the climate data focused on measurements collected for the five-month (182 day) period (the "Periods") of October 1st through March 31st of the following year (e.g. October 1, 1971 to March 31, 1972). Measurements for 45 of the 50 Periods examined provided data sets that were greater than 95 percent complete (for the 182 days in the period, measurements were recorded for at least 173 days); the data sets for the Periods 1990 to 1991, 1996 to 1997, 1998 to 1999, 2005 to 2006, and 2014 to 2015 were less than 95 percent complete and were thus excluded from the analysis. We then examined the temperature and precipitation conditions of the Periods and evaluated the effect of these conditions on the ability of crops to utilize nutrients applied during the Period.

Temperature

Temperature analysis focused on evaluation of *Growing Degree Days* (GDD), otherwise known as Heat Units (HU). Growing Degree Days are used to estimate the growth and development of crops, including the duration of the growing season. Crop growth typically follows very closely the accumulation of average daily temperatures during the crop lifetime. The GDD for a given crop is based on the accumulation of average daily temperatures while accounting for a minimum development threshold temperature (the "base temperature") that must be exceeded for growth to occur. The base temperatures of many crops are researched and defined in literature; we include United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Agronomy Technical Note No. 44, *Planting Dates for Fall Cover Crops in the Irrigated Columbia Basin* (July 2000; Spokane, Washington) as an example (Attachment B).

The GDD for a given crop on a given day is typically calculated according to the following formula:

$$GDD = \left[\frac{T_{MAX} + T_{MIN}}{2}\right] - T_{BASE}$$

Where: T_{MAX} = Daily Maximum Temperature
T_{MIN} = Daily Minimum Temperature
T_{BASE} = Base Temperature for the Crop

The daily mean temperature is calculated by taking the average of the recorded daily maximum and minimum temperatures (the first term) then subtracting the base temperature for the crop of interest. If the mean temperature is at or below the base temperature of the crop, then the GDD value is zero. Crop growth occurs when GDD is greater than zero. Triticale hay, used for dairy cow feed by producers and typically planted as an over-winter crop in eastern Washington, has a base temperature of 0°C (Attachment B). Thus, any daily mean temperature greater than freezing (32°F/0°C) will provide GDD for triticale. Alfalfa, another dairy cow feed planted as an over-winter crop in the Central Basin, has a base temperature of 5°C (41°F).

Analysis of the temperature data for the periods with respect to triticale GDD (Figure 1, 0°C TBASE) shows that except for the interval from December 14th to January 14th, the daily GDD is greater than the base temperature a majority of the time (more than 50 percent of the days for a particular day in the Period). Only during the December 14th to January 14th interval are most daily average temperatures lower than the triticale base temperature, resulting in a GDD of zero for a majority of this interval. Thus, the only time when triticale is not, on average, undergoing some growth during the Period is from December 14th to January 14th. The same analysis for alfalfa (Figure 2, 5°C TBASE) shows that outside of the interval from November 10th to February 27th, the daily GDD is greater than the base temperature a majority of the time. The time when alfalfa is not, on average, undergoing some growth during the Period is from November 10th to February 27th.

Analysis also shows that within the data set there were only 7 days total where triticale GDD (TBASE 0°C) was not greater than the base temperature; or approximately an average of 1 day each 7 years. The same data analysis for alfalfa shows 71 total days where alfalfa GDD (TBASE 5°C) was not greater than the base temperature; or approximately an average of 1.5 days for the month.

Precipitation

As an average of the data provided from 1971-2020, the annual precipitation in Sunnyside is around 4.5 inches over the 180 days between October 1 and March 31 (Attachment C). Under desert winter freeze-thaw conditions less than half will typically enter the soil column and that is spread out over the entire 180 days. We rarely observe winter conditions that lead to an actual leaching event as most of our precipitation events are very small and scattered out due to the orographic effect of the Cascades. Soils not covered in snow continue to evaporate water and any freezing tend to pull and keep water more towards the soil surface. Snow cover is prone to sublimation which is common even on cool sunny days. Crops such as triticale will continue to evapotranspirate as long as positive growing degree days occur.

In recent years dairies have been monitoring soil moisture within fields and some of the sensors were recording in the winter. Data from these sensors can be compared to some of the larger precipitation events or snow melt events which are shown in Attachment D. Two of the larger events over the past 7 years were in October of 2016 and November of 2021 which are shown in these graphs. This data shows that while precipitation or snow melt can and does impact surface (top foot) sensors, very little to no impact is typically observed at lower depths.

If manure was incorporated or injected and the field was adequately bermed or met other approved Field Management Dishcharge Practices, the risk for leaching remains low. Reduced or ceased mineralization along with generally low precipitation will not lead to nitrate leaching. The addition of manure well before a crop is planted helps to make more nutrient available when temps do start to warm resulting in a favorable crop response. Appropriately timed and managed applications can also help to manage fall lagoon storage. The main issue with the October 1st to T-SUM 200 limitation is that it can extend the winter storage time from 120 days as defined by DNMP's to 150 or even 180 days. In fact the CAFO permit as written would require a dairy to potentially store manure for 150 days. This creates an issue with the increased potential for having to implement emergency applications, as lagoon systems have not been designed to handle 150 to 180 days of storage. Unfortunately, emergency applications end up occurring under circumstances that are not ideal and generally do not meet all of the application restrictions provided within Section S4.J.3.d.

Winter Evaporation/Evapotranspiration

One of the factors other than precipitation that play an integral role in a reduced potential for leaching in the winter east of the Cascades is evaporation and evapotranspiration. Evaporation is the transformation of liquid water to water vapor and evapotranspiration (ET) is the combined process of evaporation from water and soil surfaces along with plant transpiration. Since most dairy fields have a winter crop planted, the process that would best represent east of the Cascades is Evapotranspiration (ET). ET can be expressed as either an alfalfa reference ETr or a grass reference ETo. Actual crop evapotranspiration (ETc) is calculated by multiplying a crop coefficient (Kc) to the ET of choice. There are many sources of literature that provide this sort of data and we have included a couple examples of ET data in Attachment D. The EPA data, which is older data, shows annual average pan evaporation for Yakima; showing a winter average evaporation total from October 1st through March 31st of 9.99". AgWeatherNet data from Outlook, WA (October 1st through March 31st) of 2016-2017 shows an ETr of 9.66" and an ETo or 6.73". This season was chosen due to it being the winter season with the most precipitation in the Sunnyside area since 1994. As a straight up comparison, ET always exceeds precipitation in the Sunnyside area. However, if we go a further step of calculating an ETc by multiplying the ET by a crop coefficient (Kc), we still see calculated evapotranspiration rates that are similar to higher than measured precipitation (see Chart in Attachment E). In fact only one out of the past 10 years was precipitation higher than ETc and this was by a maximum of 1.9" for the six month period, which most soils can hold within the root zone depth of planted crops. This dynamic shows that east of the Cascades, the environmental conditions are such that the risk to winter leaching is quite low.

Nitrogen Minerilization

Studies performed regarding nitrogen mineralization rates as related to temperature and moisture show that winter mineralization rates are low east of the Cascades. Research shows that mineralization rates decrease significantly below 50°F and cease below 41°F (Johnson, C. et al., 2005). Since applied liquid manure is roughly 50 percent ammonium and 50 percent organic nitrogen, it must be converted to nitrate through both ammonification and nitrification for the organic portion and nitrification for the ammonical portion. This is a result of reduced or ceased biological activity at these temperatures. Other sources of manure are even more stable as compost is essentially entirely organic nitrogen and must go through both processes to be converted to nitrate. These biological processes require both appropriate temperature and proper moisture to effectively occur, with temperature being the most significant factor. Within the 182 days between October 1st and March 31st, there are only 21 days where temperatures average above 50°F, all within October. There are 54 days with temperatures between 50°F and 41°F and 107 days with temperatures below 41°F. Thus, approximately 90 percent of the days within the October 1st to March 31st timeframe have average daily temperatures causing nitrogen mineralization to be reduced or cease completely (Attachment C).

T-SUM 200

In the development of the current CAFO permit (issued March 3, 2017), Ecology included T-SUM 200 as a tool to determine when to begin spring manure application. T-SUM 200 is essentially a 'heat unit' calculation that is an accumulation of average daily temperature above zero degrees Celsius which starts January 1st of each year. This tool has been met with many opinions either for or against as to whether it is actually a suitable tool for when to begin manure applications. Despite these differences, it is acknowledged that the Appeals Board Division II has concluded that without any significant alternative or replacement that T-SUM 200 satisfies AKART requirements and its limitations do not undermine its viability as a useful, standardized tool.

However, this conclusion regarding T-SUM 200 was likely made without examination of the research that it was based upon. The idea of T-SUM 200 actually originated from Western Europe and United Kingdom research and was re-examined in British Columbia in 1984-1986. The conclusions of this research can be found in the research report "An evaluation of the T-SUM method for efficient timing of spring nitrogen applications on forage production in south coastal British Columbia (Kowalenko, C.G. et al., 1989). The research focused on forage response to 100 kg N per hectare applied at various time intervals in the spring associated with T-SUM units of 100, 150, 200, 250, 300, 350, 400, 500, and 600 in two separate coastal locations. The findings of the combined field studies showed "early application of N usually but not always resulted in greater dry matter production (yield) of first-cut forage than later applications" and "Leaching, as shown by similar distributions and amounts of extractable N in the soil profile for all times of N applications within each trial, did not appear to be a problem with early applications". In summary, T-SUM 200 appeared to be the best average timing for increasing grass production and there is no difference in leaching between all T-SUM timings. This research was conducted in locations that receive from 54-66 inches of precipitation per year.

Therefore, it is our expert opinion and suggestion that Ecology could defend and use the same research as that used for T-SUM 200 for T-SUM 100 for East of the Cascades, as it clearly does not link soil nitrate leaching with T-SUM 200 but shows all T-SUM timings were protective. A review of yearly dates for Outlook, WA for T-SUM 200 vs. T-SUM 100 is provided in Attachment F. The average date T-SUM 200 was reached over the past 14 years is 3/3, while the average date for reaching T-SUM 100 is 2/12, a difference of 19 days. This earlier date marking the beginning of spring manure applications would of course be further balanced by the other defined restrictions of frozen soils, snow-covered soils, saturated soils, soils with a water table less than 12" deep, rain forecast within the next 24 hrs and bare fields more than 30 days from planting. Under testimony Redding (Ecology) stated that the permit team selected T-SUM because it takes into account site-specific conditions based on local temperature variations. While this is true, temperature is not the most applicable factor to consider in regards to making safe applications. I would argue that original restrictions defined in NRCS (590) based nutrient management plans and above within the permit are more important than temperature, namely precipitation, frozen soil, and soil conditions. The weather data as presented previously supports a more slack T-SUM 100 option in that February and March are not on average high rainfall months with monthly averages of 0.62" and 0.58" respectfully. This earlier T-SUM 100 date would also allow producers the flexibility of applying manure before an early season planting of forage crops such as spring triticale, spring wheat, spring barley, or other. These crops are typically planted in mid to latter February in most seasons.

FIELD SOIL SAMPLING

Permittees are required under section S4.I. to conduct soil sampling and analysis as part of the larger guidance on manure pollution prevention. This soil sampling requirement is as follows:

1. *Spring Soil Sampling and Analysis*

Each year prior to starting land applications after T-SUM 200, the Permittee must have all land application fields to which they plan to apply manure, litter , process wastewater, or other organic by-products sampled and analyzed for nutrient content. Soil samples must be taken at the depths specified in special conditions S4.I.3 or S4.I.4 depending on the amount of annual precipitation at the facility location.

2. *Fall Soil Sampling*
   Each year in the fall the Permittee must have all land application fields to which they applied manure, litter, process wastewater, or other organic by-products sampled and analyzed for nutrient content.
   Fall soil samples must be taken be October 1st, after harvest of annual crops , and before heavy rain begins in the fall or before any irrigation water is used on the field after harvest. Soil samples must be taken at the depths specified in special condition S4.I.3 or S4.I.4 depending on the amount of annual precipitation at the facility location.
3. *Depth of Soil Samples in Areas with 25 inches or less of annual precipitation*
   In areas with 25 inches of less of precipitation a separate composite soil sample must be taken for the 0-12 inch depth and for the 13-24 inch depth.
   If the soil sample is taken after October 1st or if the field is in the high or very high risk level for adaptive management (special condition S4.K.), the Permittee must take an additional composite soil sample for the 25-36 inch depth in the fall in order to account for nutrient leaching.
   If the field does not have 36 inches of soil before refusal or groundwater is reached, the Permittee must take samples in 12-inch increments until it reaches refusal or groundwater. The Permittee must indicate in its record keeping and annual report (special conditions S6.B and S7.C) at what depth refusal or groundwater was reached.

Sections S4.I. adds unnecessary requirements for deep soil sampling even on fields that fall into the LOW or MEDIUM risk levels if collected after October 1st. We ask Ecology to consider omitting fields that are sampled after October 1st from the 25-36 inch requirement.

The justification for this requirement is the assumption that there are heavy fall rains that lead to nutrient leaching. As previously discussed as part of the weather data that has been presented, this is not the case in eastern Washington with Sunnyside averaging 0.64” of precipitation in October and 0.85” in November (Attachment C). Also, it is very common for dairies to have not yet harvested by October 1st, so taking a soil sample before that it limited by harvest operations and not be an arbitrary calendar date. We continue to agree that fields that were previously in the High to Very High risk levels should have a 25-36 inch sample to show progress in bringing numbers down to favored levels, which is useful information to the dairy or consultant, but this does not make sense for lower risk fields.

Experience in working with many dairies for many years has shown that fields that typically fall into the LOW or MEDIUM risk levels do not have high subsoil levels and fields that fall into the High or Very High risk levels often times do have higher subsoil levels. This is not related to a calendar date, but is related to past management. In my experience, fields that have remained in the High to Very High risk levels for 3 consecutive years are fields where past management was poor, before a CAFO permit was obtained, and are coming down from high residuals from past over application. These fields will come into compliance rather quickly if given appropriate time as it takes time to work down the organic N pool that has been previously established. The fact that it is taking many years for fields that are mostly perennial or double cropped with past poor management to show compliance is further evidence that nitrates generated from mineralization of this organic pool are being retained within the profile with little loss. This makes sense in a lower rainfall environment.

ADAPTIVE MANAGEMENT ACTIONS

Permittees are required under section S4.K. to determine field specific risk levels and take adaptive management actions according to Table 3: Adaptive Management Actions

Fall soil nitrate levels at 2 foot depth are used to place each individual field into risk levels of Low (<15 ppm), Medium (15-30 ppm), High (31-45 ppm) and Very High (>45 ppm). The table includes required actions and required actions based upon trends for each risk level (see Table 3).

Of concern is the required actions based upon trends, which states:

"If fall soil nitrate values are Very High for 3 consecutive years for a land application field stop land application of nutrients to the field and continue the actions in the Required Action column for High and Very High risk levels until either:

- *The fall soil nitrate analysis results for the field reach a Medium risk level or*
- *Groundwater monitoring in the field demonstrates that land application of nutrients is not impacting groundwater quality. Follow the requirements of special condition S5.D. for the development of a groundwater monitoring plan."*

This requirement to stop land application of nutrients to the field until fall soil nitrate analysis results for the field reach a Medium risk level is missing the point of other Required Actions and is cumbersome. If a field has been at a field risk level of Low or Medium in the past but now is in its 3rd consecutive year of being at the Very High level, then either the other required actions are not being performed by the Permittee or the previous Ecology budget approvals were in error. Having this limitation potentially come as a result of Ecology approval is not likely a good look for Ecology. Fields that fall into this scenario that will be producing a single crop will likely not need much, if any, additional nitrogen the following summer, especially if it is in alfalfa, which can produce its own nitrogen if needed. However, fields that are double cropped with grass forages or corn often times will need additional nitrogen as they do not have the ability to generate nitrogen. As previously stated, in my experience, fields that fit into this Very High level for 3 or more years have had past mismanagement. This mismanagement has resulted in considerable "built up" nitrates that are being retained within the soil profile that takes time to reduce, even with good crop production. However, it should be noted that east of the cascades high residual nitrates typically come with higher residual salts or other high alkalinity factors that can limit production to some extent, making draw-down potentially longer. For example, a field may fall into the Very High risk level, but not have enough nitrogen for a double crop of triticale and silage corn. Consider the following basic agronomic calculation:

88 lbs N	25 ppm top foot nitrate
+ 175 lbs N	50 ppm second foot nitrate (VERY HIGH concentration)
+ 100 lbs N	organic matter release
- 20 lbs N	crop residue tie-up
+ 343 lbs N	**Total N available for crop production**
- 175 lbs N	required for 3.5 tons/ac tritcale
- 276 lbs N	required for 30 tons/ac silage corn
- 108 lbs N	**Total N deficit for a double cropped field**

Therefore, we would propose and ask Ecology to consider the following adjustment to the Adaptive Management Action Table:

"If fall soil nitrate values are Very High for 3 consecutive years for a land application field stop land application of nutrients to the field and continue the actions in the Required Action column for High and Very High risk levels until either:

- *The **fall** soil nitrate analysis results for the field reach a Medium risk level for a single cropped field or the **spring** soil nitrate analysis results for the field reach a Medium risk level for a double cropped field (this will require an updated spring budget approval by Ecology) or*

- *Groundwater monitoring in the field demonstrates that land application of nutrients is not impacting groundwater quality. Follow the requirements of special condition S5.D. for the development of a groundwater monitoring plan."*

From my perspective, the agronomic rate (budget) is key to the effectiveness of the above adaptive management actions. If the required action of making budget adjustments is executed effectively and evaluated effectively then continued problems should not persist. This may take getting a consultant involved, which can be helpful, but may not be necessary. Other considerations could be discussed as having a spring 3-foot depth sampling requirement, but we don't think that this would be necessary either.

LAGOONS

A key conclusion by the Court in *Washington State Dairy Federation v. State* [18 Wn.App.2d 259, 490 P.3d 290 (2021)] was ensuring that the Permit conditions apply and insure compliance with technology-based treatment requirements that reflect "all known, available, and reasonable methods of prevention, treatment, and control", or "AKART" requirements. These AKART requirements may be implemented through the use of (1) effluent limitations or (2) best management practices (BMPs). Best management practices are "schedules of activities, prohibitions of practices, maintenance procedures, and other management practices" that are designed to "prevent or reduce the pollution of the waters of the state." Much of the Court's perceived deficiencies of the Permit were the lack of AKART requirements for various elements of the Permit.

The mission of Natural Resources Conservation Service (NRCS), a division of the United States Department of Agriculture (USDA), is to provide technical assistance to farmers and other private landowners and managers relating to the conservation of soil, water, air, and related plant and animal resources. As part of their mission, the NRCS performs research and develops technical guides that are the primary scientific references for their work. Technical guides used in each State are localized so that they apply specifically to the geographic area for which they are prepared; these localized documents are referred to as Field Office Technical Guides (FOTGs). The FOTGs include the Conservation Practice Standards (CPS) for each State, which contain information on why and where a given practice is applied, and it sets forth the minimum quality criteria that must be met during the application of that practice in order for it to achieve its intended purpose(s); the CPS for a given subject provides the following:

- explains the purpose of conservation practices;
- identifies the conditions where practices can be used;
- lists required criteria when practices are implemented;
- explains considerations for site-specific implementation;
- lists requirements for plans and specifications;
- specifies requirements for operation and maintenance, and;
- cites technical references related to the practice standard.

State-specific CPS are developed for numerous agricultural activities, particularly as related to animal management. Conservation Practice Standards are "living documents" and are updated to ensure that the information contained is the most current and the practice is the best available based on existing science. Washington State CPS are located at https://efotg.sc.egov.usda.gov/#/state/WA.

The United States Environmental Protection Agency (EPA) February 2012 *NPDES Permit Writers' Manual for Concentrated Animal Feeding Operations* (the "PWM"), EPA Document EPA 833-F-12-001, https://www.epa.gov/npdes/npdes-permit-writers-manual-concentrated-animal-feeding-operations), provides information to National Pollutant Discharge Elimination System (NPDES) permit writers on permitting requirements for CAFOs. The Manual reflects the current NPDES regulations and Effluent Limitation Guidelines (ELGs) applicable to CAFOs under the Clean Water Act (CWA). Technology-based effluent limitations and standards for CAFOs must address all discharges from a CAFO. For EPA, technology-based standards are established through national ELG for some CAFO discharges. All other discharges must be addressed through technology-based effluent limitations developed on a case-by-case basis by the permit writer using their best professional judgement, or a combination of the two methods. Any EPA NPDES permit issued to a CAFO of any size must include a requirement to implement a Nutrient Management Plan (NMP) that contains, at a minimum, BMPs that meet the requirements specified in the NPDES CAFO regulatory requirements. Chapter 5.2 (*Developing Permit Terms*) of the PWM makes the following statement:

> *"**NMP requirements may be addressed through the use of one or more of USDA's conservation practice standards where the standards meet applicable state requirements**, as long as they are identified in the operation's site-specific NMP and appropriate O&M activities are identified. A USDA conservation practice standard may be captured as a site-specific term, or when appropriate, it may be identified as a broadly applicable term. NRCS's standards are identified in USDA's Comprehensive Nutrient Management Plans and National Instruction (USDA-NRCS 2009). The practice standards are also included in each state NRCS Field Office Technical Guides."*

EPA accepts that the NRCS CPS can be used to meet Nutrient Management Plan requirements, and that NRCS CPS can serve as BMPs to meet CAFO regulatory requirements. We assert that given the mission, research, and expertise of the NRCS, the BMPs provided by the CPS are sufficiently protective and meet AKART requirements when implemented to address nutrient or manure management elements of a CAFO operation.

The NRCS has developed a number of CPS that directly address the siting, design, construction, and operation of waste storage facilities (also known as “waste storage ponds” or commonly referred to as “lagoons”) intended to “store manure, agricultural by-products, wastewater, and contaminated runoff in order to provide the agricultural operation management flexibility for waste utilization” (CPS 313, 2021). The specific CPS related to waste storage facilities is **CPS 313 – Waste Storage Facility** and provides conditions where the practice applies, criteria (those elements that must be addressed during implementation of the CPS), considerations (those elements that may be addressed during implementation of the CPS), plans and specifications, and operation and maintenance. Implementation of CPS 313 to site, design, construct, and operate a waste storage facility requires (or may require) the use of the following additional CPS or NRCS technical materials:

- CPS 520 – Pond Sealing or Lining – Compacted Soil Treatment
- CPS 521 – Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner
- CPS 522 – Pond Sealing or Lining, Concrete
- USDA NRCS National Engineering Handbook, Part 561 - Agricultural Waste Management Field Handbook (AWMFH) Chapter 10: Agricultural Waste Management System Component Design and Part 642 – Material Specification
- USDA NRCS National Engineering Manual, Part 531 – Geology and Part 536 – Structural Design

As developed and maintained by the NRCS, CPS provide BMPs for the siting, design, construction, and operation and maintenance of CAFO waste storage facilities in Washington. The EPA has recognized CPS as BMPs for their own CAFO NPDES permit program. We ask that as part of the Permit re-authorization, Ecology accept NRCS CPS as sufficiently protective BMPs meeting AKART requirements for waste storage facilities in Washington.

COMPOSTING AREAS

Similar to lagoons, the NRCS CPS provide BMPs for the siting, design, construction, and operation and maintenance of compost areas at CAFO facilities that are intended to “contain and facilitate an aerobic microbial ecosystem for the decomposition of manure, other organic material, or both, into a final product sufficiently stable for storage, onfarm use, and application to land as a soil amendment” (CPS 317, 2021). The specific CPS related to composting areas is **CPS 317 – Composting Facility**.

With respect to comments in the June 29, 2021 State of Washington Court of Appeals Division II decision pertaining to composting areas, it is important to consider that *infiltration* is the characteristic that controls movement of compost leachate into the subsurface. The infiltration rate of liquids into the subsurface is governed by: (1) the saturated hydraulic conductivity of the soil, (2) the depth of liquid ponded on the surface, and (3) the depth of penetration of the saturation surface. By controlling the depth of liquid ponding on the soil surface and siting the composting facility on soils with low saturated hydraulic conductivity the amount of liquid seepage into the subsurface can be limited.

We ask that Ecology consider the following additional design elements as BMPs for composting area pads:

- Composting area pads are graded at a minimum slope of two (2) percent to facilitate liquid runoff, and pads are graded to liquid collection areas, *and*;
- Composing area pads are constructed on soils that are documented by NRCS with a soil permeability class of slow (0.06 to 0.22 inches per hour) or less, *or*;
- Composting area pad soils are amended, compacted, or both to achieve a hydraulic conductivity of 10^{-4} centimeters per second (cm/s), a rate equivalent to 0.14 inches per hour.

Incorporation of these two design elements (sloped pads and low hydraulic conductivity soils) will diminish liquid infiltration potential to a negligible amount. Combining these design elements with the NRCS CPS 317 will provide sufficiently protective BMPs meeting AKART requirements for the siting, design, construction, and operation and maintenance of CAFO composting facilities in Washington.

Sunnyside Dairy (Sunnyside Washington) provides a case study illustrating the protectiveness of the recommended design standards. Sunnyside Dairy is a CAFO dairy that operates approximately 45 acres of windrow manure composting. The compost areas were developed with a native soil working surface that was graded to minimum 2 percent slopes, followed by compaction of the soil and drainage of stormwater runoff to lagoon storage. Sunnyside's composting area has been in operation for over 20 years. Environmental protectiveness of the operation has been established through on-site groundwater monitoring. Shallow groundwater monitoring wells were placed immediately downgradient of the composting area to assess potential impacts to groundwater. Groundwater monitoring results have confirmed no impacts to groundwater quality. The monitoring wells continue to comply with the groundwater MCL for nitrate. Deeper groundwater has also been evaluated with deeper wells and those wells also comply with the nitrate groundwater MCL.

GROUNDWATER

A primary focus June 29, 2021 State of Washington Court of Appeals Division II decision was related to the protection of Washington water quality. A point made by the Court is that CAFOs engage in practices (manure lagoons and compost areas) that could "cause or contribute to a violation of water quality standards", specifically groundwater quality. Additionally, the Court found that soil sampling and visual inspections are insufficient monitoring methods to ensure compliance with the Permit. While the Court's decision doe not specifically direct Ecology to implement groundwater monitoring as part of the Permit, it strongly infers that in lieu of other changes to the Permit, groundwater monitoring would be necessary to ensure permit compliance.

We would ask Ecology to consider that for specific CAFO practices, implementation of BMPs meeting AKART requirements would be sufficiently protective of groundwater quality and avoid a requirement for direct groundwater monitoring. For example, use of the NRCS CPS for lagoons would provide for source detection and monitoring; the CPS 521 requires that a leak detection system be installed as part of the lagoon design and construction, allowing for direct leakage monitoring.

Direct groundwater monitoring at CAFO facilities is problematic and would likely lead to conflicting and wide-ranging regulatory actions and conflicts. As Ecology is aware, most CAFOs are situated in areas of intensive agricultural usage by a variety of producers (vegetable and grain growers, orchardists, vintners, hop growers, in addition to other neighboring CAFO facilities) and these areas have a long history of agricultural use and production. Various types of producers are often located adjacent to each other, and their crop nutrient needs vary and result in widely diverse fertilization practices. Nitrate in groundwater is mobile but can be environmentally persistent based on the external forces that facilitate leaching and transport. Additionally, in general analysis, nitrate derived from organic sources (animal manure) is molecularly the same as nitrate derived from inorganic sources (manufactured ammonium nitrate fertilizers) and many of these areas receive both organic and inorganic nitrate fertilization as part of typical agricultural actives. While organic and inorganic nitrogen can be differentiated by isotopic analysis to varying degrees of success, many growers and producers incorporate the use of both organic and inorganic nitrogen fertilizers on a regular basis, thus resulting in an "overprinting" of nitrate sources.

Any direct groundwater monitoring requirements of CAFO facilities would need to account for these realities when establishing enforcement limits, points of compliance, and early waring values as required under WAC 173-200. We would ask that Ecology carefully consider any requirement for direct groundwater monitoring at CAFOs and instead rely on the development of Permit requirements that provide for the evaluation of impacts as allowed under WAC 73-200-080. Ecology should evaluate if the use of BMP meeting AKART requirements will meet the minimum requirements for evaluation. Should Ecology determine that implementation of management practices are not sufficient to monitor potential groundwater degradation at CAFO facilities, we would request that Ecology form a working group that includes members of the affected industry and their technical representatives to examine the realities of groundwater monitoring in areas of intensive agricultural production, particularly at facilities encompassing a variety of practices combined with a long history of use. At a minimum, Ecology should fully document their process and rational for determining groundwater monitoring requirements as related to specific CAFO practices.

DNNP-MPPP HARMONIZATION

It is recognized that this topic is a difficult one to concisely articulate as there are differences between State only and Combined (NPDES) Permits. In regards to State only Permits, it would seem that the current RCW 42.56.610 is clear that there is certain information within plans that should remain confidential and not be shared with the general public.

"*The following information in plans, records, and reports obtained by state and local agencies from dairies, animal feeding operations, and concentrated animal feeding operations, not required to apply for a national pollutant discharge elimination system permit is disclosable only in ranges that provide meaningful information to the public while ensuring confidentiality of business information regarding: (1) Number of animals; (2) volume of livestock nutrients generated; (3) number of acres covered by the plan or used for land application of livestock nutrients; (4) livestock nutrients transferred to other persons; and (5) crop yields. The department of agriculture shall adopt rules to implement this section in consultation with affected state and local agencies"*.

However, the fact that the Combined Permit enfolds NPDES, the RCW is also clear that this confidentiality no longer applies.

It is our opinion that when NPDES is involved that the MPPP should include all information that the NPDES would require for public review. As to the method and process that this takes place, we would defer to Ecology.

In regards to functional use of the DNMP and MPPP by producers, there does need to be a concerted effort to streamline record keeping so that duplicative and unnecessary records are not retained. Having completely different documents provide input on required records has likely been one of the most significant reasons for dairy record errors.

CLIMATE CHANGE

It is recognized that the Court of Appeals ruling states that Ecology must "consider climate change in writing the Permits", but this statement continues to be nebulous. What does that statement really mean? It would seem counter intuitive that the Permit, which aims to reduce the potential for pollution through its guidance, regulation, and enforcement, would necessarily contribute to climate change. By improving both management and infrastructure a dairy would inherently increase its ability to agronomically return manure back into soils for use in plant production.

Since we went to all of the work to compile and evaluate large amounts of weather data for Sunnyside, WA, we retrospectively considered using that data set to assess if there were any perceivable climate changes over the past 50 years. The data show that over the past 50 years the average temperatures are very slightly trending downward, but the R2 value shows that there is virtually zero confidence in making that statement. Average precipitation over the past 50 years is very slightly trending upward, but also has a very low R2 value. Basically, in regards to the past 50 years, the trends for temperature and precipitation are flat, with no statistical ability to prove otherwise. However, there does appear to be a slight moderation of temperatures overall in that there appears to be less extremes now than in the past. In regards to growing degree days there may also be a slight trend in warmer falls and colder late winters (or a gentle shift of winter to after Christmas time).

In reality, with a Permit cycle having a relatively short interval and no evidence of recent change, there will not be any significant change that cannot be fully accounted for within normal permit cycles.

CONCLUSION

IES and Agrimanagement are grateful for the opportunity to provide this input to Ecology. We are providing under separate cover a number of the reference documents used to support our comments. Both IES and Agrimanagement are available to address any comments or questions you or other Ecology staff may have. We thank you for you attention and consideration.

Very Truly Yours,

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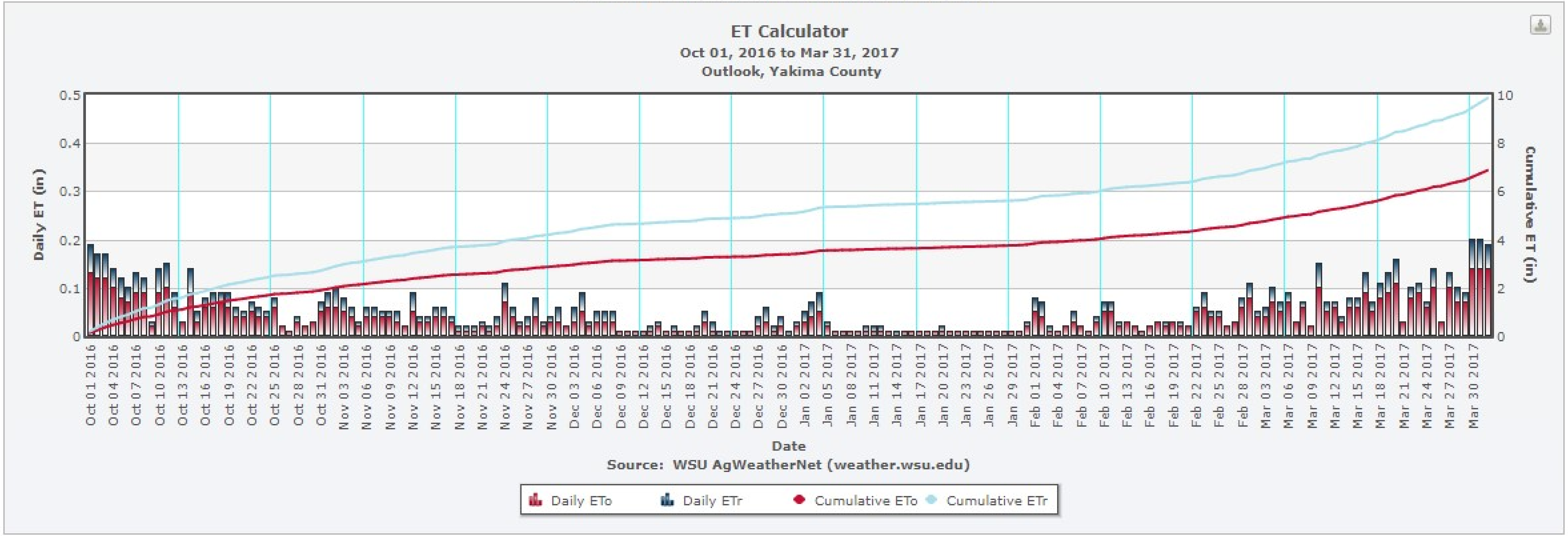
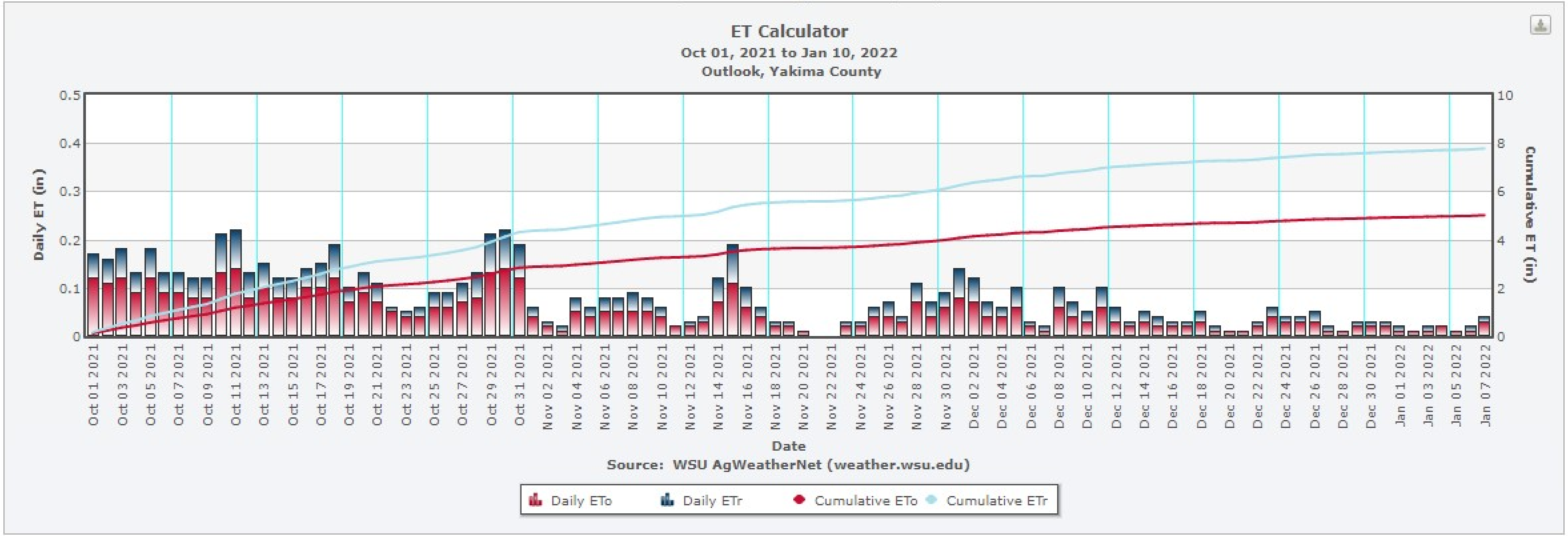
Outlook, Yakima County, Washington

October 01, 2016 through March 31, 2017



Outlook, Yakima County, Washington

October 01, 2021 through January 10, 2022



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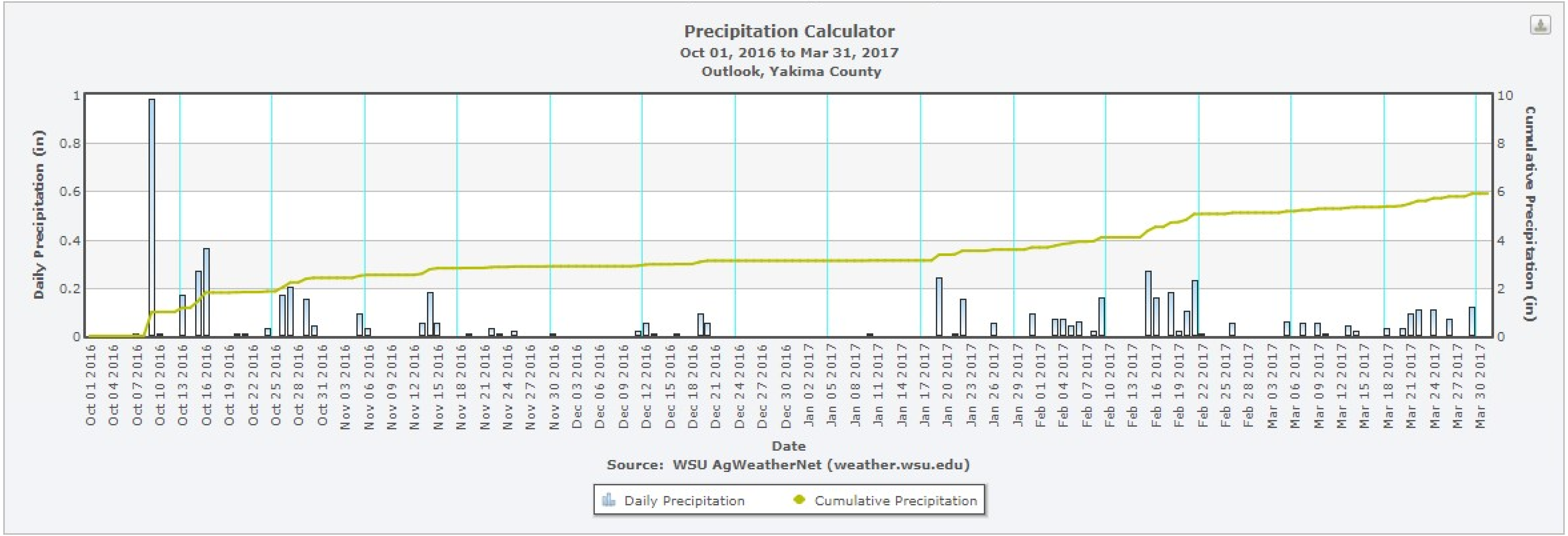

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October 01, 2021 through January 10, 2022