Aerial view of Oconomowoc Wastewater Treatment Facility, Oconomowoc, WI

53rd Annual W.W.O.A. Conference
October 8-11
KI Convention Center, Green Bay
The Clarifier is the publication of the Wisconsin Wastewater Operators’ Association and is intended to inform and educate the membership on issues related to the treatment and control of wastewater. The Clarifier is produced five (5) times each year: February, April, June, September, and December. All members are encouraged to contribute to the mission of the Clarifier.

The Wisconsin Wastewater Operators’ Association is a non-profit organization dedicated to educating, informing, and advancing the wastewater profession. WWOA has approximately 2,000 members divided throughout six regions: Southeast, Southern, Lake Michigan, North Central, Northwest, and West Central.
Presidents Message: Make a memory this summer

Summer is here! It’s the time of year when school is out for most kids and families are thinking of vacations and taking time off work for leisure activities. For many, camping, swimming, hiking, bike riding, theme parks and ball parks are the activities of choice.

For my family, we usually went camping. Camping is something you can find just about anywhere you go and it’s usually pretty inexpensive. The smell of the burning wood and glow of the flames seems to have a calming effect for most people. Sitting around the campfire is also a great place to get kids to talk and take a break from their cellphones.

My kids are all grown up now but they still go camping and talk about the different places we went and the things we did. These are good memories that are engrained in their hearts and minds. I want to encourage you to make a memory for your family or a friend this summer. Taking time for leisure is good medicine for your health.

Summer is also a great time to start thinking about attending our annual conference in Green Bay this October. We have great activities, speakers and technical sections planned for you. Online registration will be ready by mid-June.

It’s also a good time to get your nominations in for Regional Operator of the Year. Nominations are due July 5th. Also, the other annual awards are due August 1st. Please start thinking about who you would like to nominate now and submit using the nomination form on our website: www.wwoa.org under “Organization” – “Annual Awards” or this quick link: https://www.wwoa.org/organization/annual-awards/ All the conference information can be found on our website.

Wishing you a safe and great summer hoping you will make some awesome memories with your friends and family.

Sincerely, Jeff “Juice” Simpson

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**Meetings**

**Northwest WWOA**
**Wednesday, August 7**
**Location: St. Croix Falls**

**Southern WWOA**
**Wednesday, August 15**
**Location: Marinette**

**West Central WWOA**
**Tuesday, August 13**
**Location: Sparta**

**Lake Michigan WWOA**
**Thursday, August 15**
**Location: Marinette**

Register at www.wwoa.org/calendar/
City of Oconomowoc Wastewater Treatment Facility Overview

By Kevin Freber (City of Oconomowoc) and Dave Arnott (Ruekert & Mielke, Inc.)

The City of Oconomowoc is located in Lake Country in western Waukesha County and has a population of 16,700.

It is optimally located in close proximity to Silver, Fowler, Oconomowoc and Lac La Belle Lakes providing abundant resources and recreational activities. Oconomowoc is proud of its numerous lakes, parks, walking trails and biking trails it has to offer.

Oconomowoc's strategic location provides ready access to large markets, all forms of transportation, and a favorable tax climate. The City boasts three business parks, two of which are at capacity and one near total occupancy.

The Pabst Farms development, located adjacent to I-94 and STH 67, will provide an additional 200 acres for manufacturing/business purposes and 60 acres for retail/office development once construction is complete.

An additional five other residential developments are presently in place in the City. The full build-out of these developments should be completed by 2023.

Oconomowoc strives to attract strong stable businesses in order to offer a diverse employment market.

To accomplish this, the City maintains a full-time Economic Development Department to address business and industry needs. The City aims to keep prosperous businesses to retain existing jobs and create new opportunities by continually promoting business growth.

A Common Council comprised of the Mayor and eight aldermen govern the City, and a full-time administrator oversees all day-to-day operations for the City's full range of services including: utilities, public works, public safety, library, parks/recreation services, planning, and economic development.

Oconomowoc's Wastewater Utility is part of the Utility Department which also consists of water and electric services.

The wastewater treatment facility (WWTF) serves the City of Oconomowoc and eight other entities including portions continued on page 6
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of other municipalities, utility districts and sanitary districts. Figure 1 depicts the service area of the WWTF. The WWTF is staffed by 7 resource recovery professionals with a combined 120 years of service.

In 1976 the WWTF was constructed and was commissioned in 1977. This original facility was designed to serve the City and surrounding tributary areas through 1995. It utilizes a conventional activated sludge process to remove carbonaceous biological oxygen demand (BOD) and nitrify ammonia nitrogen. The solids stabilization process is accomplished via anaerobic digestion.

The facility's design annual average day capacity is 4.05 million gallons per day (MGD), and the peak capacity is 9.05 MGD. Presently, the WWTF treats an annual average of 3.16 MGD and is utilizing approximately 78% of its average daily hydraulic capacity. Organically, the facility design loading is 8,340 pounds of BOD per day, and the WWTF treats an average of approximately 5,460 pounds of BOD per day. This is approximately 65% of its average daily

continued on page 8
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organic capacity. Past upgrades have been approached by increasing the unit process hydraulic capacity to an annual average flow rate level to 5 MGD and increasing the peak capacity to 12 MGD. However, the organic treatment capacity of the WWTF remains at 4.05 MGD as these unit processes have not been upgraded.

The facility consistently nitrifies ammonia-nitrogen year-round to a level below 1.0 mg/L and it uses ferric chloride to achieve an effluent total phosphorus level of approximately 0.75 mg/L. Additionally the City is in the midst of a comprehensive adaptive management program for phosphorus compliance. This program will result in a final effluent phosphorus limit of 0.6 mg/L.

The adaptive management program is designed to improve the water quality of the many lakes and rivers in the Oconomowoc River watershed. The watershed is 49 miles long and covers 131 square miles (See Watershed photo). Reduction of non-point source pollution from urban storm water, construction sites, and agricultural land for water quality improvement is the goal. This will enable the City to reach compliance with the Department of Natural Resources wastewater and storm water permit requirements in a cost-effective manner. The specific pollutants to be reduced are phosphorus and total suspended solids. Since the Oconomowoc River is upstream of the Rock River, the program will also improve the water quality of the Rock River and aid in the objectives of the Rock River.
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Total Maximum Daily Load rule. In addition to improving surface water quality in area streams and lakes, the program will enhance local wildlife habitat and ecology, control excessive aquatic plant growth, and reduce algal blooms. In 2018 alone, the adaptive management program reduced phosphorus from non-point sources by 2,500 lbs.


In 2010/2011 a large WWTF upgrade took place, the following improvements were made:

- Addition of one 80' diameter secondary clarifier
- Addition of RAS pumping equipment
- Addition of activated sludge flow control structure
- Addition of groundwater pumping wells
- Replacement of current chlorine-based disinfection w/UV
- Addition of one 90 ft. diameter biosolids storage tank
- Addition of one Biosolids Pumping Building with vehicle storage
- Interconnection of biosolids storage tank piping
- Replacement of primary transformer
- Replacement of auto transfer switch
- Updated elements of SCADA instrumentation and controls in the Solids Handling Building
- Replaced the main distribution control panel and breakers

Wastewater from the main interceptors flows through two 30-inch wide, ¼ -inch step screens where it then drops into a lower wet well. The screens operate in parallel mode and are equipped with a washer and compacter device that discharges clean, dry screening into a plastic bag that is hauled to a landfill. The influent pump station is comprised of four horizontal, dry pit submersible pumps with a 12.0 MGD firm capacity. Two 18-inch force mains leading to the influent channel of the grit chamber receive the pump discharge. Each force main has a magnetic flow meter that sends flow signals back to the WWTF SCADA system. Following the grit chamber influent channel, the wastewater flows by gravity through the remainder of the facility.

At the grit influent channel, the flow is split between two grit collection tanks with an inclined tray grit removal system. These tanks were recently retrofitted from the old aerated grit removal to tanks that house an inclined stacker tray system. Wastewater is introduced in a tangential fashion from the side of the tank at each inclined tray. De-gritted water flows over the trays into the outer grit tank and over a weir to the primary clarifiers. Grit collects in the center of the trays which have an approximate 3-ft diameter hole and settle into a bottom sump. A dry pit pump, dedicated to each grit tank, pumps the grit solution to a forced vortex classifier device where the grit is further separated from...
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organics and clear water. A concentrated grit solution accumulates in the bottom cone of each vortex device while the pump de-gritted water is drained to the channel leading to the primary clarifiers. From the bottom of the cone of the classifier, the cleaner grit slurry is dumped to a dewatering escalator device. This dewatering device draws grit out of the integral settling tank with a series of inclined steps that drain to one side. By the time the grit reaches the top of the escalator, it is dewatered.

After the grit tank, the wastewater is routed to two 60-ft. diameter primary clarifiers. The clarifiers collect solids small enough to pass through the influent screens. At the bottom of the clarifiers, a collection device scrapes the solids into a pit where the primary sludge is pumped to a primary anaerobic digester. During the average daily flow, only one clarifier is necessary, but during peak capacity times both clarifiers are needed.

The wastewater then is routed to two parallel operating aeration tanks with an approximate volume of 1,139,000 gallons, and ceramic diffusers provide fine bubble aeration for each basin. Air is supplied to the diffusers with an air bearing, high efficiency, turbo blower that recently replaced numerous multi-stage, centrifugal blowers as the primary blower. Butterfly valves positioned in two stainless-steel headers equalize air distribution to each aeration train.

Mixed liquor, from the aeration basins, enters a splitter box to equalize the flow to three 80-foot diameter, peripheral feed, final clarifiers. Each clarifier has a circumferential mixed liquor feed system to reduce energy input to the clarifiers and short circuiting. Typically, two out of the three clarifiers are used during average daily flow conditions, and three during peak conditions. A tow bro® type rotating bottom collection device collects solids at the bottom of each clarifier and routes it to the RAS wet well. To reduce algae accumulation, each clarifier has covers for the effluent launder.

A two-compartment RAS wet well, equipped with telescoping valves, balances the amount of final clarifier solids drawn from the final clarifiers. Three dry pit RAS
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pumps are provided to pump the RAS back to the aeration basins. Each compartment of the wet well has two RAS pumps and is dedicated to one aeration process train. Effluent from the clarifier travels through rotating membrane disc filters which remove the remaining suspended solids. The disc filters were installed in 2009 to replace traveling bridge sand filters. Four 4 MGD units are provided yielding a firm capacity of 12 MGD for tertiary filtration. The membranes filter the water from the inside of membrane out. Upon a preset, adjustable head loss differential through the filter, a backwash cycle is initiated. With the backwash, a dry-pit pump in the filtered water basin sprays clear water through a fixed nozzle assembly against the outside of the rotating filter membrane cleaning the interior of the filter. When the water differential setting is restored, the backwash cycle stops. The backwash water collects in a separate trough inside the filter and is routed to the head of plant.

Treated wastewater is disinfected with a low intensity, high pressure ultraviolet light (UV) disinfection system before discharge to the Oconomowoc River. The UV structure was retrofitted from the previous chlorination basin. The UV system intensity automatically ramps up and down based on the effluent flow meter which is before the UV channel.

After the UV system, the clear water is routed through an aerated outfall, then down a concrete-lined channel that conveys the effluent from the WWTF approximately 800 feet west to the Oconomowoc River. The Oconomowoc River is approximately six stream miles upstream of the confluence with the Rock River.

Phosphorus removal is accomplished by chemical precipitation using ferric chloride addition in the aeration basin.

In the solids removal process, primary clarifier sludge is pumped directly to the primary digester, and waste activated sludge (WAS) is thickened from 0.75 percent solids to approximately 3 percent solids using a dissolved air flotation thickening (DAFT) process. Sludge is digested in 60-foot diameter primary and secondary digesters operated in a series configuration. The primary digester cover floats on the sludge, and the secondary digester cover floats on gas produced from the mesophilic digestion process.

Methane gas produced is used heat the heat exchanger, solids building, and biosolids building, and waste gas is flared off. Digested biosolids are pumped to a gravity belt thickener (GBT) where the solids content is increased to 5.5 percent. From the GBT, the biosolids are pumped to two 100-ft diameter, 1.2 MG circular storage tanks with an internal solids recirculation/resuspension system.

A biosolids firm is contracted for hauling and land application.
The WWTF has a complete SCADA system that monitors all set points and makes process control adjustments according to preset variables. Staff is called by an alarm dialer for all WWTF problems. The 20 lift stations that are monitored by SCADA use a cellular alarm service that sends a text message out to employees when there is a problem.

A recent upgrade, replacing the grit removal system from an aerated grit basin using a chain-and-bucket system to a stack tray forced vortex system, took place in 2018. The new system provides cleaner grit, a safer working environment, simpler operation, and increased grit capture than the old system. For this project, rehabilitating and recoating a primary and final clarifier was also included.

The second project in 2018 was the replacement of two multistage centrifugal blowers with a high efficiency, high speed, air-bearing turbo blower. The inlet, discharge piping, and equipment was configured to facilitate the future addition of two more identical turbo units for this project. Another important design aspect of the blower project was the inclusion of a variable speed drive for better dissolved oxygen control.

Previously the WWTF only had blower discharge control through the use of inlet throttling vanes which were inefficient. It was common for the dissolved oxygen level in the aeration basins to greatly overshoot and then undershoot the target DO level. The Utility received a grant for the blower replacement project from Focus on Energy and Wisconsin Public Power Inc.

The Wastewater Utility is currently in the design phase for replacement of numerous solids pumps. The dry pit RAS pumps will be replaced with dry pit submersible pumps with a specialty back swept impeller to reduce clogging and increase hydraulic efficiency. The primary sludge pumps, thickened waste activated pumps from the DAFT, and thickened sludge pumps to and from the anaerobic digesters that are presently progressing cavity pumps will be replaced with rotary lobe pumps.

Future WWTF projects include the addition of high-speed turbo blowers, digester cover replacement, digester mixing...
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and operational improvements, aeration basin expansion, and miscellaneous equipment replacement.

L to R Brian Genz-Operator, Derrick Uecker-Utility Technician, Tom Dickson- Foreman, Scott Sauer-Maint. Mech/ Electrician, Ron Stock-Operator-Advanced, McKala Kiessling-Lab Manager, Mary Moresco-Administrative Assistant, Kevin Freber-Operation Manager/Safety Director

12th Annual Northwoods Collection System Seminar

Thursday, July 25
Eagles Club Marshfield

MORNING SESSION
Collection System Technical Presentations

TECHNICAL TOPICS:
Specifying for Quality Precast Concrete
Spray-in-place Pipe Rehabilitation
Force Main Mapping & Assessment w/ Smart Ball
Up Newton Creek SSO Case Study - Superior, WI
Safety: Trench Safety
How to use and manage Milwaukee’s deep tunnel
WDNR –Update
GIS for CMOM

AFTERNOON SESSION
Vendor presentations and Equipment Displays, Door Prizes, Product Demonstrations

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Nominations are now being taken for the WWOA Board of Directors. Fill out the Board of Directors Nomination form and join us in working with an outstanding group of people and a great Association. The form is also available on the WWOA website at: https://www.wwoa.org/organization/directors-and-chairs/.

**WWOA Nomination Form**

Positions elected at the WWOA Annual Conference: Vice President, Director Positions (2-year terms for Director Position)
Complete the following form and submit it along with a photo as soon as possible to WWOA headquarters via mail or email at the address provided below. If more room is needed, please add additional sheets as needed.

Name: ____________________________________________  Home address: __________________________________________
Occupation: ________________________________________  Employer: __________________________________________
Education: __________________________________________  Organizational Experience: ______________________________
WWOA Affiliation: ____________________________________  Date Joined: ______________
Offices Held & When: _______________________________________________________________________________
Committees Served & When: __________________________________________________________________________
Regional Affiliation: ___________________________________________
Regional Positions Served: ______________________________________________________________________________

What do you see as the future of the WWOA? ____________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________

How do you feel this could be accomplished? ___________________________________________________________________
______________________________________________________________________________________________

Other qualifications for WWOA office: ________________________________________________________________________________
______________________________________________________________________________________________

I wish to place my name into nomination for the office of: ________________________________________________

Other comments: ______________________________________________________________________________________
______________________________________________________________________________________________

Committees you are interested in to serve on:
Promotions  Membership/Director
Scholarship  Government Affairs
Publicity  Permanent Arrangements  Awards
Regional Coordinator  Clarifier
Operator Training  Library  Operator Competition

Mail to: Jeff Bratz, Past President and Nominations Chair
WWOA, 7044 S 13th Street, Oak Creek WI 53154
wrcsd@tds.net  ☛
Troubleshooting Corner Volume XI: Operational considerations during periods of elevated ammonia concentrations

By: Ryan Hennessy of Midwest Contract Operations, WWOA board member rhennessy@mco-us.com

The majority of wastewater plants are designed for nitrification and required to meet ammonia limits.

Nitrification is a 2 step process in which ammonia is converted first to nitrite and finally to nitrate by nitrifying bacteria. Nitrifying bacteria are highly sensitive and require adequate conditions to grow and function properly. Conditions needed for nitrification include a high enough sludge retention time (generally >6 days), adequate dissolved oxygen concentrations, sufficient alkalinity, optimal pH, lack of inhibition/toxicity, and removal of the majority of available carbonaceous BOD.

Most plants (especially municipal plants) fully nitrify reducing ammonia concentrations in the effluent to under 1 mg/L. Generally, if ammonia concentrations are higher than 2 mg/L it is recommended to take extra precaution to ensure the correct environment is present for nitrification. This starts by checking/ ensuring the following:
• Sludge Retention Time (>6 days)
• Dissolved Oxygen in Aeration Basin: >2 mg/L (most instances)
• pH: 7-8.5
• Alkalinity in filtered mixed liquor: >100 mg/L
• MLSS concentration/ F:M (food to microorganism ratio): plant specific

Consider the above the “low hanging fruit” for elevated ammonia. If these parameters are all in place for more than a few days and the ammonia is not decreasing its likely there is something else occurring. Septicity (sulfides and elevated organic acids) are known to inhibit nitrification.

Sulfide inhibition is highly pH dependent as at lower pH values inhibition increases and as the pH increases closer to 8 sulfide disassociates to HS- (Richard, 2009). If sulfide is

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entering the plant and causing issues, reducing its formation or chemical precipitation/oxidation is recommended. Once organic acids (volatile acids) are formed these are difficult to remove and in most instances are treated biologically. The odd # carbon organic acids (propionic, valeric etc.) tend to be especially inhibitive for nitrification. These are typically formed when fermentation shifts from acetic acid to other forms under very low redox conditions (when wastewater is exposed to very septic conditions).

From a practical standpoint, a good starting place under the microscope to look at is for the higher life form organisms. In particular the presence of stalked ciliates and free swimming ciliates. If these are typically present, are now absent, and ammonia is elevated this could be an indication of either stressful conditions or a change in the prey density of dispersed bacteria (such as a slug or shock load).

After this point for further microscopy troubleshooting more advanced knowledge is needed. It is useful to have a “baseline” for normal operations to know which filaments and their abundance are normally present and get an idea of how the plant microbiology changes every few sludge cycles. People who are sufficiently trained in microscopy can determine the general health and condition of filamentous bacteria (these are typically the next most sensitive organisms; for their health to be known 1000x phase contrast oil immersion is needed).

Advanced microscopic evaluation can also indicate other signs of septicity such as sulfur granules in filamentous bacteria, high amounts of spirilla and Spirochaetes, iron sulfide deposits within the flocs, or a major change in type of filaments and their associated causes from normal...
operations. Additional signs of stress include dead/unhealthy filamentous bacteria, broken up flocs, dead cell fragments within the floc, dead cellular material dispersed in solution, and “irregular” growth patterns (often star-fish like in structure) within the flocs or attached to filamentous bacteria. Also Nitrosomonas and Nitrobacter are nitrifying bacteria that can be viewed at phase contrast 1000x oil immersion. While there are other nitrifying bacteria that can only be identified by other methods (genetic testing, fluorescence in situ hybridization etc.) seeing Nitrosomonas and Nitrobacter present (for those who see a lot of different sludges their relative abundance can be ranked) with elevated ammonia concentrations can be a sign that they are present but inhibited (their “mouths are closed”).

In addition to septicity there are hundreds (if not thousands) of other compounds that have the ability to inhibit nitrification. This makes diagnosing “stress” the easy part, but correcting or determining the source often the more difficult part. The most promising places to start are testing for heavy metals in sludge or presence of surfactants and/or cleaning chemicals such as quaternary ammonium or peracetic acid that are often used in commercial cleaning applications.

Nitrification inhibition/toxicity of influent can be confirmed through bench scale testing/feeding of suspected influent to known healthy biomass (healthy sludge from a different plant) and monitoring effect of nitrification at different ratios of healthy influent with spikes of suspected inhibitory influent.

Challenges with this can occur as composite samples have the potential to dilute toxins to suitable levels and also in order to catch something at bench scale it needs to be present (often times toxicity is periodic and can be missed in sampling).

As stated, confirming inhibition is the often the easier part, while tracking down the root cause can often be more problematic.

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Because of the slower growth rates of nitrifying bacteria, in certain instances bioaugmentation (addition of healthy nitrifying bacteria) can help decrease the period of elevated ammonia concentrations (in our experience often by a couple days).

It is important to keep in mind that if these bacteria are added and the conditions for nitrification are not present they will not “catch” and there will be no notable results. In instances where bioaugmentation of nitrifies is considered, additional factors include cost and resources available as well as urgency and politics of the situation. Also, if nitrifying bacteria are present, but inhibited, nitrification often resumes quickly after the stress has been removed from the system.

As with just about everything in wastewater there’s not always a clear cut and dry answer and every situation is unique.

Best wishes for everyone for a happy and successful month. As with the movie “Field of Dreams” if you “build it”, “they” (nitrifying bacteria) will come!
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Annual conference awards – Submit your nominations today!

It is time to start filling out the nomination papers for the Annual Conference Awards. There are many people in our industry that are deserving of these awards. We are looking for nominees for the following awards:

1) George F. Bernauer Award: Criteria include successful plant performance, and/or successful solution of important or complicated operational problems, and/or outstanding contributions in the field of wastewater technology in the State of Wisconsin. The nominee may be a municipal, industrial, or institutional operator, administrator, or educator in Wisconsin. It is not limited to WWOA members.

2) Koby Crabtree Award: Presented to a WWOA member for excellence in technical support provided to others in the field of wastewater treatment. The individual should be a recognized authority in wastewater, share knowledge through presentation, contribute to problem solving, and provide service regardless of compensation.

3) Service Award: Presented to a person who has made an outstanding contribution to the WWOA in the areas of promotion, operation, management, program participation, or education. The nominee must be an active member of WWOA for a period of ten years.

4) Newcomer of the Year Award: Recognizes an operator, support staffer, or environmental technician with less than three years of experience as of August 1st of the year nominated. The nominee should demonstrate higher than average growth in their place of employment, a willingness to learn, innovation on the job, and exceptional enthusiasm for their profession. The nominator should be a supervisor, manager, peer, co-worker, or DNR personnel familiar with the day-to-day efforts of the nominee. WWOA membership is not required, and a two year membership or renewal is included in the award.

5) Regional Operator of the Year Awards: Given out to someone who has demonstrated excellent plant performance, and/or successful solution to a problem, and/or contributions to the wastewater field. It is open to Wisconsin Certified operators of municipal, industrial, or institutional wastewater treatment facilities. The nominee must be a five year member of WWOA.

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The nomination form and instructions for all the awards can be found on the WWOA website at https://www.wwoa.org/organization/annual-awards/ or by contacting Jeff Smudde, Awards Committee Chair, at (920) 438-1040 or email at jsmudde@newwater.us.

Please note, the Regional Operator of the Year Award nominations should be submitted to the Regional officers listed on the nomination form by July 5, 2019. All other awards need to be submitted to Jeff Smudde by August 1, 2019 for consideration.

Feel free to contact me if you would like any further information on the awards, the nomination procedure, or if you have a question if a potential nominee meets specific award criteria.

Thank you in advance for taking the time and effort to nominate individuals and allowing WWOA to recognize these deserving recipients!

Sincerely,
Jeff Smudde
Awards Committee Chair

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