SCIENCE BASED TARGETS NETWORK
GLOBAL COMMONS ALLIANCE

FRESHWATER

Illustrative case study – Ursus Nourishment

Step 3: Measure, set, and disclose targets

STEP 3
MEASURE, SET & DISCLOSE

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Version History

Version	Update description	Release Date	Effective Dates
1.1	Update in alignment with V1.1 methods	9 July, 2024	July 2024 – indefinite

Contents

Step 3: Freshwater

This section provides hypothetical examples of how Ursus Nourishment set targets for water-related pressures at sites prioritized in Step 2. The examples focus on water use and water pollution for two of the company's top-priority basins within its direct operations and upstream target boundary for each of these pressures, as identified at the end of the Step 2b ranking. For simplicity, the examples focus on one direct operations basin (Belgium: Meuse basin) and one upstream basin (United States: Middle San Joaquin basin) that were each among the top-ranked basins for *both* water use and water pollution.

Model selection and stakeholder consultation

Following the Step 3 technical guidance and because the SBTN Basin Threshold Tool is still in development, the Ursus team skipped this first node in the Step 3 model selection decision-tree and proceeded to national-level consultation to determine if models were available for the Meuse and Middle San Joaquin basins. The team began a stakeholder mapping exercise that listed the stakeholders it was in contact with across the national and local stakeholders identified in the SBTN guidance (see sections 3.1.2 and 3.1.3 in the Step 3: Freshwater method). After this list was created, the Ursus team reached out to the stakeholders it had identified, beginning at the national level.

In Belgium,[1] Ursus had an existing contact at the Federal Public Service Health, Food Chain Safety and Environment (FPS Health), which oversees water management in the country. The Ursus team sent an email explaining that it is following the SBTN methods and asked if FPS Health was aware of any models for the basin. After following up a few times by email and phone, the team received a response from a representative of FPS Health, who confirmed that there are local models for both water quantity and water quality in the basin. FPS Health further advised that they believe that the water quantity model (developed by the local basin authority) is appropriate to use for Ursus's target-setting process because it

- includes environmental flows and natural flow regime alterations;
- accounts for major anthropogenic disturbances to surface flows;
- accounts for allocated water resource use rights, including acceptable water access for the population (in line with Belgium's recognition of the right to an adequate water supply, sufficient in quality and quantity in the constitution);
- accounts for major anthropogenic fluctuations in groundwater levels; and
- has been ground-tested in the basin.

FPS Health connected the Ursus team with the basin authority to obtain information about the model for use in target setting.

For water quality, FPS Health was not sure if the model—which was developed by a university—meets all the criteria required to make it appropriate for use in this target-setting process. Since national-level consultation did not yield an appropriate model for water quality, Ursus proceeded to local consultation.

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[1] https://portal.cor.europa.eu/divisionpowers/Pages/Belgium-Water-Management.aspx

In addition to the contact at the university who developed the water quality model, the Ursus team identified a contact at the local water utility (who provides water to Ursus's facility) through its facility manager. The team also realized that the basin authority is a key local stakeholder due to its development of the water quantity model. The Ursus team reached out to these three stakeholders with the questions outlined in the Step 3 Freshwater methods as follows:

- The Ursus team contacted the basin authority directly to ask, "Are there local modeling approaches used by the local water authority to manage water quality in the basin?"
    a. The basin authority confirmed that it is not yet using any water quality model to manage water in the basin.
- The team then moved on to the next question to ask the basin authority, the water utility, and the university if there are appropriate local water models and thresholds for water quality in the basin.
    a. Both the basin authority and the water utility were aware of the model that was developed by the university and recommended by FPS Health, but they had not reviewed it in depth. The basin authority was supportive of exploring use of the university's model, as it was considering doing so as well in the future.
    b. Ursus was then able to meet with the university researcher, who confirmed that the water quality model is appropriate for target setting, as demonstrated by the following supporting evidence:
        i. the model accounts for allocated water resource use rights, including acceptable water access for the population (in line with Belgium's recognition of the right to an adequate water supply, sufficient in quality and quantity in the constitution);
        ii. it accounts for national or international water quality standards for nutrient pollutants (namely phosphorous);
        iii. it accounts for major anthropogenic sources of nutrient pollutants in the basin (namely phosphorous);
        iv. it accounts for aquatic ecosystems and their associated ecological services; and
        v. its predictions have been corroborated by observed data.

As one local stakeholder pointed to an appropriate local model and support was received by another, the Ursus team was required to use those models and thresholds for its target setting and was able to end the local-level consultation on the basis of model identification.

For the basin in the United States, due to the large size of the country, national-level water authorities or agencies do not oversee water management in the state (California) where the Middle San Joaquin basin is located. Therefore, for national-level consultation, the Ursus team approached WWF-US (an SBTN partner organization with whom Ursus had previously partnered) to consult them on the existence of any appropriate local models for water quantity and water quality for the Middle San Joaquin basin. WWF-US reached out to the various staff who have worked on water issues in the state, and while some were aware of some models that were in development, none of them was aware of a model that would meet the SBTN criteria. WWF-US connected the Ursus team to a contact they had at the State of California Water

Resources Control Board,[2] who replied to the group email to say they had seen a water quantity model for a larger basin, but it did not include environmental flows and would not be appropriate for use for the Middle San Joaquin basin.[3] They also stated that they were not aware of a water quality model that had been finalized. The team then asked its local tree nut farm managers if they were aware of any other local contacts that might know of water quantity or water quality models for the basin. The farm managers shared the name of a community-based water-related non-profit organization and the local irrigation district. The Ursus team sent a message to the general email of the non-profit and irrigation district. After following up, the team received a note from the non-profit that they were not aware of any models and did not have science teams on staff at this time. The Ursus team never heard back from the irrigation district and asked one of its farm managers to follow up. At a pre-scheduled meeting, a representative of the irrigation district advised the farm manager that they were not aware of any local models for water quality or quantity either. The farm manager also spoke to a representative of the local community, who did not have any information on models. This indicated that Ursus would need to use a global model to complete its target setting for both water quality and water quantity in the Middle San Joaquin basin.

Ursus completed the consultation process for validation by documenting and submitting a list of the stakeholders it contacted, all the email exchanges with identified national- and local-level stakeholders in Belgium and the United States, minutes and attendance of stakeholder meetings, and the data provided for the Meuse basin. As a result of this process, the Ursus team will use the locally developed modeling approach for water use and water pollution in the Meuse basin in Belgium and the globally developed modeling approach for water use and water pollution in the Middle San Joaquin basin in the United States. The company also noted down lessons learned for target setting in its additional priority basins, including that it might be useful to have additional in-house capacity to manage stakeholders and identify local models, and that it could be useful to have its facility and farm managers more regularly collect information on stakeholders as they establish working relationships with suppliers or acquire new direct operations sites.

Target-setting process

FRESHWATER QUANTITY TARGETS

Locally developed modeling approach: Freshwater Quantity target (freshwater use boundary)

As discussed above, following stakeholder consultation, the Ursus team determined that local e-flow requirements and results from a locally developed model were available for the Meuse basin in Belgium. Therefore, the team chose to set a Freshwater Quantity target using these tools and the back-calculation from the existing results approach. Because accessing model results requires special technical expertise, the team engaged with a technical consultancy to assist it.

The team began by specifying the cumulative pressures of the company's operations. Its facility directly monitors its water use, withdrawing water at a rate of 10,000 m^3/year (0.83 ML/month on average). Existing e-flow requirements had been specified in the locally developed model on a monthly basis. Hydrologic model results were available for river flows in the Meuse basin, representing the natural stream flow regime and the present-day stream flow regime, and were compiled into monthly averages. These values are shown in

[2] Mentioned for the purposes of this hypothetical case study only.

[3] These statements are for the purposes of this hypothetical case study only.

Table 1 for a single year, along with the required reduction percentage for each month, calculated using Equation 1. For the example year depicted in Table 1, no reductions were required for 10 months of the year because present-day stream flows exceeded e-flow requirements for those months.

Table 1: Local environmental flow requirements and model-predicted flows in the Meuse River by month for a single hypothetical example year.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Direct Operations	Environmental flow requirement (ML/month)	64	146	152	136	120	104	75	54	42	49	58	65
	Natural stream flow (ML/month)	80	183	190	170	150	130	93	67	52	61	72	81
	Present-day stream flow (ML/month)	70	173	180	160	140	115	78	52	37	51	62	71
	Required reduction in withdrawal (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11%	31%	N/A	N/A	N/A

Because the model simulates a 40-year period of record, the final step for the Ursus team in this example was to repeat the flow calculations (environmental, natural and present-day) in Table 1 for each year in the period of simulation and rank the required reduction percentage by month and year as shown in Table 2. Note that the ranking is performed independently by month such that each row in Table 2 may correspond to multiple years. The rank of the 75th percentile reduction percentage is calculated based on the length of the simulation as:

75th percentile rank = 0.75 × (Number of years evaluated + 1)

For this example, simulation of 40 years, the 31st-highest reduction percentage corresponds to the 75th percentile. The team decided to choose a single annual target because its planned control option for Step 4 provides a reduction in withdrawal over the entire course of the year, so it based it on the most stringent 75th percentile monthly reduction in Table 2 (39%). Application of Equation 2 from the Step 3 technical guidance indicates that, with a present-day pressure of 0.83 ML/month and a required reduction of 39%, Ursus has a target of 0.5 ML/month for its facility in the Meuse basin. Note that as an alternative to the single annual target, Ursus could have specified monthly targets using each month's 75th percentile reduction percentage in Table 2.

Because the pressure reduction target is above 25%, the Ursus team can submit its target with a target year of up to ten years from the submission date. The team submitted 2030 as the target year, six years from submission.

Table 2: Reduction percentages for 40-year period of record. For each month, Ursus independently ranked the values for each month across years from lowest to highest percent reduction for the Meuse basin. The bolded value is the 75th percentile used in the target-setting process.

		REQUIRED REDUCTION IN WITHDRAWAL (%)											
Direct Operations	Rank	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	2	0%	0%	0%	0%	0%	0%	0%	3%	5%	0%	0%	0%
	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
	31	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**5%**	**20%**	**39%**	**8%**	**0%**	**0%**
	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
	39	2%	5%	9%	13%	16%	21%	26%	31%	59%	27%	9%	1%
	40	3%	6%	11%	15%	18%	24%	29%	54%	68%	35%	14%	2%

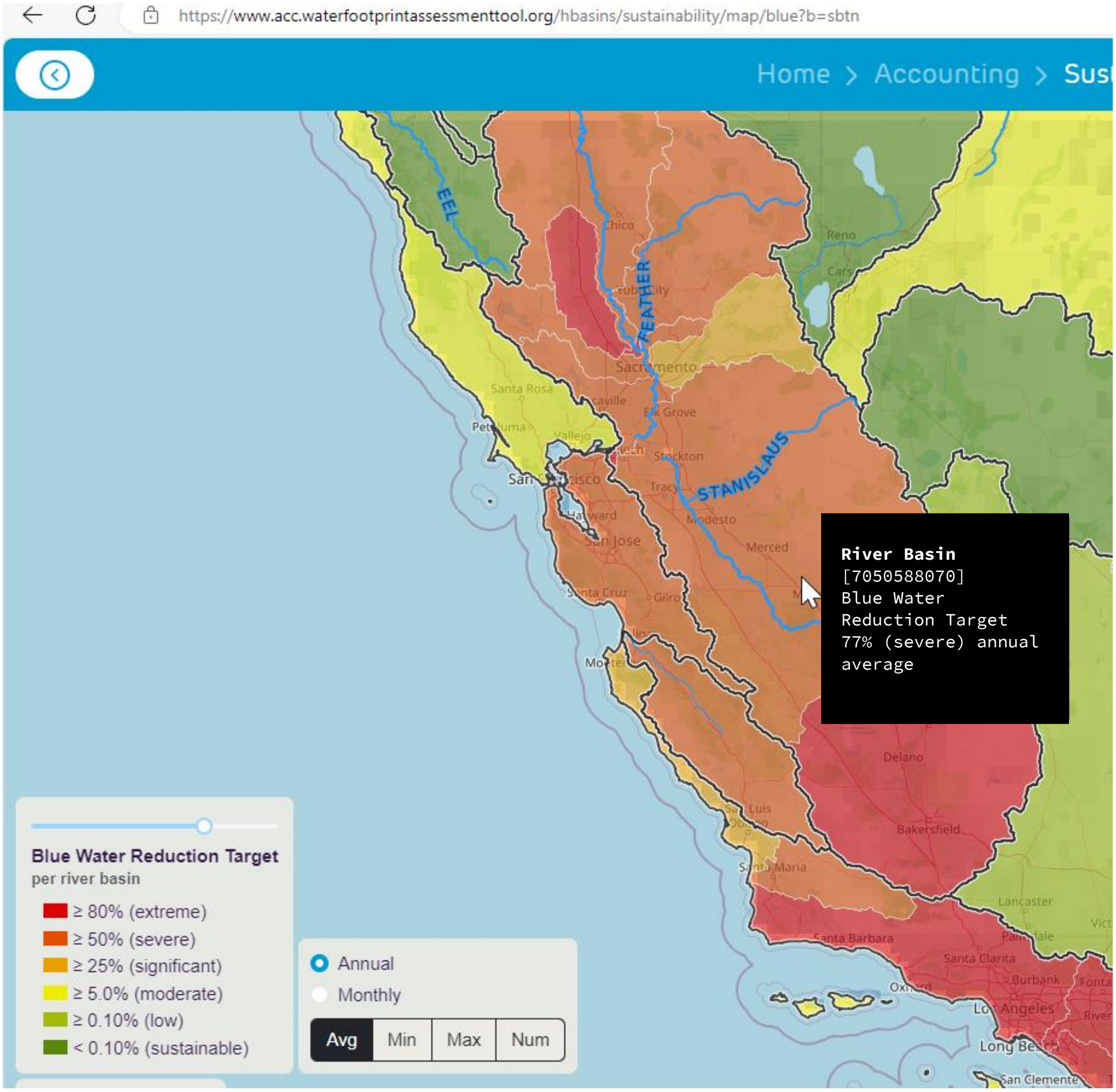
Globally developed modeling approach: Freshwater Quantity target (freshwater use boundary)

For the prioritized basin where Ursus grows tree nuts in the Middle San Joaquin basin in the United States, following stakeholder engagement, the team determined that no site-specific hydrologic model or local e-flow requirements have been developed.[4] Therefore, the team chose to set a Freshwater Quantity target using a globally developed approach. Ursus determined that its suppliers are located in the same basin defined by Hogeboom et al. (2020) with a calculated blue-water footprint from pressure tables in Step 2 of 22,400,000 m^3/year (corn/maize = 1,890,000 m^3/year, paperboard = 154,000 m^3/year, and tree nuts = 20,380,000 m^3/year), or 22,400 ML/year.

The team took the required annual reduction percentage from the [Water Footprint Assessment Tool] provided by Hogeboom et al. (2020), which for this example is 77% (see Figure 1).

[4] While hydrologic models *may* actually exist for the Middle San Joaquin basin in California in the United States, this statement is for the purposes of this hypothetical example only.

Figure 1: Screenshot of application of Water Footprint Assessment Tool.



Application of Equation 2 from the Step 3 technical guidance indicates that the company's science-based target for Freshwater Quantity with a present-day withdrawal of 22,400 ML/year and a required reduction of 77% results in a target of 5,152 ML/year. The Ursus team submitted 2034 as the target year, ten years from submission.

FRESHWATER QUALITY TARGETS

Locally developed modeling approach: Freshwater Quality target (freshwater pollution boundary)

After consulting with national and local stakeholders, Ursus Nourishment determined that a local nutrient threshold and results from an approved freshwater quality model are available in the Meuse basin in Belgium. Therefore, the team chose to set a Freshwater Quality target using the approved model and threshold and the back-calculation from existing results approach. The spatial domain of Ursus's assessment is defined by the scale of the local model, which was Pfafstetter Level 5. Ursus began by calculating the cumulative pressures of its operations over the spatial scale considered in the model. Its facility directly monitors its nutrient load, discharging phosphorus at a rate of 5,000 kg/year (417 kg/month) (Noted in Step 1 of the Case Study: Table 7 and Step 2 of the Case Study: Table 4).

The company had access to results from the freshwater quality model but did not have the resources to conduct additional model simulations. For this reason, the team used the back-calculation from existing results approach, which combines existing model results with information on the freshwater quality threshold, to define the required reduction percentage. The local nutrient threshold is specified by the basin authority as a seasonal (May through September) average phosphorus (P) concentration of 0.1 mg/L, as shown in the first row of Table 3. Freshwater quality model results were available, representing the monthly instream nutrient concentration associated with present-day nutrient load over a 20-year period of historical stream flows. These values are shown in the second row of Table 3 for a single year of simulation. The third row of Table 3 converts each of the five-monthly average concentrations into a single May–September average, to allow direct comparison with the time period specified by the threshold.

The final row of Table 3 applies Equation 3 to calculate the required reduction percentage for the May–September period. For the example year depicted, existing nutrient loads must be reduced by 33% (i.e., [0.15-0.10]÷0.15) to meet the seasonal average threshold.

Table 3: Freshwater quality nutrient threshold and model-predicted flows by month and season for a single hypothetical example year for the Meuse basin.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Direct operations	Threshold P concentration (mg P/L)	N/A	N/A	N/A	N/A	0.1					N/A	N/A	N/A
	Present-day P concentration (mg P/L)	0.12	0.13	0.11	0.11	0.14	0.14	0.15	0.16	0.16	0.14	0.14	0.13
	May–September P concentration (mg P/L)	N/A	N/A	N/A	N/A	0.15					N/A	N/A	N/A
	Required reduction in load (%)	N/A	N/A	N/A	N/A	33%					N/A	N/A	N/A

The final step for the Ursus team in this example was to repeat the calculations in Table 3 for each year in the period of simulation and rank the required reduction percentage by year as shown in Table 4. The rank of the 75th percentile reduction percentage is calculated based on the length of the simulation as:

$$\textit{75th percentile rank} = 0.75 \times (\textit{Number of years evaluated} + 1)$$

For this example, simulation of 20 years, the 75th percentile corresponds to the 16th-highest reduction percentage, indicating a required nutrient load reduction of 35% (Table 4).

Application of Equation 4 from the Step 3 technical guidance indicates that with a present-day pressure of 417 kg/month and a required reduction of 35%, Ursus has a target of 271 kg/ month for its facility in Belgium. Because the nutrient threshold applies only during the May–September period, Ursus has the option of meeting the target only for the May–September period or for the entire year. The Ursus team submitted 2030 as the target year, six years from submission.

Table 4: Reduction percentages for 20-year period of record in the Meuse basin. The bolded value is the 75th percentile used in the target-setting process.

	Rank	Required reduction in load (%)
Direct Operations	1	0%
	2	3%
	. . .	. . .
	16	**35%**
	. . .	. . .
	19	43%
	20	45%

Globally developed modeling approach: Freshwater Quality target (freshwater pollution boundary)

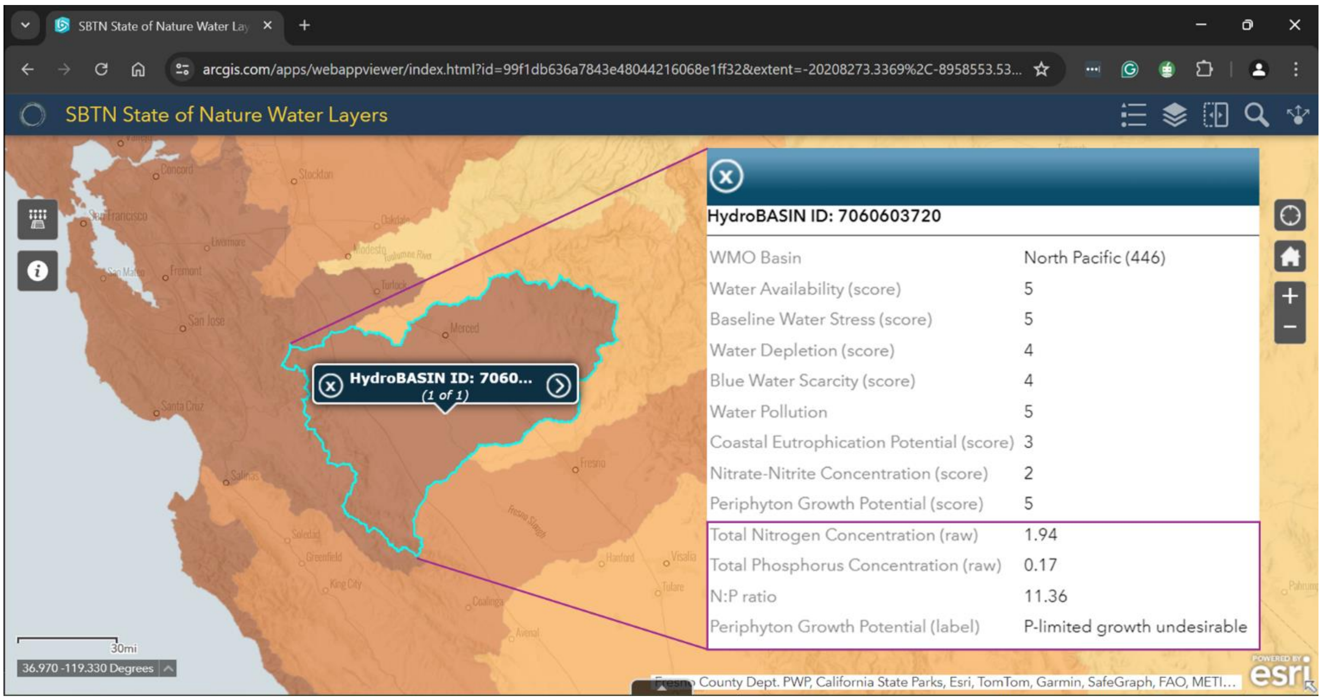
For the Middle San Joaquin basin where Ursus grows tree nuts in the United States, following stakeholder consultation, the team determined that no site-specific water quality model or nutrient concentration threshold have been developed.[5] Therefore, the team chose to set a Freshwater Quality target using a globally developed approach. Ursus determined that its suppliers are located in a single level 6 basin consistent with reprocessed McDowell et al. (2020) results in the SBTN State of Nature Water Layers app with a calculated phosphorus load from Table 8 in Step 2 of the Case Study of 28,800 kg P/year (corn/maize = 10,800 kg P/year, paperboard = 299 kg P/year, and tree nuts = 17,700 kg P/year).

The SBTN State of Nature Water Layers app was used to define the median growing season nutrient concentrations and the limiting nutrient. The limiting nutrient from McDowell in the app for the Middle San Joaquin basin (Figure 2 below) is phosphorus. Ursus consulted its farm manager and received confirmation that P is the limiting nutrient at all times and locations,

[5] While water quality models may actually exist for the San Joaquin basin in California in the United States, this statement is for the purposes of this hypothetical example only.

such that no reductions were required for nitrogen. Because P is the limiting nutrient, the company applied Equation 3 from the Step 3 technical guidance to define the required reduction percentage using the site-specific predicted median growing season total P concentration and the global P threshold provided by McDowell et al. (2020). The median growing season total P concentration is 0.17 mg/L, which is also provided by McDowell in the app (Figure 2 below).

Figure 2: Modeled limiting nutrient and total P concentrations from reprocessed McDowell et al. (2020) results in the SBTN State of Nature Water Layers app.



The global P threshold provided by McDowell is 0.046 mg/L. The required reduction percentage calculated from Equation 3 is 73% ([0.17−0.046] ÷ 0.17). Globally developed Freshwater Quality targets are specified on an annual basis, so the application of Equation 4 from the Step 3 technical guidance indicates that Ursus's science-based target for Freshwater Quality for a present-day pressure of 28,800 kg/year and a required reduction of 73% results in a target of 7,800 kg P/year. The Ursus team submitted 2034 as the target year, ten years from submission.

Ursus has now finalized the Freshwater target-setting process for two of its priority basins and will proceed to socializing these targets with stakeholders identified and then begin to implement actions to meet these targets (Step 4). It will also proceed to begin target setting in its other prioritized basins, taking the learnings from the process used in these two. Moreover, as Ursus is also setting land targets in the Meuse basin, they will look to prioritize any response options that maximize co-benefits for both their freshwater and land science-based targets.

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