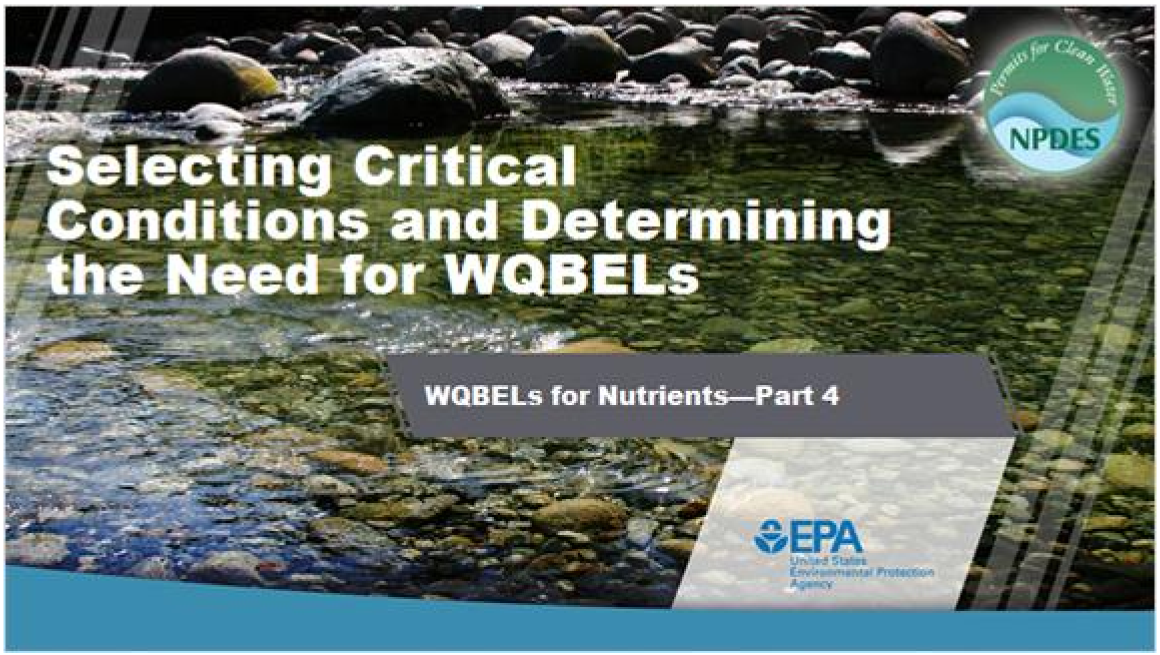
Selecting Critical Conditions and Determining the Need for WQBELs

1. Part 4: Selecting Critical Conditions and Determining the Need for WQBELs

1.1 Selecting Critical Conditions and Determining the Need for WQBELs



Notes:

Welcome to this presentation on addressing nutrient pollution in National Pollutant Discharge Elimination System, or NPDES, permits.

This presentation is part four of a six part section of the training on establishing water quality-based effluent limitations or WQBELs for nutrients. This training is sponsored by the U.S. Environmental Protection Agency's Water Permits Division.

In this presentation we will discuss selection of critical conditions for our water quality model that we will use to determine the need for WQBELs.

Before we get started with the presentation, let's introduce our speakers, take care of a housekeeping item, and review where we are within the training series.

1.2 Presenters

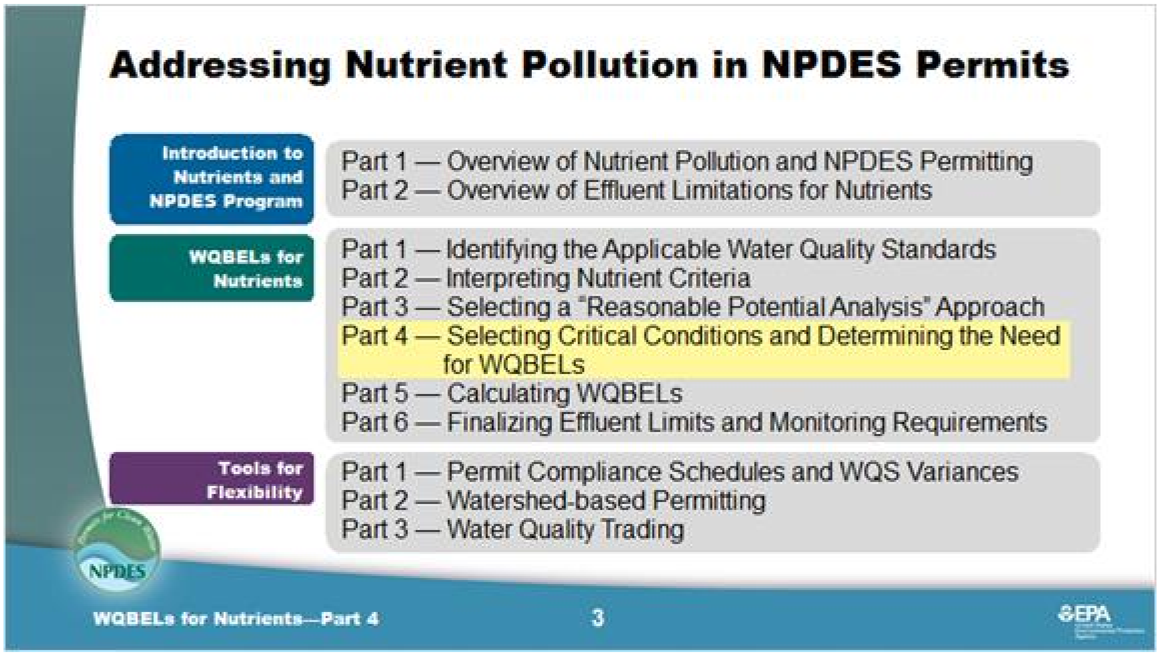
Notes:

First the introductions, your speakers for this presentation are me, Danielle Stephan, and Amelia Letnes. We both are with the Water Permits Division of the US Environmental Protection Agency in Washington, DC.

Now for our housekeeping item. I need to let you know that the materials used in this presentation have been reviewed by USEPA staff for technical accuracy; however, the views of the speakers are their own and do not necessarily reflect those of USEPA. NPDES permitting is governed by the existing requirements of the Clean Water Act and USEPA's NPDES implementing regulations. These statutory and regulatory provisions contain legally binding requirements. The information in this presentation is not binding. Furthermore, it supplements, and does not modify, existing USEPA policy, guidance, and training on NPDES permitting. USEPA may change the contents of this presentation in the future.

Let's take a look at where we are in the overall training series.

1.3 Addressing Nutrient Pollution in NPDES Permits



Notes:

This presentation is part four of the section of our training on water quality-based effluent limitations for nutrients.

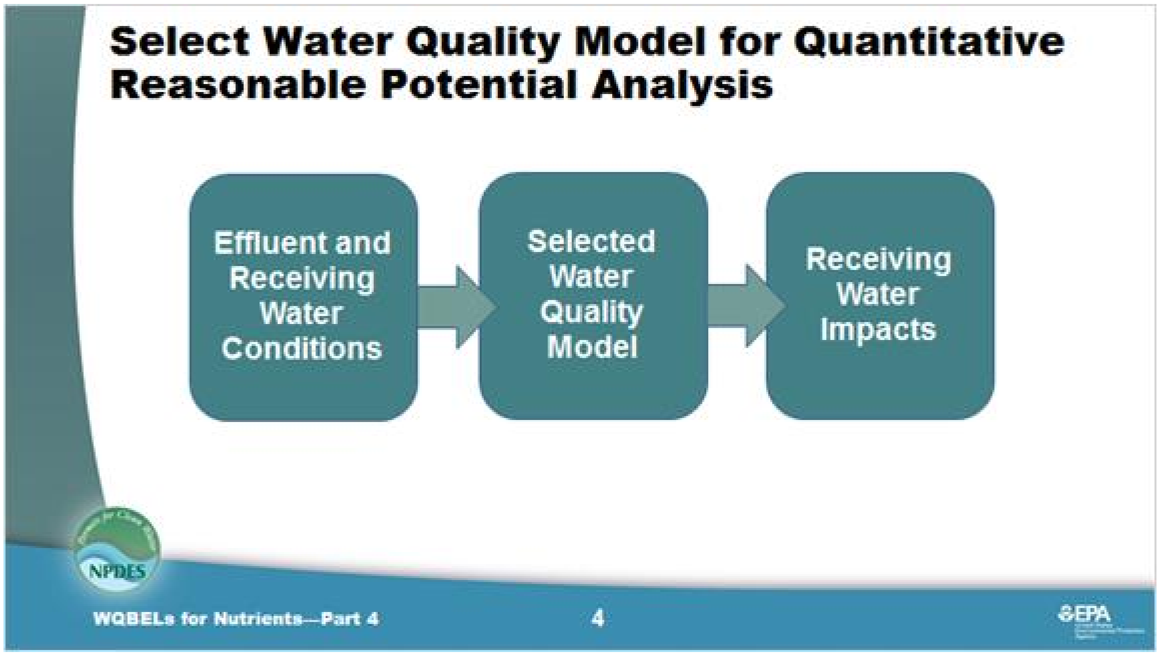
In parts one and two, we looked at how we identify the applicable water quality standards and interpret nutrient criteria in those standards in order to use them for NPDES permitting.

In part three, we focused on selecting an approach to determining the need for water quality-based effluent limits-our "reasonable potential analysis" approach. One of the decisions we considered in part three was selection of a water quality model to help us with a quantitative reasonable potential analysis.

Now, in this presentation, we will select the appropriate inputs to our water quality model and use the model to determine the need for water quality-based effluent limits.

Can you get us started, Amelia?

1.4 Select Water Quality Model for Quantitative Reasonable Potential Analysis



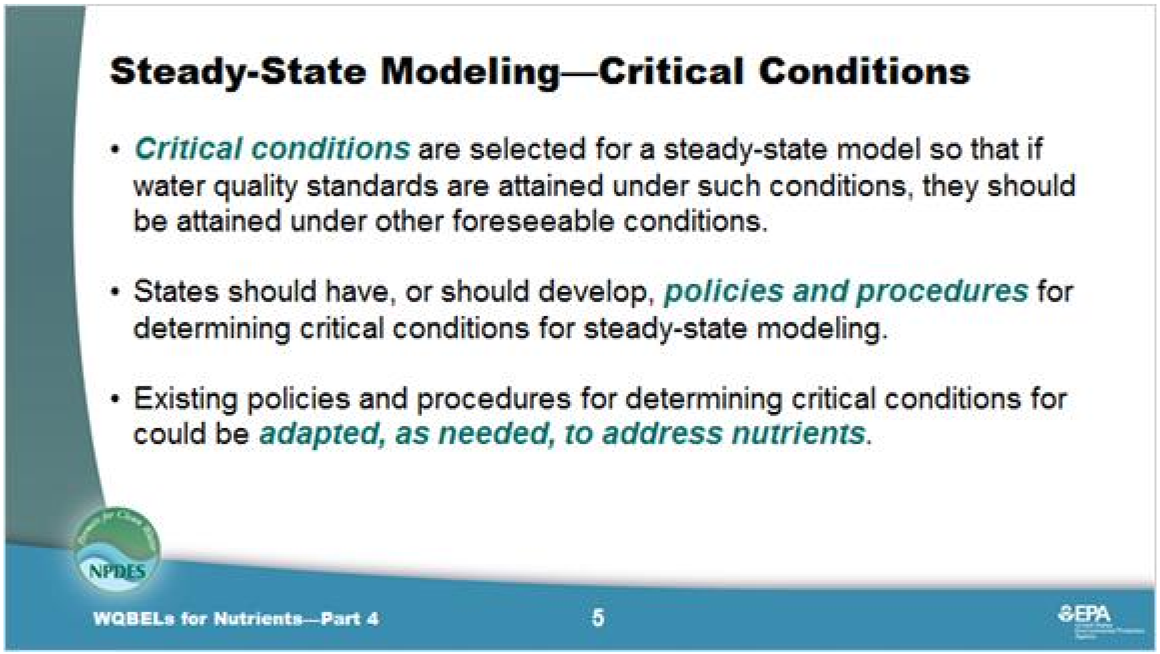
Notes:

Sure, Danielle.

As Danielle noted, in part three of this section we discussed ways to conduct either a qualitative or quantitative reasonable potential analysis. Where we selected a quantitative approach, we also discussed selecting a water quality model and populating it with data on effluent and receiving water conditions. We will now set these conditions and use the model to assess the impact of an effluent discharge of nutrients on the receiving water.

In this training we'll use a very simple, steady-state water quality model to illustrate how we might conduct a quantitative reasonable potential analysis for nutrients. As we work through the example using the mass-balance equation, we will consider ways we could adapt existing reasonable potential procedures in EPA's Te*chnical Support Document for Water Quality-based Toxics Control,* or TSD, to account for the unique characteristics of nutrients.

1.5 Steady-State Modeling—Critical Conditions



Notes:

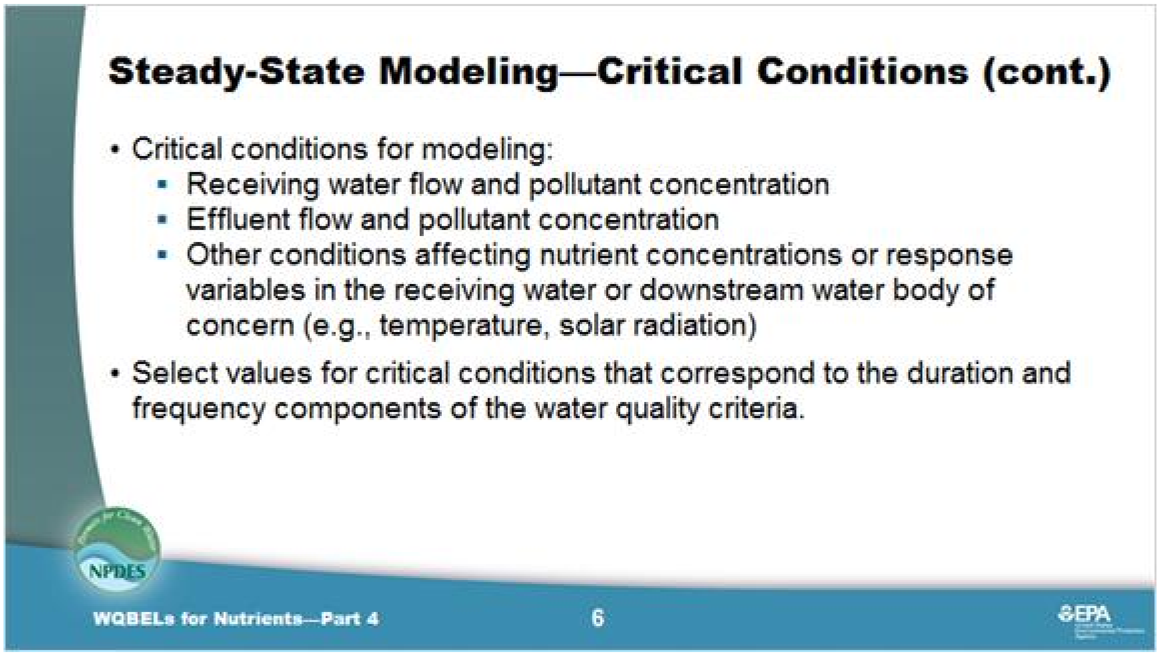
Using a steady-state water quality model to determine the impacts of a discharge on the receiving water requires us to select conditions that we input to the steady state model.

Because we want to make sure that water quality standards are attained under various combinations of effluent and receiving water conditions, the inputs we select for our steady-state water quality model are what we call “critical conditions.” We select a set of critical conditions so that if water quality standards are attained under such conditions, they should also be attained under other foreseeable conditions.

States should have in place policies and procedures to determine the critical conditions that are inputs to steady-state models; however, such policies and procedures are often developed to address toxic pollutants and other pollutants that behave in a similar manner.

Existing procedures for determining critical conditions for toxic pollutants could be adapted as needed for nutrients.

1.6 Steady-State Modeling—Critical Conditions (cont.)



Notes:

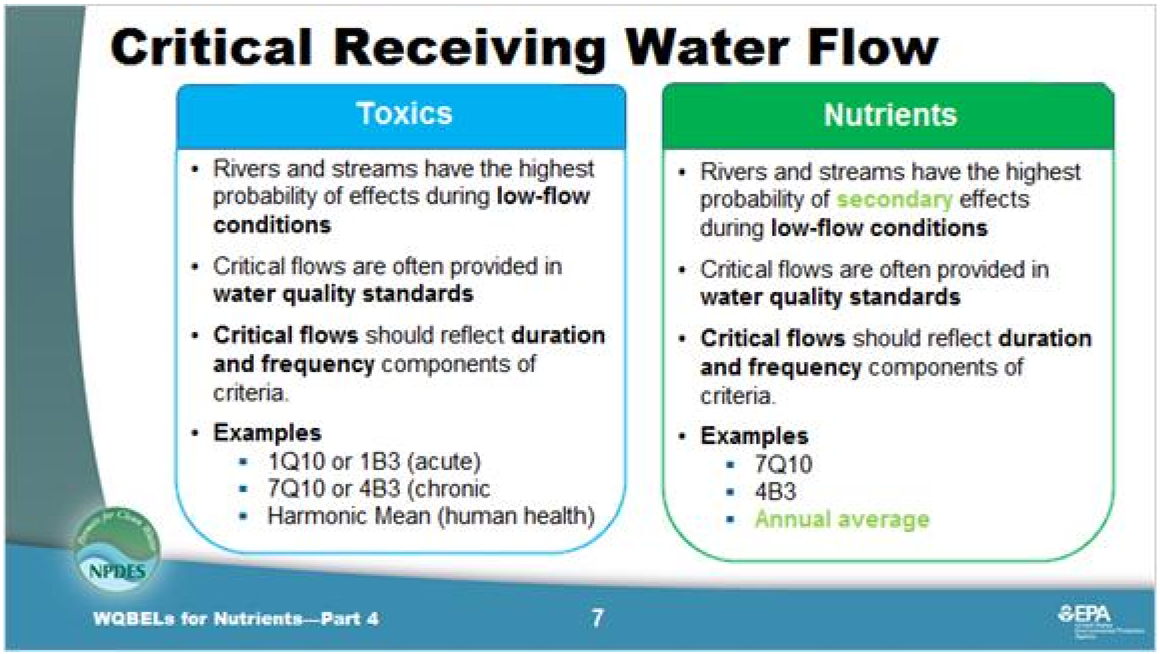
The critical conditions we need as inputs to our water quality model include flow and pollutant concentration conditions for both the effluent and receiving water, as well as any other environmental conditions that might affect the impact of nutrient discharges on the water body of concern.

When simulating a single set of environmental conditions, we need to select values for model inputs to ensure that the permit will be protective of critical conditions while not representing conditions that are extremely unlikely to occur and, therefore, are unnecessarily overprotective.

To accomplish this goal, we can select critical conditions that correspond to the duration and frequency components of applicable nutrient water quality criteria.

For the rest of this presentation, Danielle and I will discuss various water quality model inputs and, by way of an example, consider how we might select critical conditions for those inputs when addressing nutrients.

1.7 Critical Receiving Water Flow



Notes:

Up first is the critical receiving water flow.

As with other pollutants, rivers and streams are likely to have the highest chance of experiencing the secondary effects of excess nutrients during low flow conditions. Often, state water quality standards specify the critical flow for rivers and streams under low flow conditions.

For any pollutant, the critical receiving water flow generally should reflect the duration and frequency components of the applicable water quality criterion.

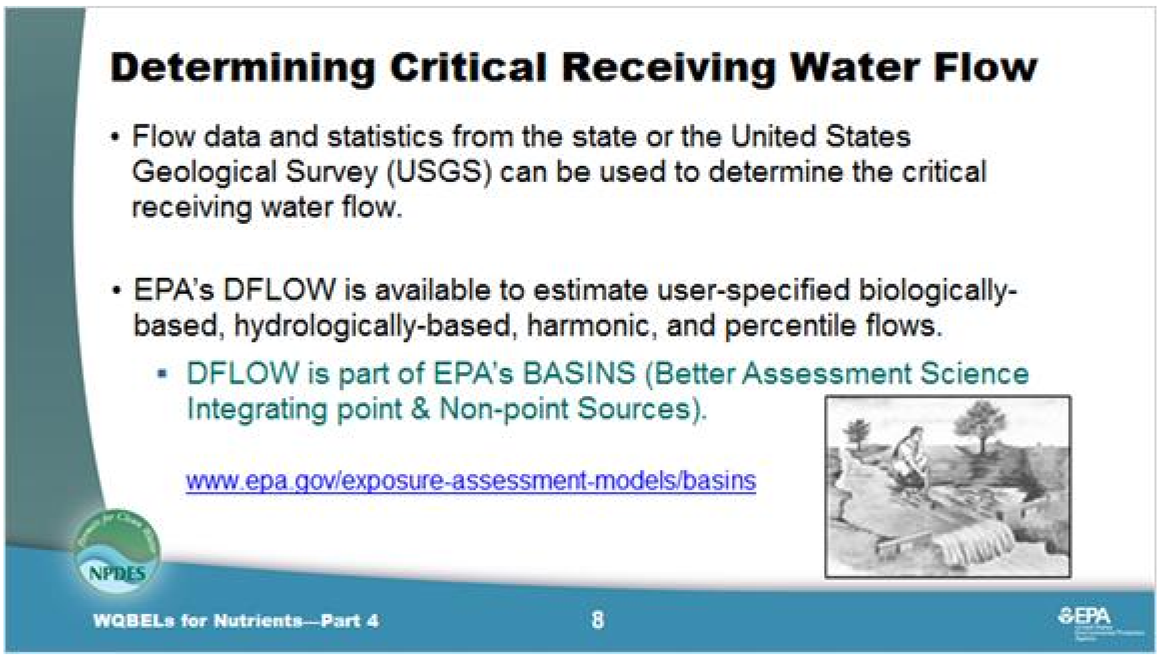
When using hydrologically-based flows for water quality calculations, states tend to use low flow statistics that are readily available. For example, commonly used critical low flows used to assess the impact of toxic pollutants include the 1Q10 or 1-day average, once in 10 years low flow, for acute aquatic life criteria; the 7Q10 or 7-day average, once in 10 years low flow for chronic aquatic life criteria; and the harmonic mean flow for human health criteria.

An alternative to using hydrologically-based flows is to calculate biologically based flows directly from the duration and frequency of the criteria, such as the 1B3 or 4B3 flows.

For nutrients, we also want to select critical flows for rivers and streams that reflect the duration and frequency components of the applicable nutrient criteria. This is one reason why it is important that numeric criteria or an interpretation of narrative criteria for nutrients include duration and frequency components.

For example, if the applicable nutrient criterion is an annual average criterion, an appropriate hydrologically-based critical flow for our steady-state model might be a measure of the annual average flow.

1.8 Determining Critical Receiving Water Flow

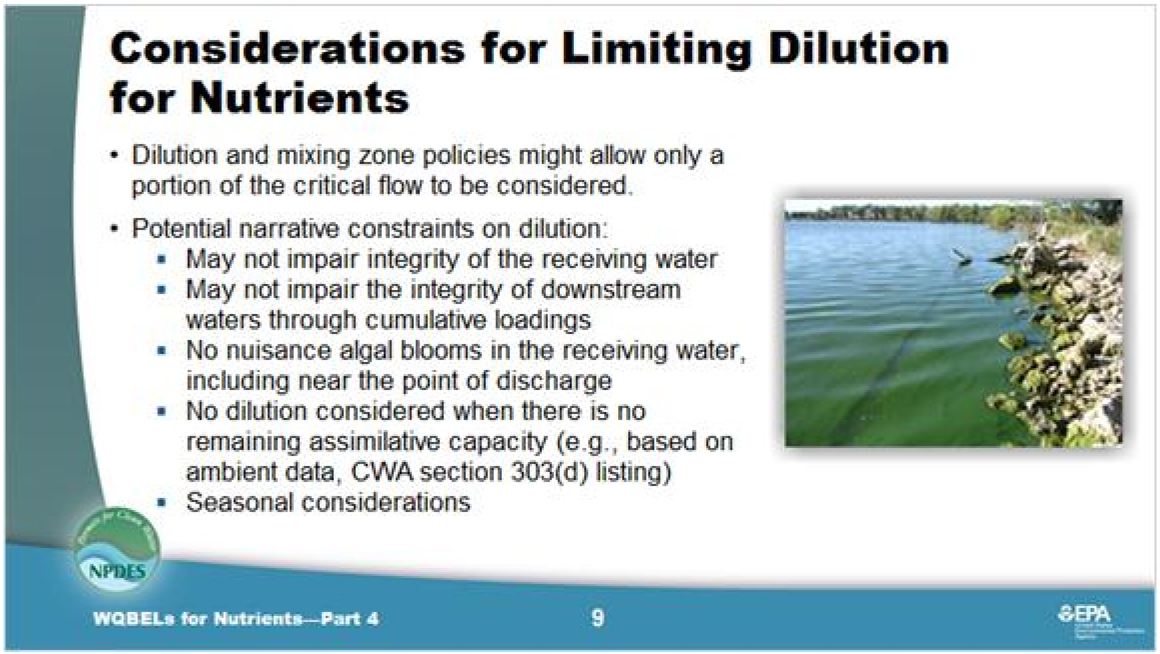


Notes:

Using flow data and statistics from state or federal sources, EPA's DFLOW program allows us to estimate a biologically-based, hydrologically-based, harmonic, or percentile flow value. DFLOW is available as part of EPA's BASINS program. The web site to access BASINS is shown on the slide.

The trick, of course, is getting good flow data from or near the discharge location or at a location that would allow us to estimate the flow at the location of concern.

1.9 Considerations for Limiting Dilution for Nutrients



Notes:

Something else to keep in mind is that many state water quality standards or implementation procedures on dilution allowance and mixing zones include narrative constraints that could limit the portion of the critical receiving water flow considered in a specific permitting situation.

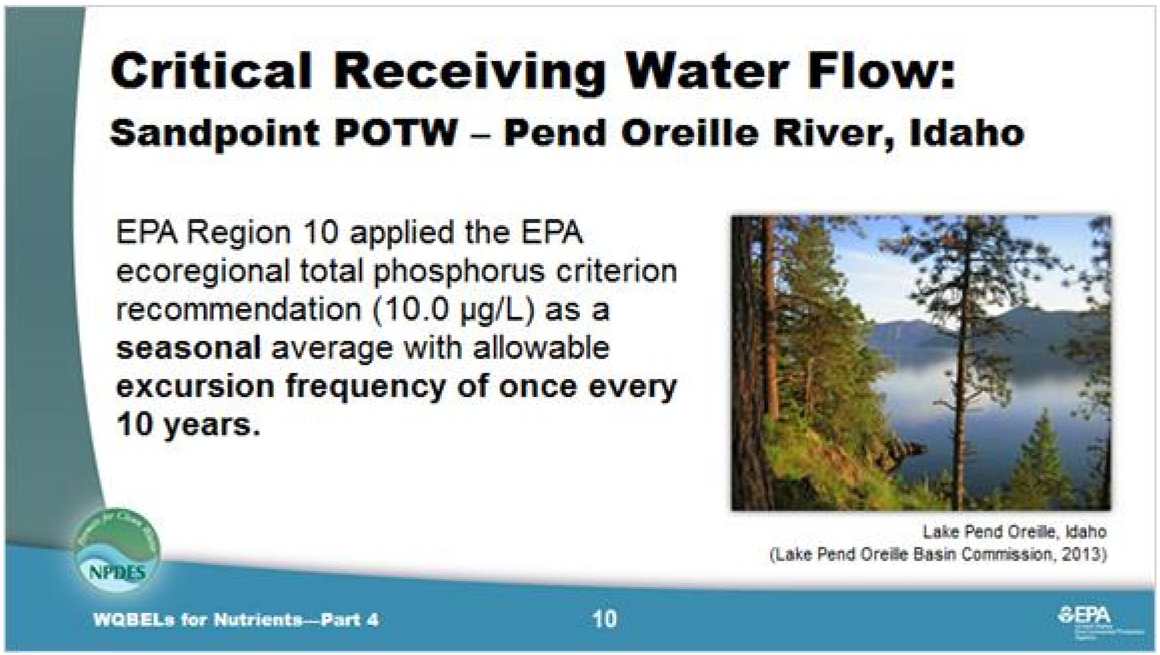
This slide lists some possible narrative constraints on dilution as they might be applied to a discharge of nutrients.

How might these be implemented in a specific permitting situation?

As an example, let’s assume that the water quality standards include annual average numeric criteria for nutrients. We apply the state’s dilution and mixing zone policy and determine that under critical conditions for attainment of the annual average criteria, we can give a dilution allowance of up to 50% of the critical receiving water flow. However, let’s assume that the water quality standards also include the narrative restrictions on dilution allowance or mixing zone size such as those shown on the slide. Further, let’s assume that data indicate that there has been a history of periodic nuisance algal blooms during the summer months due to high concentrations of nutrients in the slow-moving area of the river near the discharge point.

Based on this information and the narrative restrictions in the water quality standards, we might further limit the size of the mixing zone, at least during the summer months, to prevent spikes in nutrient concentrations that lead to nuisance algal blooms in the receiving water.

1.10 Critical Receiving Water Flow: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

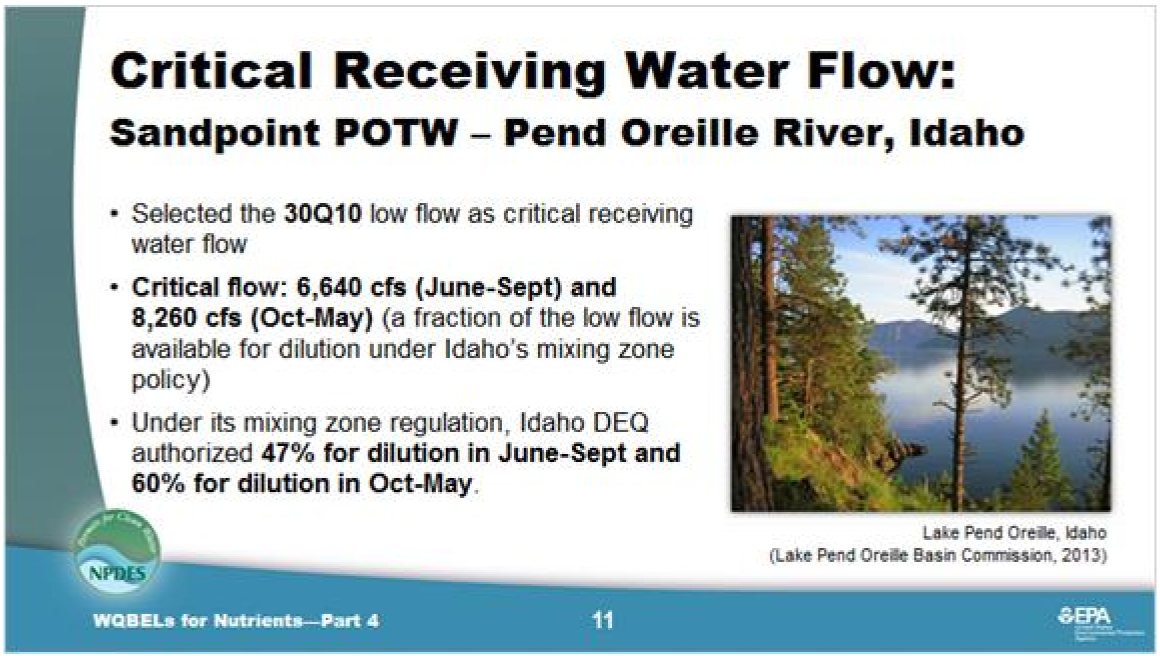
Throughout the rest of this presentation, we are going to use a permit issued by EPA Region 10 for the Sandpoint, Idaho, publicly-owned treatment works, or POTW, to illustrate selection of critical conditions and use a simple mass-balance equation to assess "reasonable potential."

The Sandpoint POTW discharges to the Pend Oreille River in Idaho. Idaho does not have numeric nutrient criteria for the river. It does have an applicable narrative nutrient criterion that reads "surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses."

EPA Region 10 interpreted Idaho's narrative water quality criterion using EPA's aggregate Ecoregion II total phosphorus criterion recommendation for rivers and streams of 10 µg/L.

The Region applied the ecoregional criterion as a seasonal average and set an allowable excursion frequency of once every 10 years.

1.11 Critical Receiving Water Flow: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

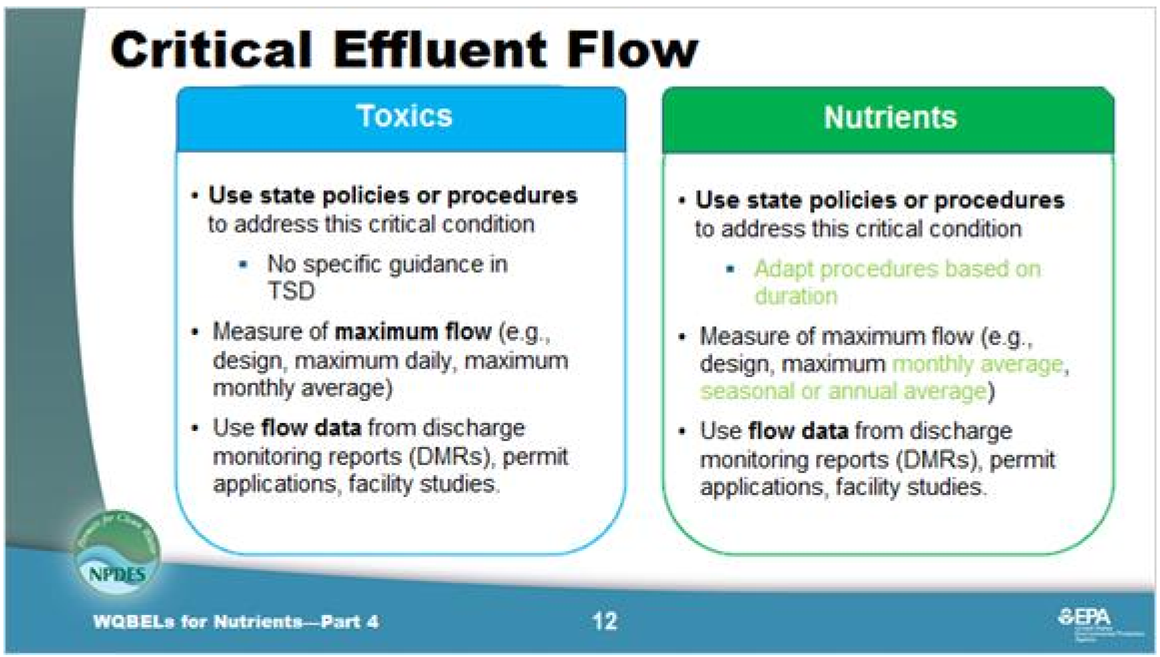
To reflect the seasonal interpretation of the narrative nutrient criterion, and in consideration of comments received during an initial public comment period, EPA Region 10 selected a critical river flow set at the 30Q10 low flow. The low flow was applied during two different seasonal periods-June through September and October through May. Although it is a somewhat conservative approach to use a 30-day low flow to reflect a seasonal average criterion, EPA determined that the approach was reasonable for this purpose.

The Pend Oreille River is a large river, so the critical flow is 6,640 cubic feet per second, or cfs, for the months of June through September and 8,260 cfs for the months of October through May. The flow had to be estimated based on flow measurements from a station on the Pend

Oreille River downstream of the discharge. The Region subtracted the flow of a tributary that enters the Pend Oreille River between the discharge point and the downstream flow gauge station.

Under its mixing zone regulations, Idaho may authorize a mixing zone using up to 25% of the stream flow or a greater amount if certain conditions are met. For this permit, Idaho was able to authorize 47% of the stream flow for mixing during June through September and 60% for October through May.

1.12 Critical Effluent Flow



Notes:

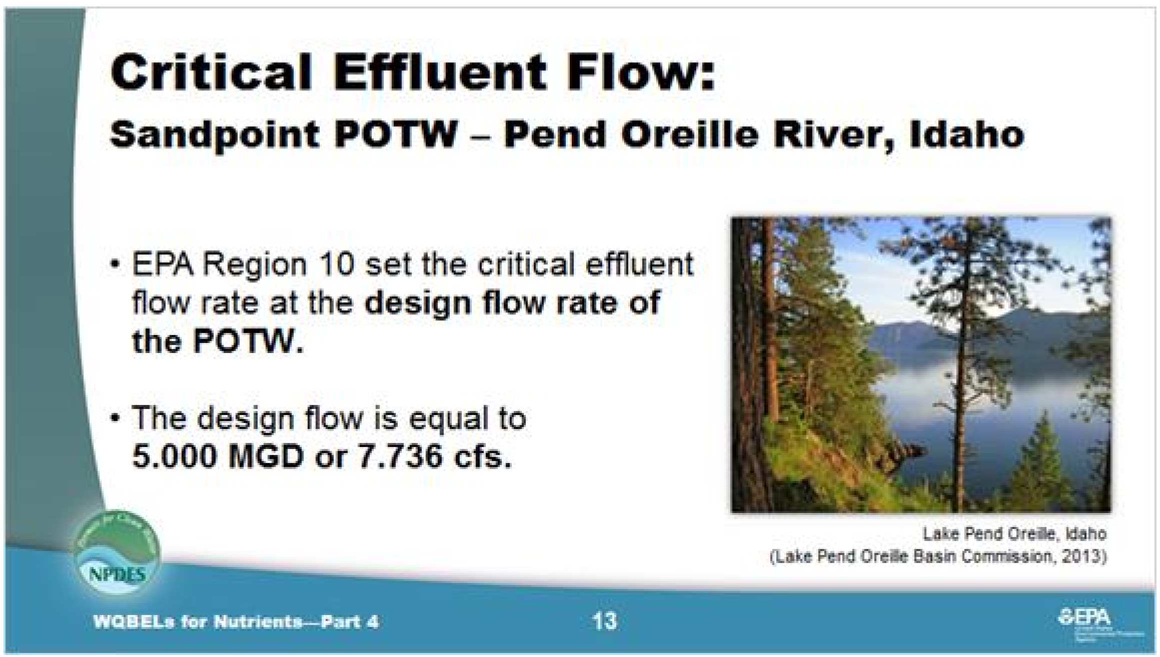
Thanks for taking us through critical receiving water flow, Danielle. Now let's turn to effluent flow.

A state's existing permitting policies or procedures generally specify what flow measurement to use as the critical effluent flow in a steady-state model. Permitting authorities could use existing procedures for determining the critical effluent flow or adjust the existing procedures for nutrient criteria with longer durations, such as annual average criteria.

The procedures may define a measure of maximum flow such as: maximum monthly average flow or maximum daily flow from the past permit term for industrial discharges or, the design flow for POTWs. For nutrient criteria with longer durations, the seasonal or annual average flow might be appropriate.

The data used to determine the critical effluent flow can come from a variety of sources, including discharge monitoring reports, application data, and data submitted by the facility specifically for this purpose.

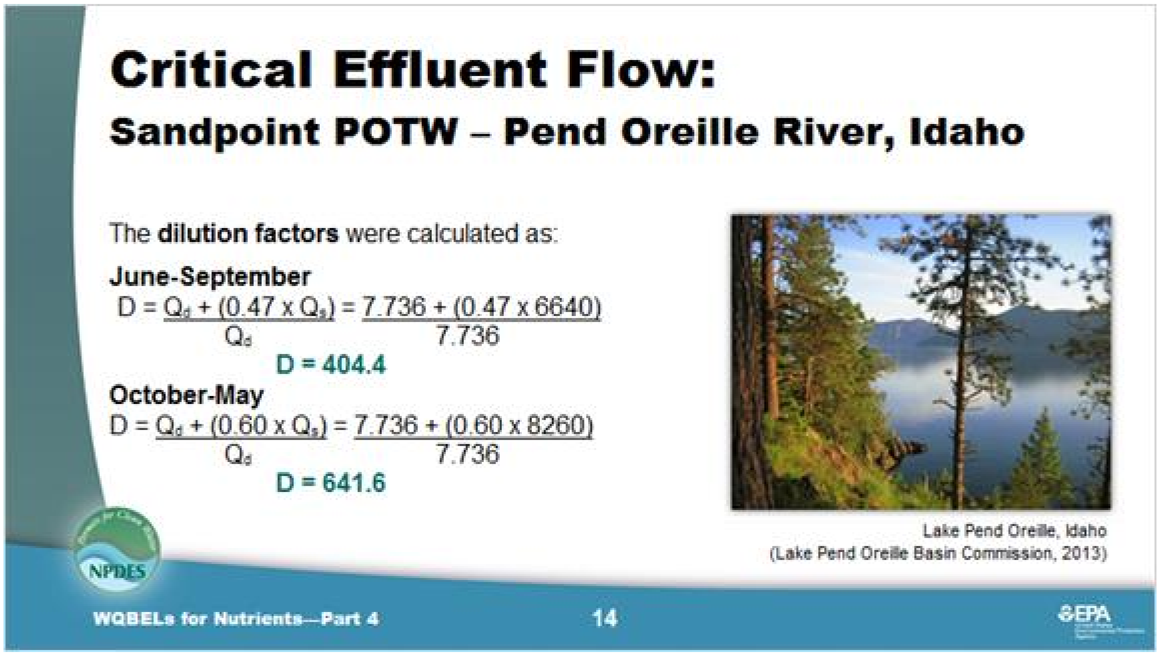
1.13 Critical Effluent Flow: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

For the Sandpoint POTW permit, EPA Region 10 used the facility's design flow of 5.000 million gallons per day or 7.736 cubic feet per second.

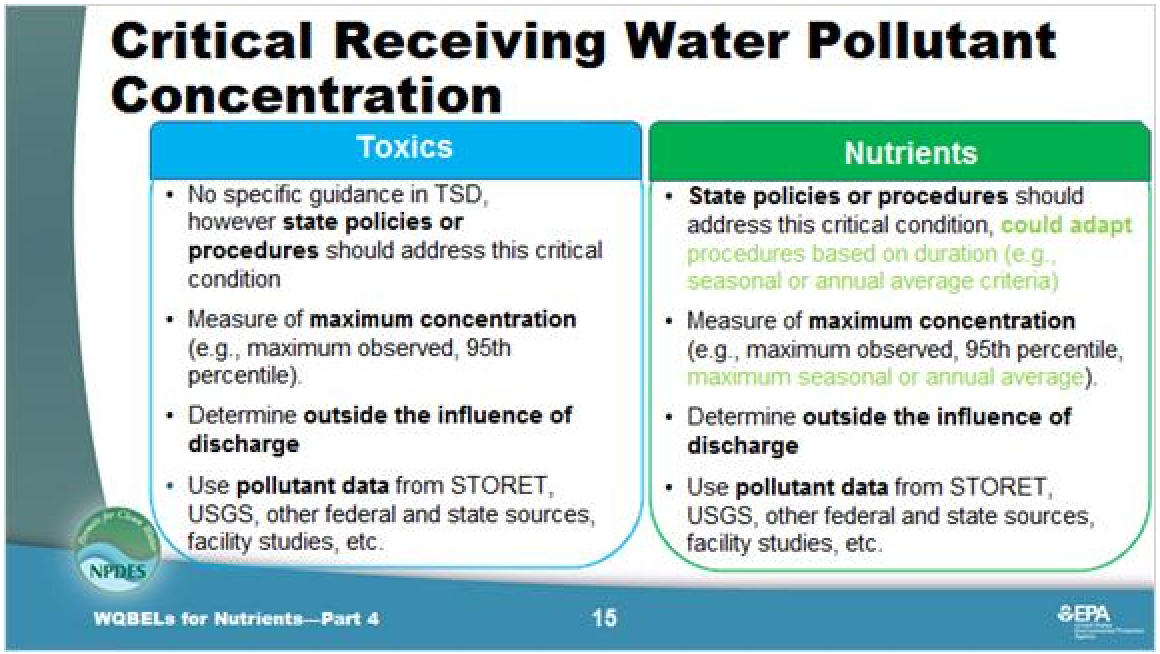
1.14 Critical Effluent Flow: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

Using this critical effluent flow and the portion of the critical low flow of the Pend Oreille River authorized by Idaho for each six-month period, the Region calculated dilution factors (D) as shown on the slide, resulting in a dilution factor of 404.4 for June through September and 641.6 for October through May.

1.15 Critical Receiving Water Pollutant Concentration



Notes:

Next, we need to know the critical receiving water pollutant concentration upstream of the discharge if we are going to consider dilution or mixing of the effluent with the receiving water or if we are going to assess the discharge's contribution to the total loading to the downstream water.

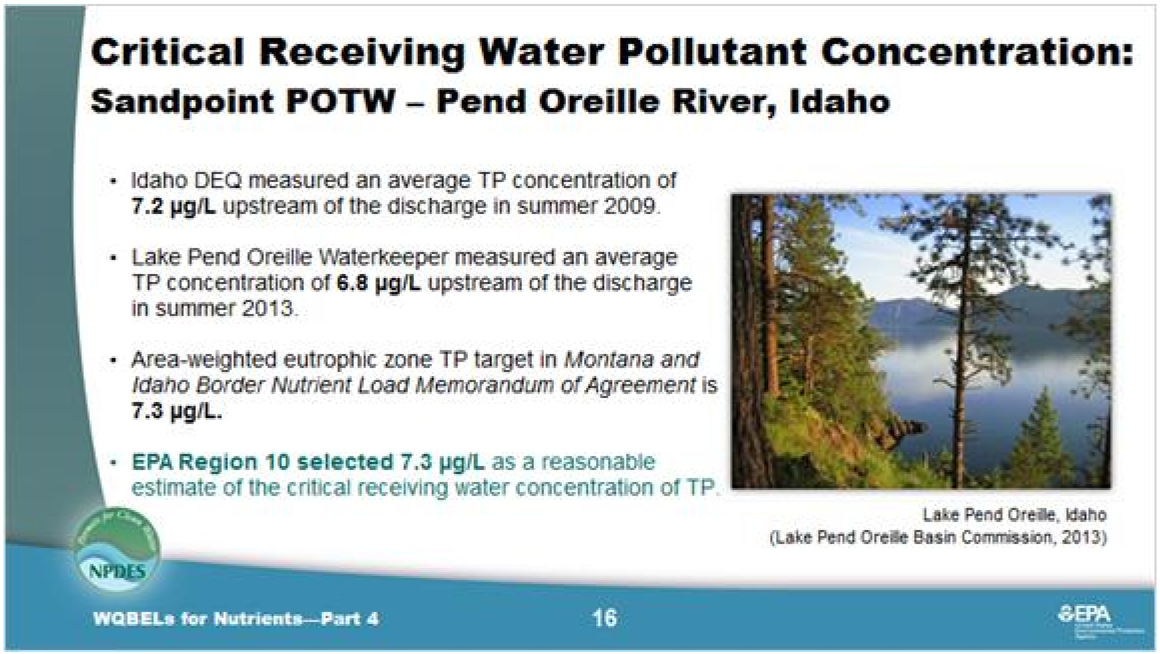
Permit writers should use existing state procedures to determine the critical receiving water pollutant concentration. These procedures might already distinguish between assessing the condition of the receiving water against short-term versus long-term average criteria or it may be possible to adapt them to account for seasonal or annual nutrient criteria. If there are no state procedures for determining the critical receiving water pollutant concentration, we should use an approach that accounts for the duration of the criterion of concern. For example, we might consider a long-term average receiving water pollutant concentration if the criterion of concern is an annual or seasonal average.

The receiving water pollutant concentration needs to be determined at some point outside of the influence of the discharge we are permitting. For example, if the discharge is to a stream, we want to know the concentration upstream of the discharge. If it is to a lake, we want to know the concentration in the lake near the point of discharge but without the effects of the discharge.

To determine this concentration, ambient data might be available from both federal and state sources such as EPA’s Storage and Retrieval, or STORET, database, US Geological Survey data such as the National Water Information System, National Water Quality Assessment or National Stream Quality Accounting Network, the National Water Quality Monitoring Council Water Quality Portal, or state databases.

In addition, many permitting authorities require dischargers to conduct ambient monitoring studies either as part of their permit requirements or part of the permit application process.

1.16 Critical Receiving Water Pollutant Concentration: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

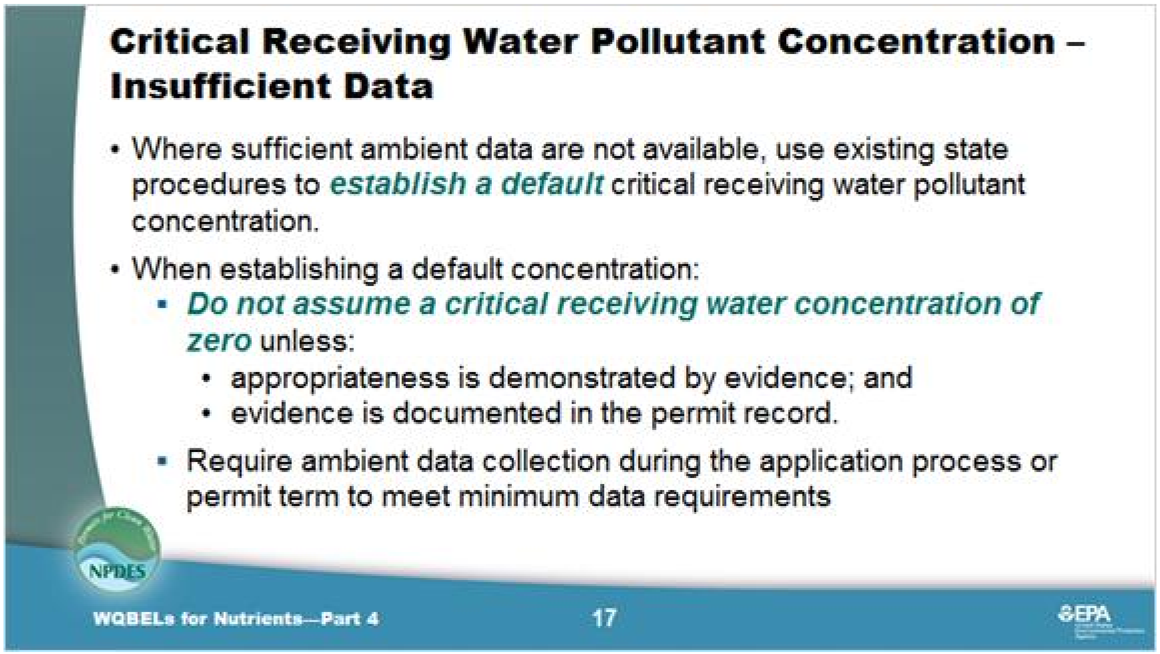
In the Sandpoint POTW calculations, EPA Region 10 looked at several sources of information on phosphorus concentrations in the river.

These sources included sampling conducted by the state, which showed an average total phosphorus concentration of 7.2 µg/L, and sampling by the Pend Oreille Waterkeeper, which measured an average total phosphorus concentration of 6.8 µg/L.

In addition, the eutrophic zone total phosphorus target in the Montana and Idaho Border Nutrient Load Memorandum of Agreement was 7.3 µg/L.

Given these sources, EPA determined that a concentration of 7.3 µg/L was a reasonable estimate of the critical receiving water pollutant concentration upstream of the discharge.

1.17 Critical Receiving Water Pollutant Concentration – Insufficient Data



Notes:

We need to be aware that there might be times when ambient data are not sufficient to calculate a critical receiving water background concentration. In such cases, we should use available state procedures to establish a default critical concentration.

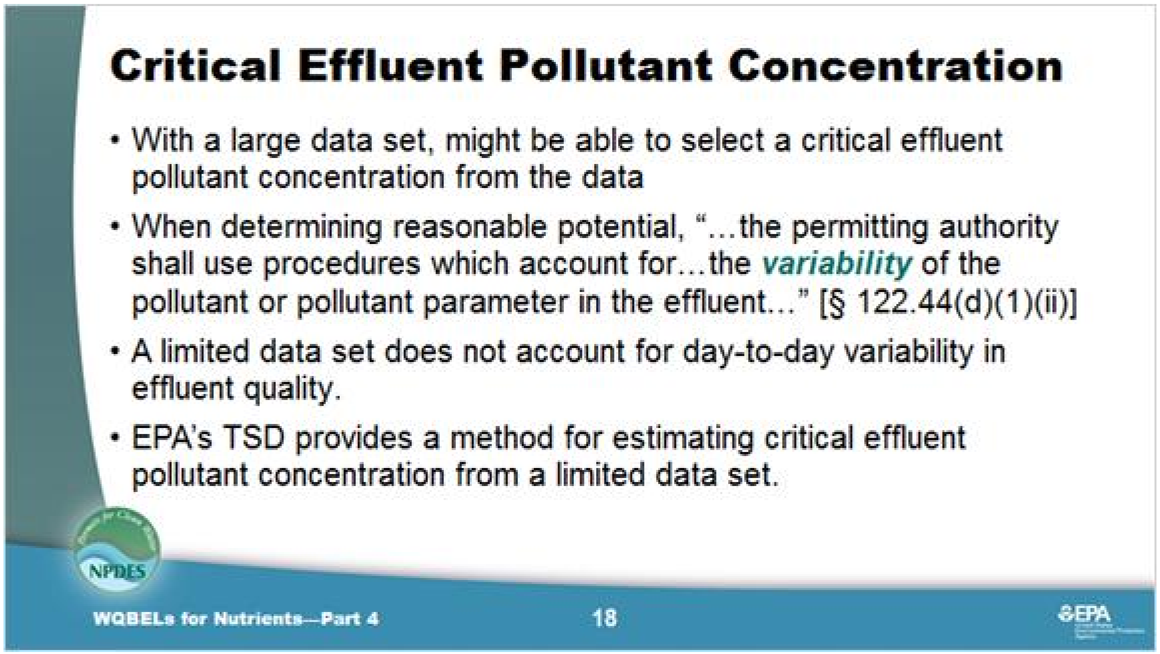
It is important to remember that assuming that the critical receiving water concentration of the nutrient of concern is zero is not really an option unless the appropriateness of that assumption is demonstrated by evidence and documented in the permit record.

We could require ambient data collection during the application process or during the permit term.

If sufficient data are collected during the application process, the default critical receiving water pollutant concentration would not be necessary.

If we require the discharger to collect receiving water data during the permit term, we might also consider including a specific reopener in the permit indicating that the permit could be modified based on the new data.

1.18 Critical Effluent Pollutant Concentration



Notes:

Our final critical condition is the critical effluent pollutant concentration.

If we have enough effluent data, we might be able to select a critical effluent pollutant concentration from the measured effluent concentrations in the data set. For example, a permitting authority might choose to use the maximum measured effluent concentration or an upper-bound value selected from the data set as the critical effluent pollutant concentration.

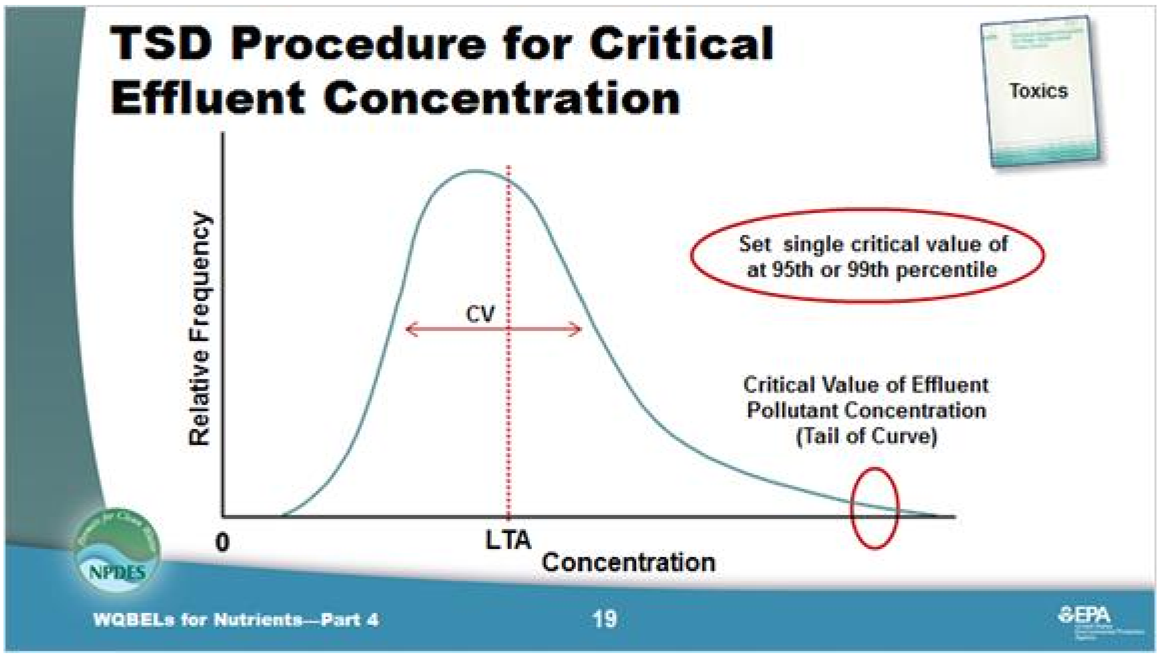
In many instances, we have a rather small data set of measured effluent nutrient concentrations; however, the NPDES regulations at 40 CFR 122.44(d)(1)(ii) require that we consider how an effluent varies over time when we conduct a reasonable potential analysis. Would a small data set capture that variability and, with it, the critical effluent pollutant concentration? Not likely.

For nearly any wastewater treatment system, there will be "good days" and there will be "bad days." With a small data set we cannot ensure that we have captured the potential variations in effluent concentration that we would expect to occur over time, and that small data set is not likely to include the critical effluent concentration, which would be on the upper end of the expected effluent concentrations.

This means that we need a way to establish the critical effluent pollutant concentration, accounting for a small data set and the variability of the effluent.

Fortunately for us, the TSD provides a statistical methodology that accomplishes this goal.

1.19 TSD Procedure for Critical Effluent Concentration



Notes:

Here is a diagram that illustrates the basic procedure used in the TSD to determine the critical effluent concentration.

The curve in the slide depicts the relative frequency of various effluent pollutant concentrations for a particular pollutant. The TSD procedure is based on the assumption that these effluent data tend to follow a lognormal distribution.

This lognormal curve can be described using a couple of key terms:

The first is the long-term average, or LTA. The long-term average is the point on the x-axis that bisects the area under the curve. Because the curve is skewed toward upper end values, the LTA is to the right of the peak of the curve.

The second term is the coefficient of variation or CV. The CV is calculated as the standard deviation of the data divided by the mean. It represents a measure of the relative distribution or variation of the data around the long-term average.

So, where on that curve is the critical value of the pollutant concentration in the effluent?

The critical value would be a value somewhere toward the upper tail end of the lognormal distribution curve, at a point representing a concentration rarely exceeded in the effluent.

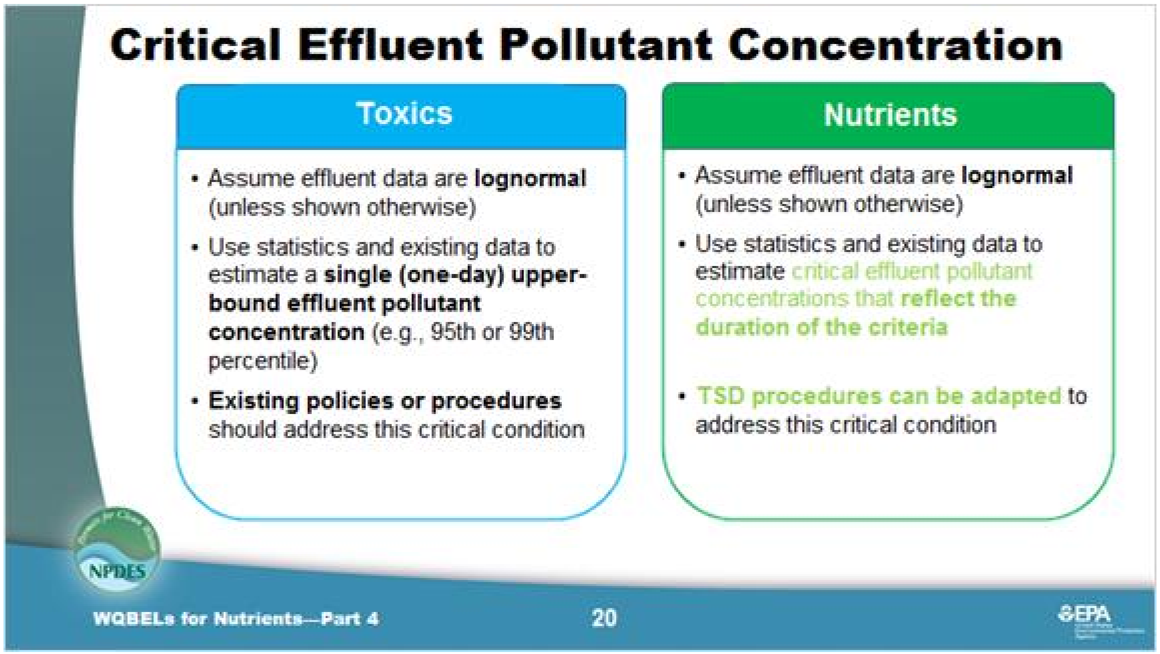
We can pick a specific point by deciding what percentage of measured concentrations of the pollutant in the effluent should be below the critical value. In other words, we establish the critical concentration at a specific percentile value on the curve.

EPA recommends that the critical value for the pollutant concentration in the effluent be set at the 90th percentile or above.

Most permitting authorities establish the critical concentration at a point such as the 95th or 99th percentile one-day effluent concentration.

While this approach makes sense for toxic pollutants and similar pollutants of concern, let's consider whether there is a way we might adapt this procedure when we are addressing nutrients.

1.20 Critical Effluent Pollutant Concentration

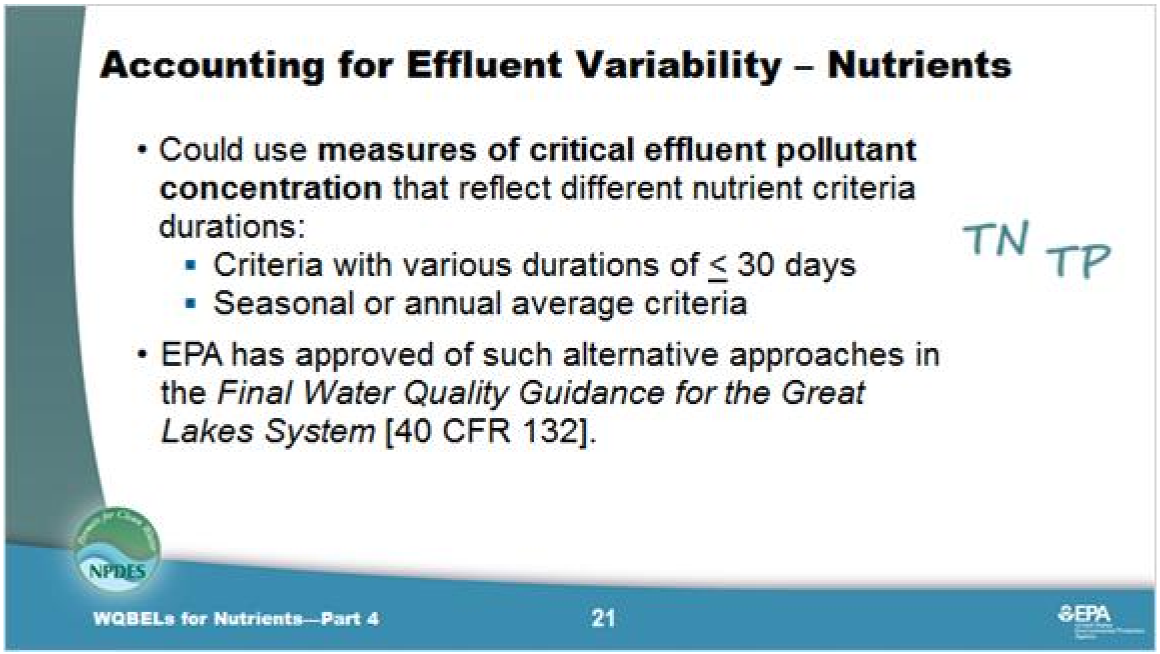


Notes:

As with other pollutants, we can assume that effluent concentration data for nutrients follows a lognormal distribution unless effluent data show otherwise.

The way that we might adapt the TSD statistical procedures for nutrients is in how we estimate the upper bound effluent concentration. We could estimate different critical, upper-bound effluent concentrations for nutrients than for toxic pollutants to reflect the durations of the numeric nutrient criteria or interpretations of narrative criteria that we are implementing.

1.21 Accounting for Effluent Variability – Nutrients



Notes:

We will likely not always be concerned about the single highest expected nutrient concentration in the effluent, as we might be for toxics.

As we have discussed before, nutrients tend to have impacts over some span of time and nutrient criteria generally are based on longer durations than criteria for toxic pollutants.

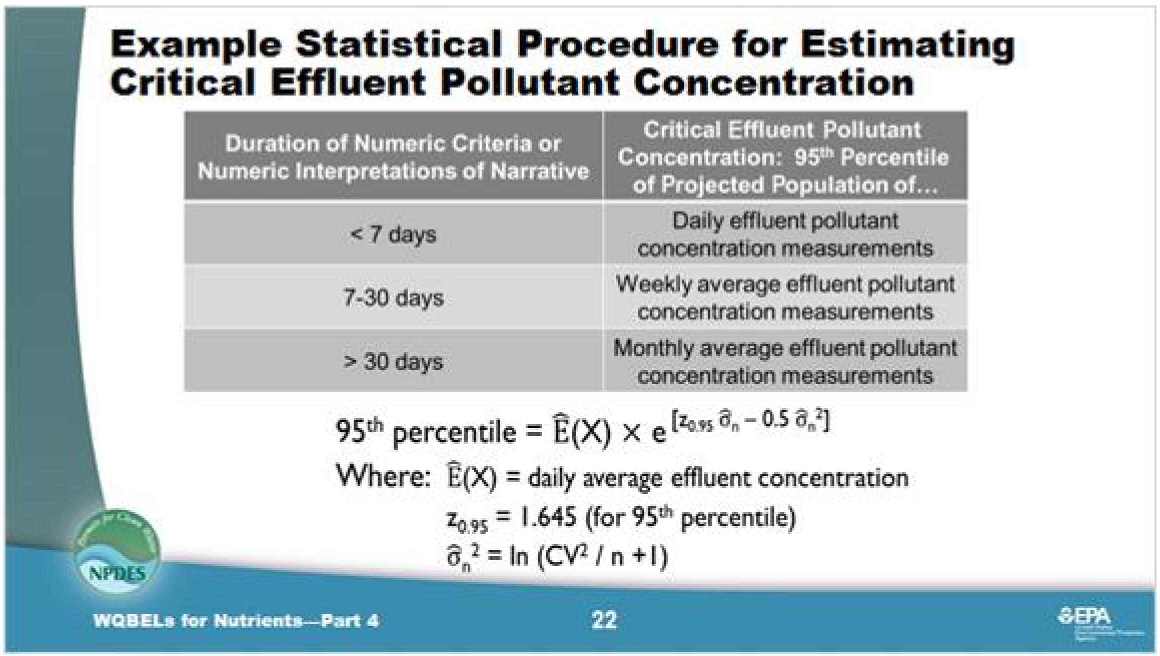
Nutrient criteria might be based on longer term averages, such as 30-day, seasonal, or annual averages instead of short-term durations for toxic pollutant criteria. Therefore, rather than estimating the upper-bound of an individual, one-day concentration, for nutrients we could estimate the upper bound of longer term averages of effluent nutrient concentrations.

There is precedent in EPA regulations and guidance for this kind of approach.
In its final Wate*r Quality Guidance for the Great Lakes System, EP*A provides an alternative to the TSD procedure. The Great Lakes procedure, as we'll call it, accounts for differences in the durations of criteria. It allows for the calculation to use of daily measurements when considering acute aquatic life criteria; weekly averages and monthly averages when considering chronic aquatic life criteria; and monthly averages when considering wildlife and human health criteria.

State permitting authorities in the Great Lakes basin have developed specific procedures to implement this alternative approach.

In the next few slides, we'll look at some examples of how we might use a similar approach to determine a critical effluent pollutant concentration for nutrients.

1.22 Example Statistical Procedure for Estimating Critical Effluent Pollutant Concentration



Notes:

This slide presents a statistical procedure to project a critical effluent concentration of nutrients based on the approach in the Great Lakes Water Quality Guidance. Using this approach, our determination of the critical effluent concentration would depend on the duration of the criterion of concern.

If we are writing a permit and developing conditions based on criteria with short durations (for example, less than 7 days), we might establish the critical effluent pollutant concentration as a projected upper-bound value on a lognormal distribution of daily pollutant concentrations, as the TSD procedure does for toxic pollutants.

Where we are permitting to meet criteria with durations of 7 to 30 days, we might set the critical effluent pollutant concentration at an upper bound value on the lognormal distribution of weekly average pollutant concentrations.

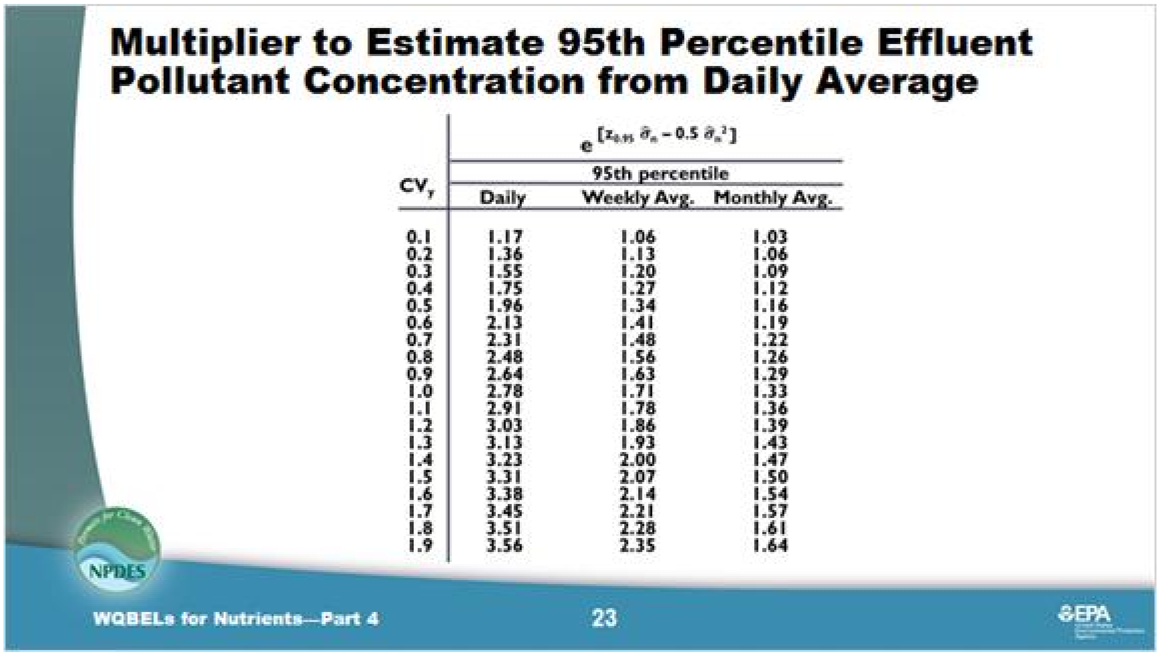
Finally, if we are permitting to meet longer-term criteria, such as annual or seasonal averages, we could establish the critical effluent pollutant concentration as an upper bound value on the lognormal distribution of monthly average pollutant concentrations.

The percentile at which we establish the critical effluent concentration depends on our permitting authority's policy. Let's assume, in our case, that our policy says that the critical effluent pollutant concentration is the 95th percentile concentration. So, we would use existing effluent pollutant concentration data to estimate, depending on the duration of the criterion of concern, the daily, weekly average, or monthly average pollutant concentration.

The equation at the bottom of the slide shows how we would estimate the 95th percentile.

Using this equation, we would multiply the daily average of all of the effluent samples that we are using in the calculation times a multiplier. The multiplier varies depending on whether we are calculating the 95th percentile of daily, weekly average, or monthly average concentrations.

1.23 Multiplier to Estimate 95th Percentile Effluent Pollutant Concentration from Daily Average



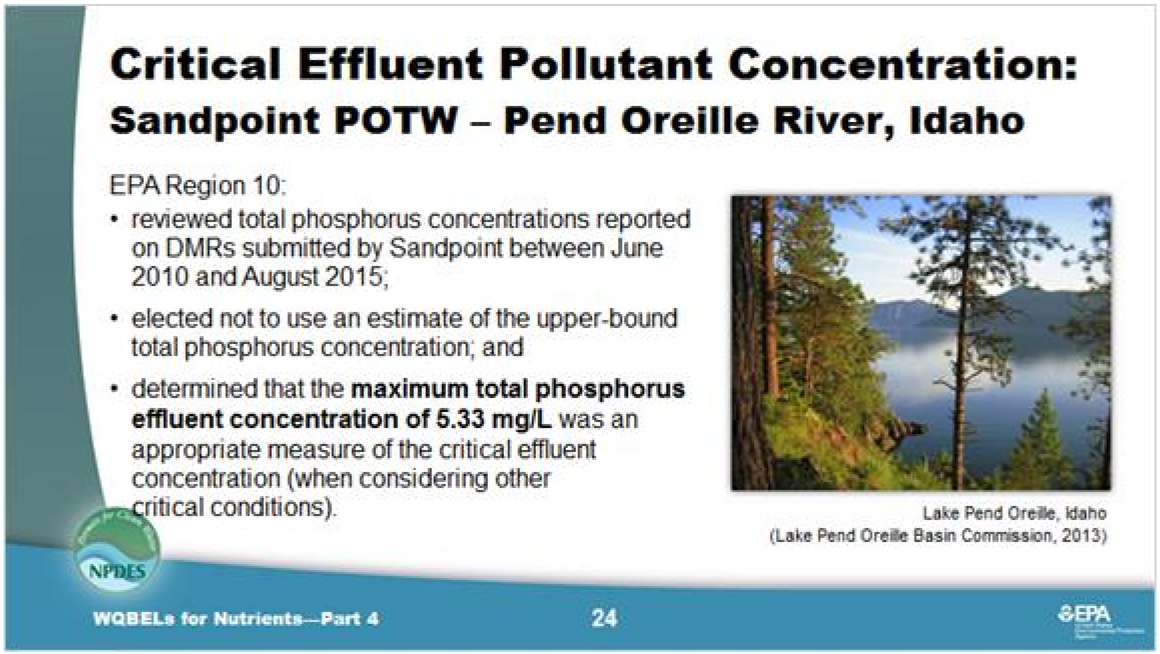
CV_y	$e^{[z_{0.95}\hat{\sigma}_n - 0.5\hat{\sigma}_n^2]}$ 95th percentile Daily	Weekly Avg.	Monthly Avg.
0.1	1.17	1.06	1.03
0.2	1.36	1.13	1.06
0.3	1.55	1.20	1.09
0.4	1.75	1.27	1.12
0.5	1.96	1.34	1.16
0.6	2.13	1.41	1.19
0.7	2.31	1.48	1.22
0.8	2.48	1.56	1.26
0.9	2.64	1.63	1.29
1.0	2.78	1.71	1.33
1.1	2.91	1.78	1.36
1.2	3.03	1.86	1.39
1.3	3.13	1.93	1.43
1.4	3.23	2.00	1.47
1.5	3.31	2.07	1.50
1.6	3.38	2.14	1.54
1.7	3.45	2.21	1.57
1.8	3.51	2.28	1.61
1.9	3.56	2.35	1.64

Notes:

Here is a look-up table that provides the calculated multipliers for determining the 95th percentile of daily, weekly average, or monthly average effluent pollutant concentrations.

Selection of the appropriate multiplier is also based on the coefficient of variation, or CV, of the effluent data.

1.24 Critical Effluent Pollutant Concentration: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

Now, let's turn to some examples of determining a critical effluent concentration for nutrients.

First, let's take a look at the critical effluent pollutant concentration used in the Sandpoint, Idaho, POTW permit.

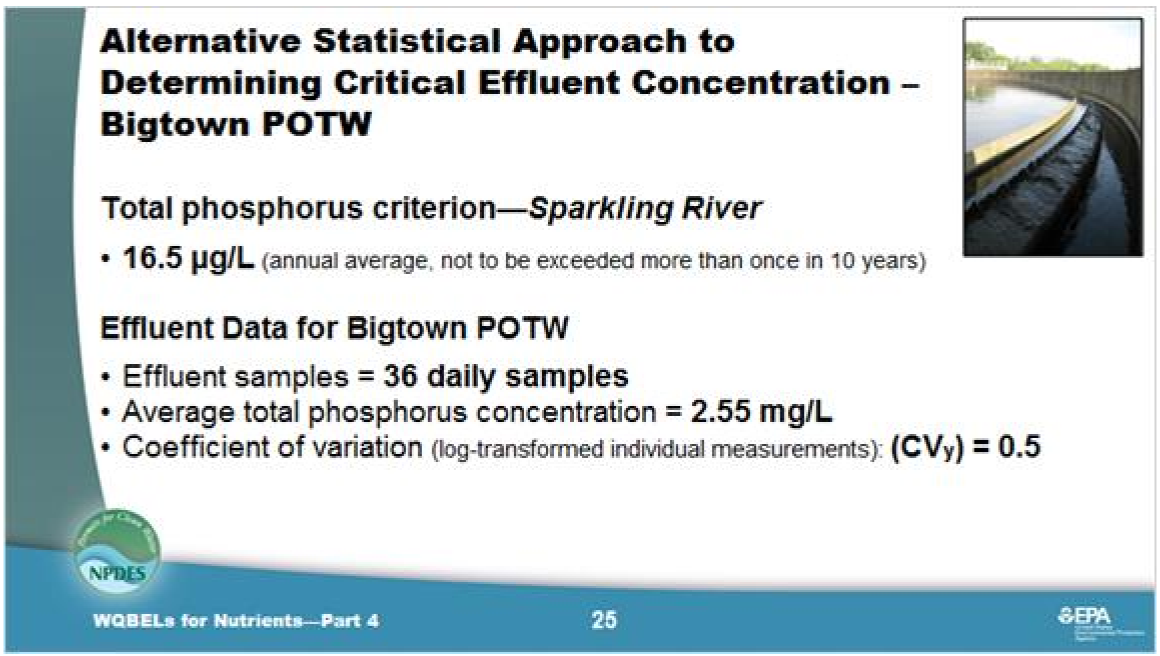
Remember, EPA Region 10 interpreted Idaho's narrative nutrients criterion using the EPA ecoregional criterion for total phosphorus expressed as a seasonal average.

The facility had been measuring the total phosphorus concentration under the previous permit at least quarterly. EPA Region 10 selected as a critical effluent concentration, the maximum reported total phosphorus concentration from the Sandpoint POTW's Discharge Monitoring Reports submitted between June 2010 and August 2015.

Could the Region have used a more conservative or less conservative estimate of critical effluent concentration, perhaps by estimating an upper-bound value or by using an average concentration? Sure. But, it determined that, on balance, this was an appropriately conservative value when taken together with the other critical conditions and the seasonal average numeric interpretation of the narrative criterion.

The maximum total phosphorus effluent concentration for June 2010 through August 2015 was 5.33 mg/L. So this served as the critical effluent concentration for the Sandpoint POTW discharge.

1.25 Alternative Statistical Approach to Determining Critical Effluent Concentration – Bigtown POTW



Notes:

Now let's work through a different example using a hypothetical facility, the Bigtown POTW, and using a statistical approach to projecting a critical effluent concentration.

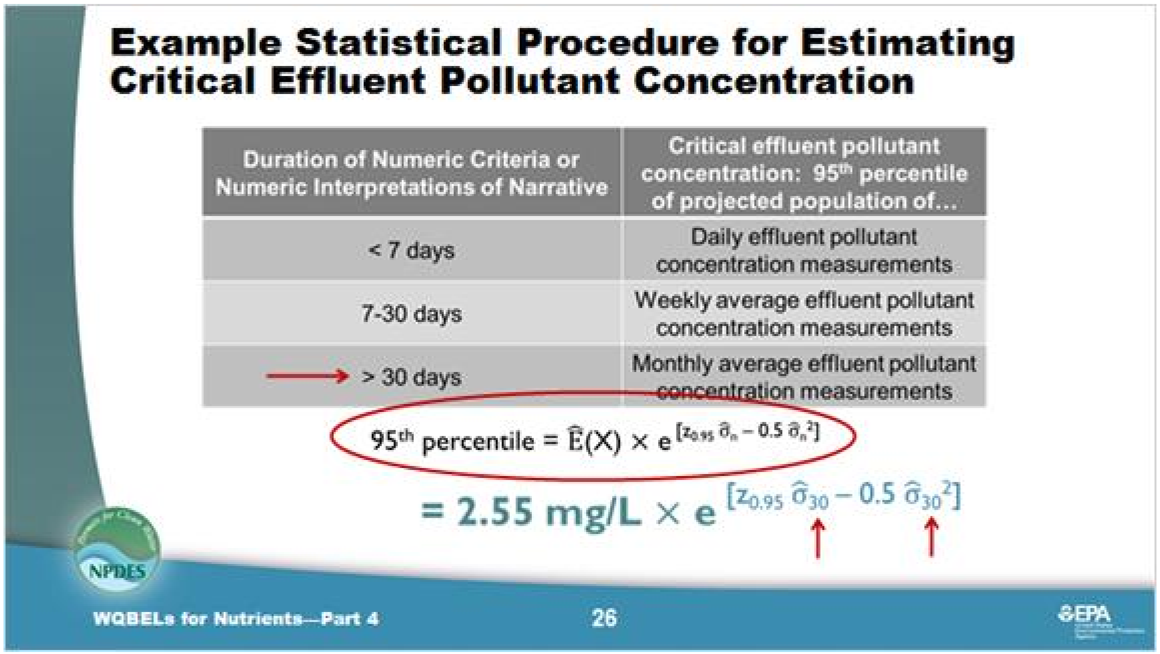
The Bigtown POTW discharges to the Sparkling River, which has a total phosphorus criterion of 16.5 µg/L expressed as an annual average not to be exceeded more than once in 10 years.

Assume that we have a data set consisting of 36 effluent samples collected one day per month over the past three years.

Also, assume that we know that the average concentration calculated from these 36 samples is 2.55 mg/L.

Finally, assume that we have calculated the coefficient of variation of the data, and it is 0.5.

1.26 Example Statistical Procedure for Estimating Critical Effluent Pollutant Concentration



Notes:

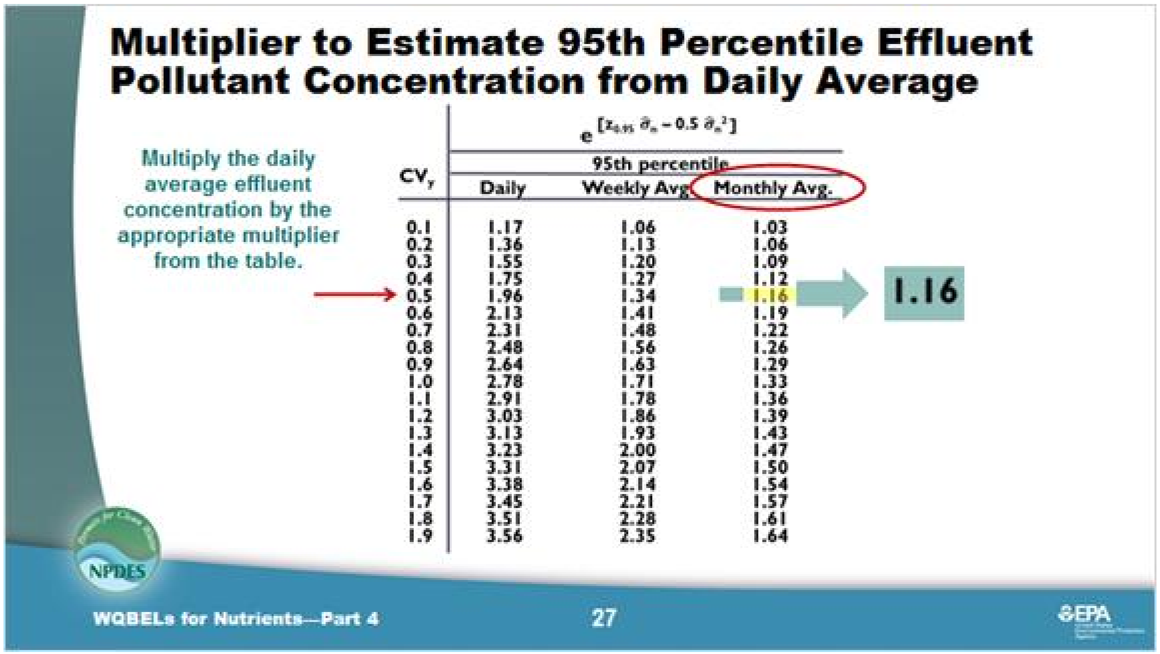
We are going to use the example statistical procedure we discussed earlier that based the critical effluent pollutant concentration on the duration of the criterion we are trying to attain.

Remembering that the applicable total phosphorus criterion for the Sparkling River has an averaging period of one year (which, of course, is greater than 30 days), the critical effluent concentration that we will use in our water quality model is the 95th percentile of monthly average effluent concentrations.

Here is our equation for calculating the 95th percentile.

We multiply the daily average concentration from our data set, 2.55 mg/L, times the statistical multiplier. Again, the multiplier varies depending on whether we are estimating the 95th percentile of daily, weekly, or monthly effluent pollutant concentrations. In our case, because we want to estimate the 95th percentile of monthly average effluent concentrations, the “n” in the equation becomes “30,” the number of days, on average, in a month.

1.27 Multiplier to Estimate 95th Percentile Effluent Pollutant Concentration from Daily Average



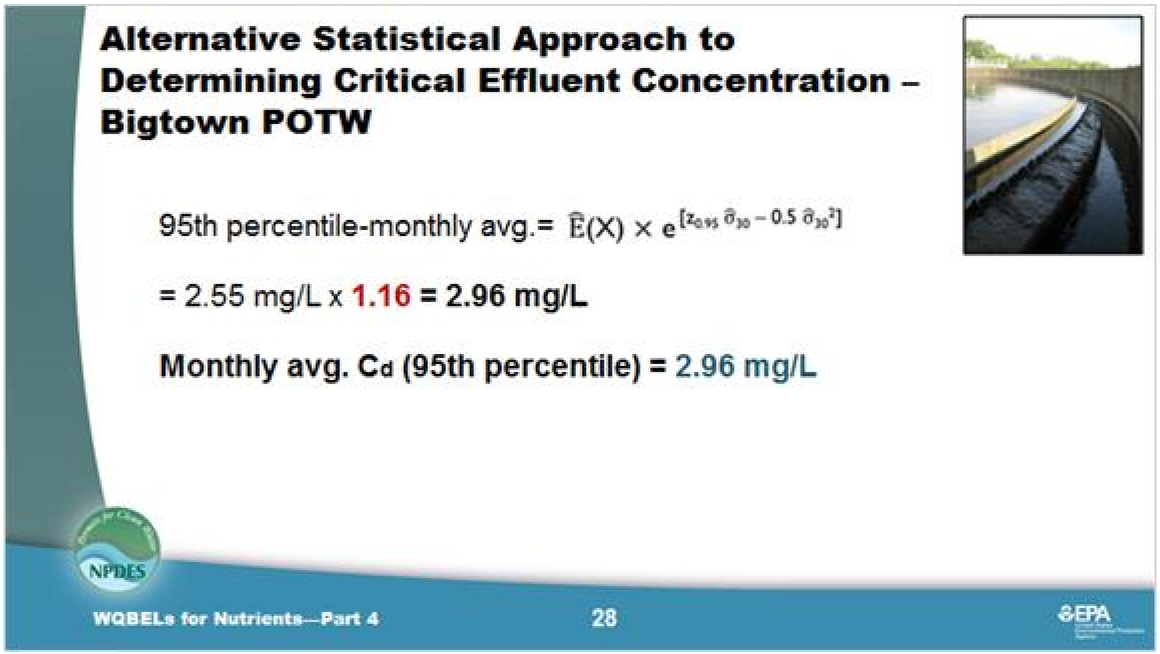
Notes:

Here is the look-up table that provides the calculated multipliers for determining the 95th percentile of daily, weekly average, or monthly average effluent pollutant concentrations.

We choose the appropriate multiplier to get the 95th percentile of monthly averages for data with a CV of 0.5.

This gives us a multiplier of 1.16 to determine the 95th percentile of monthly averages.

1.28 Alternative Statistical Approach to Determining Critical Effluent Concentration – Bigtown POTW



Notes:

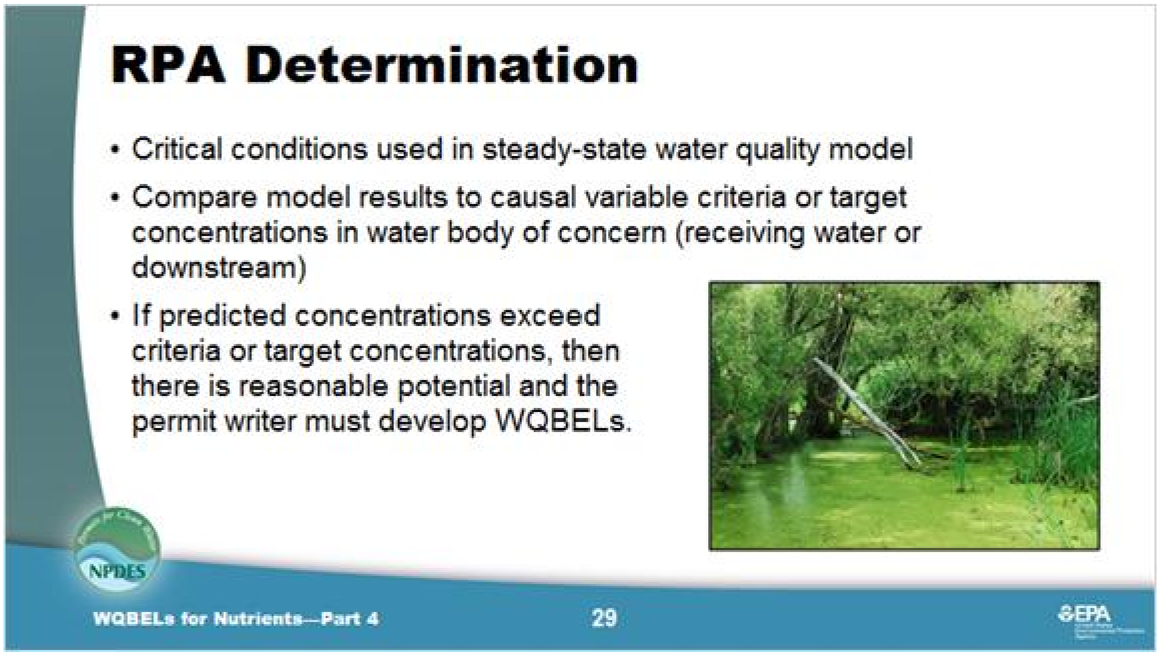
Multiplying the daily average by the 1.16, we get 2.96 mg/L as the estimated 95th percentile of monthly average effluent concentrations, which is the critical effluent concentration.

Estimating an upper-bound value on the distribution gives us a more conservative result than taking only the average of our measured concentrations as the critical effluent concentration.

Remember, the approach we use to determine this critical condition is a matter of policy. The point here is to show one way that it can be done, adapted from procedures in EPA’s TSD.

Now that we have identified all our required critical conditions what do we do with them? Amelia, can you help us with this?

1.29 RPA Determination



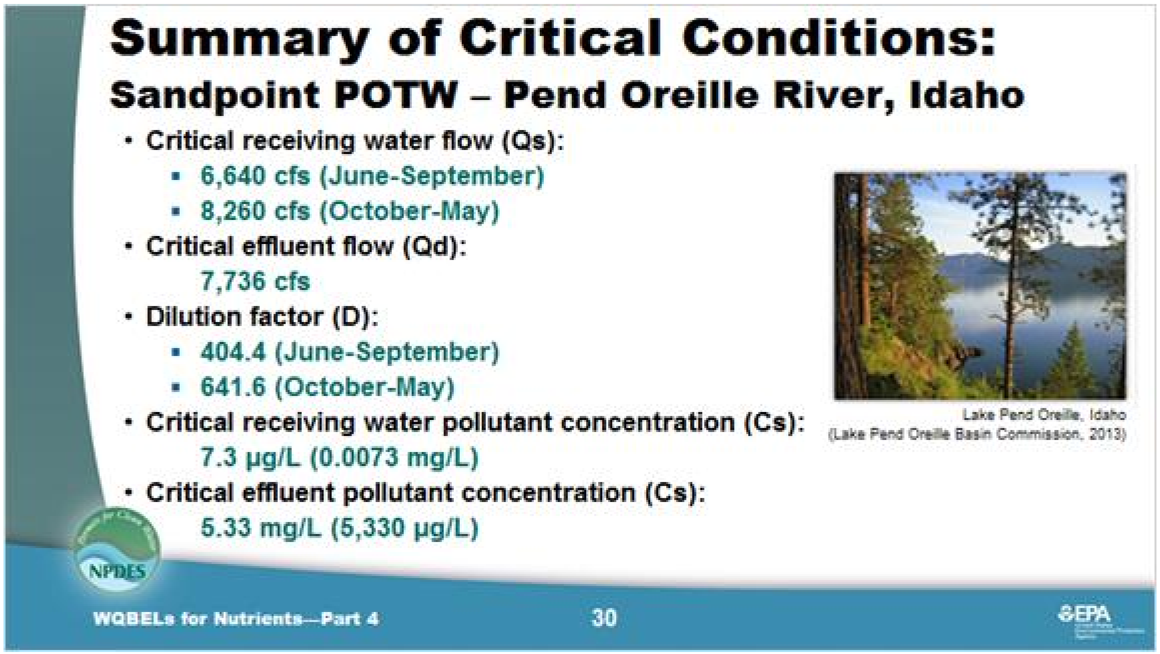
Notes:

Well, we use them as inputs to our steady-state model and compare the model results to our water quality criteria or interpretations of narrative criteria and determine whether there is "reasonable potential."

If we project that the concentration in the receiving water under critical conditions will exceed the applicable criterion, then there is "reasonable potential" and we must develop water quality-based effluent limitations from the applicable water quality criteria.

Let's return to Sandpoint, Idaho, one more time and see how EPA Region 10 worked through these calculations.

1.30 Summary of Critical Conditions: Sandpoint POTW – Pend Oreille River, Idaho



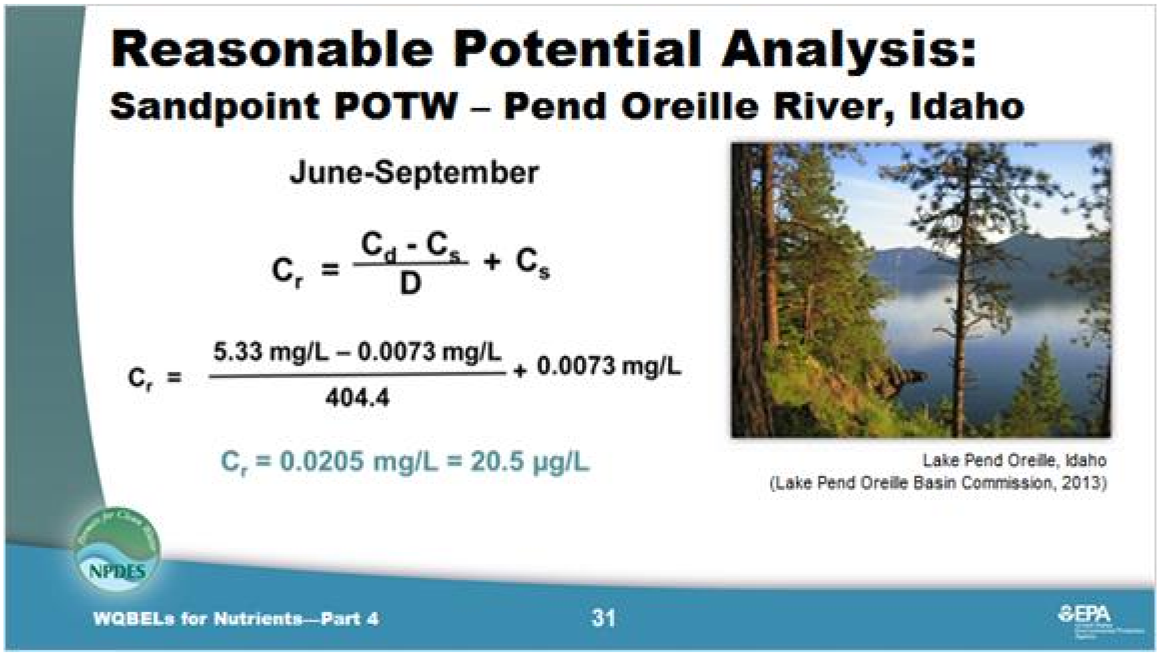
Notes:

Here is a reminder of the critical conditions that EPA Region 10 used in its analysis.

Recall that we have two critical receiving water flow rates for two different times of the year-June through September and October through May.

That gives us two different dilution factors to use in our calculations.

1.31 Reasonable Potential Analysis: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

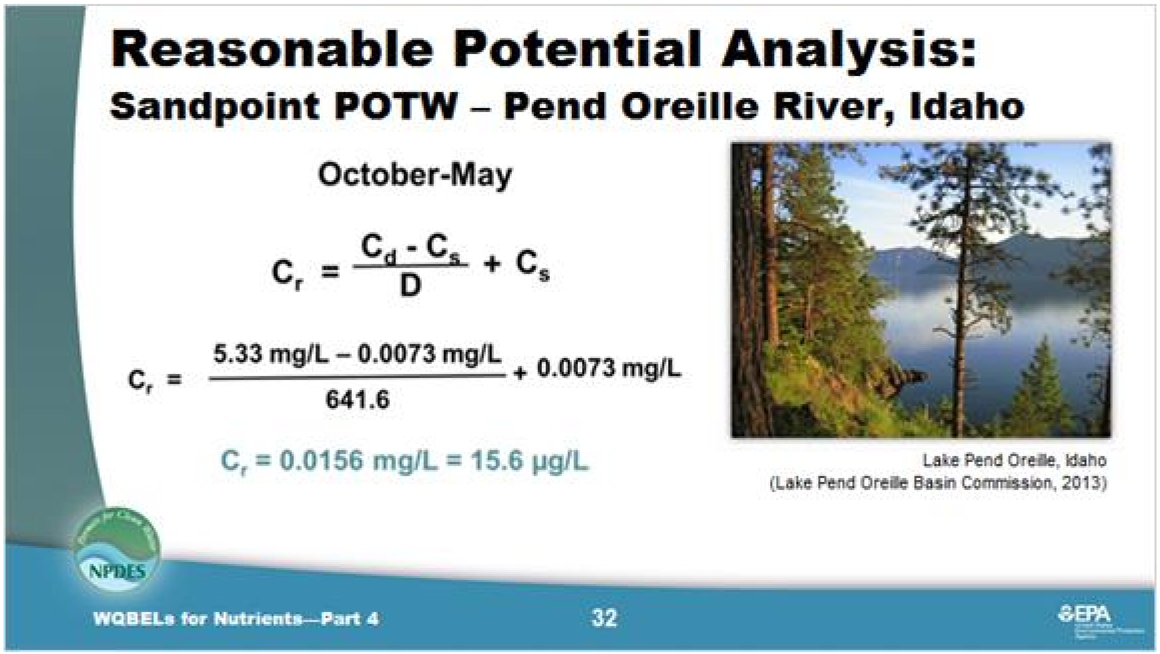
Here is the reasonable potential calculation for June through September.

We are solving for Cr, which is the concentration of total phosphorus downstream of the Sandpoint POTW discharge.

On the right-hand side of the equation, we plug in the critical effluent concentration of 5.33 mg/L (Cd) and the critical receiving water pollutant concentration of 0.0073 mg/L (Cs) and the dilution factor of 404.4, which is based on the critical effluent flow of 7.736 cubic feet per second and the critical receiving water flow of 6,640 cubic feet per second for June through September.

This calculation gives us a phosphorus concentration in the Pend Oreille River downstream of the discharge from Sandpoint POTW of 20.5 µg/L.

1.32 Reasonable Potential Analysis: Sandpoint POTW – Pend Oreille River, Idaho



Notes:

And here is the reasonable potential calculation for October through May.

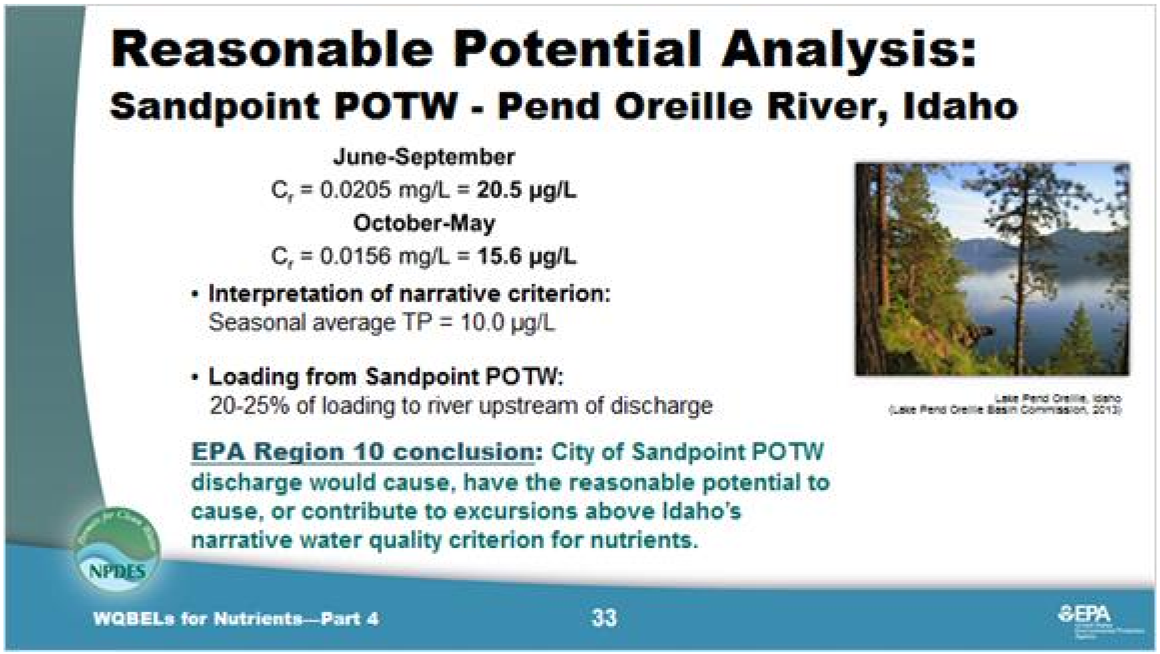
Once again, we are solving for Cr, the concentration of total phosphorus downstream of the Sandpoint POTW discharge.

The critical effluent concentration of 5.33 mg/L and critical receiving water concentration of 0.0073 mg/L are the same concentrations we used in the calculation for June through September.

What is different in this calculation is the dilution factor, which is based on the critical effluent flow of 7.736 cubic feet per second and the critical receiving water flow of 8,260 cubic feet per second for October through May.

This calculation gives us a phosphorus concentration in the Pend Oreille River downstream of the discharge from Sandpoint POTW of 15.6 µg/L.

1.33 Reasonable Potential Analysis: Sandpoint POTW - Pend Oreille River, Idaho



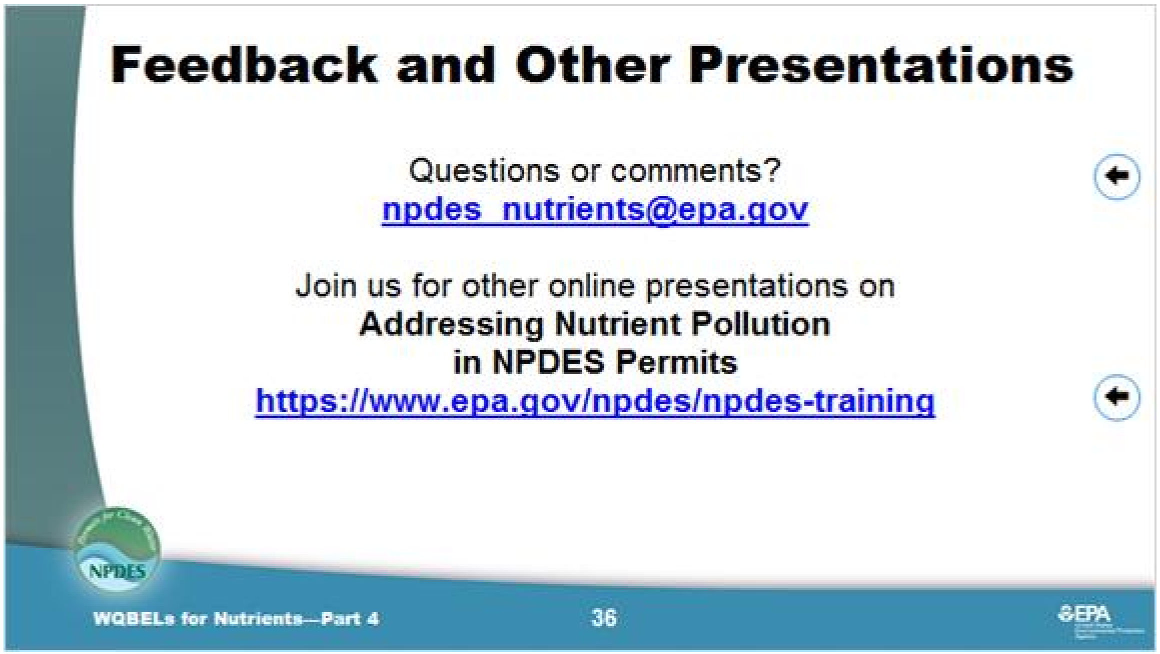
Notes:

We can compare the concentration downstream of the Sandpoint POTW discharge for the two seasons to EPA's numeric interpretation of Idaho's narrative water quality criterion, which was 10.0 µg/L as a seasonal average.

In both June through September and October through May, the projected phosphorus concentrations in the Pend Oreille River of 20.5 µg/L and 15.6 µg/L, respectively, exceed the Region's numeric interpretation of the narrative criterion.

To further strengthen its analysis, the Region also calculated the total phosphorus loading from the Sandpoint POTW and compared it to the total phosphorus loading upstream of the discharge. It determined that, depending on the season, the POTW's loading is between 20 and 25 percent of the loading into the Pend Oreille River upstream of the discharge under 30Q10 low flow conditions. Thus, the discharge adds significant additional loading of total phosphorus to the river.

1.41 Feedback and Other Presentations



Notes:

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Thanks again for joining us!