Area Wide Optimization Program

Individual Program Background Information 2019

Name of Agency:

Drinking Water Services is in the Center for Health Protection of the Public Health Division within the Oregon Health Authority.

Official Recognition of AWOP

Please provide the AWOP start date and describe any official recognition of AWOP in agency newsletters, web pages, awards programs, annual meetings, etc.

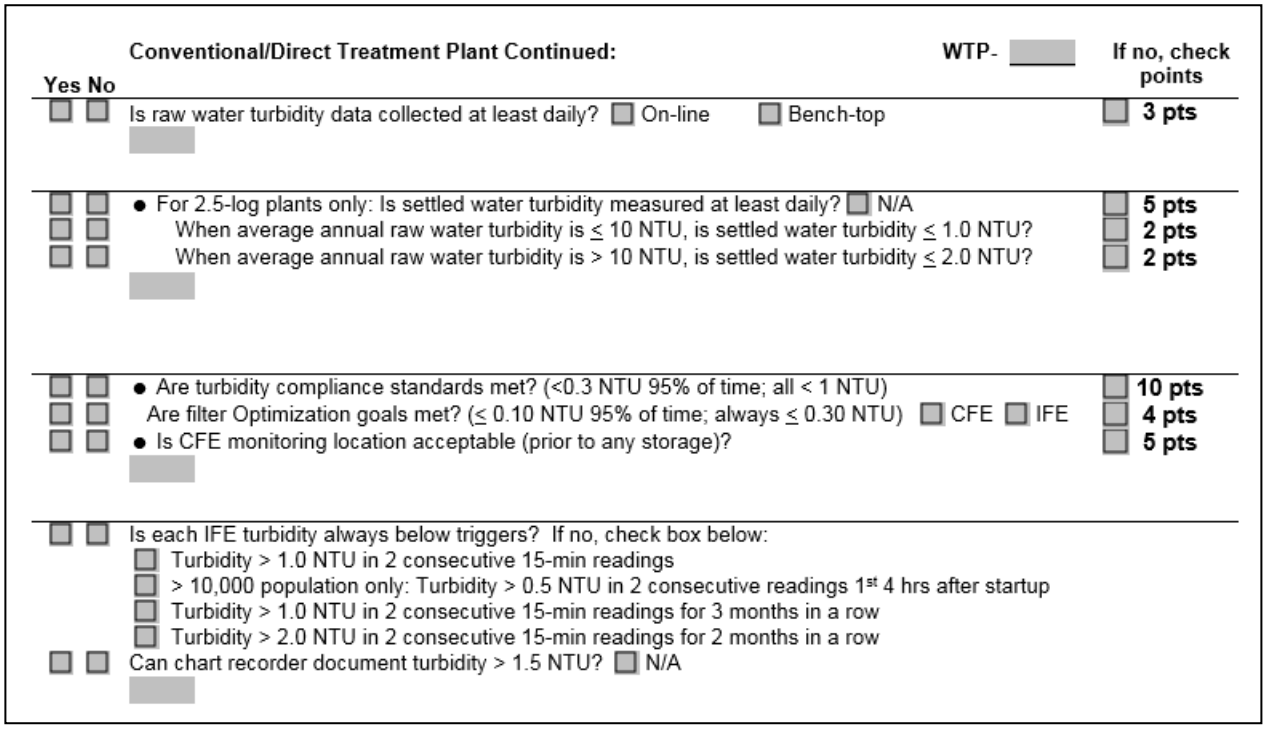
Oregon's program started in 2003. AWOP activities are included as part of our Capacity Development Work Plan and are reported on in the Annual State Capacity Development Program Implementation Report to EPA R10 each year.

AWOP staff are routinely engaged to develop enhancement to primacy program implementation activities and operator training in order to promote optimization as a tool to ensure on-going compliance. There is a website that addresses optimization at www.healthoregon.org/swt.

Official Adoption of AWOP Goals

Please describe when and how AWOP goals were adopted by your agency and communicated to the water systems.

AWOP goals were adopted in 2003 and communicated via direct mailings, conference presentations, and trainings provided by DWS Staff. The goals are also communicated during water system surveys, which include the following questions concerning turbidity monitoring:



Yes	No	Conventional/Direct Treatment Plant Continued: WTP- ____	If no, check points
☐	☐	Is raw water turbidity data collected at least daily? ☐ On-line ☐ Bench-top	☐ 3 pts
☐	☐	• For 2.5-log plants only: Is settled water turbidity measured at least daily? ☐ N/A	☐ 5 pts
☐	☐	When average annual raw water turbidity is ≤ 10 NTU, is settled water turbidity ≤ 1.0 NTU?	☐ 2 pts
☐	☐	When average annual raw water turbidity is > 10 NTU, is settled water turbidity ≤ 2.0 NTU?	☐ 2 pts
☐	☐	• Are turbidity compliance standards met? (<0.3 NTU 95% of time; all < 1 NTU)	☐ 10 pts
☐	☐	Are filter Optimization goals met? (≤ 0.10 NTU 95% of time; always ≤ 0.30 NTU) ☐ CFE ☐ IFE	☐ 4 pts
☐	☐	• Is CFE monitoring location acceptable (prior to any storage)?	☐ 5 pts
☐	☐	Is each IFE turbidity always below triggers? If no, check box below:	
		☐ Turbidity > 1.0 NTU in 2 consecutive 15-min readings	
		☐ > 10,000 population only: Turbidity > 0.5 NTU in 2 consecutive readings 1st 4 hrs after startup	
		☐ Turbidity > 1.0 NTU in 2 consecutive 15-min readings for 3 months in a row	
		☐ Turbidity > 2.0 NTU in 2 consecutive 15-min readings for 2 months in a row	
☐	☐	Can chart recorder document turbidity > 1.5 NTU? ☐ N/A	

National Optimization Goals adopted by your PWSS Program – Check all that apply:
(refer to Attachment I for descriptions of the NOLT optimization goals.)

Water Treatment Plants

Microbial (Turbidity): Raw Water__X__ Individual Settled__X__ CFE___XX_ IFE____
Post BW w/FTW__X__ Post BW wo/FTW_X___ Disinfection (CT) __X__

DBPs (TTHM/HAA5): Plant Effluent____ Enhanced Coagulation____ Disinfection____

Chloramine Application: Ammonia Control____ Dosing (Chlorine & Ammonia) ____

Distribution Systems

Individual Site DBPs ____ Long Term System DBPs____ Tank Operations____
Secondary Disinfection, Free Chlorine ____
Secondary Disinfection, Chloramines (monochloramine, Ammonia & Nitrite) ____

Modifications to the national goals or other optimization goals utilized by your Agency:
Please describe any modified AWOP goals and/or any additional optimization goals adopted by your agency and communicated to the water systems.

There are draft optimization goals and guidelines for slow sand filters on-line at:
www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/TREATMENT/Documents/slowsand/draftoptgoals.pdf

Optimization goals for conventional and direct filtration plants are on-line at:
www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/TREATMENT/Documents/AWOPFactSheetOct2009.pdf

The conventional and direct filtration goals are summarized in the table below:

Table 1. Oregon Area Wide Optimization (AWOP) and Water Treatment Plant Goals are listed below (refer to water treatment and system type)

SEDIMENTATION (for Conventional Filtration)	Turbidity	Criteria
Settled Water	≤ 2.0 NTU, 95% of the time.	If average annual raw water turbidity is > 10 NTU.
	≤ 1.0 NTU, 95% of the time.	If average annual raw water turbidity is ≤ 10 NTU.
FILTRATON (for Conventional and Direct Systems)	**Turbidity**	**Criteria**
IFE and CFE Filtered Water	• Turbidity ≤ 0.10 NTU, 95% of the time. • Max. turbidity ≤ 0.30 NTU.	Based on maximum values recorded during 4-hour increments (excluding the 15-minute period following backwash).
IFE filtered water after backwash	• Turbidity returns to ≤ 0.10 NTU within 15 minutes after backwash. • Max. spike ≤ 0.30 NTU. • Turbidity at return to service ≤ 0.10 NTU.	Goals apply to both systems with and without filter-to-waste capability. Goals also apply to the backwash recovery period starting immediately after backwash.
IFE = Individual Filter Effluent; CFE = Combined Filter Effluent		

Description of *Current* AWOP Team Members and Responsibilities

Please provide the name, position/title, description of AWOP duties and approximate FTE that each team member spends on AWOP. Also indicate who serves as the AWOP team lead/point of contact.
Example: Nevel O. Meter, District Engineer, PBT trainer, ~ 0.3 FTE

(Note that if you submitted this information in 2017, that information is being provided and if there are no changes, simply indicate "no change" in this section.)

No change. Below is the same information provided for the 2017 meeting.

David Emme 	Drinking Water Services Manager (effective February 6, 2017). Oversees the entire Drinking Water Services program in support of AWOP activities.
Tony Fields	Planning Protection and Certification Unit Manager. Oversees the Capacity Development and Operator Certification programs (among others) in support of AWOP activities.
Kari Salis	Technical Services Unit – Region 1 Manager. Oversees the activities field staff in Region 1, the AWOP Coordinator, and the Region 1 Core AWOP Team members in support of AWOP activities.
Casey Lyon	Technical Services Unit – Region 2 Manager. Oversees the activities of field staff in Region 2, including the Region 2 Core AWOP Team member in support of AWOP activities.
Joe Carlson	Data Management and Compliance Assurance Unit Manager. Oversees enforcement and compliance functions and the entry and management of data housed in SDWIS/STATE, which is used to develop AWOP program reports and Status Component Scores.
Debra Lambeth	Environmental Engineer 3 Capacity Development Coordinator. Integrates AWOP activities into the Capacity Development Program
Evan Hofeld (AWOP Coordinator - 0.25 FTE)	Environmental Engineer 3 Develops/Maintains the Status Component, PBT, and other operator training opportunities.
James Nusrala (AWOP Core Team Member - 0.25 FTE)	Environmental Engineer 3 AWOP Core Team Member – Region 1. Oversees development of Technical On-site Assistance Process, contributes to on-line resources, and participates in AWOP field events and operator trainings.
Jay MacPherson (AWOP Core Team Member - 0.25 FTE)	Environmental Engineer 3 AWOP Core Team Member – Region 2. Contributes to the Technical On-site Assistance Process, and participates in AWOP field events and operator trainings.
Rebecca Templin (AWOP Core Team Member - 0.25 FTE)	Environmental Engineer 3 AWOP Core Team Member – Region 2. Contributes to the Technical On-site Assistance Process, and participates in AWOP field events and operator trainings.

Description of *Former* AWOP Team Members:

Please provide the name of former AWOP team members, and their reason for leaving the team. This information is for historical purposes and also to support networking as AWOP continues to expand.

(Note that if you submitted this information in 2017, that information is being provided and if there are no changes, simply indicate "no change" in this section.)

1. No change. Below is the information provided in 2017.

NAME:	**REASON for LEAVING the AWOP:**
Dave Leland, Drinking Water Services Manager 	Retired after 34 years in December 2016
Fred Kalish, AWOP Core Team Member	Retired July 1, 2015
Casey Lyon, AWOP Core Team Member	Became Region 1 Technical Services Manager in 2014 – he is still involved in AWOP as much as he can.
Chris Hughes, Unit Manger	Retired in 2011.
George Waun, Capacity Development and AWOP Coordinator	Left State Employment in 2008.
Shane Phelps, AWOP Core Team Member	Left State Employment prior to 2008.
Brian Rigwood, AWOP Core Team Member	Left State Employment prior to 2008.

Below is the same information provided in 2017, which is largely the same. Staffing shortages and computer operating system upgrades make getting this information in a timely manner difficult.

Inventory of State-Wide Treatment Facilities[1]	**Number**
Rapid rate filtration treatment plants[2,3]	106
Utilizing static settling without tubes or plates	Unknown
Utilizing static settling with tubes or plates	Unknown
Utilizing sludge blanket clarification (upflow, pulsator)	Unknown
Utilizing contact adsorption clarification	Unknown
Utilizing sludge recirculation (including ballasted clarification)	Unknown
Utilizing DAF, or other alternative clarification process	Unknown
Utilizing direct/in-line filtration	35 (71 of 106 rapid rate plants have some type of clarification process (e.g., static basin, CAC, tube, plate, etc.)
Utilizing packaged filtration (package plants)	Unknown
Slow sand filter plants	30
Diatomaceous earth filter plants	1
Membrane treatment plants	36
Bag or cartridge filtration plants	50 (all cartridge)
Total Number of Filtration Plants (SW or GU sources)	***223***
Primary disinfectant*	
Free chlorine	265**
Chloramines	0
Ozone	5
UV	20
Secondary disinfectant	
Free chlorine	262
Chloramines	3

*Disinfection data is a count of disinfection treatment process codes in SDWIS/STATE for SW/GU system (excludes consecutive systems). Some plants may be counted for more than one disinfection process as some plants may have multiple oxidants used for primary disinfection depending upon the target pathogen.

**Includes treatment plants with gas chlorine, sodium hypochlorite, and mixed oxidants.

[1]Limited to surface water treatment plants (includes surface, GUDI, blended sources).
[2]All surface water treatment plants, except cartridge, membrane and slow sand.
[3]When a plant utilizes multiple treatment processes or configurations identified below, please include them all in this inventory, e.g., a package plant that utilizes a CAC will be included as a rapid rate plant using CAC and packaged filtration.

AWOP Vision:

Please describe the vision for your AWOP

The object of Oregon's Area Wide Optimization Program is to educate water system operators in optimization principles with the goal of improving public health protection. This is accomplished by imparting an understanding of not only the basics of water treatment and the multiple barrier concepts, but also providing the opportunity and incentive to learn and engage in optimizing treatment beyond regulatory standards and using data to monitor performance and identify areas for improvement.

The long-term vision is to have all conventional and direct filtration plants meet the optimization goals.

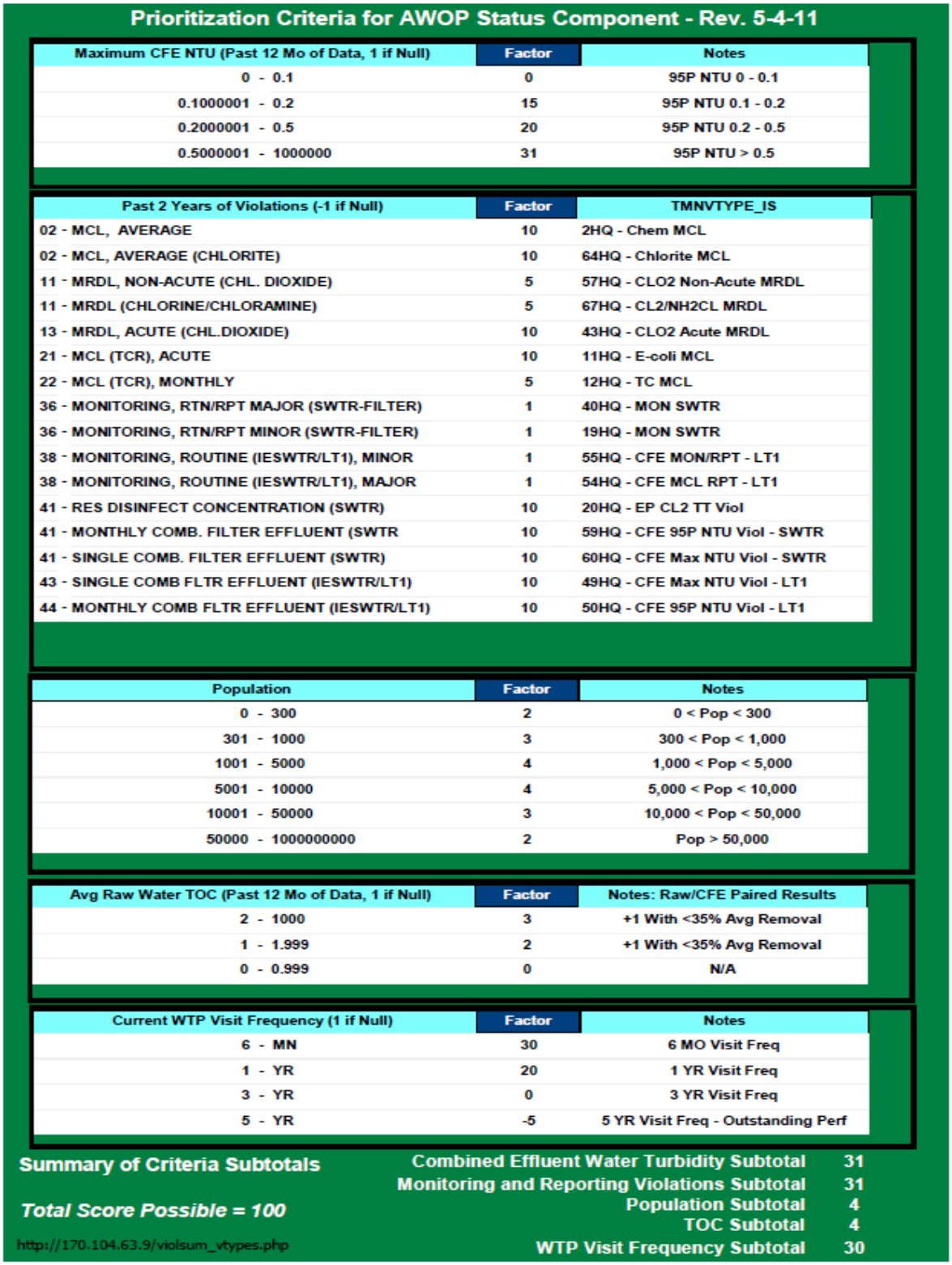
Status Component Implementation:

Please describe status component activities that are implemented in your agency, e.g., (are water systems ranked according to public health risk and how is this information used; how is water system data integrity ensured):

In general, systems with higher status component scores are prioritized when scheduling on-site assistance activities, however, on-site assistance may also be provided upon request.

Status component scores are determined as follows:

- All data used to develop status component scores is housed in SDWIS/STATE.
- The data housed in SDWIS/STATE includes:
    - Filter type code;
    - Population served;
    - Maximum daily combined filter effluent turbidity data reported by water systems on the monthly operating report (along with compliance turbidity data and CT parameters).
    - Violations;
    - A score entered based on information gathered during water system surveys and treatment plant inspections; and
    - TOC data.
- A Microsoft Access database is used to extract the data, calculate and archive system scores, and generate reports.
- A factor is applied to the data extracted from SDWIS/STATE and the sum of the factors is used to generate the status component scores. These factors are shown in the status component criteria shown on the following page.



Prioritization Criteria for AWOP Status Component - Rev. 5-4-11

Maximum CFE NTU (Past 12 Mo of Data, 1 if Null)	Factor	Notes
0 - 0.1	0	95P NTU 0 - 0.1
0.1000001 - 0.2	15	95P NTU 0.1 - 0.2
0.2000001 - 0.5	20	95P NTU 0.2 - 0.5
0.5000001 - 1000000	31	95P NTU > 0.5

Past 2 Years of Violations (-1 if Null)	Factor	TMNVTYPE_IS
02 - MCL, AVERAGE	10	2HQ - Chem MCL
02 - MCL, AVERAGE (CHLORITE)	10	64HQ - Chlorite MCL
11 - MRDL, NON-ACUTE (CHL. DIOXIDE)	5	57HQ - CLO2 Non-Acute MRDL
11 - MRDL (CHLORINE/CHLORAMINE)	5	67HQ - CL2/NH2CL MRDL
13 - MRDL, ACUTE (CHL.DIOXIDE)	10	43HQ - CLO2 Acute MRDL
21 - MCL (TCR), ACUTE	10	11HQ - E-coli MCL
22 - MCL (TCR), MONTHLY	5	12HQ - TC MCL
36 - MONITORING, RTN/RPT MAJOR (SWTR-FILTER)	1	40HQ - MON SWTR
36 - MONITORING, RTN/RPT MINOR (SWTR-FILTER)	1	19HQ - MON SWTR
38 - MONITORING, ROUTINE (IESWTR/LT1), MINOR	1	55HQ - CFE MON/RPT - LT1
38 - MONITORING, ROUTINE (IESWTR/LT1), MAJOR	1	54HQ - CFE MCL RPT - LT1
41 - RES DISINFECT CONCENTRATION (SWTR)	10	20HQ - EP CL2 TT Viol
41 - MONTHLY COMB. FILTER EFFLUENT (SWTR	10	59HQ - CFE 95P NTU Viol - SWTR
41 - SINGLE COMB. FILTER EFFLUENT (SWTR)	10	60HQ - CFE Max NTU Viol - SWTR
43 - SINGLE COMB FLTR EFFLUENT (IESWTR/LT1)	10	49HQ - CFE Max NTU Viol - LT1
44 - MONTHLY COMB FLTR EFFLUENT (IESWTR/LT1)	10	50HQ - CFE 95P NTU Viol - LT1

Population	Factor	Notes
0 - 300	2	0 < Pop < 300
301 - 1000	3	300 < Pop < 1,000
1001 - 5000	4	1,000 < Pop < 5,000
5001 - 10000	4	5,000 < Pop < 10,000
10001 - 50000	3	10,000 < Pop < 50,000
50000 - 1000000000	2	Pop > 50,000

Avg Raw Water TOC (Past 12 Mo of Data, 1 if Null)	Factor	Notes: Raw/CFE Paired Results
2 - 1000	3	+1 With <35% Avg Removal
1 - 1.999	2	+1 With <35% Avg Removal
0 - 0.999	0	N/A

Current WTP Visit Frequency (1 if Null)	Factor	Notes
6 - MN	30	6 MO Visit Freq
1 - YR	20	1 YR Visit Freq
3 - YR	0	3 YR Visit Freq
5 - YR	-5	5 YR Visit Freq - Outstanding Perf

Summary of Criteria Subtotals

Combined Effluent Water Turbidity Subtotal	31
Monitoring and Reporting Violations Subtotal	31
Population Subtotal	4
TOC Subtotal	4
WTP Visit Frequency Subtotal	30

Total Score Possible = 100

http://170.104.63.9/violsum_vtypes.php

- Medium sized systems are weighted more than very large or very small systems, as they are deemed to have somewhat limited technical or managerial capacity, but enough capacity to effectively use information provided by AWOP team members to improve treatment performance and resolve performance limiting factors.

- An example of the list of ranked water systems is shown below, with those systems having the highest status component scores appearing at the top of the list:

AWOP Status Component - Ranking of Systems **Page 1 of 9**

(Conventional and Direct Filtration Systems) 6/14/2017 8:53:04 AM

2016Q4 EndDT: 12/31/2016

WTP	Total Score	Visit Score	CFE Score (95P NTU)	Violation Score	TOC Score (CF Only)	Population Score	FILTER TYPE	GIARDIA RMVL FILTR
01139	MIDLAND WATER ASSOCIATION							Columbia
WTP-A	TP FOR COMBINED CREEK/SPRINGS						DF	2.0
	85	20	31	31	1	2		
		1YR	0.74			160		
00707	LAWSON ACRES WATER ASSOCIATION							Douglas
WTP-A	TP FOR COW CREEK						DF	2.0
	76	30	20	23	1	2		
		6MN	0.25			75		

Targeted Performance Improvement (TPI) Implementation:

Please list all activities that are implemented as TPI activities in your state, e.g., CPEs, PBT, Enhanced Sanitary Surveys, technical assistance, other):

Oregon's TPI activities include:

- Conducting CPEs, on-site technical assistance site visits, and data integrity audits
- Offering the following classes at least once each year worth 0.6 CEU each:
  - Essentials of Surface Water Treatment
  - Slow Sand Filtration
  - Conventional and Direct Filtration
- Conducting PBT (a total of 32 hours of instruction (3.2 CEU) for operators of conventional and direct filtration plants)
- Provide outreach and information through conference presentations, direct mailings, and a website (www.healthoregon.org/swt).
- Completing work on implementing slow sand and membrane filtration optimization goals.

In general, systems with higher status component scores are prioritized when scheduling on-site assistance activities, however, on-site assistance may also be provided when requested by a water system.

AWOP Maintenance Component Implementation:

Integrate

Please check the following areas where AWOP has been integrated into the PWSS Program:
Plan Reviews__X___ Permitting_____ Capacity Development__X___ Operator Training__X___
Technical Assistance__X___ DWSRF Prioritization_____ Enforcement__X___ Sanitary Surveys__X__
Other(identify)_____

Enhance

Please describe any AWOP enhancements that have been implemented in your program. One example could include modifying status component criteria

No further enhancements have been made since 2017.

Sustain

Please describe any activities that you implement to sustain your agency's AWOP. Some examples could include efforts to promote and incentivize AWOP (e.g., publish regular newsletter, awards program, AWOP participation = higher ranking for grant/loan funding, etc.).

The knowledge and experience gained as a result of participation in the Region 10 AWOP group has had a positive impact in sustaining support for AWOP enhancing the following program areas:

Plan Review:

Efforts to optimize conventional, direct, membrane and slow sand filtration systems has led to a better understanding and review of construction plans among plan review staff. AWOP Core Team members have been instrumental in revising plan review forms and procedures as a result of the knowledge and experience gained through participation in AWOP activities.

Capacity Development:

AWOP activities are written into the Capacity Development Work Plan. AWOP Core Team Members have been instrumental in the development of financial and managerial capacity outreach materials.

Operator Training:

Classes and PBT developed and offered by AWOP staff are used by operators to gain CEU's that go towards their operator certification CEU requirements. Operators are also able to obtain CEU's by attending conference presentations presented by AWOP staff.

Enforcement:

AWOP core team members have recently completed two Comprehensive Performance Evaluations (CPEs) in late 2013 and early 2015, one of which was required under ESWTRLT1 for individual filter effluent turbidity exceedances. The training AWOP staff received as a result of participating in AWOP Region 10 events has prepared Oregon staff to be able to complete these CPE's in a thorough much more effective manner.

Lessons Learned:

Please list "lessons learned" that you feel would be helpful to other programs, e.g., how to build and maintain internal support, how to integrate AWOP into your PWSS program, etc). If you are new to AWOP, please list a question or concern you'd like to know more about.

The following lessons have been learned in implementing AWOP in Oregon:

1. Obtain clear expectations and performance measures or benchmarks from management;
2. Ensure criteria used for benchmarks or performance measures are relatively easy to track and can be sustained;
3. Ensure the integrity of turbidity and other status component data early on in the process;

4. Involve as many drinking water staff as possible;
5. Include AWOP as a part of all-staff meetings;
6. Integration into Capacity Development Programs helps to sustain funding and management support for AWOP activities.
7. Attending regular regional meetings and participating in multi-state trainings is crucial to keeping on top of new developments and learning innovative ways to implement AWOP activities.

Attachment I: Optimization Goals Adopted by the NOLT

Category	Goal	Applies to	Description
Microbial	Minimum Data Monitoring Goal Raw Water Turbidity	Rapid Rate Filtration Plants	— Record maximum daily raw water turbidity.
Microbial	Individual Sedimentation Basin Performance and Monitoring Goals	Rapid Rate Filtration Plants	— Settled water turbidity ≤ 2 NTU in 95% of readings when the annual average raw turbidity is > 10 NTU. Optimization is based on the daily maximum values recorded from all readings. — Settled water turbidity ≤ 1 NTU in 95% of readings when the annual average raw turbidity is ≤ 10 NTU. Optimization is based on the daily maximum values recorded from all readings. — Record individual sedimentation basin effluent turbidity readings at intervals of 4-hours or less if taking grab samples, or 15 minutes or less for continuous monitoring.
Microbial	Individual and Combined Filter Performance and Monitoring Goals	Rapid Rate Filtration Plants	— Combined filter effluent turbidity ≤ 0.10 NTU in 95% of readings. Optimization is based on the daily maximum values recorded from all readings. — Individual filter effluent turbidity ≤ 0.10 NTU in 95% of readings (excluding 15-minute period following filter backwash). Optimization is based on the daily maximum values recorded from all readings. —Post backwash individual filter effluent turbidity for filters <u>without</u> filter-to-waste capability: Maximum individual filter effluent turbidity following backwash ≤ 0.30 NTU and achieve ≤ 0.10 NTU within 15 minutes. —Post backwash individual filter effluent turbidity for filters <u>with</u> filter-to-waste capability: Minimize individual filter effluent turbidity during filter-to-waste period and record maximum value. Return the filter to service at ≤ 0.10 NTU. — Record individual and combined filter effluent turbidity readings at intervals of 1-minute or less for continuous monitoring.
Microbial	Disinfection Performance and Monitoring Goals	Rapid Rate Filtration Plants	—Meet CT requirements to achieve inactivation of *Giardia* and viruses plus a system-specific factor of safety. — Record disinfectant residual, temperature, and pH at maximum daily flow for CT calculations.
Disinfection By-Product	Plant Effluent Disinfection Byproducts (DBPs) Performance and Monitoring Goals	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	—System Specific Targets: Could be a discrete value or range that is based on a running annual average. Recommended goal value/range should be 30% to 50% of long term LRAA goals (e.g., 20-30 ppb for TTHM, 15-20 ppb for HAA5). —Collect quarterly TTHM and HAA5 samples at the plant effluent and distribution system compliance sites.
Disinfection By-Product	Enhanced Coagulation Performance and Monitoring Goals	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	—Meet Stage 1 D/DBP Rule TOC removal requirements for enhanced coagulation, which are based on source water alkalinity and TOC levels, or an alternative compliance criterion, as a running annual average (RAA) of the performance ratio (actual TOC removal/required TOC removal) plus a factor of safety of 10% (or performance ratio ≥ 1.1). —Collect monthly total organic carbon samples for raw and treated water (only applies to parent systems).
Disinfection By-Product	Disinfection Performance and Monitoring Goal	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	—Meet CT requirements to achieve inactivation of *Giardia* and viruses plus a system-specific factor of safety. —Record disinfection residual, temperature, and pH at maximum daily flow for CT calculations (only applies to parent systems).

Distribution System	Disinfection Byproducts Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize any Secondary Disinfectant	—Individual Site Goal: Quarterly Maximum Locational Running Annual Average TTHM/HAA5 values not to exceed 70/50 ppb. —Long-Term System Goal: Average of Maximum Locational Running Annual Average TTHM/HAA5 values not to exceed 60/40 ppb (the average of the last 8 quarters cannot exceed 60/40 ppb). —For systems in compliance with the TTHM and HAA5 MCLs, collect quarterly DBP samples at all compliance locations; for systems not in compliance, collect monthly samples.
Free Chlorine Distribution System	Disinfection Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize Free Chlorine as a Secondary Disinfectant	—Maintain ≥ 0.20 mg/L free chlorine residual at all monitoring sites in the distribution system, at all times. —Monitoring should be performed at least monthly, but more frequently at critical times (i.e., summer months). —Sample locations should include bacteriological and DBP compliance sites, all distribution system entry points (e.g., plant effluent, consecutive system connections), all tanks (preferably while draining), and identified critical sites base on investigative sampling (minimum of one critical site in each quadrant of the system, four sites total).
Plants that Utilize Chloramine	Disinfection: Ammonia Control Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant	—Maintain a detectable free ammonia residual in the plant effluent ≤ 0.10 mg/L as NH3-N. —Monitor free ammonia at <u>least</u> once per day in the plant effluent. • The monitoring frequency may be adjusted based on the variability observed over an extended period of time. • Free ammonia may be monitored in the source water periodically (e.g., once per week) to assess variability.
Plants that Utilize Chloramine	Operational Guideline Chlorine and Ammonia Dosing	Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant	—Maintain a chlorine-to-nitrogen mass ratio between 4.5:1 and 5.0:1 (or chlorine-to-ammonia mass ratio between 3.7:1 and 4.1:1), which should result in a detectable free ammonia in the plant effluent that is ≤ 0.10 mg/L as NH3-N.
Chloramine Distribution System	Disinfection: Monochloramine and Nitrification-Related Parameters Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant	—Maintain ≥ 1.50 mg/L monochloramine residual at all monitoring sites in the distribution system, at all times, to provide a disinfection barrier against both microbial contamination and nitrification prevention. —Monitor monochloramine, free ammonia, and nitrite in the distribution system and at the entry points (to establish a baseline). • Monochloramine and free ammonia should be monitored at <u>all sample locations</u>. • Nitrite should be monitored at sample locations where monochloramine is ≤ 1.50 mg/L; nitrate may also be monitored, to further assess nitrification. • Sample locations should include bacteriological and DBP compliance sites, all distribution system entry points (e.g., plant effluent, consecutive system connections), all tanks (preferably while draining), and identified critical sites base on investigative sampling (minimum of one critical site in each quadrant of the system, four sites total). • Monitoring should be done at least monthly, but more frequently at critical times (e.g., summer months).
Distribution System	Operational Guidelines Tank Operations	Parent and Consecutive Water Systems that Contain Storage Tanks (any secondary disinfectant)	—Maintain an average turnover time < 5 days; or establish and maintain a water turnover rate at each storage facility. —Maintain good mixing (i.e., Performance Ratio ≥ 1) at all times; for tanks where the PR cannot be calculated, adequate mixing (i.e., uniform water quality) should be confirmed by alternate means (e.g., tank profiling/water quality sampling).