Appendix B.6

Final - Surface Water Quality Modelling Assessment Report, Golder Associates

REPORT

Fifteen Mile Stream Gold Project

Surface Water Quality Modelling Assessment

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Executive Summary

Atlantic Mining NS Corp (AMNS), a wholly owned subsidiary of St. Barbara Ltd., is planning to develop the Fifteen Mile Stream Gold Project (the Project), located approximately 115 km east of Halifax, in Halifax County, in the province of Nova Scotia. Golder Associates Ltd. (Golder) has prepared water quality models for the operations and post-closure phases of the Project. The key objective of the water quality modelling was to estimate the water quality of the Project site drainage and potential changes to water quality in the receiving surface water environment, that may occur as a result of the Project. This water quality modelling report is an Appendix of the Environmental Impact Statement (EIS) for the Project.

Water quality models were developed using GoldSim Version 12.1 for the operations phase and the post-closure stage of the closure phase. The modelling approach is a mass-balance mixing cell model for site-specific components, consisting of both natural components (e.g., natural runoff, rainfall) and Project components (e.g., effluent discharge, seepage), that are linked together to form a series of mixing cells. Each mixing cell has two or more sources of mass load that are combined to determine a “mixed” or combined water quality. Geochemical source terms and baseline surface water and groundwater quality inputs were integrated with flow rates and the site water management plan to calculate mass loading rates. A stochastic modelling approach using a 56-year climate record, provides a framework for the range of probabilistic climate conditions that the site and receiving surface water environment are likely to experience over the period of the Project.

The Project site components that were considered in the water quality models are as follows: open pit wall runoff, non acid-generating waste rock storage area (WRSA) drainage, potentially acid-generating WRSA drainage, low-grade ore stockpile drainage, topsoil stockpile drainage, till stockpile drainage, process water (water associated with the tailings from the plant site), tailings management facility (TMF) tailings beach runoff, TMF embankment runoff, tailings seepage and water treatment plant effluent.

The water quality model simulated surface water quality at key surface water features within, and directly downgradient/downstream of the Project footprint (Seloam Lake, Seloam Brook, East Lake, and Anti-Dam Flowage). The surface water receivers are those that; 1) receive discharge of effluent from the TMF pond during operations and the flooded open pit during post-closure, 2) receive seepage from the TMF that bypasses the seepage collection system, or 3) are downstream of receivers of effluent/seepage.

The predicted water qualities of the Project site components are compared to the federal Metal and Diamond Mines Effluent Regulations. The surface water quality predictions for the receiving environment are compared to the Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Aquatic Life, Nova Scotia Environmental Quality Standards for Contaminated Sites (Tier 1) for Surface Water (Fresh Water), Environment Canada Federal Environmental Quality Guideline (for cobalt), site-specific water quality objective (for arsenic), and 95th percentile baseline concentrations, as applicable.

A discussion of the water quality predictions with respect to Project effects, is presented in the EIS.

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1.0 INTRODUCTION

Atlantic Mining NS Corp (AMNS), a wholly owned subsidiary of St. Barbara Ltd., is planning to develop the Fifteen Mile Stream Gold Project (the Project) located approximately 115 km east of Halifax, in Halifax County, in the province of Nova Scotia (Figure 1).

Golder Associates Ltd. (Golder) has prepared water quality models for the operations and post-closure phases of the Project. The key objective of the water quality modelling was to estimate the water quality of the Project site drainage and potential changes to water quality in the receiving surface water environment that may occur as a result of the Project. The Project infrastructure and surrounding watercourses are presented in Figure 1.

This water quality modelling report is an Appendix of the Environmental Impact Statement (EIS) for the Project. The purpose of this report is to describe the modelling approach, input data and assumptions, and to provide results from the water quality modelling. The flow input data are derived from the water balances that are based upon the hydrologic and hydrogeologic models; as such, it is suggested that the reader consult the accompanying Hydrological Modelling and Hydrogeological Modelling Appendices prior to reading this report.

2.0 WATER QUALITY MODELLING METHODOLOGY

2.1 Modelling Approach

In support of the water quality component of the EIS, water quality models were developed for the Project using GoldSim Version 12.1. Water quality models were developed for the operations phase and the post-closure stage of the closure phase; a detailed discussion on the Project phases that were included in the water quality modelling (i.e., temporal boundaries) for the effects predictions is provided in the EIS. The objective of the water quality modelling is to predict the combined-net effect that the Project components and activities may have on the quality of the surface water environment.

GoldSim is a graphical, object-oriented mathematical model, where the input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors that influence an engineered or natural system, which allows for estimating the potential changes to surface water quality.

The modelling approach used for the surface water quality predictions is a mass-balance mixing cell model for site-specific components, consisting of both natural components (e.g., natural runoff, rainfall) and Project components (e.g., effluent discharge, seepage), that are linked together to form a series of mixing cells. Each mixing cell has two or more sources of mass load that are combined to determine a “mixed” or combined water quality. The surface water quality model was constructed by building upon the GoldSim hydrology model, whereby, geochemical source-terms and baseline water quality inputs were integrated with flow rates to calculate mass loading rates. The flow logic, which forms the basis of the water balance interconnectivity, is used to configure the model linkages, including determining the direction of mass movement along the flow paths and defining the location of mass mixing points. The flow rates were used with baseline water quality and geochemistry inputs to derive mass loading rates for each of the model components. The mass mixing can be represented by the following equation:

$$C_x = \frac{\sum_{i=1}^{n} C_i Q_i}{\sum_{i=1}^{n} Q_i}$$

where:
C_x = predicted concentration of constituent 'x' at a given location
C_i = concentration of constituent 'x' in inflow 'i' discharging to a given location
Q_i = flow rate of inflow 'i'
n = number of inflows to the location in question

Each flow rate is multiplied by the corresponding input concentration value, and the sum of all these calculations is divided by the sum of each flow rate to predict the final concentration of each parameter in the waterbody.

2.2 Description of Conceptual Water Quality Models

2.2.1 Project Site Components

To predict the water quality of Project site effluents, and to assess the potential impacts of the Project on the receiving environment, the Project site components that were considered in the water quality models are as follows:

- open pit wall runoff
- non acid-generating (NAG) waste rock storage area (WRSA) drainage
- potentially acid-generating (PAG) WRSA drainage
- low grade ore (LGO) stockpile drainage
- topsoil stockpile drainage
- till stockpile drainage
- process water (water associated with the tailings from the plant site)
- tailings management facility (TMF) tailings beach runoff
- TMF embankment runoff
- tailings seepage
- water treatment plant effluent

Descriptions of these Project site components, and how these components are expected to influence Project site water quality, are presented below.

2.2.1.1 Open Pit

The excavation of mine rock and development of the open pit results in the rock face of the pit walls being exposed to atmospheric conditions. The blasting of the rock typically results in a “damaged zone” of rock that consists of shallow fractures that extend into the bedrock from the face of the pit wall. The surfaces of the fractures in the damaged zone are also exposed to atmospheric conditions. The exposed rock surfaces are susceptible to weathering processes that can lead to the mobilization of constituents through oxidation and dissolution reactions. Explosive residues can persist on the pit walls, and within blasted mine rock fines that remain in the open pit, which are a source of ammonia and nitrate.

Water can interact (come into contact) with the weathered rock surfaces and residual explosives; this water is referred to as “contact” water. Water that comes into contact with the exposed rock surfaces (i.e., direct precipitation, groundwater inflow, and runoff from the open pit catchment area) can transport soluble constituents into the pit sump, which affects its water quality.

During the operations phase, the runoff and groundwater inflow that enters the open pit will be collected in sumps and then pumped to the ore and open pit pond, which will subsequently be dewatered to the TMF pond.

Once mining is complete, dewatering activities will cease and the open pit will be allowed to flood. During the post-closure stage of the closure phase, the quality of the open pit is influenced by the following sources:

- runoff from the TMF embankments, reclaimed beach, and catchments
- input from the TMF seepage collection ponds
- runoff and seepage from the NAG WRSA and the covered PAG WRSA
- groundwater inflow
- pit wall runoff
- precipitation and natural runoff from undisturbed ground

2.2.1.2 Waste Rock Storage Facility

Subaerial storage of waste rock in the NAG and PAG WRSAs will result in the rock being exposed to atmospheric conditions. The exposed rock surfaces, in particular, the fine-grained portions, are susceptible to weathering processes that can lead to the mobilization of constituents through oxidation and dissolution reactions. In addition to the weathering by-products, residual explosives from blasting can persist in the waste rock, which are water soluble and sources of ammonia and nitrate. Water-rock interaction in the WRSAs, results in the mobilization of soluble constituents (i.e., major ions, metals, and nitrogen species) present in the waste rock.

During the operations phase, the contact water from the NAG and PAG WRSAs will report to the NAG and PAG waste rock ponds, respectively, which will subsequently be dewatered to the TMF pond. The water quality of the NAG and PAG waste rock ponds will be strongly influenced by the rock reactivity, degree of water-rock interactions, and amounts of soluble explosive residues.

During the post-closure stage of the closure phase, an engineered cover system will likely need to be applied to the PAG WRSA, due to the potentially acid-generating nature of the waste rock. The post-closure water quality model considered a clay cover over the WRSA with an assumed infiltration rate of 15% (i.e., 85% of the precipitation that falls on the WRSA will be shed from the cover and 15% will infiltrate and report as contact water seepage). The post-closure water quality model assumes that the NAG WRSA will not be covered.

2.2.1.3 Ore Stockpile

As described above for waste rock, subaerial storage of low-grade ore in the LGO stockpile can lead to the release of weathering by-products and residuals from explosives used in blasting.

During the operations phase, the drainage from the LGO stockpile will report to the ore and open pit pond, which will subsequently be dewatered to the TMF pond.

During the post-closure stage of the closure phase, the LGO stockpile will have been processed and the area reclaimed. Drainage from the reclaimed area will report directly to the receiving environment (the SW5 watershed).

2.2.1.4 Till and Topsoil Stockpiles

During the operations phase, drainage from the topsoil stockpile will report to receiver water bodies (the SW5 watershed). Drainage from the till stockpile will report to the till pond, which will subsequently be dewatered to the TMF pond. The quality of the water in the topsoil drainage and till pond will be influenced by the mobilization of soluble constituents (i.e., major ions, metals) present in the topsoil and till.

The stockpiled till and topsoil will be used during the reclamation stage of the closure phase. During the post-closure stage of the closure phase, the till and topsoil stockpile areas are assumed to be reclaimed. Drainage from the reclaimed topsoil stockpile will report to the SW5 watershed; drainage from the till stockpile will report to the open pit.

2.2.1.5 Tailings Management Facility

Tailings are produced as part of ore processing and will be stored in the TMF (which is a subaerial facility). Subaerial deposition of tailings results in exposure to atmospheric conditions, and the tailings are therefore susceptible to weathering processes, such as oxidation and dissolution reactions. Runoff across the surface of the tailings beach and water that infiltrates through the tailings pore space can mobilize constituents that are by-products of tailings oxidation. The seepage from the TMF can also carry constituents associated with process water.

During the operations phase, process water will be discharged from the plant site to the TMF pond. Water that infiltrates into the subsurface will in part become groundwater and flow toward the perimeter of the TMF. A seepage collection system, including the north and east seepage collection ponds, will be constructed, that captures seepage and returns the water back into the TMF pond via a pumpback system. The TMF pond quality is also influenced by the following additional inputs: tailings beach runoff, catchment runoff, embankment runoff, dewatering from the waste rock pond, dewatering from the till stockpile pond, dewatering from the ore and open pit pond, and precipitation.

During the post-closure stage of the closure phase, the TMF seepage collection system will remain in place. Contact water from the TMF seepage collection ponds and embankments will report to the open pit. The post-closure water quality model assumes that the TMF beach will be covered with a till/topsoil cover. Drainage from the cover will report to the open pit.

The TMF embankments will be constructed out of NAG waste rock. As described above for waste rock, subaerial placement of embankment material can lead to the release of weathering by-products and residuals from explosives used in blasting.

2.2.1.6 Water Treatment Plant

An on-site water treatment plant will be in place during each Project phase to provide treatment of effluent (TMF pond effluent during operations and open pit effluent during post-closure), if required, prior to discharge to Anti Dam Flowage. Effluent discharge from the water treatment plant will be required to meet the federal Metal and Diamond Mines Effluent Regulations (MDMER) requirements, as per the *Fisheries Act*.

2.2.2 Surface Water Receivers

The water quality model simulated surface water quality at key surface water features within and directly downgradient/downstream of the Project footprint.

Predicted potential change to receiving environment surface water quality were simulated at the locations presented in Table 1 and shown on Figure 2.

Table 1: Surface Water Quality Effects Assessment Locations

Assessment Location ID	Description	Rationale
SW5	Seloam Brook	Location is downstream of Seloam Lake, and collects drainage from an area that is north, and in part downgradient, of the Project Area.
SW15	East Lake Outlet	Location is in a stream system that includes the collection of drainage from an area located immediately southeast and downgradient of the TMF.
EMZ-1	Seloam Lake	Location is within Seloam Lake at a point that is positioned 100 m downstream of a potential discharge location for treated effluent (end of the mixing zone for option #1 or EMZ-1); this is one of two options assessed herein, as part of the alternatives analysis for discharge of treated effluent.
EMZ-2	Anti Dam Flowage	Location is within Anti Dam Flowage at a point that is positioned 100 m downstream of a potential discharge location for treated effluent (end of the mixing zone for option #2 or EMZ-2); this is one of two options assessed herein, as part of the alternatives analysis for discharge of treated effluent.
SW6	Anti Dam Flowage (outlet)	Far-field assessment location that is positioned at a point downstream of the receiving surface water bodies that have the potential to be affected by the Project.

The water quality model for the operations phase conservatively assumed that 15% of the total seepage that exits from the TMF at perimeter locations will bypass the perimeter seepage collection system and enter the adjacent surface water environment (14% at the SW5 watershed and 1% at the SW15 watershed). It should be noted that while the groundwater modelling results indicate that seepage will not report to SW5 and SW15 during the planned duration of the operations phase, the operations phase water quality model conservatively applies the seepage mass load to these receivers.

The water quality model for the post-closure stage of the closure phase also assumed that 15% of the total seepage that exits from the TMF at perimeter locations will bypass the perimeter seepage collection system and enter the adjacent surface water environment (14% at the SW5 watershed and 1% at the SW15 watershed).

2.3 Modelled Parameters

The following parameters were modelled in the operations phase and post-closure phase water quality models; these parameters have a corresponding geochemical source term (i.e., a Project-related source): nitrite, nitrate, ammonia (total), sulphate, aluminum, antimony, arsenic, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, uranium, and zinc. Un-ionized ammonia is not assigned a specific model input; rather, a total ammonia input is assigned, and un-ionized ammonia is subsequently calculated within the model at receiver locations using average recorded monthly field pH and field temperature.

The GoldSim water quality models did not predict changes in pH associated with the Project; pH is not a conservative constituent and is influenced by a variety of surface water geochemical reactions (e.g., buffering reactions).

The field pH of the receiver measured during the baseline water quality monitoring program ranged from 4.18 to 5.89; the measured lab pH ranged from 5.26 to 6.48 (Golder 2019). The potential change in pH in the receiver as a result of effluent discharge depends on 1) the pH of the various Project sources that contribute to the effluent and 2) the effluent flow proportion in the receiver.

During the operations phase, contact water from Project sources and non-contact water from surrounding catchments reports to the TMF pond in the relative flow proportions summarized in Table 2. On a mean annual basis, the effluent flow proportion in the receiver (i.e., (effluent flow/(receiver flow + effluent flow)) is 2.9%; Table 2 also presents the Project source flows as a proportion of the total flow in the receiver.

The largest contributing Project source flow to the TMF pond is process water at a pH of 8.0, followed by precipitation and catchment runoff at pH of 5.1 and 6.0, respectively. These flows represent approximately 1% or less, on a mean annual basis, of the total flow in the receiver. Minor contributions of Project source flows of neutral pH or pH comparable to the baseline receiver pH are not expected to significantly change the pH in the receiver. In addition, attenuation of water flows by mixing and buffering reactions will occur within the TMF pond prior to effluent release. As such, modelling of pH for the operations phase was not deemed to be warranted.

Table 2: Flow Proportion and Source Term pH of Project Source Flows – Operations Phase.

Contributing Source	Flow Proportion in TMF Pond (%)	Flow Proportion in Receiver (%)	Source Term pH (Upper-Case)
Pit wall contact runoff	4.8	0.14	7.5
PAG contact runoff	4.1	0.12	7.5
NAG contact runoff	5.1	0.15	7.5
PAG pile seepage	0.3	0.01	7.5
NAG pile seepage	0.4	0.01	7.5
Low grade ore contact runoff	1.0	0.03	7.5
TMF embankment contact runoff	5.3	0.15	7.5
Till contact runoff	2.2	0.06	5.5
Tailings beach	4.2	0.12	8.0
Process water	35.7	1.04	8.0
Catchment runoff	15.1	0.44	6.0
Precipitation	16.2	0.47	5.1
Groundwater	3.2	0.09	6.7
TMF seepage to seepage ponds	2.4	0.07	8.0
SUM	**100**	**2.9**	**N/A**

During the post-closure phase stage of the closure phase, contact water from Project sources and non-contact water from surrounding catchments reports to the flooded open pit in the relative flow proportions summarized in Table 3. On a mean annual basis, the effluent flow proportion in the receiver (i.e., (effluent flow/(receiver flow + effluent flow)) is 2.8%; Table 3 also presents the Project source flows as a proportion of the total flow in the receiver.

The largest contributing Project source flow to the open pit is runoff from the covered tailings beach at a pH of 5.3, followed by catchment runoff and precipitation at pH of 6.0 and 5.1, respectively, which is similar to the pH range observed in the receiver baseline study. These flows represent approximately 0.9% or less, on a mean annual basis, of the total flow in the receiver. The upper-case source term associated with contact runoff from the PAG pile is acidic (pH 3.5) but represents only 0.03% of the total flow in the receiver. The base-case source term pH is 4.0. Minor contributions of Project source flows are not expected to significantly change the pH in the receiver.

In addition, attenuation of water flows by mixing and buffering reactions will occur within the TMF pond prior to effluent release. As such, modelling of pH for the post-closure phase was not deemed to be warranted.

Table 3: Flow Proportion and Source Term pH of Project Source Flows – Post-Closure Phase.

Contributing Source	Flow Proportion in Open Pit (%)	Flow Proportion in Receiver (%)	Source Term pH (Upper-Case)
Pit wall contact runoff	1.4	0.04	7.5
PAG contact runoff	0.9	0.03	3.5
NAG contact runoff	7.8	0.22	7.5
Cover runoff (average of till and topsoil)	5.3	0.15	5.3
TMF embankment contact runoff	7.7	0.22	7.5
Reclaimed till stockpile runoff	3.4	0.10	5.5
Tailings beach	31.1	0.87	5.3
Catchment runoff	25.2	0.71	6.0
Precipitation	8.8	0.25	5.1
Groundwater	3.7	0.10	6.7
TMF seepage to seepage ponds	4.8	0.13	8.1
SUM	**100**	**2.8**	**N/A**

The GoldSim water quality models did not predict changes in turbidity associated with the Project, as the transport of TSS is highly influenced by site-specific hydrological conditions, engineered structures, and water management procedures. Engineered control structures, such as the collection ponds, are being incorporated into the site design to allow for settlement of TSS at specific points in the drainage collection system and Best Management Practices will be emplaced to reduce the TSS concentrations to below the applicable effluent discharge limits.

The GoldSim water quality models did not predict changes in dissolved oxygen associated with the Project. During the operations phase, the three largest contributing flows to the TMF pond are process water, precipitation, and catchment runoff. During the post-closure phase, the three largest contributing flows to the open pit are runoff from the reclaimed tailings beach, catchment runoff and precipitation. These sources are in contact with the atmosphere and considered to be oxic; while reducing conditions may exist in groundwater and seepage, these source flow contributions to the receiver on a mean annual basis are minor (<0.13%). The predicted nutrient concentrations in the receiver, which account for nutrient loading associated with residual explosives, are presented in Appendix B and are below the applicable water quality criteria. The camp septic system will be designed with septic tanks and septic fields such that direct sewage effluent is not discharged into the receiver. As such, discharge of effluent is not expected to have a significant effect on dissolved oxygen levels in the receiver.

The GoldSim water quality models did not predict changes in temperature associated with the Project; temperature is not a conservative constituent and can vary on a very small timestep. Complex hydrodynamic temperature modelling is typically reserved for cases where there is cold water refugia, which is not the case at the Site.

The preliminary design of the TMF pond is for a residence time of one to three months reclaim requirements. The largest contributing Project source flow to the TMF pond is process water, followed by precipitation and catchment runoff. The largest contributing Project source flow to the open pit is runoff from the covered tailings beach, followed by catchment runoff and precipitation.

The TMF pond and open pit will be exposed to the atmosphere and the temperature is expected to vary seasonally in a comparable manner to the receiving environment. Given the small effluent flow proportion in the receiver during operations (2.9%) and post-closure (2.9%), effluent discharge is not expected to have a significant effect on the temperature in the receiver.

2.4 Input Data

2.4.1 Site Water Management Plan

The predictions of site effluent quality are based on the site water management plan provided by Knight Piésold (see accompanying hydrological modelling report). Annual flows for inputs to and outputs from the TMF, TMF seepage collection ponds, plant site, open pit, ore and open pit pond, till pond, and waste rock pond were combined with the upper-case geochemical source terms to derive the predicted site effluent quality (for the operations phase, the quality of the TMF pond; for the post-closure phase, the quality of the flooded open pit).

The flow of effluent to the environment is also derived from the Knight Piésold site water management plan. The operations water quality model assumes that the TMF pond effluent flow rate will be actively controlled; in this model, the monthly effluent flow rate from the Knight Piésold site water management plan is applied. The post-closure water quality model assumed that effluent from the open pit will flow passively to the environment; in this model, the total annual effluent flow from the Knight Piésold site water management plan is allocated monthly, in accordance with the seasonal discharge pattern within the receiver (see Hydrological Modelling Appendix for additional detail).

2.4.2 Hydrological Model

Details on the modelling approach, methods, assumptions, and limitations are discussed in the Hydrological Modelling Appendix. Briefly, the hydrology model incorporated:

- long-term climate
- watershed areas
- watershed composition (surficial geology, lake, reservoir, and wetland area)
- reservoir bathymetry and dam structure (features/structures/design) and operational rules

- predicted operational water management (site water storage and water conveyance)

The operations and post-closure surface water quality models were constructed by building upon the GoldSim hydrology operations and post-closure models, respectively. A 56-year climate record was used as input to the hydrology numerical model. The input precipitation records for the hydrology (flow) simulations were derived by applying a stochastic (Monte Carlo) method to the 56-year climate record. This method randomly selects climate data from a distribution curve, on a monthly basis for each time step in the model – 1000 realizations were simulated for each time step to consider a complete set of climate conditions across the 56-year climate record. Therefore, the stochastic modelling approach provides a framework for the range of probabilistic climate conditions that the site and receiving surface water environment are likely to experience over the period of the Project.

2.4.3 Natural Runoff

Baseline surface water quality monitoring has been conducted at various watercourses in the vicinity of the Project site since 2017. The surface water quality sampling locations are shown on Figure 3. Additional details on the baseline surface water quality monitoring program and results are summarized in Golder (2019).

The input water qualities for the watercourses were derived from baseline surface water quality data collected by McCallum Environmental Ltd. (McCallum) between July 2017 and June 2019. An average baseline surface water quality was derived for each of the model assessment points. Values analysed as below the method detection limits, were assumed to be equal to one-half the detection limit. Analytical results for total metals were used to derive water quality model inputs.

The average baseline surface water quality is summarized in Table 2; this water quality is used in the water quality model to define the input water quality for:

1) Natural runoff to the specific assessment points

2) Undisturbed runoff in the predictions of site effluent quality

The baseline input for EMZ-2 was derived from the average of the available baseline dataset for SW14 and SW6. The baseline input for SW15 was derived from the average of the available baseline dataset for SW12, which is the nearest upstream monitoring station. In the site effluent predictions, the average baseline water quality at SW3 was assigned as the input for undisturbed site runoff; this watercourse was assumed to best represent runoff within the project area, due to its location being removed from the river mainstem and from former site operations.

Table 4: Natural Runoff Input Quality

Parameter	Average Surface Water Baseline Concentration (mg/L) [(1)]					
	SW2	SW3	SW5	SW6	SW12 [(2)]	EMZ-2 [(3)]
Aluminum	0.13	0.055	0.18	0.22	0.24	0.21
Ammonia (total)	0.025	0.025	0.025	0.025	0.039	0.025
Antimony	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Arsenic	0.00050	0.00050	0.025	0.0044	0.00063	0.0062
Boron	0.025	0.025	0.025	0.025	0.025	0.025
Cadmium	0.000013	0.0000071	0.000012	0.000017	0.000017	0.000017
Calcium	0.51	0.56	0.69	0.74	0.77	0.71
Chromium	0.00056	0.00073	0.00056	0.00050	0.00050	0.00055
Cobalt	0.00020	0.00020	0.00026	0.00020	0.00034	0.00020
Copper	0.00083	0.00089	0.00086	0.00083	0.00084	0.00077
Iron	0.14	0.029	0.39	0.40	0.59	0.36
Lead	0.00025	0.00025	0.00025	0.00031	0.00037	0.00029
Magnesium	0.31	0.26	0.33	0.36	0.35	0.36
Manganese	0.045	0.015	0.073	0.065	0.057	0.067
Mercury	0.0000065	0.0000065	0.0000095	0.0000074	0.0000065	0.0000070
Molybdenum	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Nickel	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Nitrate	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Nitrite	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Potassium	0.26	0.23	0.28	0.28	0.22	0.27
Selenium	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Silver	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Sodium	2.2	2.2	2.2	2.9	2.3	2.9
Sulphate	1.0	1.2	1.0	1.0	1.0	1.0
Thallium	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Uranium	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Zinc	0.0025	0.0025	0.0025	0.0025	0.0030	0.0025

Notes
[1] Average calculated from the available surface water quality baseline dataset (June 2017 to June 2019).
[2] Baseline water quality for SW15 is derived from the available dataset for SW12.
[3] Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

2.4.4 Groundwater Inflow to Open Pit

Baseline groundwater quality monitoring has been conducted since 2018 at monitoring wells in the vicinity of the proposed open pit footprint. The groundwater quality sampling locations are shown on Figure 4. The input water quality for groundwater inflow to the open pit was derived from baseline groundwater quality data collected by Golder between September 2018 and June 2019. An average baseline groundwater quality was derived for the groundwater inflow input; values below the method detection limits were assumed to be equal to one-half the detection limit.

The average baseline groundwater quality is summarized in Table 3.

Table 5: Open Pit Groundwater Inflow Input Water Quality

Parameter	Average Groundwater Baseline Concentration (mg/L) (1)
Aluminum	0.20
Ammonia (total)	0.077
Antimony	0.0010
Arsenic	0.031
Boron	0.0089
Cadmium	0.000023
Calcium	11
Chromium	0.0014
Cobalt	0.0022
Copper	0.0012
Iron	2.5
Lead	0.00033
Magnesium	0.91
Manganese	0.34
Mercury	0.000012
Molybdenum	0.0010
Nickel	0.0049
Nitrate	0.48
Nitrite	0.025
Potassium	2.0
Selenium	0.00055
Silver	0.000050
Sodium	6.0
Sulphate	4.1
Thallium	0.000050
Uranium	0.00046
Zinc	0.0058

Notes
[1] Average calculated from the available groundwater quality baseline dataset (September 2018 - May 2019) for wells FMS-HG18-05A, FMS-HG-05B, FMS-HG-06A, FMS-HG-07A, and FMS-HG-07B.

2.4.5 Groundwater Inflow to TMF

The input water quality for unimpacted groundwater inflow to the TMF seepage collection ponds (i.e., not contact seepage collected from the TMF) was derived from baseline groundwater quality data collected by Golder between September 2018 and June 2019. An average baseline groundwater quality was derived for the groundwater inflow input; values below the method detection limits were assumed to be equal to one-half the detection limit.

The average baseline groundwater quality is summarized in Table 4.

Table 6: TMF Groundwater Inflow Input Water Quality

Parameter	Average Groundwater Baseline Concentration (mg/L) [(1)]
Aluminum	0.042
Ammonia (total)	0.030
Antimony	0.0010
Arsenic	0.0013
Boron	0.0072
Cadmium	0.000011
Calcium	7.5
Chromium	0.00081
Cobalt	0.00053
Copper	0.0014
Iron	0.025
Lead	0.00025
Magnesium	0.72
Manganese	0.054
Mercury	0.0000080
Molybdenum	0.0010
Nickel	0.0018
Nitrate	0.012
Nitrite	0.025
Potassium	0.57
Selenium	0.00050
Silver	0.00015
Sodium	4.5
Sulphate	4.1
Thallium	0.000050
Uranium	0.00017
Zinc	0.0071

Notes
[1] Average calculated from the available groundwater quality baseline dataset (September 2018 - June 2019) for wells FMS-HG18-10A, FMS-HG18-10B, FMS-HG18-13A, and FMS-HG18-13B.

2.4.6 Project Site Components Source Terms

The source-term effluent qualities that were input into the surface water quality model were provided by Lorax Environmental Services Ltd. (Lorax) and are presented in Lorax (2019) (appended to the EIS). Lorax developed source terms for the following Project site components that have the potential to affect the overall site water quality:

- open pit wall runoff
- NAG WRSA drainage
- PAG WRSA drainage
- LGO stockpile drainage
- topsoil stockpile drainage
- till stockpile drainage
- process water (water associated with the tailings from the plant site during the operations phase)
- TMF tailings beach runoff
- TMF pore water (seepage from the TMF during the post-closure phase)

Source terms were provided for the operations (end-of-mine life) and post-closure phases of the Project and are summarized in Table 4 (base case) and Table 5 (upper-case). As described in Lorax (2019), the base case source terms are based on the median results from applicable humidity cell testing data, while the upper-case source terms are based on the 90th percentile.

Table 7: Geochemical Source Term Inputs (Base Case values)

Parameter	Geochemical Source Terms (mg/L) [1]													
	Pit Wall Runoff		NAG WRSA		PAG WRSA		TMF Embankments	LGO Stockpile	Topsoil Stockpile	Till Stockpile	Tailings Beach Runoff	Process Water	Pore Water
	EOM [2]	PC [3]	EOM	PC	EOM	PC	EOM/PC	EOM	EOM/PC	EOM/PC	EOM/PC	EOM	PC
Nitrite [4]	0.17	0.000054	0.30	0.071	0.30	0.071	0.17	0.30	-	-	-	-	-
Nitrate [4]	5.5	0.002	13	3.1	13	3.1	7.1	13	-	-	-	-	-
Ammonia (total) [4]	1.0	0.00032	1.6	0.38	1.6	0.38	0.31	1.6	-	-	-	-	-
Sulphate	704	658	1146	902	978	2439	120	764	1.7	36	79	135	225
Aluminum	0.0058	0.0058	0.0059	0.0058	0.0058	0.19	0.0057	0.0058	0.078	0.0078	0.023	0.026	0.0055
Antimony	0.00014	0.0048	0.00010	0.00034	0.000090	0.00029	0.00050	0.000080	0.000050	0.00023	0.00045	0.00031	0.0000090
Arsenic	0.011	0.0069	0.0073	0.0044	0.0078	0.024	0.0052	0.0042	0.0025	0.0021	0.0096	0.012	0.053
Boron	0.069	0.042	0.26	0.18	0.21	0.17	0.025	0.31	0.0050	0.0055	0.014	0.021	0.052
Cadmium	0.000010	0.000010	0.000030	0.000060	0.000030	0.011	0.000030	0.000020	0.000030	0.000030	0.0000050	0.0000050	0.000011
Calcium	57	59	46	50	49	36	76	55	0.95	15	22	25	42
Chromium	0.00050	0.0020	0.00050	0.0022	0.00050	0.0018	0.00050	0.00050	0.00076	0.00025	0.00014	0.00010	0.00010
Cobalt	0.00087	0.0015	0.0014	0.0018	0.0011	0.33	0.0010	0.00064	0.00069	0.00039	0.000028	0.0000090	0.0000050
Copper	0.0010	0.0077	0.0010	0.010	0.0010	0.12	0.0010	0.0010	0.00095	0.0017	0.0011	0.00010	0.00016
Iron	0.0041	0.0040	0.0041	0.0041	0.0041	14	0.0039	0.0041	0.23	0.023	0.0052	0.0010	0.00063
Lead	0.00053	0.00051	0.00045	0.00058	0.00040	0.14	0.00025	0.00087	0.00013	0.00011	0.000025	0.0000050	0.0000030
Magnesium	9.9	5.7	12	6.6	10	16	11	12	0.41	2.3	1.9	3.5	6.6
Manganese	0.092	0.071	0.14	0.11	0.16	1.1	0.31	0.20	2.2	0.19	0.011	0.018	0.22
Mercury	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000030	0.000030	0.000013	0.0000050	0.0000050
Molybdenum	0.0073	0.012	0.0018	0.0036	0.0015	0.00020	0.0020	0.0011	0.000050	0.00059	0.0096	0.016	0.040
Nickel	0.037	0.028	0.022	0.0093	0.020	2.3	0.0038	0.026	0.0014	0.0011	0.00045	0.00076	0.00073
Potassium	18	11	15	9	13	7.8	4.9	13	0.67	0.081	11	32	40
Selenium	0.0014	0.00092	0.00090	0.00090	0.00081	0.0059	0.00050	0.0030	0.00077	0.00051	0.00023	0.00028	0.00017
Silver	0.000070	0.000070	0.000050	0.000070	0.000050	0.000060	0.000050	0.000080	0.000030	0.000030	0.000025	0.0000050	0.0000050
Sodium	33	24	36	26	35	17	23	36	1.4	4.4	43	63	89
Thallium	0.000050	0.00018	0.000050	0.00022	0.000050	0.0012	0.000050	0.000050	0.000050	0.000050	0.000040	0.0000060	0.0000040
Uranium	0.016	0.0086	0.0064	0.0029	0.0065	0.025	0.0025	0.0029	0.000080	0.000060	0.00024	0.00016	0.00023
Zinc	0.0042	0.0040	0.0045	0.0045	0.0040	3.2	0.0025	0.0046	0.0050	0.0050	0.0010	0.010	0.00021

Notes
[1] Upper-case geochemical source terms provided by Lorax (2019).
[2] EOM = end of mining; operations phase.
[3] PC = post-closure phase.
[4] Accounts for depletion of nitrogen species at post-closure.
- Source term not available. The average baseline quality from SW3 was applied as the model input.

Table 8: Geochemical Source Term Inputs (Upper-Case Values)

Parameter	Geochemical Source Terms (mg/L) [1]											
	Pit Wall Runoff		NAG WRSA		PAG WRSA		TMF Embankments	Low-Grade Ore	Topsoil Stockpile	Till Stockpile	Tailings Beach Runoff	Pore Water
	EOM [2]	PC [3]	EOM	PC	EOM	PC	EOM/PC	EOM	EOM/PC	EOM/PC	EOM/PC	PC
Nitrite [4]	0.54	0.00017	0.59	0.14	0.59	0.14	0.30	0.59	-	-	-	-
Nitrate [4]	18	0.0057	26	6.1	26	6.1	9.0	26	-	-	-	-
Ammonia (total) [4]	6.9	0.0022	3.2	0.77	3.2	0.77	0.49	3.2	-	-	-	-
Sulphate	964	801	1370	1095	1189	3013	184	1562	2	68	83	244
Aluminum	0.0058	0.0058	0.0059	0.0058	0.0059	0.21	0.0058	0.0059	0.55	0.10	0.026	0.010
Antimony	0.00030	0.00051	0.00024	0.00036	0.00022	0.00030	0.0010	0.00010	0.000050	0.00054	0.00045	0.00014
Arsenic	0.023	0.0075	0.014	0.0045	0.016	0.025	0.0052	0.0098	0.0070	0.015	0.013	0.11
Boron	0.10	0.058	0.37	0.25	0.30	0.25	0.050	0.49	0.0050	0.017	0.015	0.053
Cadmium	0.000020	0.000020	0.000080	0.000090	0.000070	0.020	0.000070	0.000060	0.000060	0.00029	0.0000050	0.000022
Calcium	50	53	44	47	46	35	99	42	1.1	42	22	44
Chromium	0.0010	0.0021	0.0010	0.0023	0.0010	0.0020	0.0010	0.0010	0.0011	0.00086	0.00015	0.00010
Cobalt	0.0023	0.0020	0.0030	0.0026	0.0025	0.45	0.0022	0.0024	0.00096	0.011	0.000032	0.0000070
Copper	0.0020	0.013	0.0020	0.020	0.0020	0.21	0.0020	0.0020	0.0027	0.0041	0.0014	0.00029
Iron	0.0041	0.0041	0.0042	0.0041	0.0042	63	0.0040	0.0042	0.42	0.18	0.0044	0.0011
Lead	0.0015	0.0016	0.0013	0.0024	0.0012	0.46	0.00050	0.0022	0.00094	0.00052	0.000030	0.0000050
Magnesium	12	6.0	14	7.1	12	17	15	13	0.53	6.5	1.9	7.3
Manganese	0.11	0.090	0.20	0.13	0.21	1.3	0.82	0.22	0.11	0.72	0.012	0.39
Mercury	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000030	0.000030	0.000020	0.0000050
Molybdenum	0.017	0.022	0.0053	0.0074	0.0039	0.00039	0.0022	0.0021	0.000050	0.0065	0.014	0.055
Nickel	0.080	0.042	0.052	0.015	0.048	3.8	0.0078	0.043	0.0017	0.020	0.00050	0.0012
Potassium	23	11	19	9.5	16	7.9	6.9	19	1.4	1.3	14	45
Selenium	0.0024	0.0010	0.0022	0.00095	0.0017	0.0063	0.0010	0.0044	0.00096	0.00091	0.00033	0.00031
Silver	0.000070	0.000070	0.000080	0.000080	0.000070	0.000070	0.00010	0.000080	0.000030	0.000030	0.000025	0.0000050
Sodium	46	25	50	27	48	34	26	54	2.1	6.2	54	92
Thallium	0.00010	0.00022	0.00010	0.00027	0.00010	0.0014	0.00010	0.00010	0.000050	0.000090	0.0000050	0.0000060
Uranium	0.021	0.013	0.0089	0.0045	0.0089	0.039	0.0076	0.0037	0.00010	0.00075	0.00025	0.00025
Zinc	0.0043	0.0043	0.0046	0.0047	0.0041	3.4	0.0050	0.0048	0.0099	0.014	0.0010	0.00028

Notes
[1] Upper-case geochemical source terms provided by Lorax (2019).
[2] EOM = end of mining; operations phase.
[3] PC = post-closure phase.
[4] Accounts for depletion of nitrogen species at post-closure.
- Source term not available. The average baseline quality from SW3 was applied as the model input.

The source terms were applied in conjunction with the site water management plan flows to derive the mass loads from the Project site components. Table 7 summarizes the source terms applied to the various Project site components for the operations and post-closure phase water quality models.

Table 9: Source Terms Applied to Project Site Components.

Project Site Component	Source Term Applied
Runoff from NAG WRSA (operations and post-closure)	NAG WRSA
Seepage from NAG WRSA (operations and post-closure)	NAG WRSA
Runoff from PAG WRSA (operations)	PAG WRSA
Runoff from covered PAG WRSA (post-closure)	Average of Topsoil Stockpile and Till Stockpile
Seepage from PAG WRSA (operations and post-closure)	PAG WRSA
Runoff from Till Stockpile (operations)	Till Stockpile
Runoff from Topsoil Stockpile (operations)	Topsoil Stockpile
Runoff from LGO Stockpile (operations)	LGO Stockpile
Runoff from the walls of the open pit (operations and closure)	Pit Wall Runoff
Seepage from the TMF (operations)	Process Water
Seepage from the TMF (post-closure)	Pore Water
Runoff from the TMF embankments (operations and post-closure)	TMF Embankments
Runoff from tailings beach (operations)	Tailings Beach
Runoff from covered tailings beach (post-closure)	Average of Topsoil Stockpile and Till Stockpile

2.5 Water Quality Comparison Criteria

Effluent discharges from the site will be required to adhere to the MDMER maximum allowable concentration limits. For the purposes of comparison and evaluating the overall Project site water quality, the predicted water qualities of the Project site components presented in Section 3 are compared to the MDMER maximum allowable monthly mean concentration.

The surface water quality predictions for the receiving environment presented in Section 3, are compared to the following federal and provincial criteria:

- Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQGs)
- Nova Scotia Environmental Quality Standards (NSEQS) for Contaminated Sites (Tier 1) for Surface Water (Fresh Water)
- Environment Canada Federal Environmental Quality Guideline (FEQG) for cobalt

In addition to the guidelines above, a site-specific water quality objective (SSWQO) for arsenic of 0.03 mg/L has been developed as an aquatic risk-based comparator (Intrinsik 2019).

The surface water quality predictions are also compared to the 95th percentile baseline concentrations from the available dataset for each model assessment point.

2.6 Key Model Limitations and Assumptions

Detailed assumptions that govern the model are presented throughout the text. A number of limitations and assumptions inherent to the model, in general, are described below. General limitations to the model include:

- Changes to operational Project or site conditions – The Project Description (see EIS Report) and inputs, as discussed in this document, are the basis for the water quality models. Changes in Project scope or design details will necessarily result in changes to water quality predictions. The models are limited in their ability to forecast operational conditions, due to the dynamic nature of developments in a project of this nature, and potential short-term changes to site conditions; as such, the purpose of the water quality modelling is to assist with planning at the Environmental Assessment stage of the Project.
- Changes to post-closure site conditions – Several assumptions were made with respect to the water quality and flows at the Project site during the post-closure phase. These assumptions are based on the conceptual rehabilitation plan (McCallum 2019) and may change with changes to operational Project or site conditions.
- System complexity – Known processes were incorporate, as understood, during model development; however, it should be noted that, in natural systems and complex man-made systems, observed conditions will vary with respect to predicted conditions.
- Limitation of baseline data – Surface water quality data used for natural runoff water quality and receiver baseline quality is based upon eight sample events. Groundwater monitoring wells have been sampled four times since installation. The water quality inputs are based on existing monitoring and laboratory data and may change as operational monitoring is conducted.

3.0 MODEL RESULTS

3.1 Treated Effluent Discharge Location Alternatives

Two surface water bodies were assessed for the receiver of treated (if required) effluent from the site (i.e., receivers of discharge from the water treatment plant): Seloam Lake and Anti Dam Flowage. The specific assessment points are referred to as EMZ-1 and EMZ-2 for each of Seloam Lake and Anti Dam Flowage, respectively – see Table 1 and Figure 2. The assessment points are located 100 m downstream of the two proposed treated effluent discharge locations – that is, the effects assessment assumes a 100 m mixing zone, located downstream of the effluent outfall (or ‘end-of-pipe’) location. The “EMZ” in the assessment location IDs, refers to the “End of Mixing Zone”. The 100 m length of the mixing zone is consistent with the approach taken for other projects in Nova Scotia, such as the Touquoy and Beaver Dam Projects. The objective of the mixing zone is to meet the CCME CWQGs, NSEQSs, FWQG, SSWQO, or 95th percentile baseline concentration (as applicable) at the downstream end of the mixing zone (EMZ-1 or EMZ-2).

The treated effluent discharge alternatives analysis consisted of determining the assimilative capacity of the two potential receivers. For the purposes of this study, the assimilative capacity is defined here as the limit of the surface water receiver to incorporate treated effluent, to the point that the concentrations in the surface water receiver do not increase to levels above the CCME CWQGs, NSEQSs, FWQG, SSWQO, or 95th percentile baseline concentration (as applicable). As discussed in Section 2.4.2, the modelling approach implemented a stochastic method to simulate a range of probabilistic flow conditions over a 56-year climate record. Therefore, the simulations of the assimilative capacity of the two receivers considered the range of flow conditions observed over the 56-year climate record. The assimilative capacity of the two potential receivers for the average, 5th and 95th percentile flow, is presented for key parameters in Figure 5. In this case, the assimilative capacity is represented as a mass loading rate, or as the upper limit of additional mass that can be added to the system before exceeding the CCME CWQGs, NSEQSs, FWQG, SSWQO, or 95th percentile baseline concentration (as applicable) at a point 100 m downstream of the effluent outfall (i.e., end of the mixing zone).

Based on the results of the numerical modelling, the assimilative capacity is greater at Anti Dam Flowage than Seloam Lake. Anti Dam Flowage is located further downstream in the watershed, as compared to Seloam Lake, and therefore, the higher assimilative capacity reflects the larger catchment area that reports to Anti Dam Flowage.

Anti Dam Flowage is the preferred option for discharge of treated effluent, and this option has been carried forward into the effects assessment, including discussion on residual effects and significance in the EIS. No further discussion of potential effects to Seloam Lake is presented in the EIS.

3.2 Project Site Components

3.2.1 Tailings Management Pond Effluent

In the water quality model for the operations phase, the predicted TMF pond effluent quality was used as the model input for the effluent discharge to Anti Dam Flowage. The predicted TMF pond effluent quality (using both base case and upper-case geochemical source terms) is presented in Appendix A (Table A-1) and compared to the MDMER maximum monthly mean concentrations for new mines. The TMF pond effluent concentrations using base and upper-case source terms, are predicted to be lower than the MDMERs for all parameters.

3.2.2 Tailings Management Facility Seepage

The water quality model for the operations phase assumed that seepage from the TMF is represented by the geochemical source term for process water (Table 4 and Table 5). The TMF seepage concentrations using both base and upper-case source terms, are predicted to be lower than the MDMERs for all parameters.

The water quality model for the post-closure stage of the closure phase also assumed that some seepage that exits from the TMF at perimeter locations will bypass the perimeter seepage collection system and enter the adjacent surface water environment (SW5 and SW15 catchments). The quality of the TMF seepage is assumed to be represented by the base case and upper-case geochemical source term for tailings pore water (Table 4 and Table 5, respectively). The TMF seepage concentrations are predicted to be lower than the MDMERs for all parameters.

3.2.3 Topsoil Drainage

The site water management plan and the water quality model for the operations phase assumes that drainage from the topsoil stockpile will report directly to the environment. The quality of the drainage from the topsoil stockpile is assumed to be represented by the geochemical source term for the stockpile (Table 4 and 5). The topsoil stockpile drainage concentrations using both base and upper-case source terms, are predicted to be lower than the MDMERs for all parameters.

3.2.4 Flooded Open Pit

During the post-closure stage of the closure phase, the surplus in the flooded open pit will be discharged (after treatment, if required) to Anti Dam Flowage.

The predicted quality of the flooded open pit effluent is presented in Appendix A (Table A-2). The predicted open pit effluent concentrations (using both base case and upper-case geochemical source terms) are predicted to be lower than the MDMERs for all parameters.

3.3 Surface Water Receiving Environment

Predicted effects on receiving environment surface water quality for the average, 5^{th} percentile and 95^{th} percentile flow were simulated by the operations phase and post-closure phase water quality models at SW5, SW15, EMZ-2, and SW6 for the Anti Dam Flowage effluent discharge location option. Predicted annual concentrations of these parameters (average, 5^{th} percentile and 95^{th} percentile) in the receiving surface water environment, using both base and upper-case geochemical source terms, are presented in Appendix B (Table B-1 through B-4) and compared to the 95^{th} percentile baseline concentrations and the CCME CWQGs, NSEQSs, FEQG, and SSWQO, as applicable.

In addition to the annual average statistical summary, predicted monthly concentrations (average, 5^{th} percentile and 95^{th} percentile) are presented graphically in Appendix B (Figures B-1 through B-88).

A discussion of the water quality predictions with respect to Project effects, is presented in the EIS.

3.4 Sensitivity Analysis

A sensitivity analysis was conducted to evaluate the potential effects of misclassified PAG waste rock being placed in the NAG WRSA or being used for construction material in the TMF embankment. The sensitivity analysis simulated four scenarios as described below:

- 1% PAG waste rock placed in the NAG WRSA
- 2% PAG waste rock placed in the NAG WRSA
- 1% PAG waste rock placed in the TMF embankment
- 2% PAG waste rock placed in the TMF embankment

Due to the fine interbedding of the PAG (mostly argillite) and NAG (mostly greywacke), it can be assumed that PAG material erroneously deposited with “NAG blasts” are intimately mixed, thereby reducing the potential for localized PAG hotpots. Larger zones/thicknesses of PAG rock are assumed to be effectively segregated and stored in the PAG WRSA. An inclusion of 1% and 2% PAG waste rock in the NAG WRSA corresponds to 4% and 8%, respectively, of the total PAG inventory being misclassified as NAG, based on the relative tonnages in the geologic model. For the purposes of a sensitivity analysis these scenarios are modelled; however, a rigorous operational monitoring program will be implemented into the mine plan to minimize the amount of PAG rock being placed in the NAG WRSA or used for construction and misclassification of this degree is considered unlikely and these simulations are considered to be conservative.

3.4.1 Inputs

The sensitivity analysis was completed by revising the geochemical source terms assigned to the NAG WRSA and TMF embankments as described below. The water balance and other source term inputs as described in Section 2.4 were unchanged. Only the post-closure phase was modelled, as the waste rock is not expected to generate acid during the period of operations.

Revised source terms for the sensitivity analysis were provided by Lorax for the post-closure phase of the Project and are summarized in Table 10 (base case) and Table 11 (upper-case) (Lorax, pers. comm., 2019). As described in Section 2.4.6, the base case source terms are based on the median results from applicable humidity cell testing data, while the upper-case source terms are based on the 90th percentile. The source terms are derived from modelling of the NAG WRSA; for the purposes of the sensitivity analysis these source terms are also applied to the TMF embankments. This assumption is considered reasonable as monitoring data from AMNS' Touquoy mine site indicates that the WRSA and TMF embankment drainage are similar in chemistry.

Table 10: Geochemical Source Term Inputs (Base Case values)

Parameter	Geochemical Source Terms (mg/L) (1)	
	1% PAG (2)	2% PAG (3)
Aluminum	0.0058	0.0058
Antimony	0.0034	0.0030
Arsenic	0.0046	0.0047
Boron	0.18	0.18
Cadmium	0.00029	0.00029
Calcium	50	49
Chromium	0.0010	0.0010
Cobalt	0.0090	0.016
Copper	0.0028	0.0028
Iron	0.0041	0.0041
Lead	0.0022	0.0022
Magnesium	6.7	6.9
Manganese	0.11	0.12
Mercury	0.000012	0.000012

Parameter	Geochemical Source Terms (mg/L) [1]	
	1% PAG [2]	2% PAG [3]
Molybdenum	0.0036	0.0035
Nickel	0.052	0.10
Potassium	9.3	9.3
Selenium	0.0010	0.0010
Silver	0.000070	0.000070
Sodium	26	28
Sulphate	929	957
Thallium	0.00010	0.00010
Uranium	0.0031	0.0033
Zinc	0.052	0.075

Notes
[1] Base-case geochemical source terms for post-closure phase provided by Lorax (pers. comm., 2019).
[2] Source term represents the inclusion of 1% PAG waste rock in the NAG WRSA.
[3] Source term represents the inclusion of 2% PAG waste rock in the NAG WRSA.

Table 11: Geochemical Source Term Inputs (Upper-Case Values)

Parameter	Geochemical Source Terms (mg/L) [1]	
	1% PAG [2]	2% PAG [3]
Aluminum	0.0059	0.0059
Antimony	0.00036	0.00040
Arsenic	0.0047	0.0049
Boron	0.25	0.25
Cadmium	0.00047	0.00058
Calcium	46	46
Chromium	0.0020	0.0020
Cobalt	0.013	0.023
Copper	0.0056	0.0056
Iron	0.0041	0.0041
Lead	0.0044	0.0044
Magnesium	7.2	7.4

Parameter	Geochemical Source Terms (mg/L) [1]	
	1% PAG [2]	2% PAG [3]
Manganese	0.14	0.15
Mercury	0.000012	0.000012
Molybdenum	0.0073	0.0071
Nickel	0.089	0.16
Potassium	9.5	9.5
Selenium	0.0010	0.0011
Silver	0.000080	0.000080
Sodium	28	29
Sulphate	1127	1158
Thallium	0.00020	0.00020
Uranium	0.0048	0.0050
Zinc	0.054	0.10

Notes
[1] Upper-case geochemical source terms for post-closure phase provided by Lorax (pers. comm. 2019).
[2] Source term represents the inclusion of 1% PAG waste rock in the NAG WRSA.
[3] Source term represents the inclusion of 2% PAG waste rock in the NAG WRSA.

3.4.2 Sensitivity Analysis Results – Project Site Components

During the post-closure stage of the closure phase, the surplus in the flooded open pit will be discharged (after treatment, if required) to Anti Dam Flowage.

The predicted quality of the flooded open pit effluent for the four scenarios simulated in the sensitivity analysis is presented in Appendix C (Tables C-1 and C-2). The predicted open pit effluent concentrations (using both base case and upper-case geochemical source terms) are predicted to be lower than the MDMERs for all parameters.

3.4.3 Sensitivity Analysis Results – Receiving Water Environment

Predicted effects on receiving environment surface water quality for the average, 5th percentile and 95th percentile flow were simulated by the post-closure phase sensitivity analysis water quality model at SW5, SW15, EMZ-2, and SW6 for the Anti Dam Flowage effluent discharge location option. Predicted annual concentrations of these parameters (average, 5th percentile and 95th percentile) in the receiving surface water environment, using both base and upper-case geochemical source terms, are presented in Appendix C (Table C-3 through C-10) and compared to the 95th percentile baseline concentrations and the CCME CWQGs, NSEQSs, FEQG, and SSWQO, as applicable.

In addition to the annual average statistical summary, predicted monthly concentrations (average, 5th percentile and 95th percentile) are presented graphically in Appendix C (Figures C-1 through C-176).

For key parameters (i.e., parameters for which the predicted receiver concentration is greater than the applicable water quality criteria), complementary cumulative distribution function plots for the annual model results (12,000 data points representing 1000 model realizations per month) are presented in Appendix C (Figures C-177 through C-184). Also shown on the curves are the calculated monthly 95th percentile concentrations which are greater than the applicable water quality guideline; this illustrates the low frequency of guideline exceedances.

A discussion of the water quality predictions with respect to Project effects, is presented in the EIS.

4.0 REPORT USE LIMITATIONS

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5.0 REFERENCES

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Signature Page

Golder Associates Ltd.

Signature:

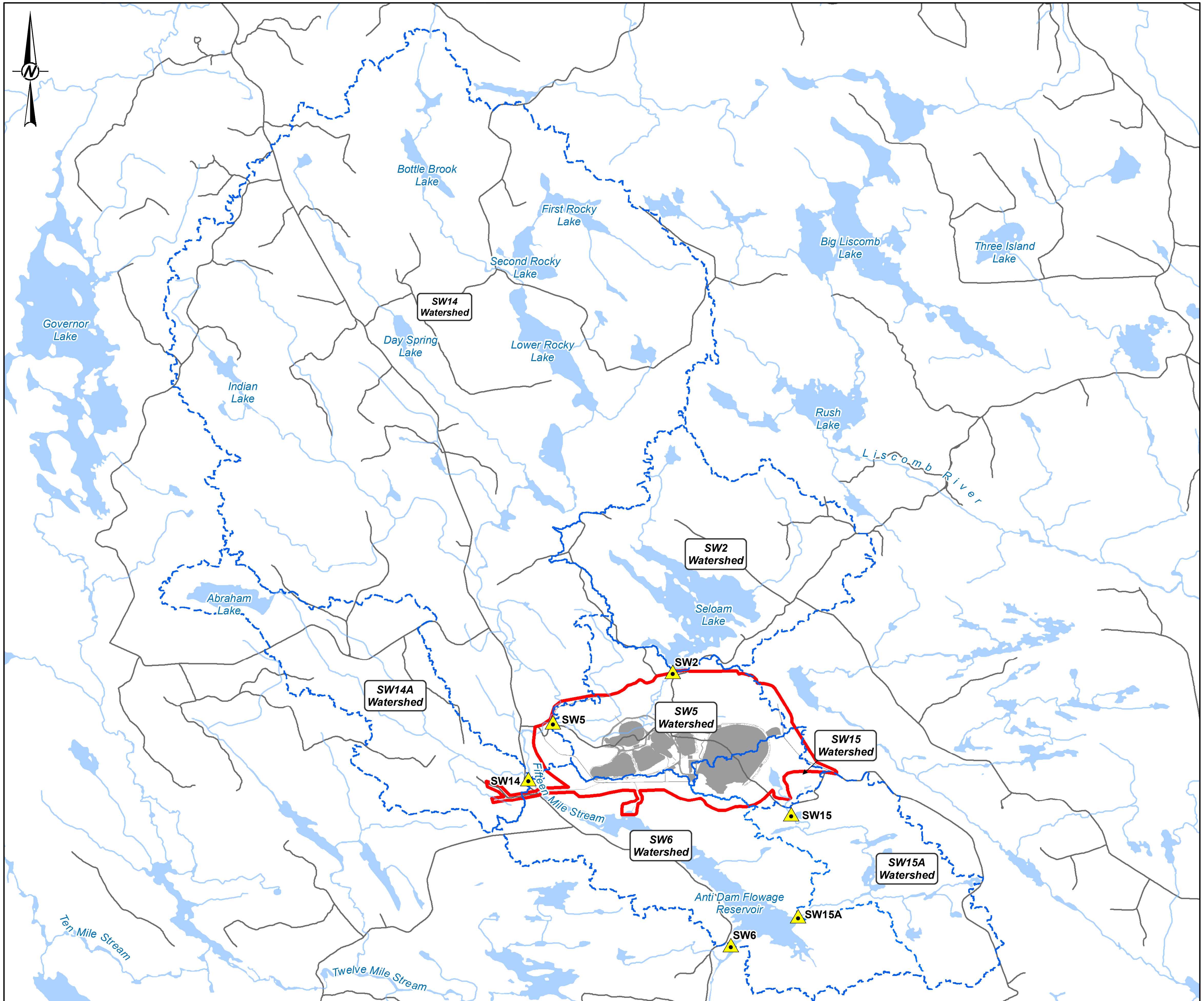
Date: September 14, 2020

Natalie Korczak, M.Sc., P.Geo.
Geochemist

David Brown, M.Sc.
Principal

NK/BT/SK/DB/ca/sm

https://golderassociates.sharepoint.com/sites/23819g/deliverables/1895674-026-r-surface wq model fms/rev 2/1895674-026-r-rev2-surface wq model fms 14sep_2020.docx



LEGEND

- Hydrological Modeling Location
- Roads
- Watercourse
- Waterbody
- Watersheds
- Proposed Infrastructure
- Fifteen Mile Stream Study Area

0 1,300 2,600
1:80,000 METRES

NOTE(S)
1. MCCALLUM ENVIRONMENTAL LTD. EIS PROJECT AREA, (VER.190313, RECEIVED 2019-03-18).
2. MCCALLUM ENVIRONMENTAL LTD. PROPOSED INFRASTRUCTURE, (VER.190620, RECEIVED 2019-06-28).

REFERENCE(S)
BASE MAP DATA: ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

PROJECT
SURFACE WATER QUALITY MODELLING ASSESSMENT
FIFTEEN MILE STREAM GOLD PROJECT

TITLE
LOCAL WATERSHEDS AND HYDROLOGICAL MONITORING

CONSULTANT

YYYY-MM-DD	2019-09-18
DESIGNED	---
PREPARED	RRD
REVIEWED	NK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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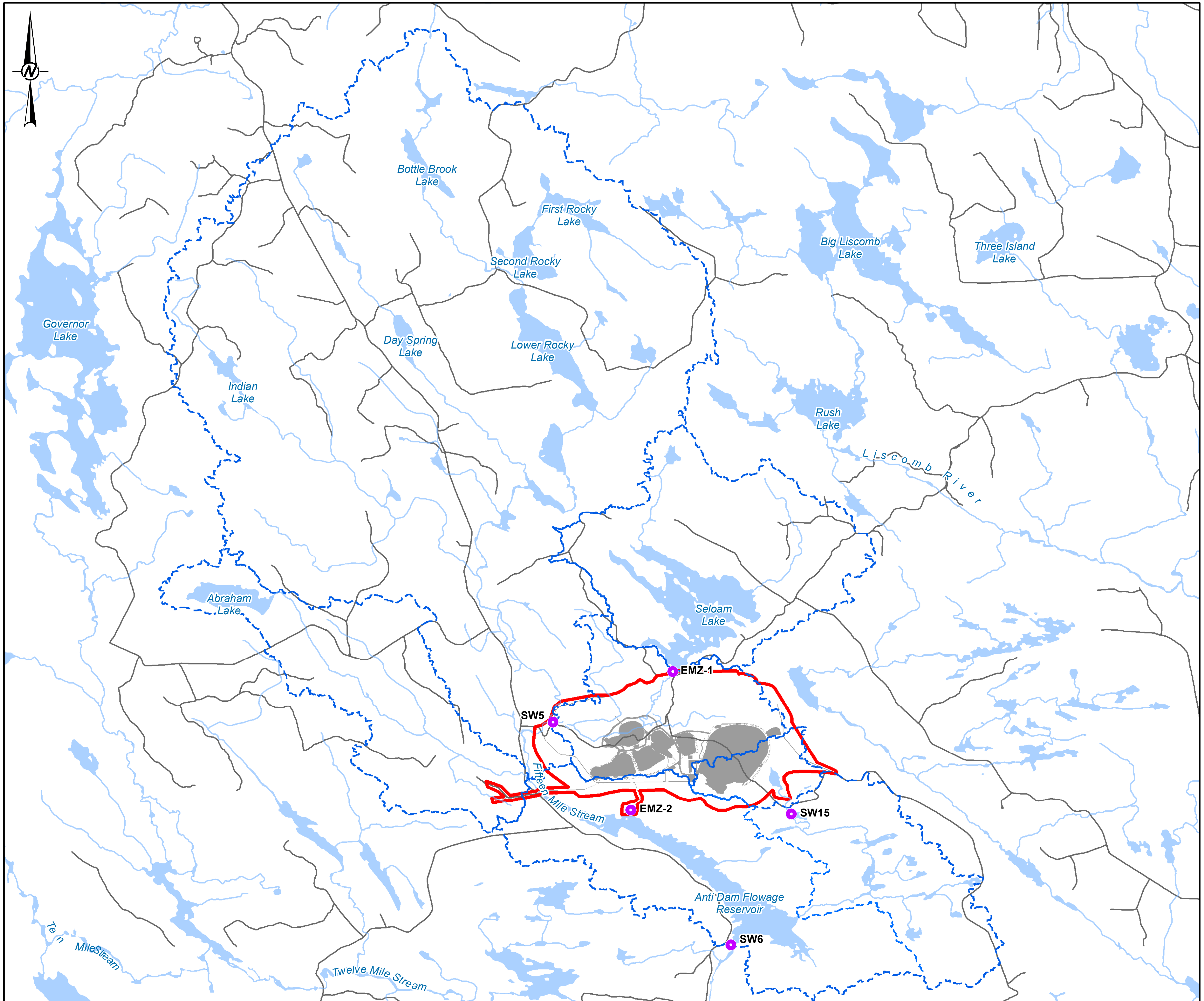

LEGEND

- Water Quality Model Assessment Locations
- Roads
- Watercourse
- Waterbody
- Watersheds
- Proposed Infrastructure
- Fifteen Mile Stream Study Area

0 1,300 2,600

1:80,000 METRES

NOTE(S)

1. MCCALLUM ENVIRONMENTAL LTD. EIS PROJECT AREA, (VER.190313, RECEIVED 2019-03-18).
2. MCCALLUM ENVIRONMENTAL LTD. PROPOSED INFRASTRUCTURE, (VER.190620, RECEIVED 2019-06-28).

REFERENCE(S)

BASE MAP DATA: ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

Atlantic Gold

PROJECT
SURFACE WATER QUALITY MODELLING ASSESSMENT
FIFTEEN MILE STREAM GOLD PROJECT

TITLE
WATER QUALITY MODEL ASSESSMENT LOCATIONS

CONSULTANT

GOLDER

YYYY-MM-DD	2019-09-18
DESIGNED	---
PREPARED	RRD
REVIEWED	NK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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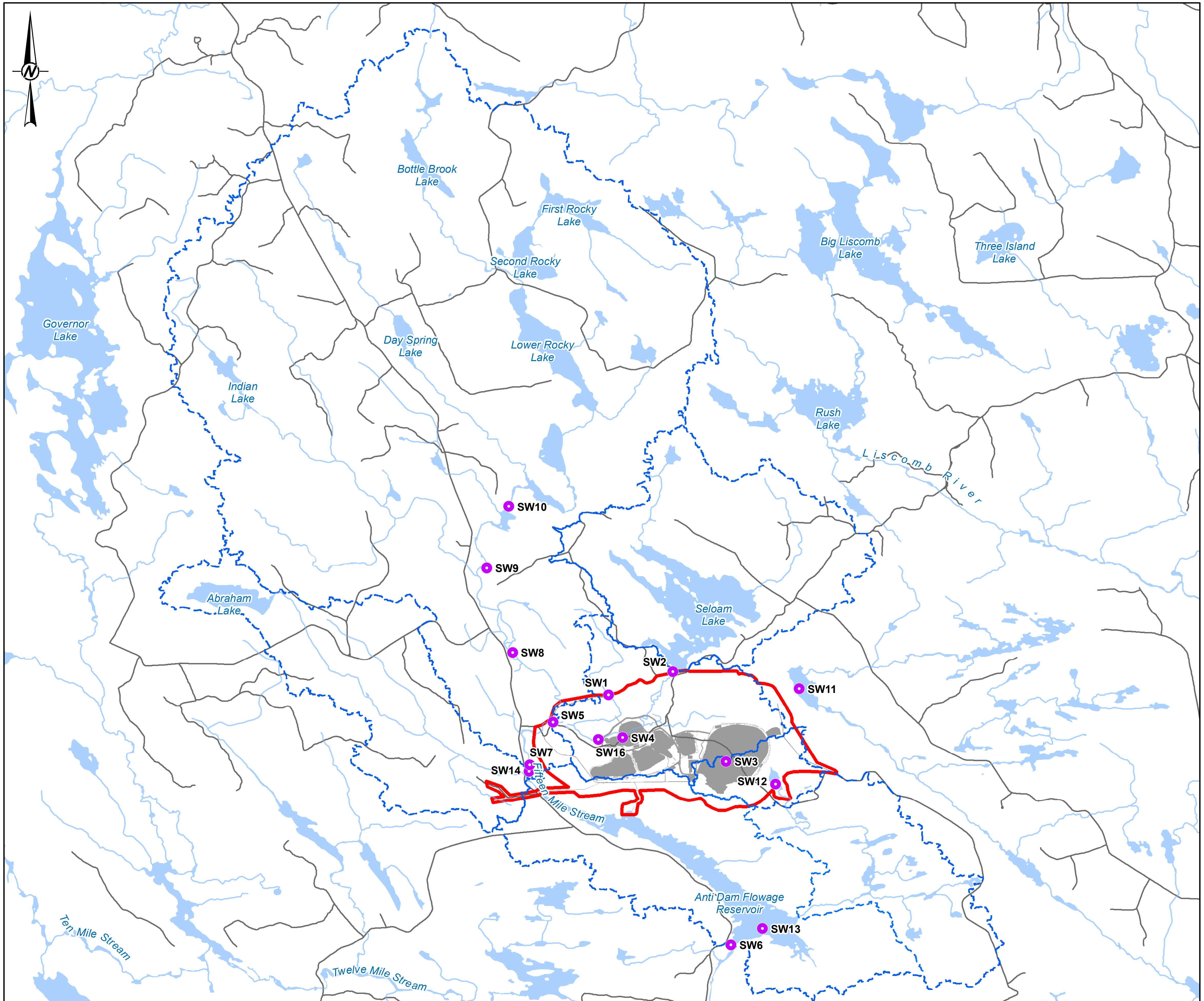

LEGEND

- Water Quality Model Assessment Locations
- Roads
- Watercourse
- Waterbody
- Watersheds
- Proposed Infrastructure
- Fifteen Mile Stream Study Area

0 1,300 2,600

1:80,000 METRES

NOTE(S)

1. MCCALLUM ENVIRONMENTAL LTD. EIS PROJECT AREA, (VER.190313, RECEIVED 2019-03-18).
2. MCCALLUM ENVIRONMENTAL LTD. PROPOSED INFRASTRUCTURE, (VER.190620, RECEIVED 2019-06-28).

REFERENCE(S)

BASE MAP DATA: ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP
Atlantic Gold

PROJECT
SURFACE WATER QUALITY MODELLING ASSESSMENT
FIFTEEN MILE STREAM GOLD PROJECT

TITLE
SURFACE WATER QUALITY BASELINE MONITORING LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-18
DESIGNED	---
PREPARED	RRD
REVIEWED	NK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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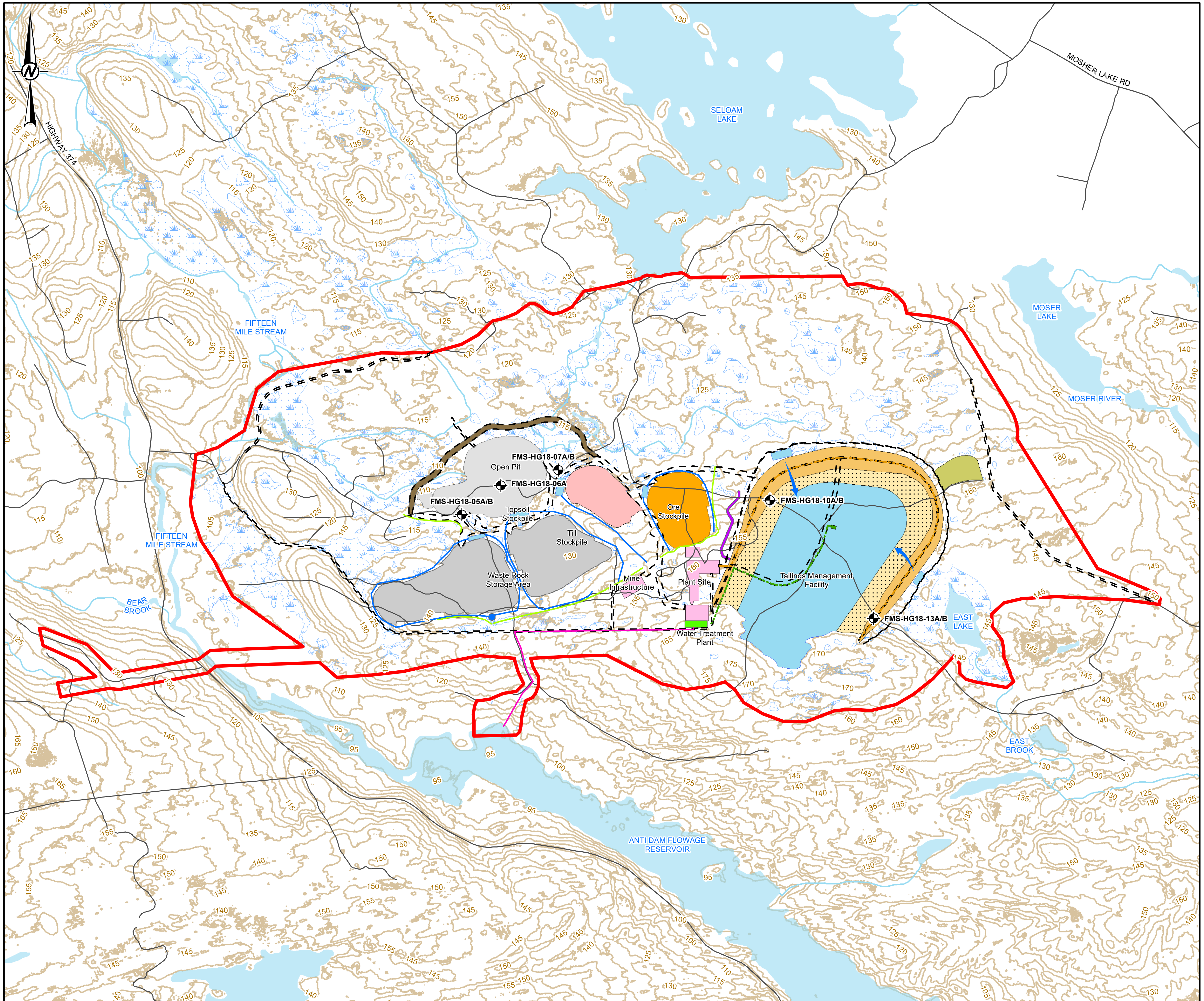


LEGEND

- Hydrogeological Drilling Location
- Fifteen Mile Stream EIS Project Area
- Existing Road
- Topographic Contour (5m Interval)
- Access Road
- Watercourse
- Wetland
- Waterbody

PROPOSED SITE INFRASTRUCTURE

- Diversion Dam
- Embankment
- Open Pit
- Ore Stockpile
- Plant Site
- Pond; Collection Ponds
- Reclaim Barge
- Runoff Collection Sump
- Spillway Outlet Channel
- Tailings
- Till Stockpile
- Topsoil Stockpile
- Waste Rock Storage Area
- Water Treatment Plant
- Tailings Pipeline
- Collection Ditch
- Reclaim Pipeline
- Non-Contact Water Ditch
- Water Treatment Pipeline

0 430 860
1:25,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. MCCALLUM ENVIRONMENTAL LTD. EIS PROJECT AREA, (VER.190313, RECEIVED 2019-03-18).
2. MCCALLUM ENVIRONMENTAL LTD. PROPOSED INFRASTRUCTURE, (VER.190620, RECEIVED 2019-06-28).
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP
Atlantic Gold

PROJECT
SURFACE WATER QUALITY MODELLING ASSESSMENT
FIFTEEN MILE STREAM GOLD PROJECT

TITLE
HYDROGEOLOGICAL DRILLING LOCATIONS USED FOR WATER QUALITY MODEL INPUTS

CONSULTANT
GOLDER

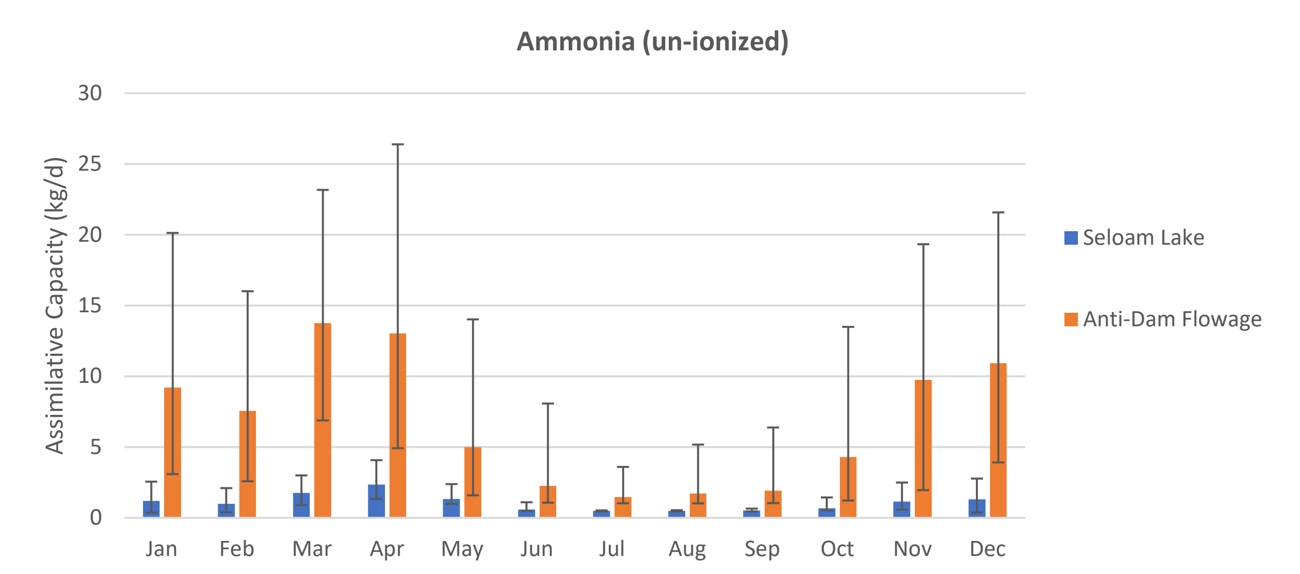
YYYY-MM-DD	2019-09-18
DESIGNED	--
PREPARED	RRD
REVIEWED	NK
APPROVED	--

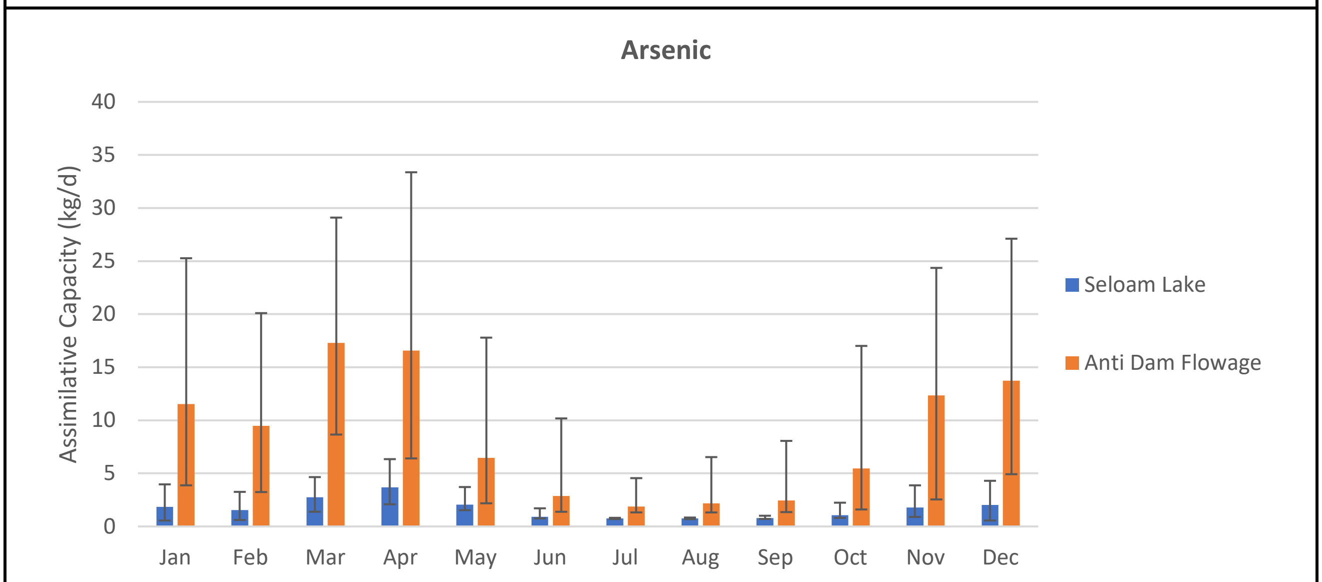
PROJECT NO.	CONTROL	REV.	FIGURE
1895674	0026	0	4

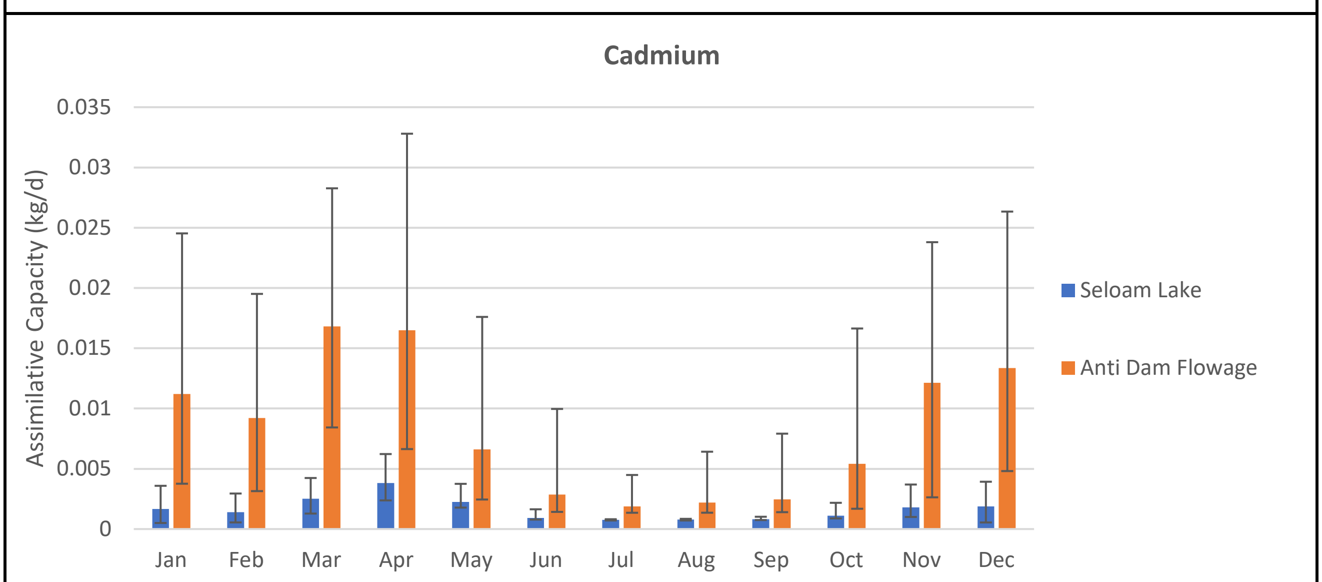
FIGURE 5

ASSIMILATIVE CAPACITY COMPARISON - SELOAM LAKE AND ANTI-DAM FLOWAGE RESERVOIR

FIFTEEN MILE STREAM PROJECT





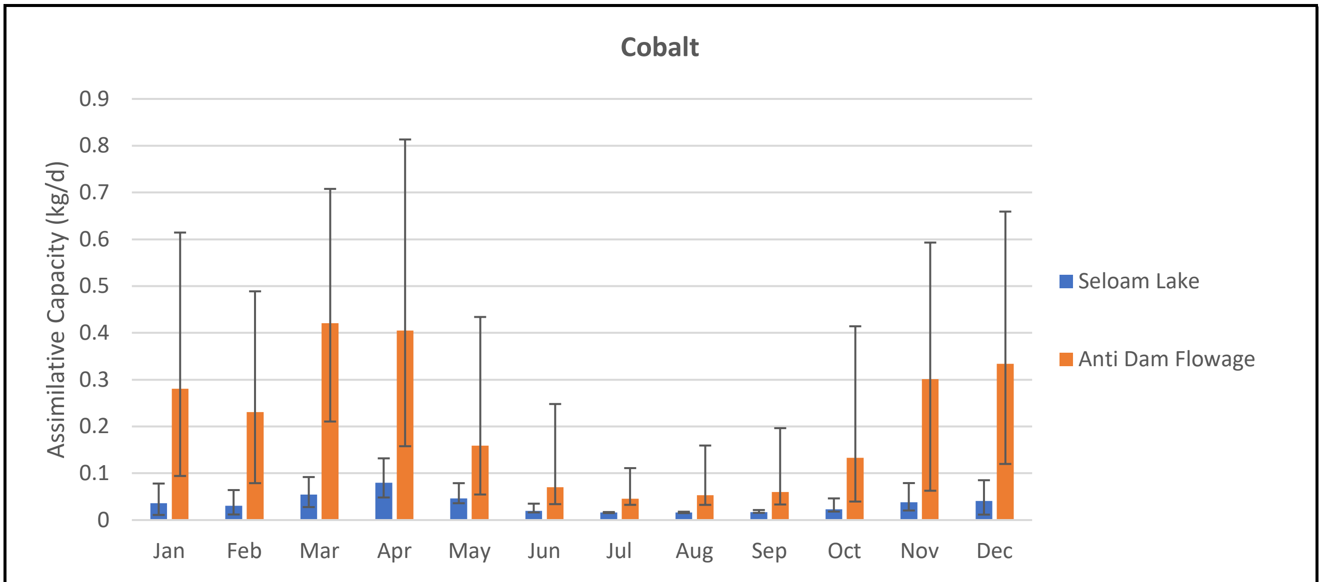


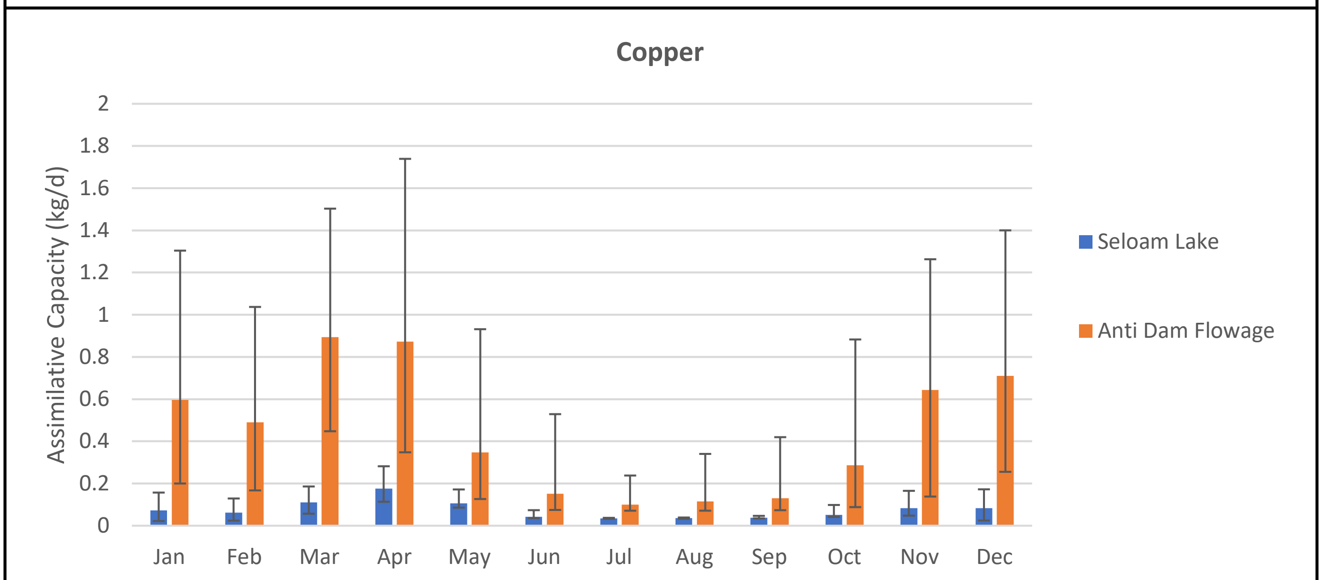
Note: vertical bars represent the 5th percentile and 95th percentile.

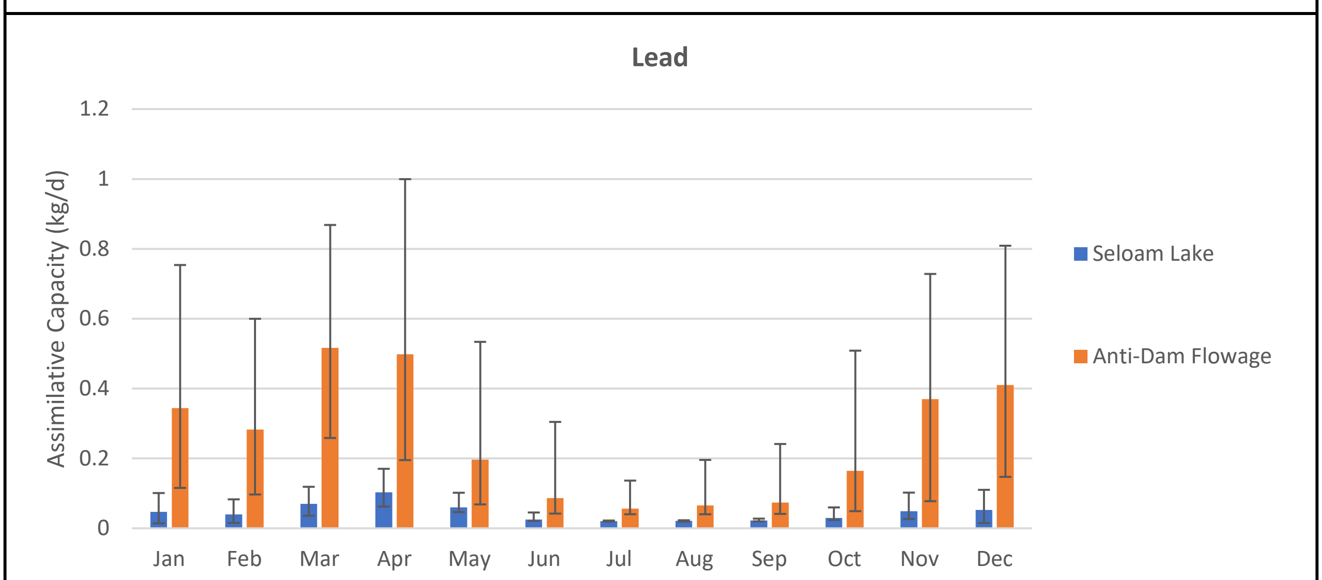
FIGURE 5

ASSIMILATIVE CAPACITY COMPARISON - SELOAM LAKE AND ANTI-DAM FLOWAGE RESERVOIR

FIFTEEN MILE STREAM PROJECT



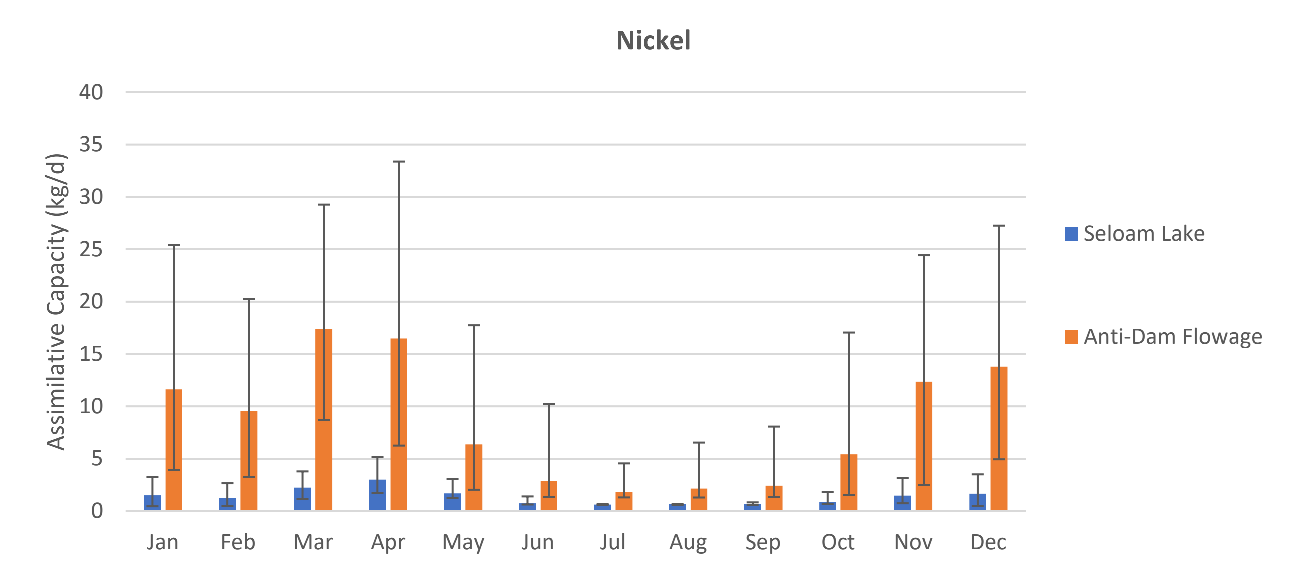


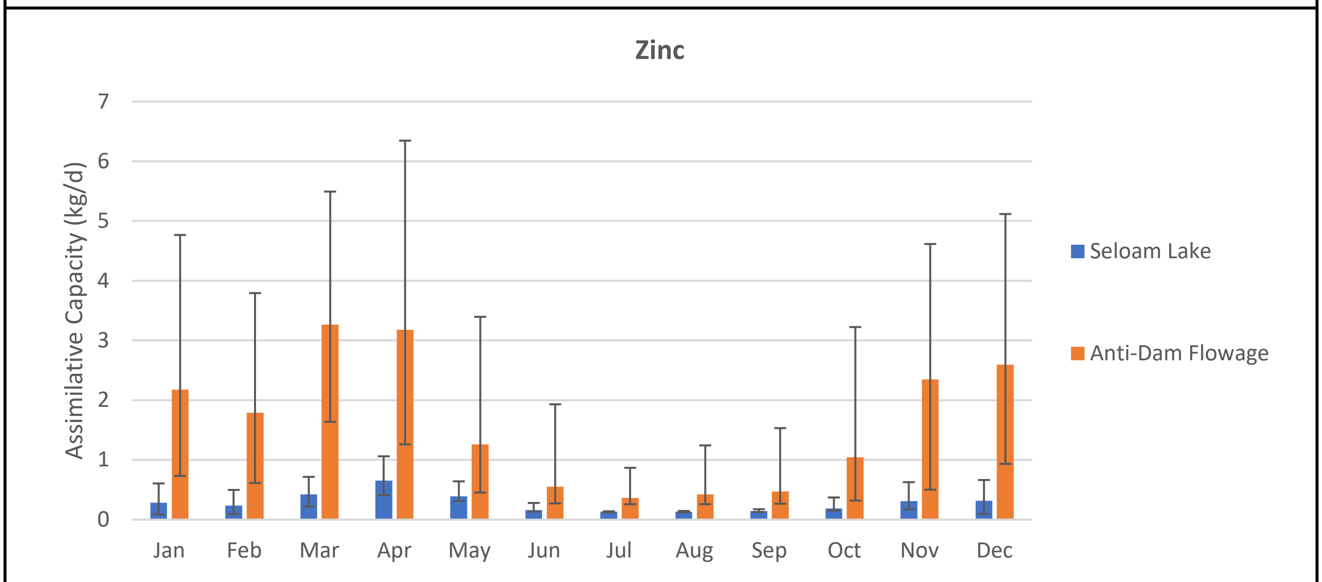


Note: vertical bars represent the 5th percentile and 95th percentile.

FIGURE 5

ASSIMILATIVE CAPACITY COMPARISON - SELOAM LAKE AND ANTI-DAM FLOWAGE RESERVOIR
FIFTEEN MILE STREAM PROJECT





Note: vertical bars represent the 5th percentile and 95th percentile.

APPENDIX A

Water Quality Modelling Results - Project Site Components

TABLE A-1: WATER QUALITY MODEL RESULTS, OPERATIONS PHASE - PREDICTED TAILINGS MANAGEMENT FACILITY POND EFFLUENT QUALITY

Parameter	MDMER (mg/L) (1)	Tailings Management Facility Pond Effluent Concentration (mg/L) (2)	
		Base Case (3)	Upper Case (4)
Aluminum	-	0.028	0.031
Ammonia (total)	-	0.31	0.82
Ammonia (un-ionized) (5)	0.5	0.00012	0.00033
Antimony	-	0.00032	0.00038
Arsenic	0.1	0.0081	0.010
Boron	-	0.047	0.064
Cadmium	-	0.000011	0.000025
Calcium	-	25	26
Chromium	-	0.00033	0.00046
Cobalt	-	0.00035	0.00093
Copper	0.1	0.00055	0.00085
Iron	-	0.078	0.081
Lead	0.08	0.00015	0.00033
Magnesium	-	4.1	4.8
Manganese	-	0.066	0.11
Mercury	-	0.0000071	0.0000074
Molybdenum	-	0.0080	0.0092
Nickel	0.25	0.0054	0.012
Nitrate	-	2.4	4.6
Nitrite	-	0.058	0.12
Potassium	-	17	18
Selenium	-	0.00046	0.00069
Silver	-	0.000027	0.000033
Sodium	-	36	39
Sulphate	-	228	278
Thallium	-	0.000025	0.000038
Uranium	-	0.0018	0.0027
Zinc	0.4	0.0058	0.0062

Notes:

0.1 − Denotes a value that is greater than (or outside of the range of) the applicable MDMER effluent limits.

(1) Maximum monthly mean concentrations for new mines, as per the Metal and Diamond Mining Effluent Regulations (MDMER), Canada Fisheries Act. 2018.

(2) The effluent concentration in the TMF pond was calculated based on the site water balance (Knight Piesold 2019) and the base case and upper case geochemical source terms (Lorax 2019).

(3) TMF pond effluent concentration predicted using base case geochemical source terms provided by Lorax (2019).

(4) TMF pond effluent concentration predicted using upper case geochemical source terms provided by Lorax (2019).

(5) For the purposes of comparing effluent quality to MDMER, a temperature of 20°C and a pH of 6 was assumed for calculation of un-ionized ammonia. Receiver un-ionized ammonia is predicted in the GoldSim model for each timestep based on effluent total ammonia concentrations and seasonal field pH and field temperature.

TABLE A-2: WATER QUALITY MODEL RESULTS, POST-CLOSURE PHASE - PREDICTED OPEN PIT EFFLUENT QUALITY

Parameter	MDMER (mg/L) (1)	Open Pit Effluent Concentration (mg/L) (2)	
		Base Case (3)	Upper Case (4)
Aluminum		0.036	0.14
Ammonia (total)		0.073	0.11
Ammonia (un-ionized)	0.5	0.000029	0.000043
Antimony		0.00029	0.00040
Arsenic	0.1	0.0055	0.012
Boron		0.029	0.040
Cadmium		0.00013	0.00028
Calcium		17	25
Chromium		0.00065	0.00092
Cobalt		0.0037	0.0075
Copper	0.1	0.0030	0.0056
Iron		0.25	0.79
Lead	0.08	0.0015	0.0050
Magnesium		2.6	4.0
Manganese		0.13	0.31
Mercury		0.000016	0.000016
Molybdenum		0.0030	0.0056
Nickel	0.25	0.024	0.044
Nitrate		0.37	0.64
Nitrite		0.011	0.017
Potassium		3.7	4.4
Selenium		0.00057	0.00075
Silver		0.000037	0.000042
Sodium		11	12
Sulphate		134	171
Thallium		0.000068	0.000089
Uranium		0.00085	0.0017
Zinc	0.4	0.034	0.039

Notes:

0.1 − Denotes a value that is greater than (or outside of the range of) the applicable MDMER effluent limits.

(1) Maximum monthly mean concentrations for new mines, as per the Metal and Diamond Mining Effluent Regulations (MDMER), Canada Fisheries Act. 2018.

(2) The effluent concentration in the flooded open pit was calculated based on the site water balance (Knight Piesold 2019) and the base case and upper case geochemical source terms (Lorax 2019).

(3) Open pit effluent concentration predicted using base case geochemical source terms provided by Lorax (2019).

(4) Open pit effluent concentration predicted using upper case geochemical source terms provided by Lorax (2019).

(5) For the purposes of comparing effluent quality to MDMER, a temperature of 20°C and a pH of 6 was assumed for calculation of un-ionized ammonia. Receiver un-ionized ammonia is predicted in the GoldSim model for each timestep based on effluent total ammonia concentrations and seasonal field pH and field temperature.

APPENDIX B

Water Quality Modelling Results - Receivers

TABLE B-1: WATER QUALITY MODEL RESULTS, OPERATIONS PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING BASE CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									average	5%	95%	average	5%	95%	average	5%	95%	average	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.20**	**0.19**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.20**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.047	0.038	0.058	0.035	0.035	0.035	0.043	0.037	0.05
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.0000011	0.00000086	0.0000013	0.00000078	0.00000078	0.00000079	0.0000010	0.00000081	0.0000011
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00048	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0062**	**0.0062**	**0.0063**	0.00070	0.00064	0.00074	**0.0056**	**0.0054**	**0.0058**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.027	0.025	0.025	0.025	0.026	0.025	0.026
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000017	0.000016	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.75	0.72	0.77	1.9	1.1	2.8	0.93	0.81	1.0	1.6	1.0	2.2
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00054	0.00053	0.00055	0.00050	0.00050	0.00050	0.00054	0.00053	0.00054
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00021	0.00020	0.00021	0.00034	0.00033	0.00034	0.00022	0.00021	0.00022
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00076	0.00075	0.00077	0.00084	0.00084	0.00084	0.00077	0.00077	0.00078
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.34**	**0.36**	**0.58**	**0.58**	**0.59**	**0.37**	**0.36**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.00058	0.00055	0.00025	0.00025	0.00025	0.00028	0.00028	0.00029	0.00037	0.00037	0.00037	0.00029	0.00029	0.00030
Magnesium	-	-	-	-	0.36	0.44	0.49	0.45	0.34	0.33	0.34	0.54	0.41	0.68	0.37	0.35	0.38	0.49	0.40	0.58
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.073	0.073	0.073	0.067	0.067	0.067	0.056	0.056	0.057	0.066	0.066	0.067
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000070	0.0000070	0.0000070	0.0000065	0.0000065	0.0000065	0.0000070	0.0000070	0.0000070
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0013	0.0011	0.0016	0.0011	0.0010	0.0011	0.0013	0.0011	0.0014
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0012	0.0011	0.0014	0.0010	0.0010	0.0010	0.0012	0.0011	0.0013
Nitrate	3	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.12	0.040	0.21	0.0050	0.0050	0.0050	0.088	0.035	0.15
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0075	0.0058	0.010	0.0050	0.0050	0.0050	0.0068	0.0057	0.0082
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.35	0.31	0.38	1.1	0.52	1.7	0.43	0.27	0.54	0.87	0.48	1.3
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000048	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.4	4.5	3.4	5.8	2.6	2.3	2.9	4.0	3.2	4.9
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.3	1.1	1.4	12	4.6	21	1.9	1.2	2.3	9.1	4.0	15
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000048	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.00013	0.000076	0.00020	0.000051	0.000050	0.000051	0.00011	0.000072	0.00016
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0027	0.0026	0.0028	0.0030	0.0030	0.0030	0.0027	0.0026	0.0027

Notes
(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.
(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).
(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).
(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).
(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).
(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax 2019); statistics presented are the mean, 5th percentile and 95th percentile.
(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.
(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.
(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.
(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.
(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.
(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.
(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE B-2: WATER QUALITY MODEL RESULTS, OPERATIONS PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									average	5%	95%	average	5%	95%	average	5%	95%	average	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.22**	**0.21**	**0.22**	**0.24**	**0.23**	**0.24**	**0.22**	**0.22**	**0.22**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.071	0.046	0.10	0.035	0.035	0.035	0.061	0.043	0.081
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.0000016	0.0000010	0.0000022	0.00000078	0.00000078	0.00000079	0.0000014	0.0000009	0.0000018
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0063**	**0.0062**	**0.0065**	0.00070	0.00064	0.00074	**0.0057**	**0.0055**	**0.0059**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.027	0.026	0.028	0.025	0.025	0.025	0.026	0.025	0.027
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000017	0.000017	0.000018	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.75	0.72	0.77	1.9	1.1	2.9	0.93	0.81	1.0	1.6	1.0	2.3
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00055	0.00055	0.00055	0.00050	0.00050	0.00050	0.00054	0.00054	0.00054
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00023	0.00021	0.00026	0.00034	0.00033	0.00034	0.00024	0.00022	0.00025
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00077	0.00077	0.00078	0.00084	0.00084	0.00084	0.00078	0.00078	0.00079
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.34**	**0.36**	**0.58**	**0.58**	**0.59**	**0.37**	**0.36**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.0002904	0.00028906	0.0002921	0.00037	0.00037	0.00037	0.00030	0.00030	0.00030
Magnesium	-	-	-	-	0.36	0.44	0.49	0.45	0.34	0.33	0.34	0.57	0.42	0.74	0.37	0.35	0.38	0.51	0.41	0.63
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.073	0.073	0.073	0.069	0.068	0.071	0.056	0.056	0.057	0.068	0.067	0.069
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000070	0.0000070	0.0000070	0.0000065	0.0000065	0.0000065	0.0000070	0.0000070	0.0000070
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0014	0.0011	0.0017	0.0011	0.0010	0.0011	0.0013	0.0011	0.0015
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0015	0.0012	0.0020	0.0010	0.0010	0.0010	0.0014	0.0011	0.0017
Nitrate	3	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.22	0.072	0.40	0.0050	0.0050	0.0050	0.16	0.062	0.28
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.010	0.0067	0.015	0.0050	0.0050	0.0050	0.0090	0.0064	0.012
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.35	0.31	0.38	1.1	0.54	1.8	0.43	0.27	0.54	0.9	0.49	1.4
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00050	0.00051	0.00050	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.4	4.6	3.4	6.0	2.6	2.3	2.9	4.1	3.3	5.0
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.3	1.1	1.4	14	5.3	25	1.9	1.2	2.3	11	4.7	18
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.00018	0.00009	0.00028	0.000051	0.000050	0.000051	0.00014	0.000083	0.00021
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0027	0.0026	0.0028	0.0030	0.0030	0.0030	0.0027	0.0026	0.0028

Notes
(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.
(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).
(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).
(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).
(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).
(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the upper case geochemical source terms (Lorax 2019); statistics presented are the mean, 5th percentile and 95th percentile.
(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.
(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.
(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.
(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.
(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.
(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.
(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.
0.1 Grey shading indicates a concentration greater than the NSEQS.
0.1 Double outline indicates a concentration greater than the FEQG.
0.1 Bold outline indicates a concentration greater than the SSWQO.
0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE B-3: WATER QUALITY MODEL RESULTS, POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING BASE CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									average	5%	95%	average	5%	95%	average	5%	95%	average	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.20**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.20**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.036	0.035	0.037	0.035	0.035	0.035	0.035	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000081	0.00000078	0.00000083	0.00000079	0.00000078	0.00000079	0.00000078	0.00000075	0.00000080
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00048	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0061**	**0.0061**	**0.0062**	0.0010	0.00071	0.0011	**0.0056**	**0.0054**	**0.0057**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000022	0.000018	0.000026	0.000017	0.000017	0.000017	0.000021	0.000018	0.000023
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.5	0.95	2.1	1.0	0.84	1.2	1.3	0.92	1.7
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00056	0.00056	0.00056	0.00050	0.00050	0.00050	0.00055	0.00054	0.00055
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00036	0.00025	0.00049	0.00034	0.00033	0.00034	0.00033	0.00025	0.00041
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00087	0.00080	0.00095	0.00084	0.00084	0.00084	0.00085	0.00081	0.00090
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.35**	**0.36**	**0.58**	**0.58**	**0.59**	**0.38**	**0.37**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.00058	0.00055	0.00025	0.00025	0.00025	0.00034	0.00031	0.00039	0.00037	0.00037	0.00037	0.00034	0.00031	0.00036
Magnesium	-	-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.46	0.39	0.55	0.39	0.36	0.41	0.43	0.38	0.49
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.073	0.073	0.074	0.070	0.068	0.072	0.058	0.057	0.058	0.068	0.067	0.070
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0010	0.0011	0.0011	0.0010	0.0012	0.0013	0.0011	0.0014	0.0011	0.0010	0.0011
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0020	0.0013	0.0029	0.0010	0.0010	0.0010	0.0018	0.0013	0.0023
Nitrate	3	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.021	0.010	0.034	0.0050	0.0050	0.005	0.017	0.0092	0.025
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0053	0.0051	0.0055	0.0050	0.0050	0.0050	0.0052	0.0051	0.0053
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.37	0.32	0.41	0.45	0.33	0.59	0.48	0.29	0.62	0.40	0.32	0.49
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.6	2.8	2.4	3.1	3.1	2.9	3.3
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.2	1.7	7.2	3.1	12	2.5	1.4	3.2	5.6	2.8	8.9
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000051	0.000050	0.000050	0.000050	0.000051	0.000050	0.000051
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000086	0.000061	0.00012	0.000051	0.000050	0.000052	0.000076	0.000059	0.000095
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0039	0.0029	0.0051	0.0029	0.0029	0.0030	0.0036	0.0029	0.0043

Notes
(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.
(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).
(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).
(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).
(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).
(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax 2019); statistics presented are the mean, 5th percentile and 95th percentile.
(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.
(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.
(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.
(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.
(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.
(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.
(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.
0.1 Grey shading indicates a concentration greater than the NSEQS.
0.1 Double outline indicates a concentration greater than the FEQG.
0.1 Bold outline indicates a concentration greater than the SSWQO.
0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE B-4: WATER QUALITY MODEL RESULTS, POST-CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									average	5%	95%	average	5%	95%	average	5%	95%	average	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.21**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.21**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.038	0.035	0.040	0.035	0.035	0.035	0.036	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000084	0.00000079	0.00000089	0.00000079	0.00000078	0.00000079	0.00000081	0.00000076	0.00000085
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0065**	**0.0063**	**0.0067**	0.0013	0.00080	0.0017	**0.0058**	**0.0055**	**0.0060**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.026	0.025	0.025	0.025	0.026	0.025	0.026
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000027	0.000020	0.000035	0.000017	0.000017	0.000017	0.000024	0.000020	0.000030
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.8	1.1	2.7	1.1	0.84	1.2	1.5	1.0	2.1
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00057	0.00056	0.00058	0.00050	0.00050	0.00050	0.00056	0.00055	0.00057
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00052	0.00030	**0.00079**	0.00034	0.00033	0.00034	0.00045	0.00029	0.00062
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00087	0.00086	0.00087	0.0010	0.00084	0.0012	0.00084	0.00084	0.00084	0.00094	0.00084	0.0011
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.38**	**0.37**	**0.39**	**0.58**	**0.58**	**0.59**	**0.39**	**0.39**	**0.41**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.00058	0.00055	0.00025	0.00025	0.00025	0.00050	0.00035	0.00067	0.00037	0.00037	0.00037	0.00045	0.00035	0.00056
Magnesium	-	-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.52	0.41	0.66	0.39	0.36	0.42	0.48	0.40	0.57
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.074	0.073	0.074	0.078	0.071	0.087	0.059	0.057	0.060	0.074	0.069	0.080
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0012	0.0012	0.0011	0.0014	0.0014	0.0011	0.0015	0.0012	0.0011	0.0013
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0029	0.0016	0.0045	0.0010	0.0010	0.0010	0.0024	0.0015	0.0034
Nitrate	3	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0051	0.033	0.014	0.056	0.005	0.0050	0.005	0.026	0.012	0.041
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0055	0.0052	0.0060	0.0050	0.0050	0.0050	0.0054	0.0051	0.0057
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.38	0.33	0.42	0.48	0.34	0.65	0.52	0.29	0.67	0.43	0.32	0.54
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00050	0.00051	0.00050	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.7	2.8	2.4	3.1	3.2	2.9	3.4
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.3	1.8	8.9	3.6	15	2.6	1.4	3.4	6.8	3.2	11
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000052	0.000051	0.000053	0.000050	0.000050	0.000050	0.000051	0.000050	0.000052
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.00012	0.000073	0.00019	0.000051	0.000050	0.000052	0.00010	0.000069	0.000144
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0041	0.0030	0.0055	0.0029	0.0029	0.0030	0.0037	0.0030	0.0046

Notes
(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.
(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).
(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).
(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).
(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).
(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the upper case geochemical source terms (Lorax 2019); statistics presented are the mean, 5th percentile and 95th percentile.
(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.
(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.
(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.
(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.
(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.
(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.
(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.
0.1 Grey shading indicates a concentration greater than the NSEQS.
0.1 Double outline indicates a concentration greater than the FEQG.
0.1 Bold outline indicates a concentration greater than the SSWQO.
0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

FIGURE B-1: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ALUMINUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

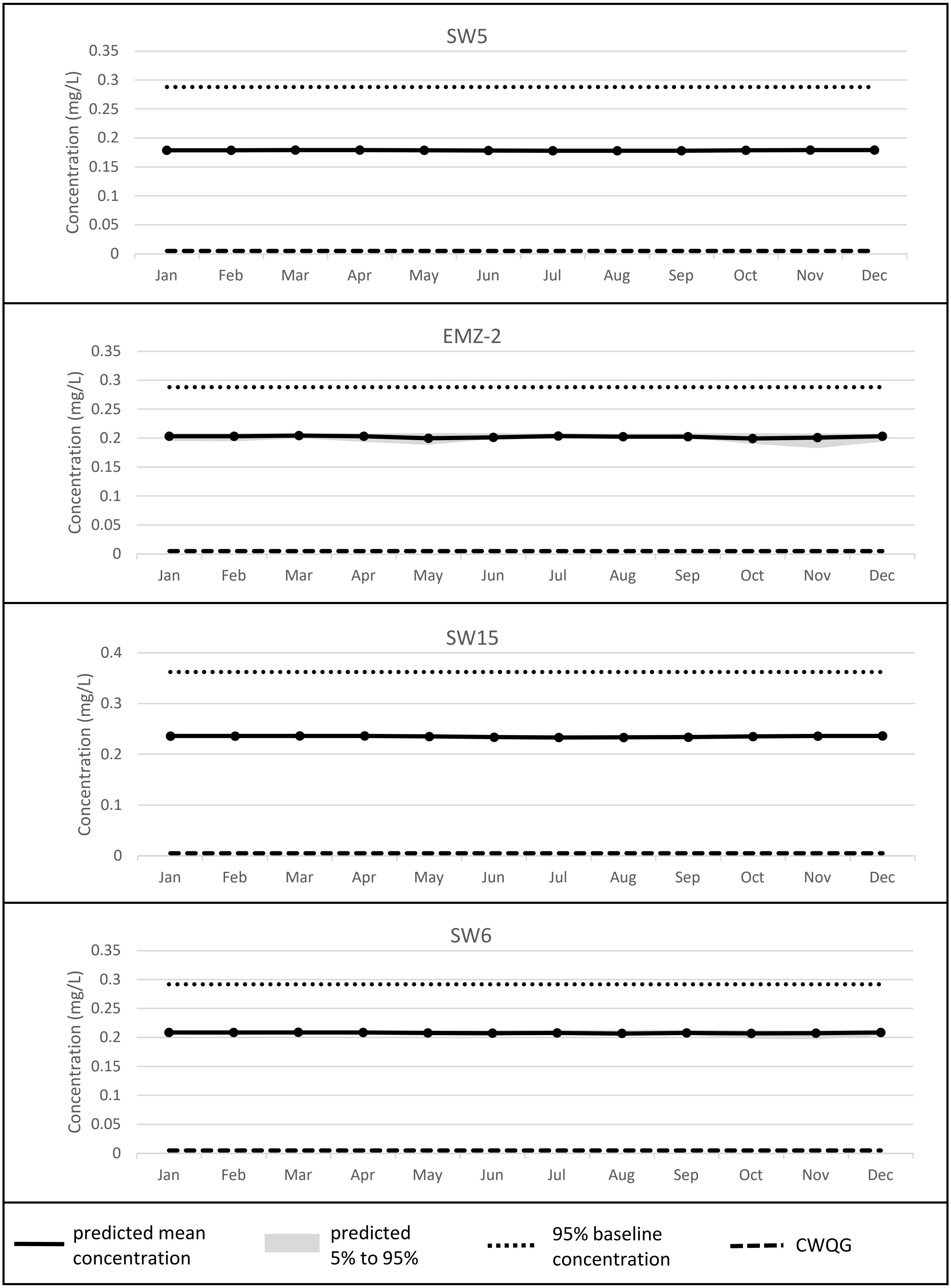


FIGURE B-2: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ANTIMONY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

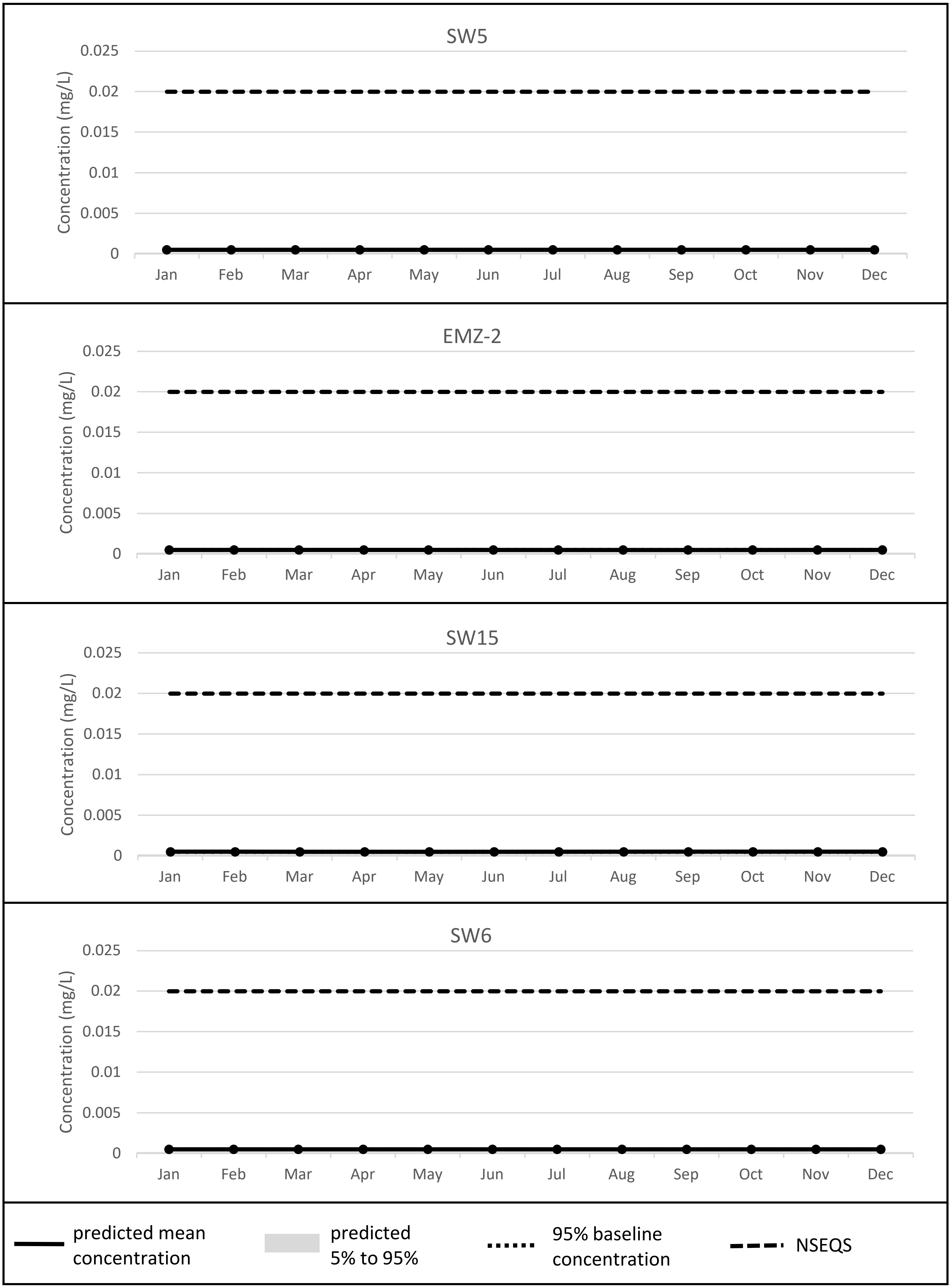


FIGURE B-3: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ARSENIC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

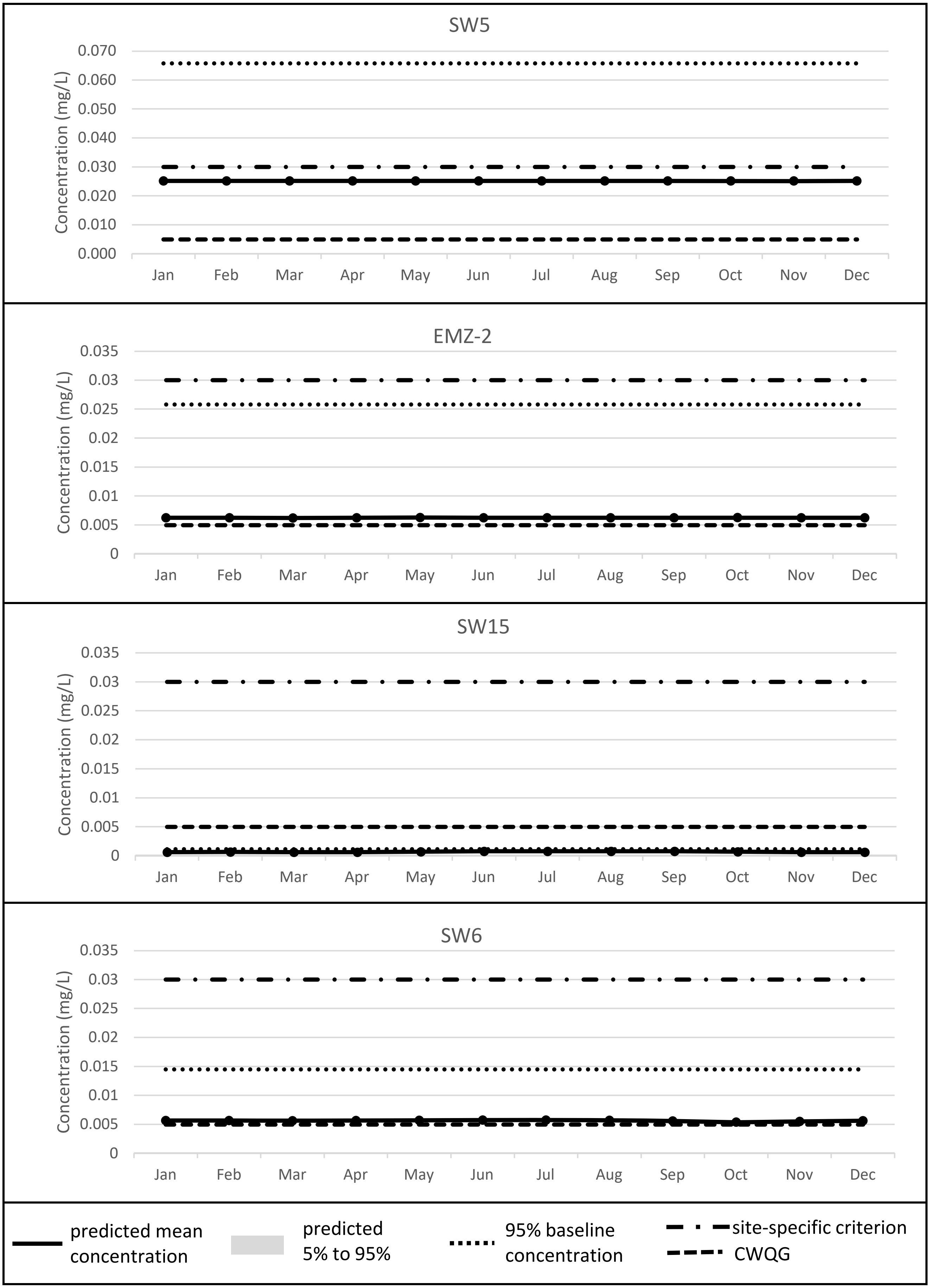


FIGURE B-4: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE
PREDICTED BORON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

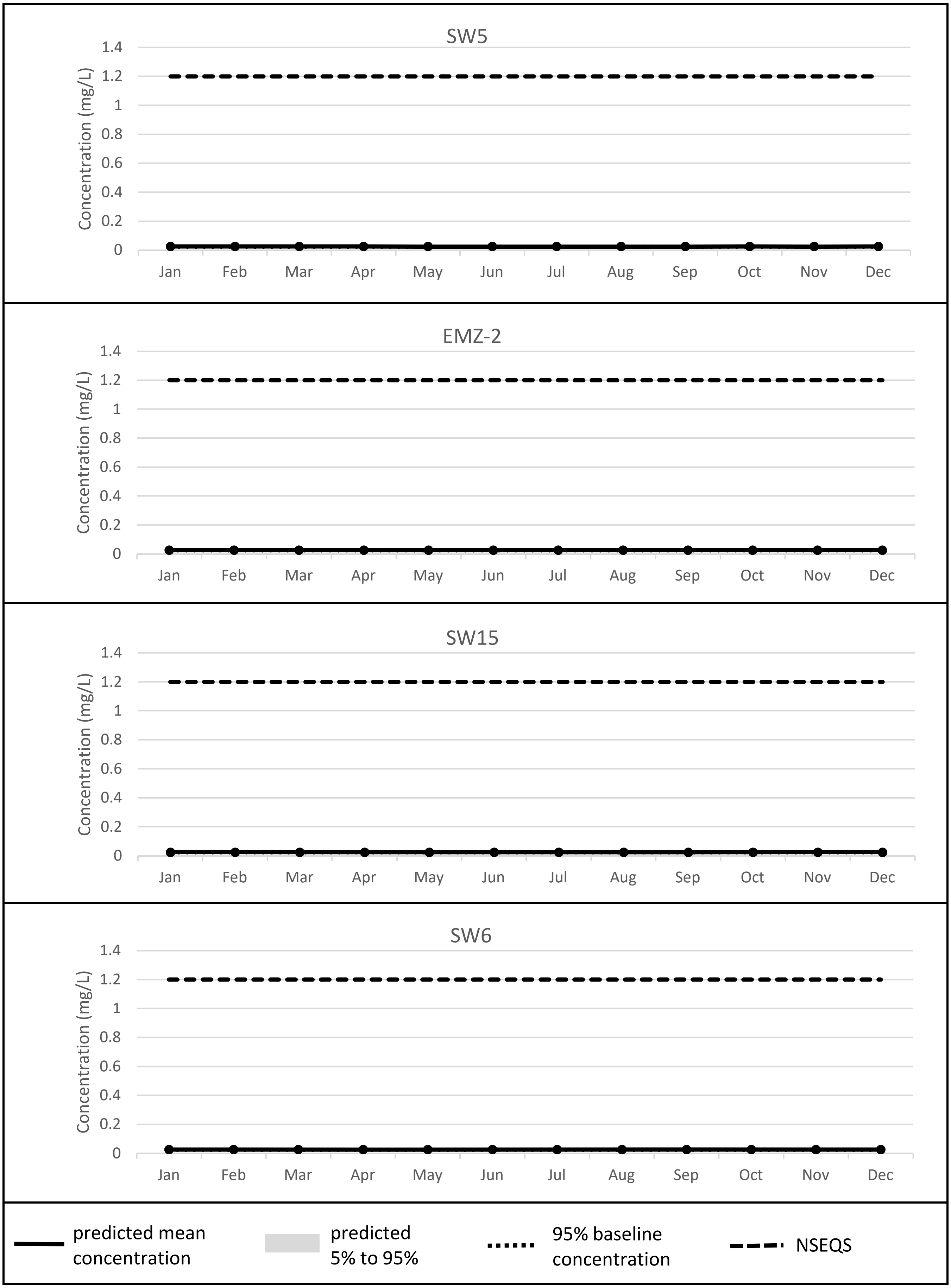


FIGURE B-5: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED CADMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

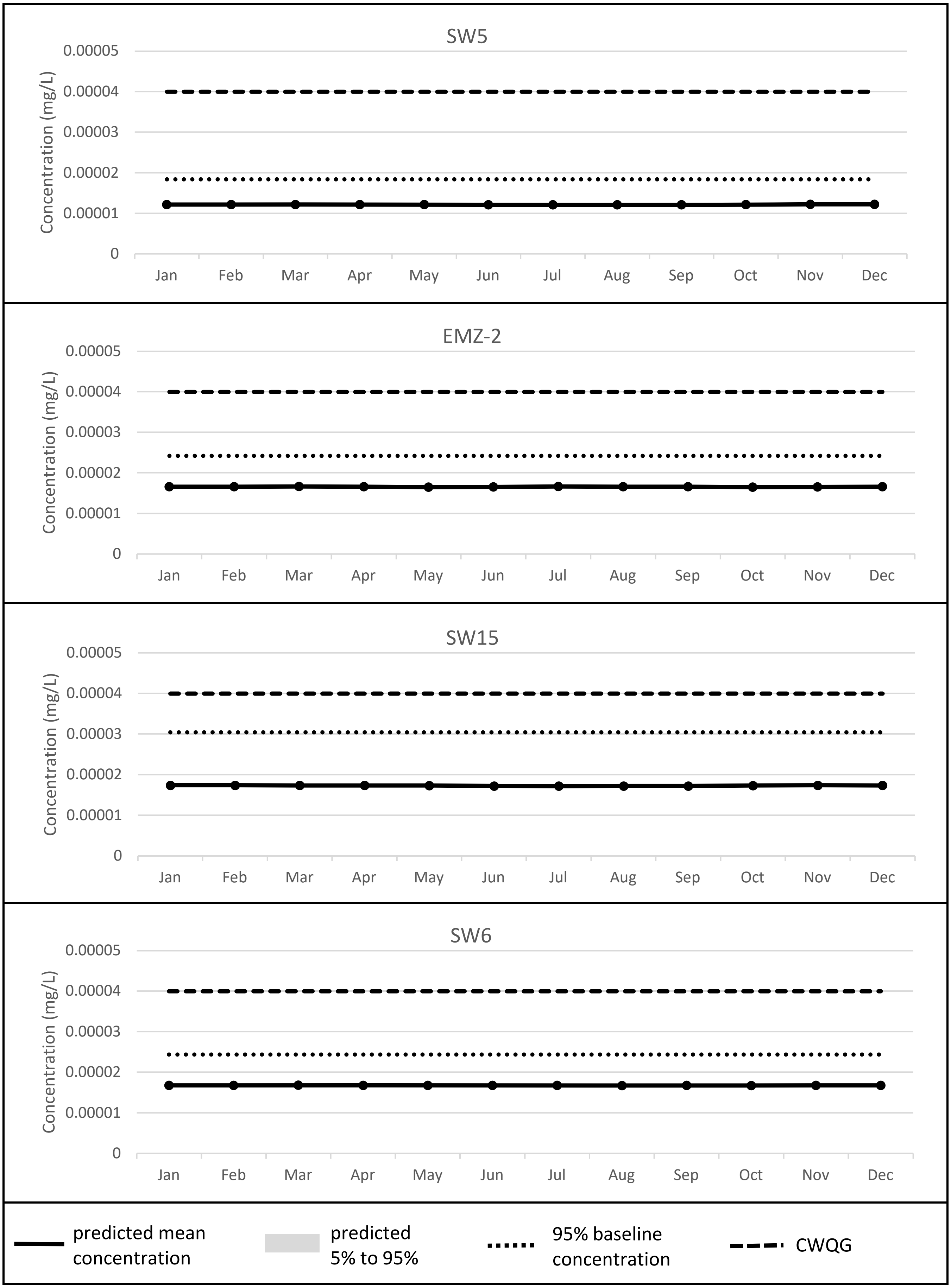


FIGURE B-6: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED CHROMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

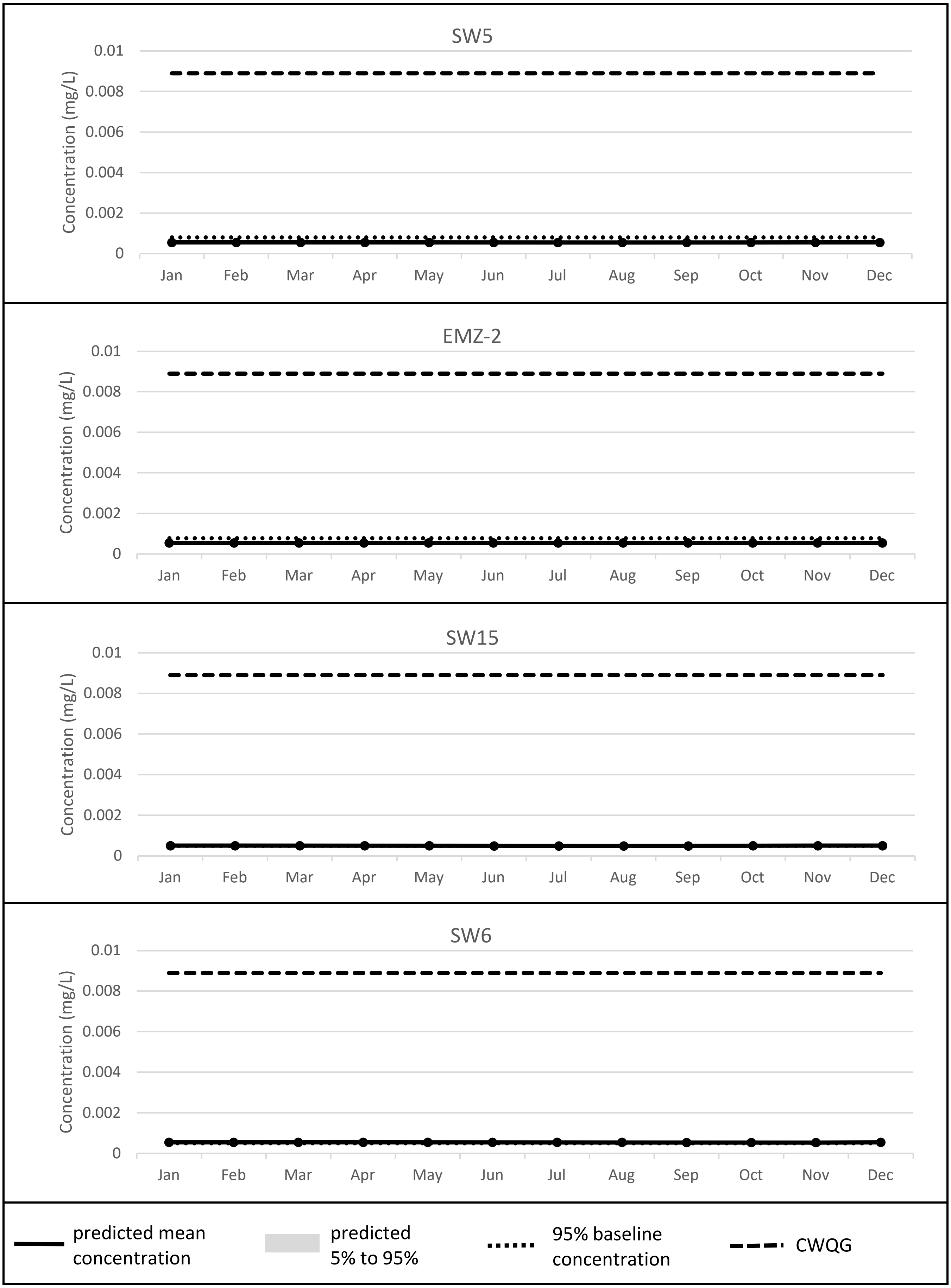


FIGURE B-7: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED COBALT CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

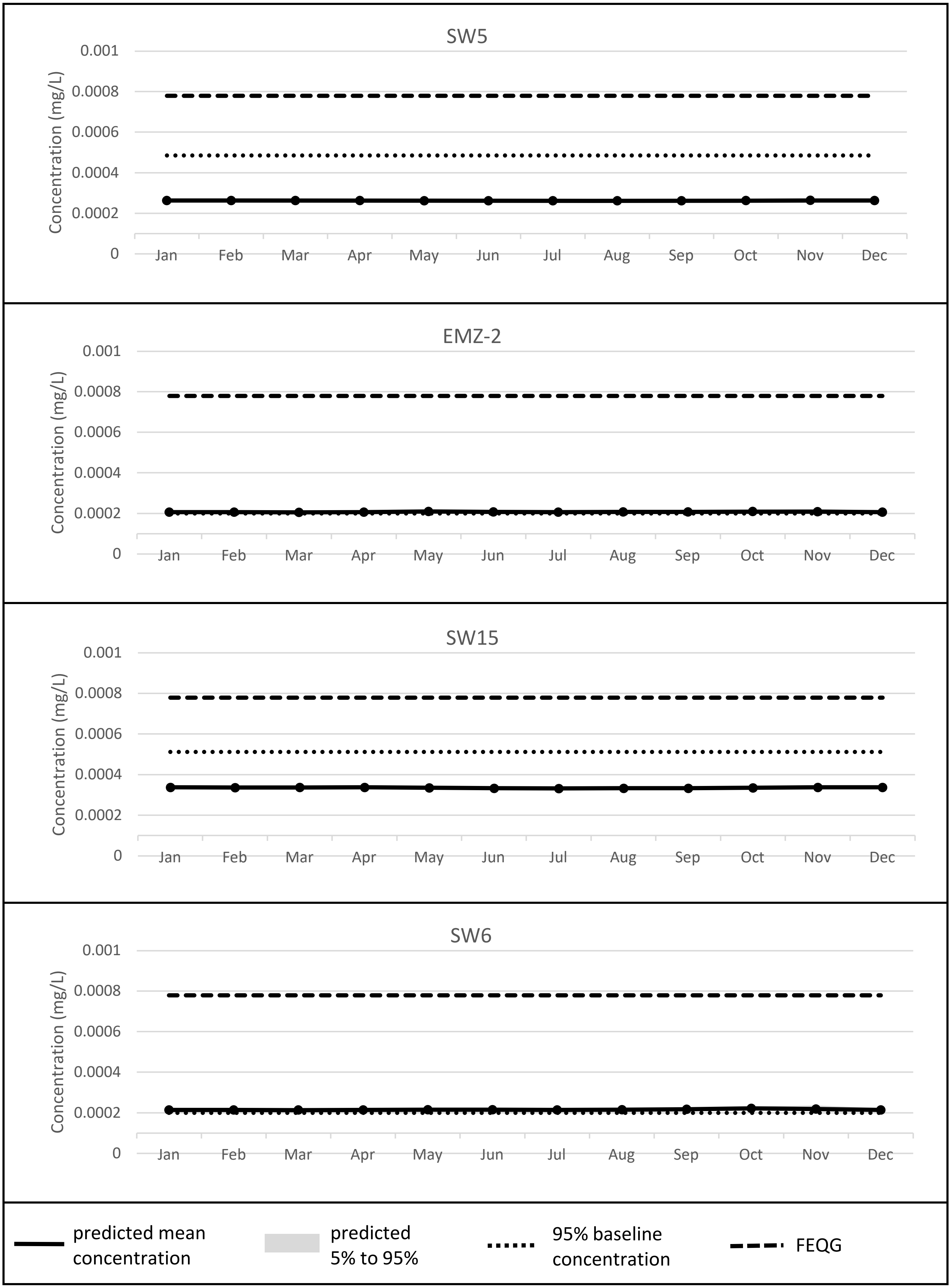


FIGURE B-8: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED COPPER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

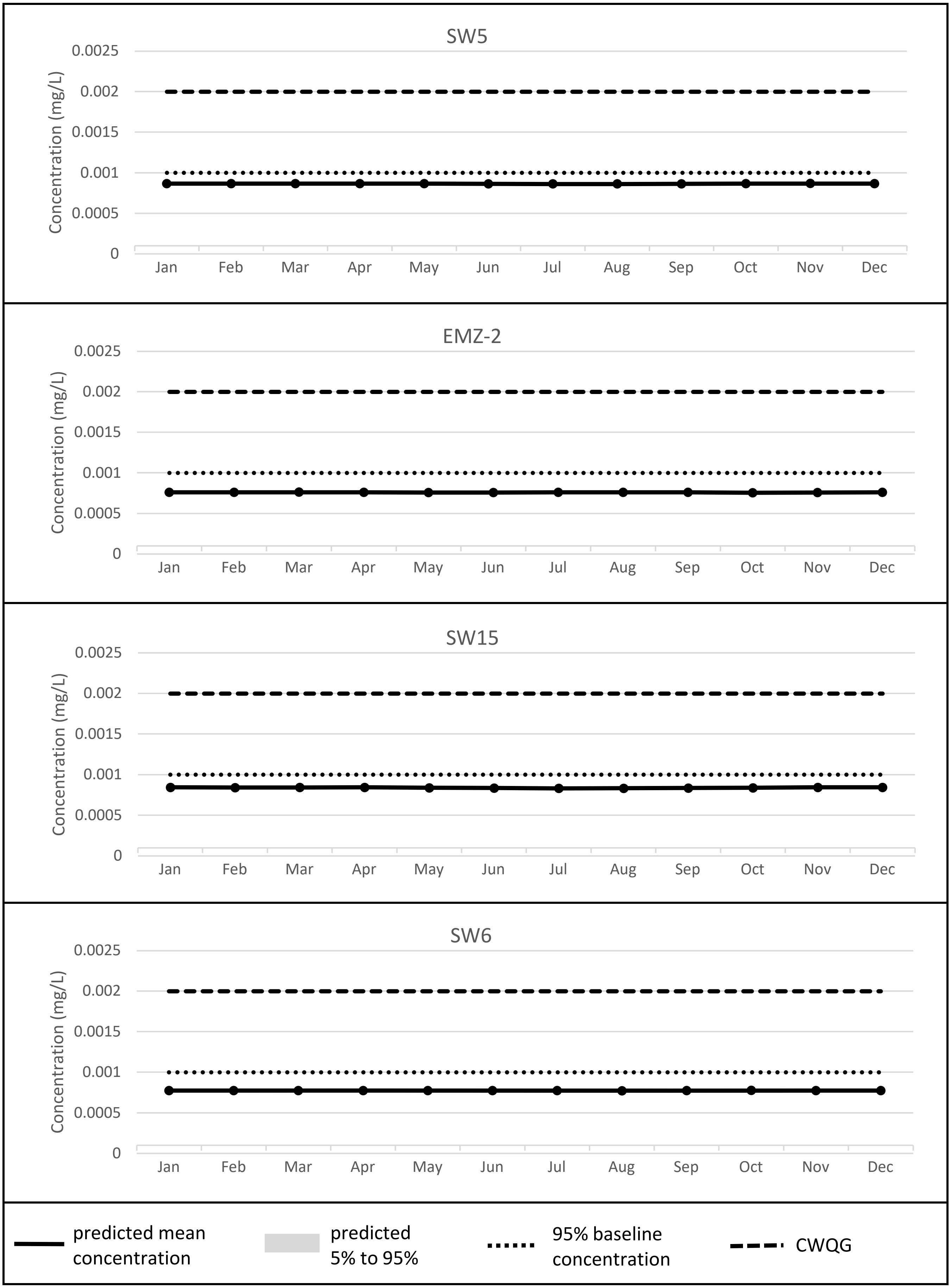


FIGURE B-9: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED IRON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

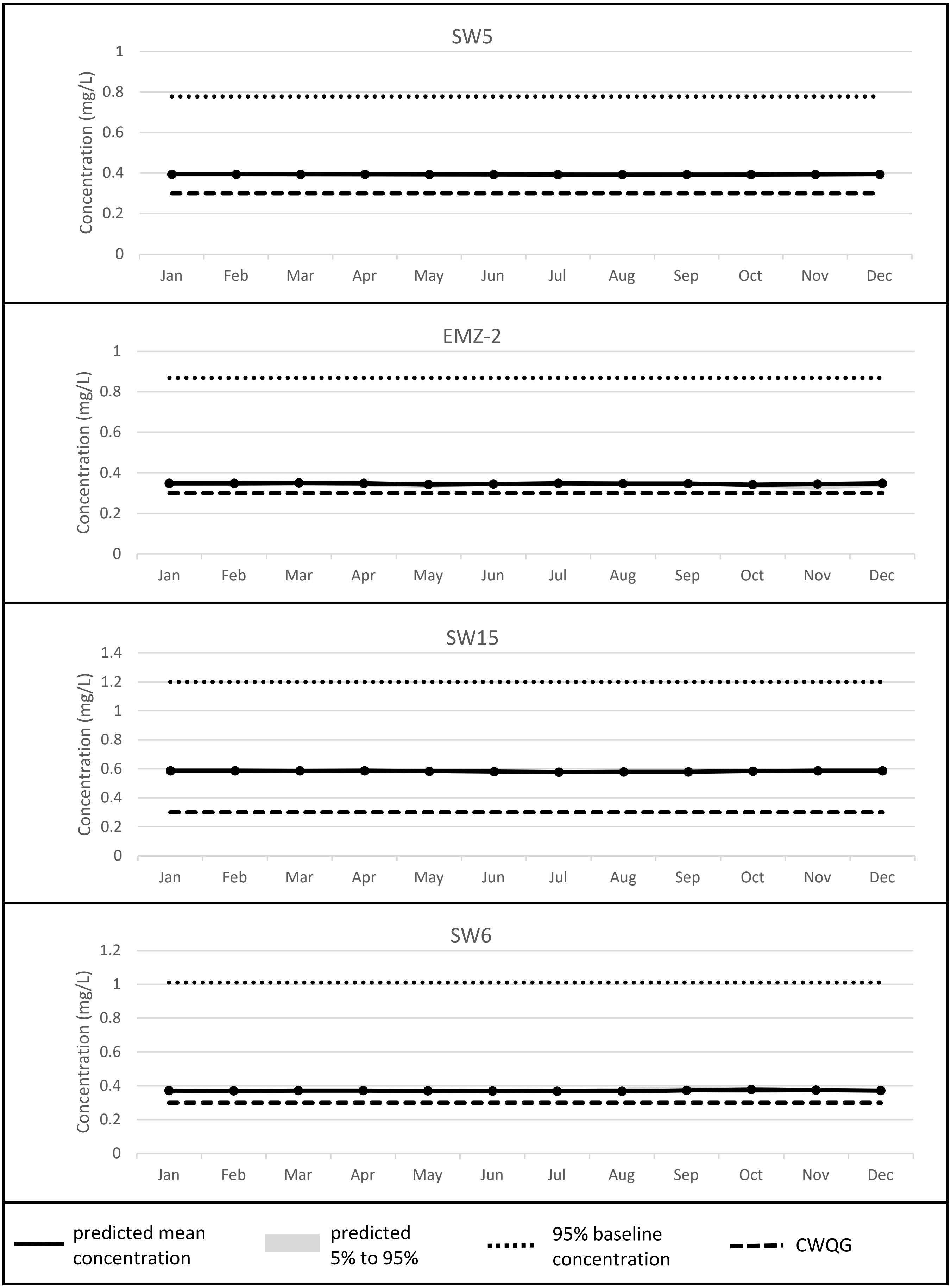


FIGURE B-10: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED LEAD CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

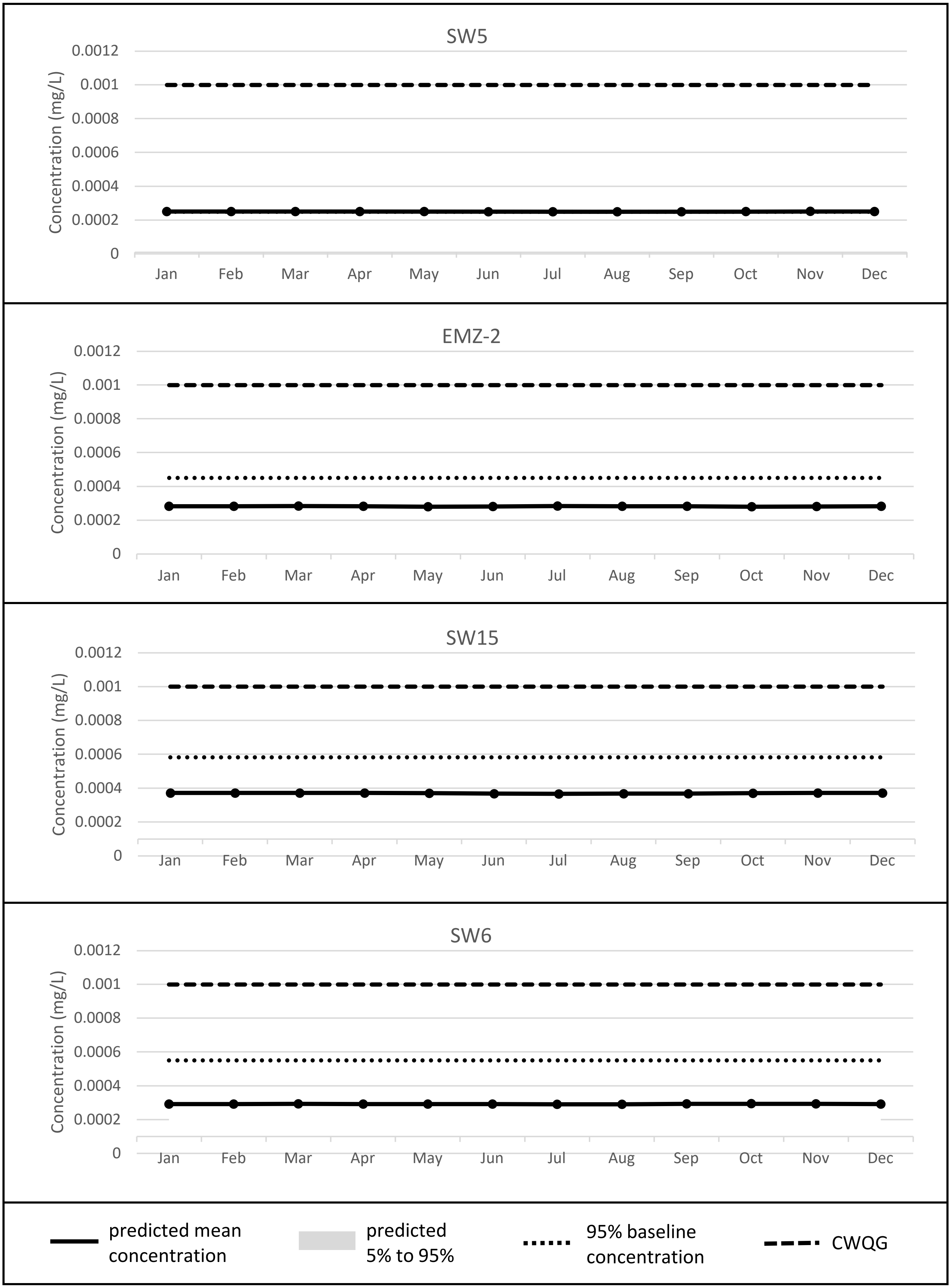


FIGURE B-11: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED MANGANESE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

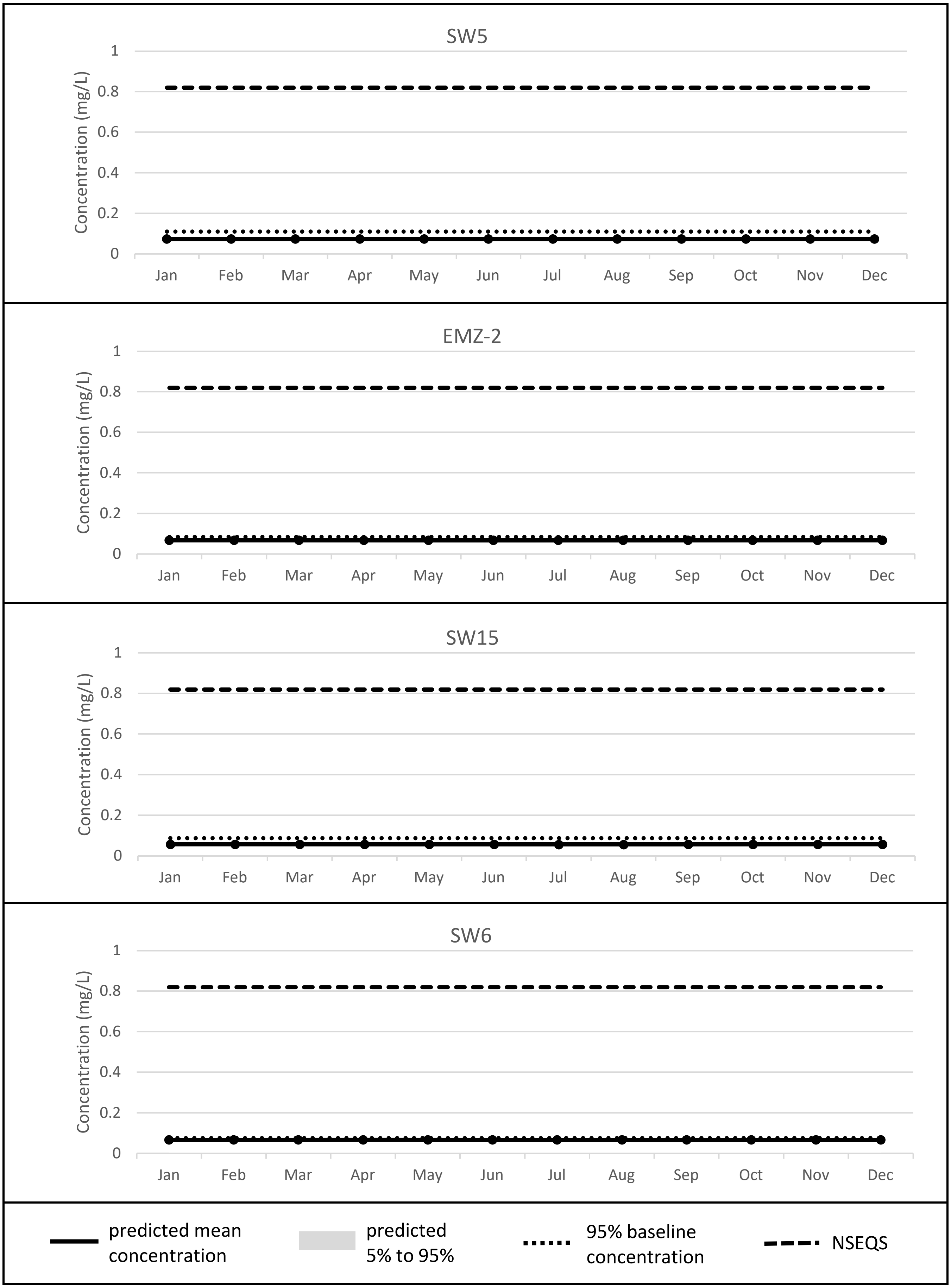


FIGURE B-12: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED MERCURY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

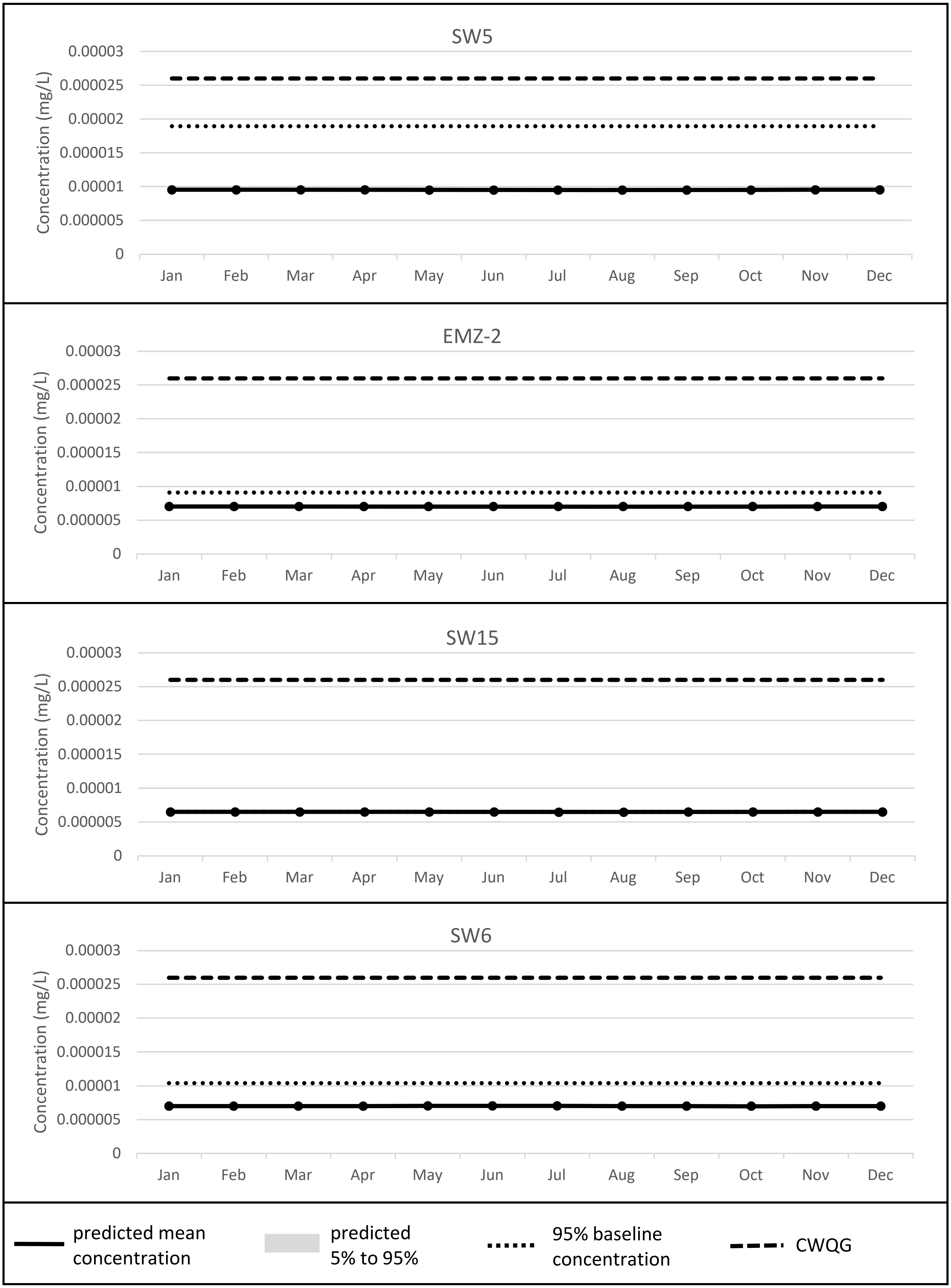


FIGURE B-13: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED MOLYBDENUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

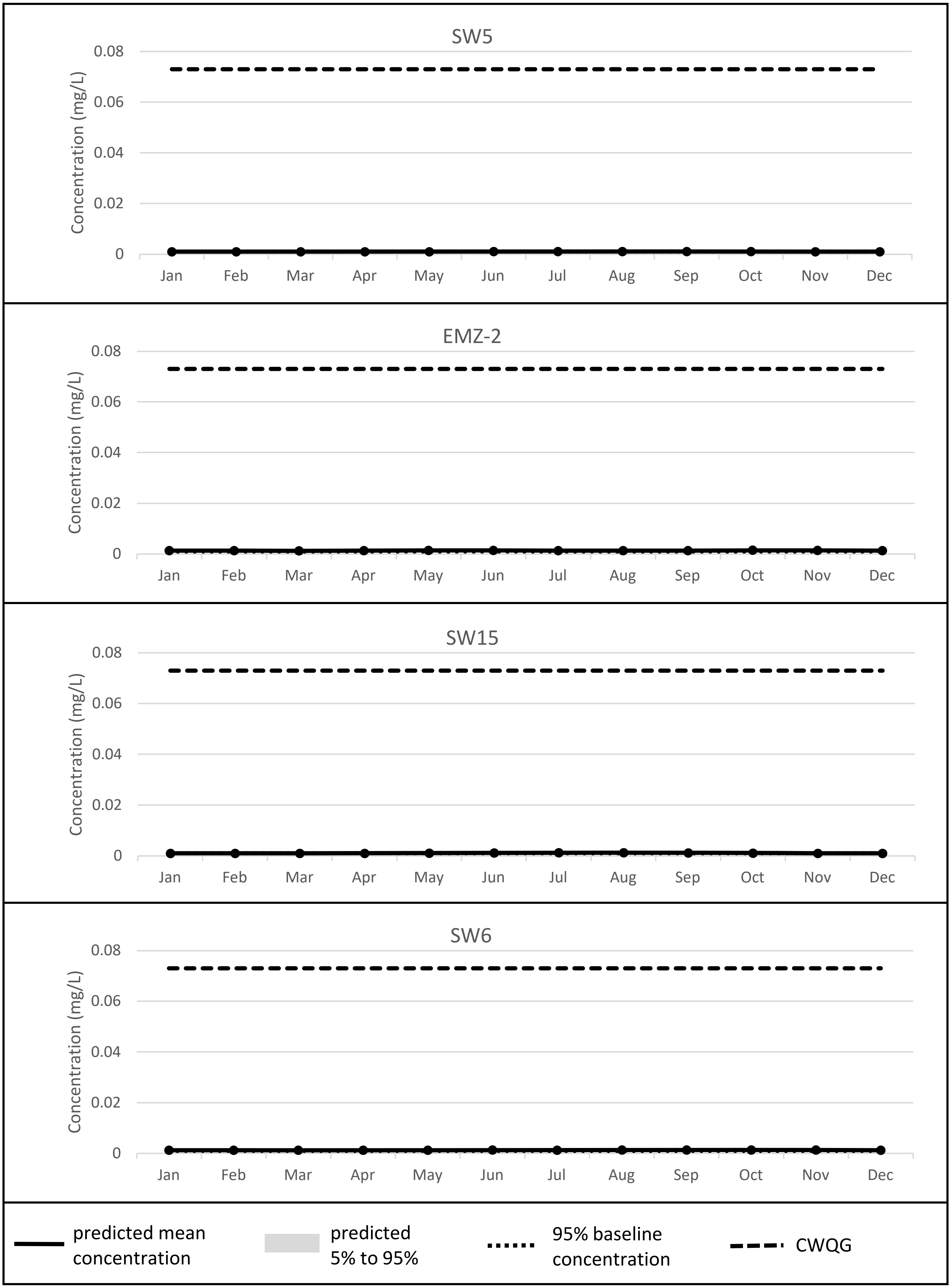


FIGURE B-14: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED NICKEL CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

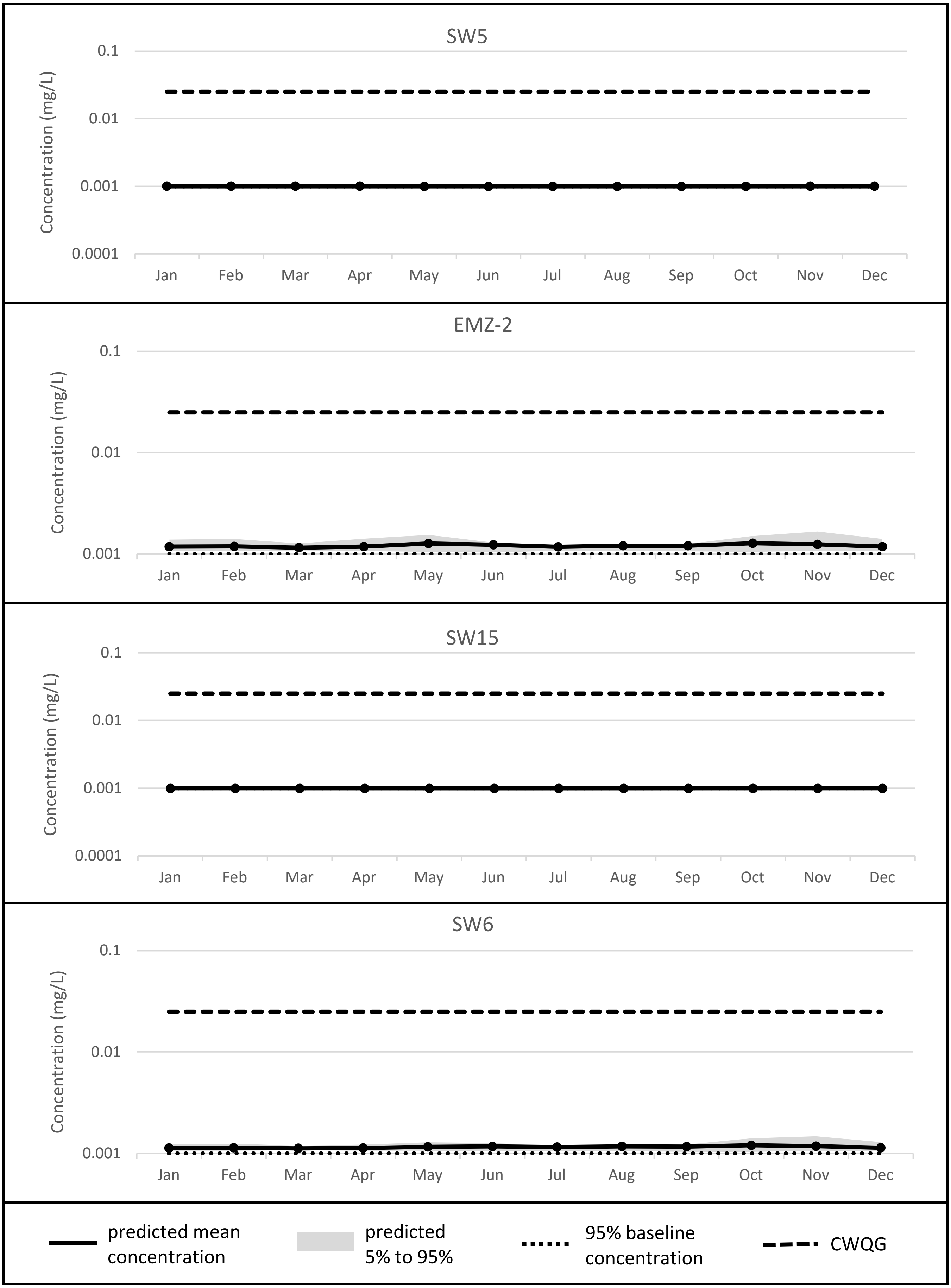


FIGURE B-15: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED NITRATE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

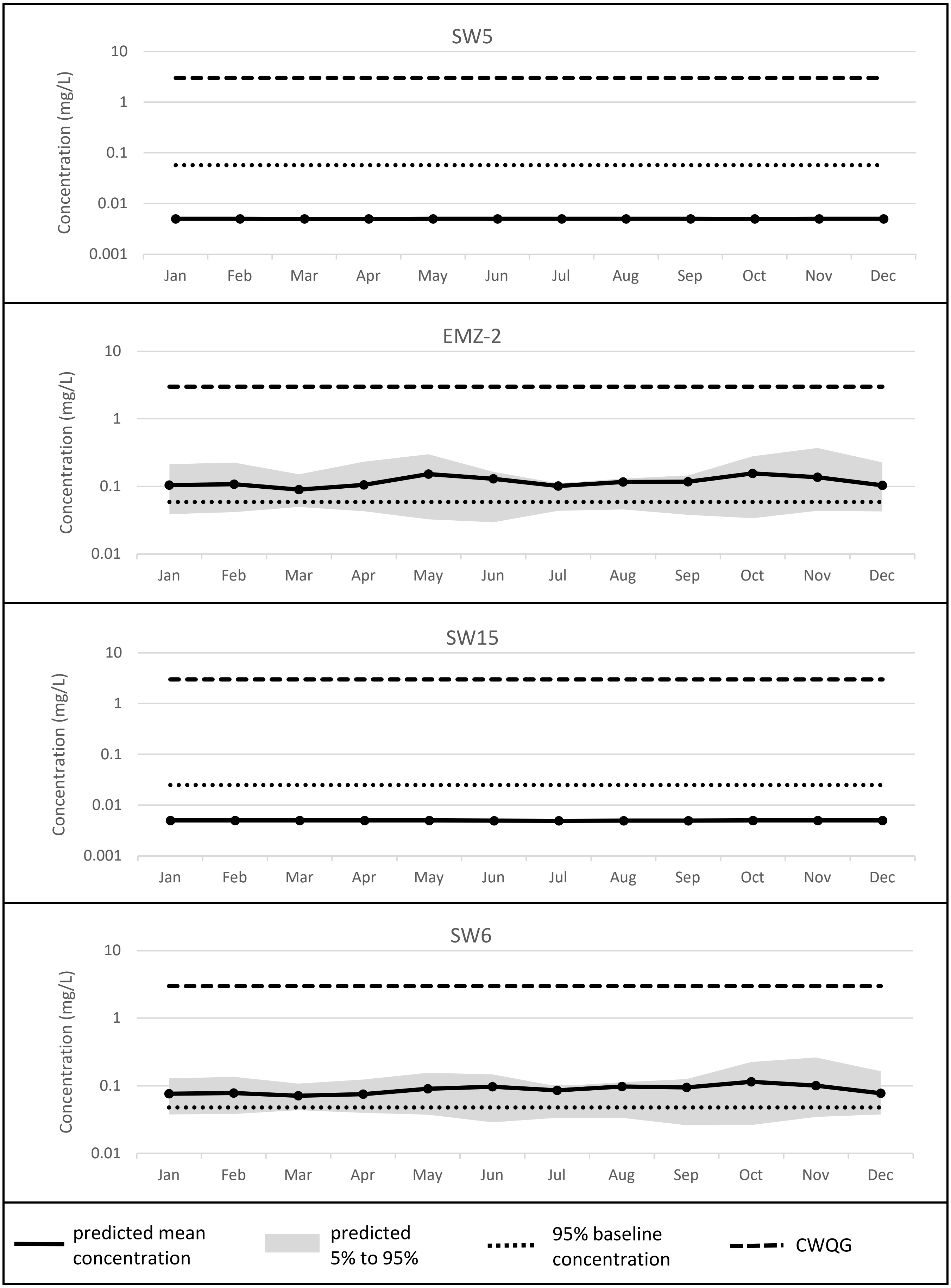


FIGURE B-16: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED NITRITE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

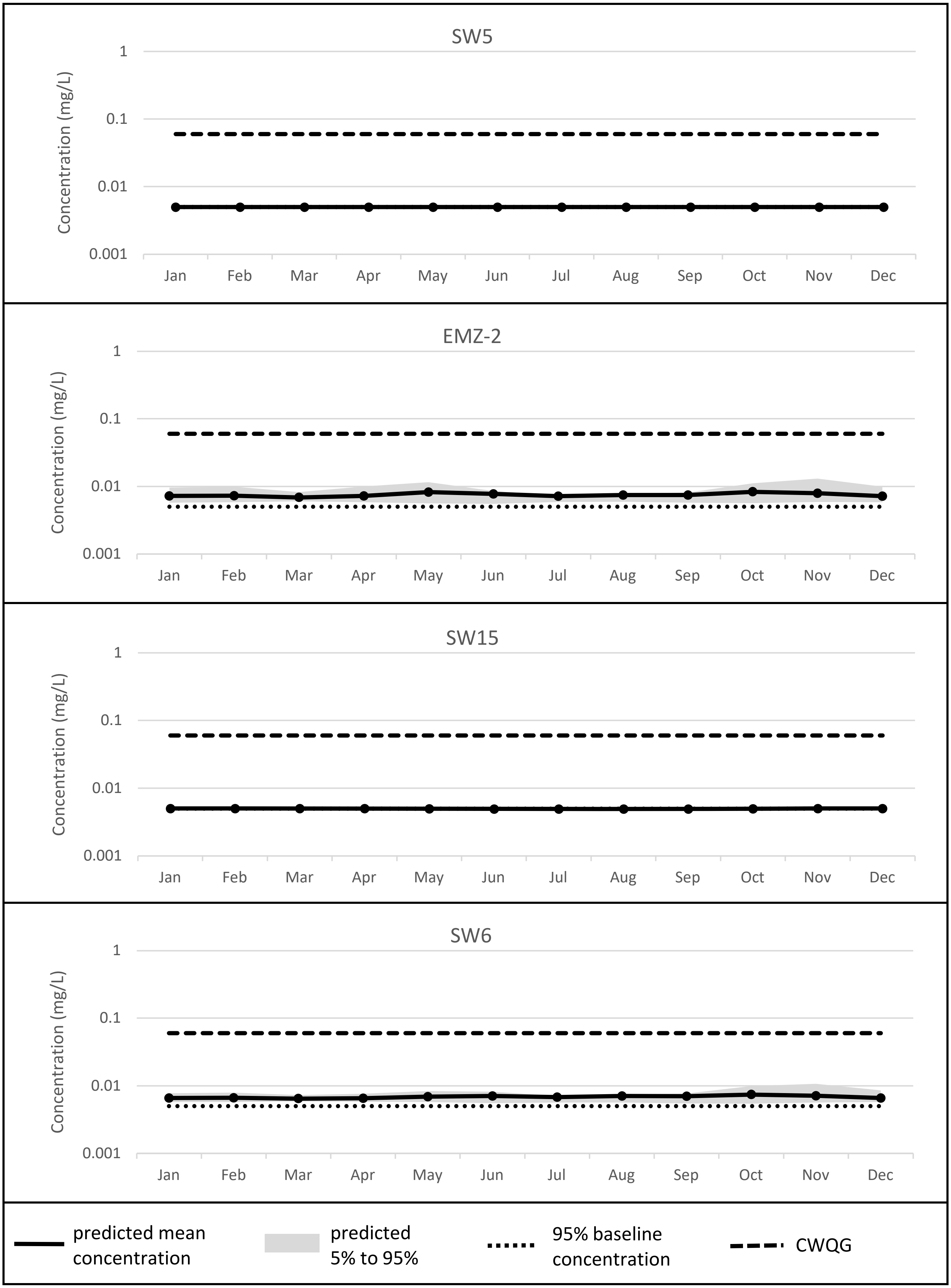


FIGURE B-17: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED SELENIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

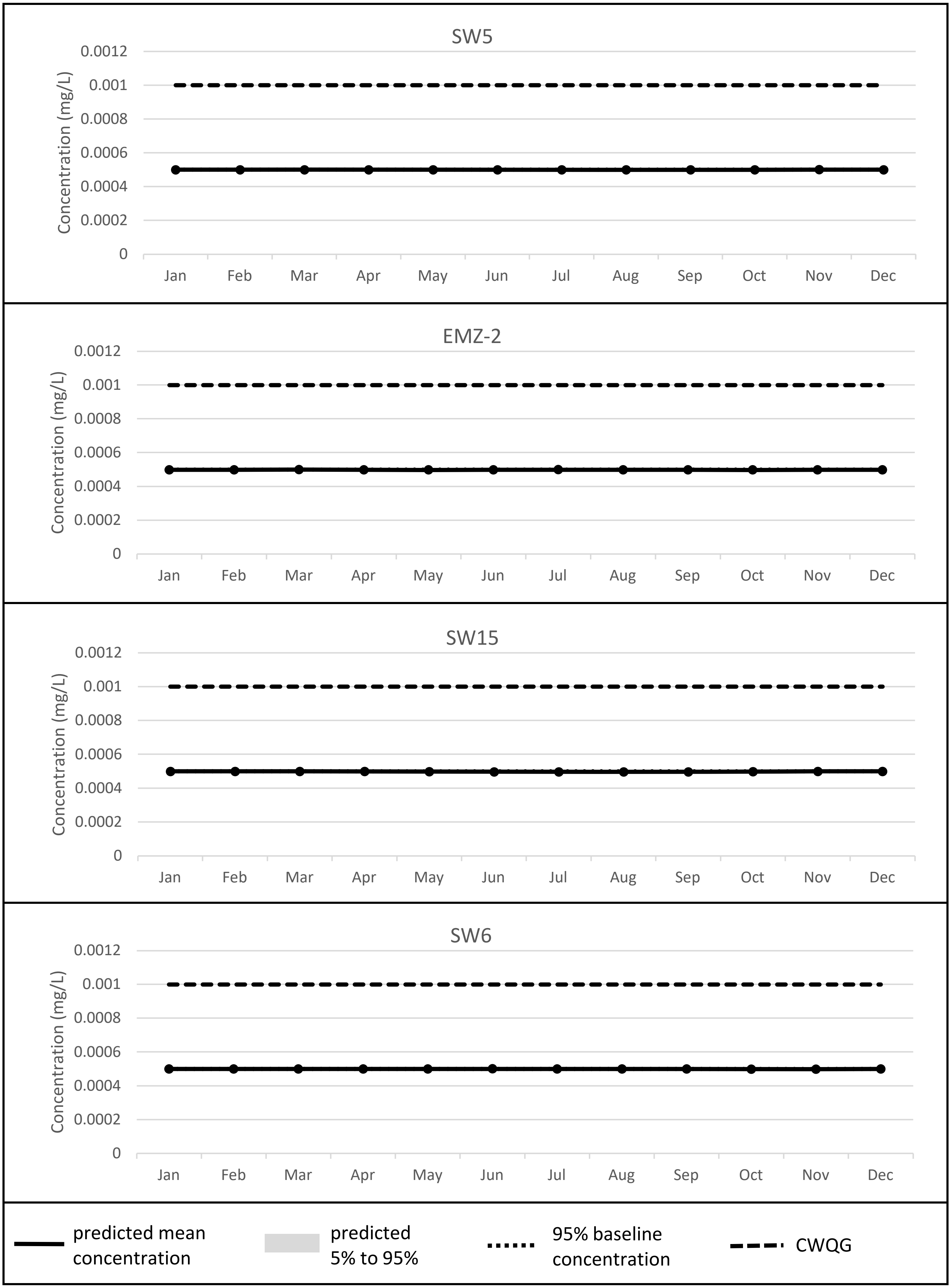


FIGURE B-18: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED SILVER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

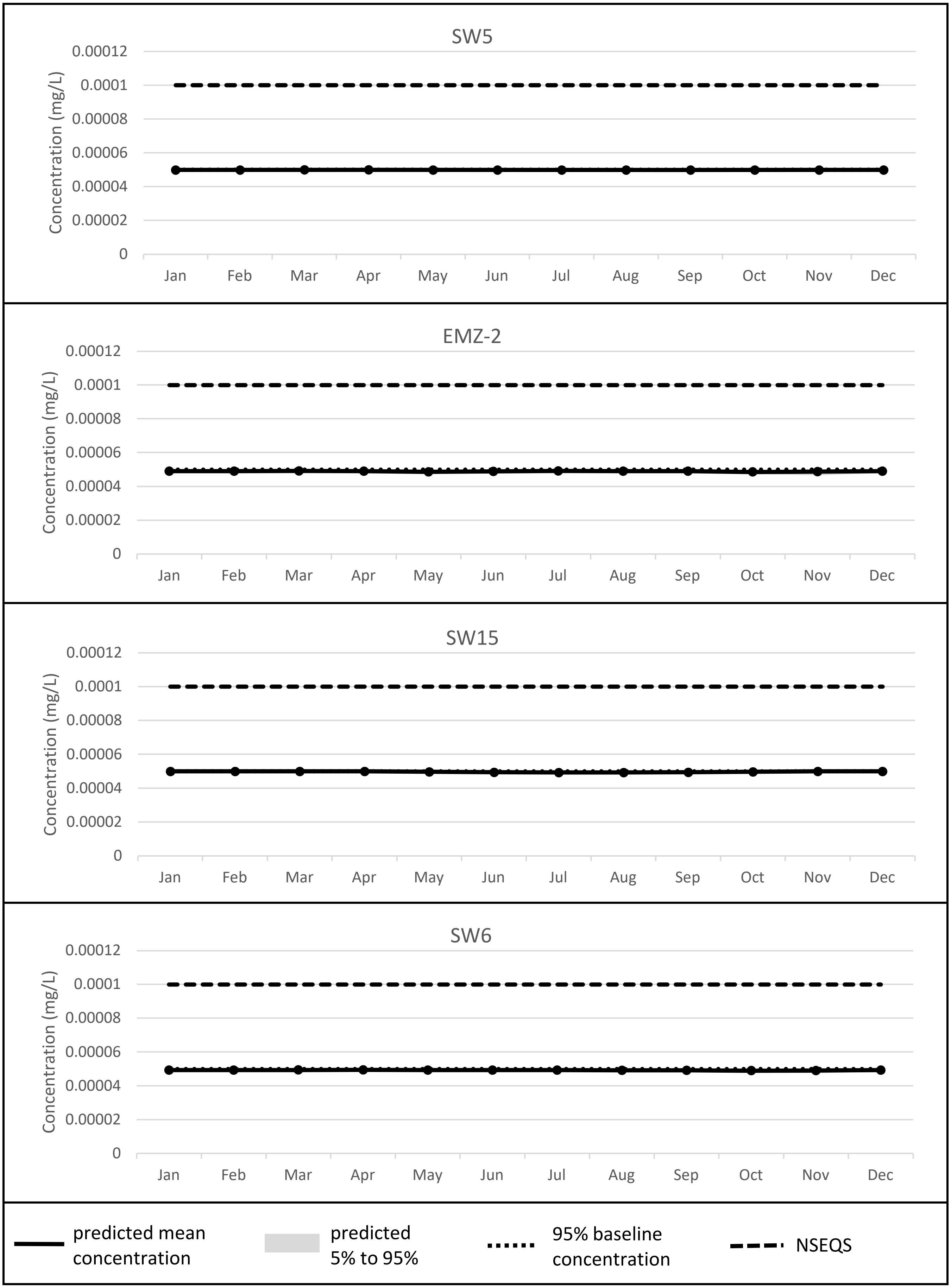


FIGURE B-19: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED THALLIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

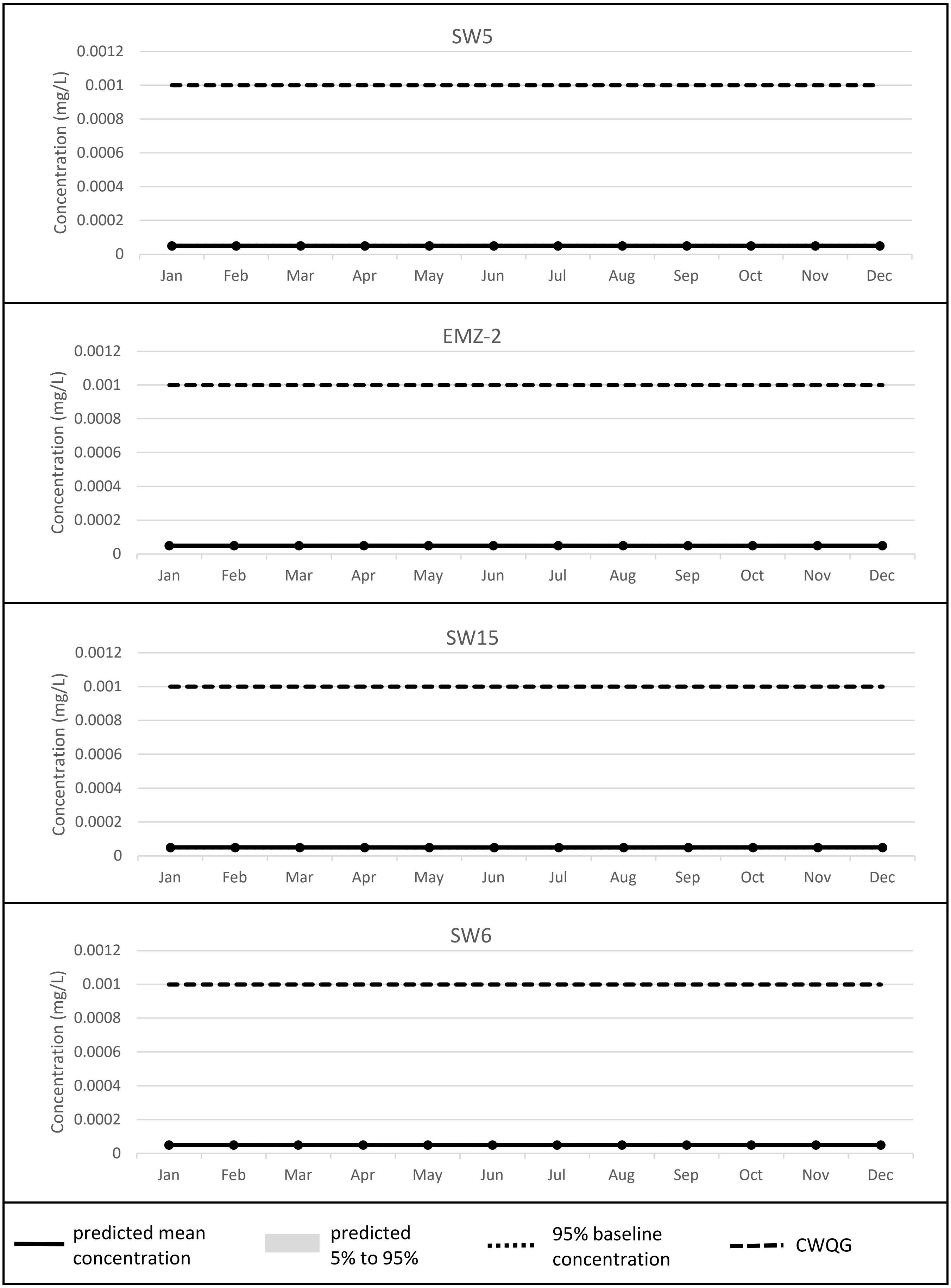


**FIGURE B-20: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE
PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING BASE CASE SOURCE TERMS)**

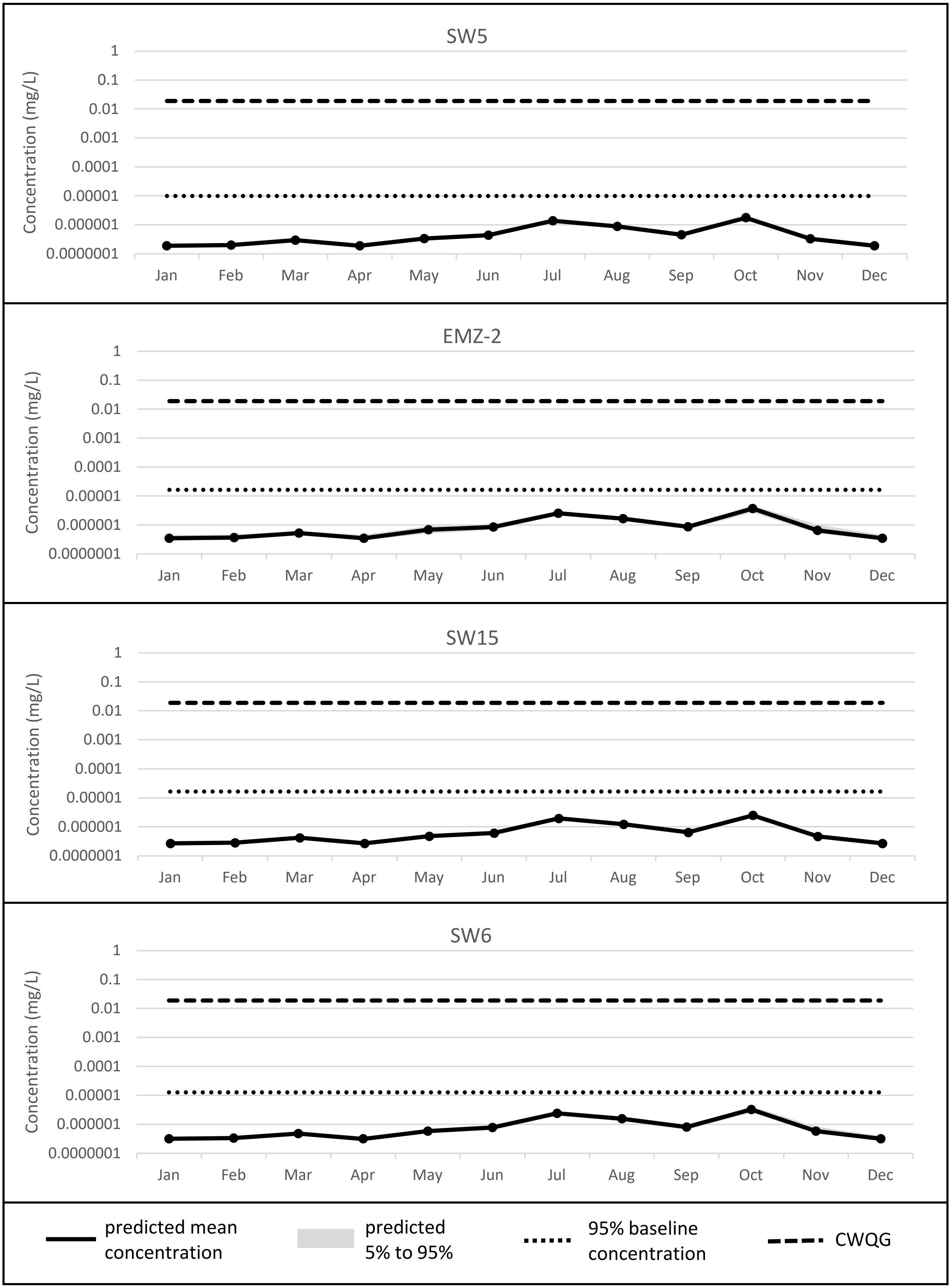


FIGURE B-21: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED URANIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

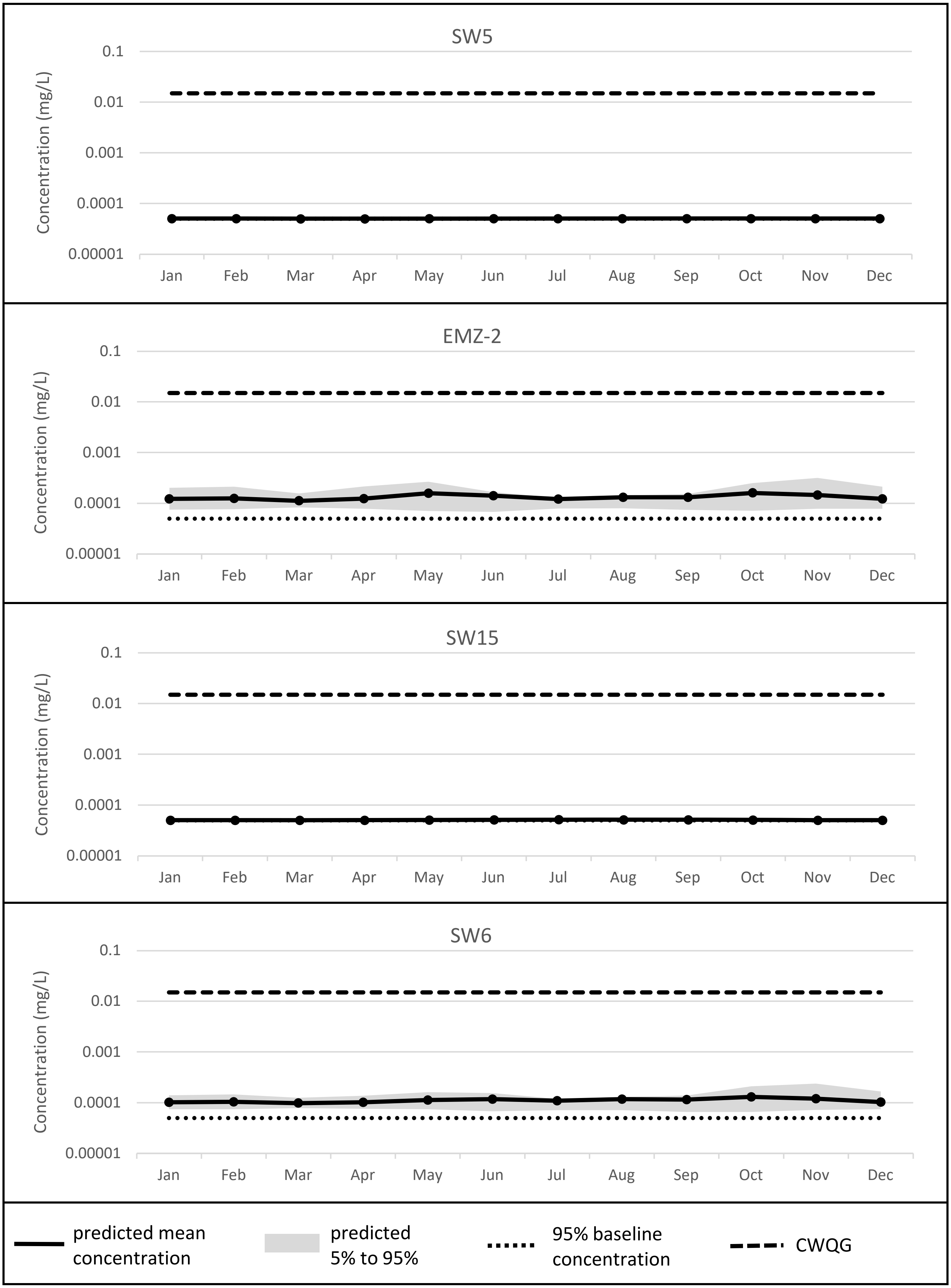


FIGURE B-22: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ZINC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

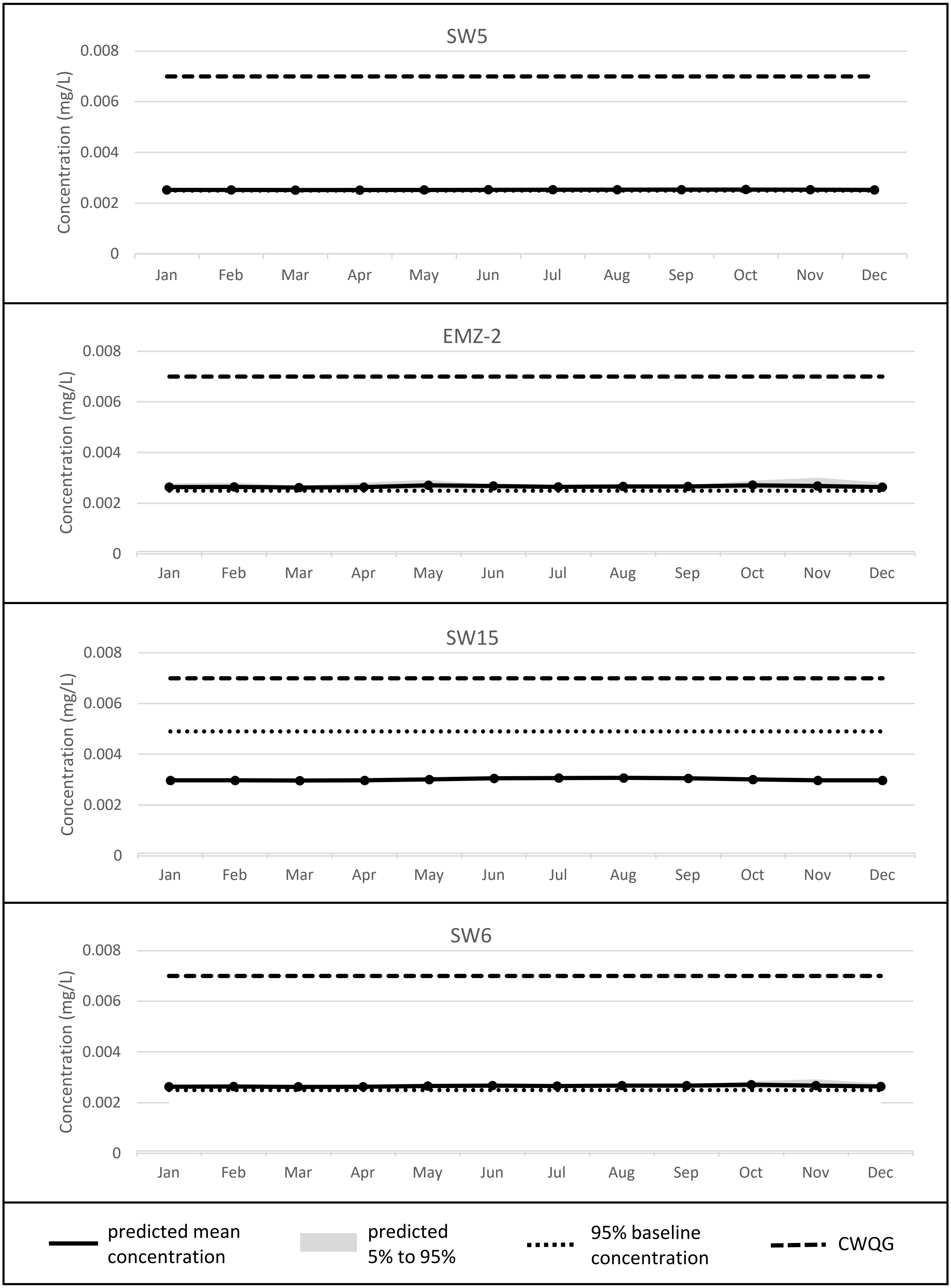


FIGURE B-23: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ALUMINUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

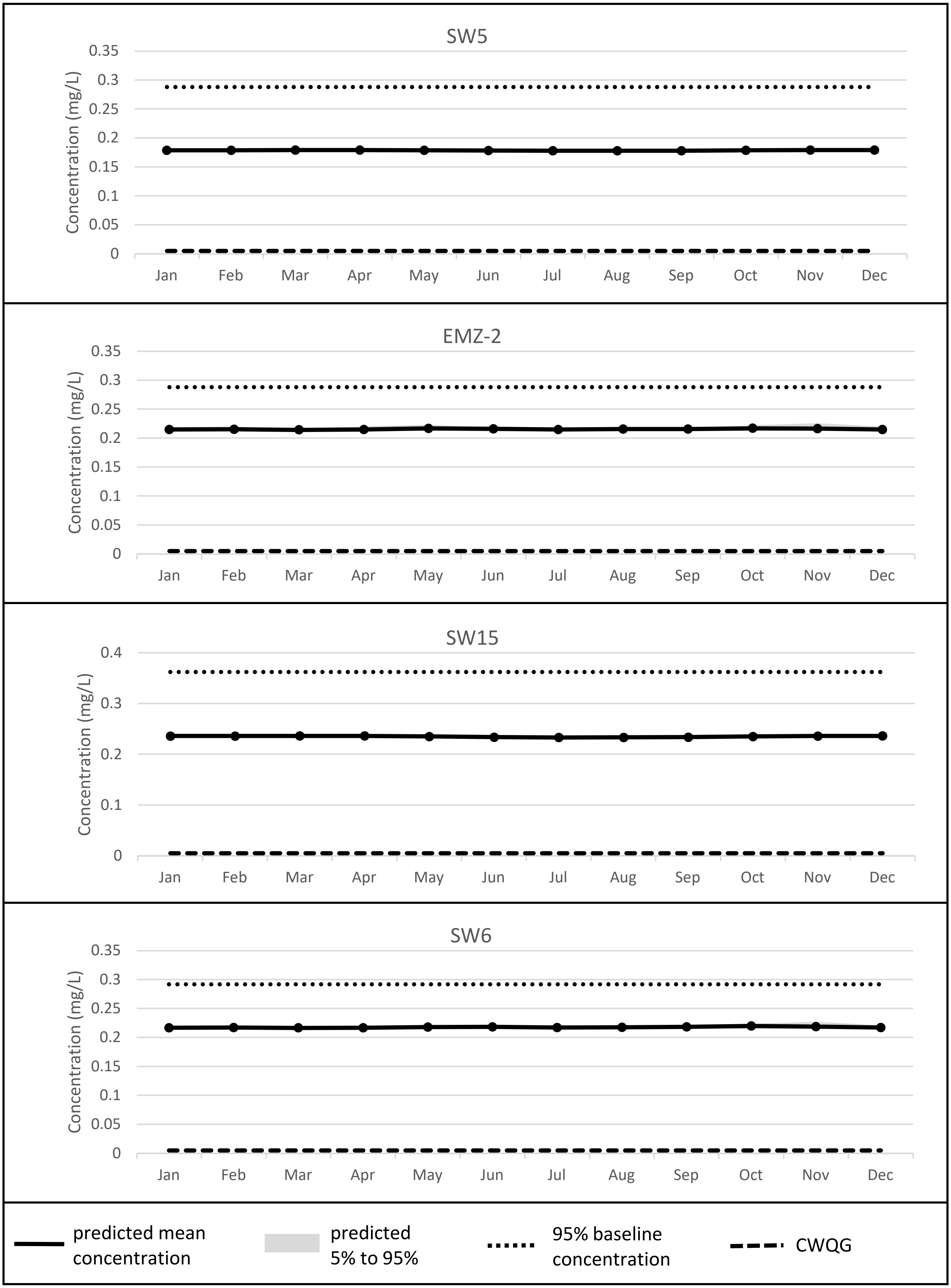


FIGURE B-24: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ANTIMONY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

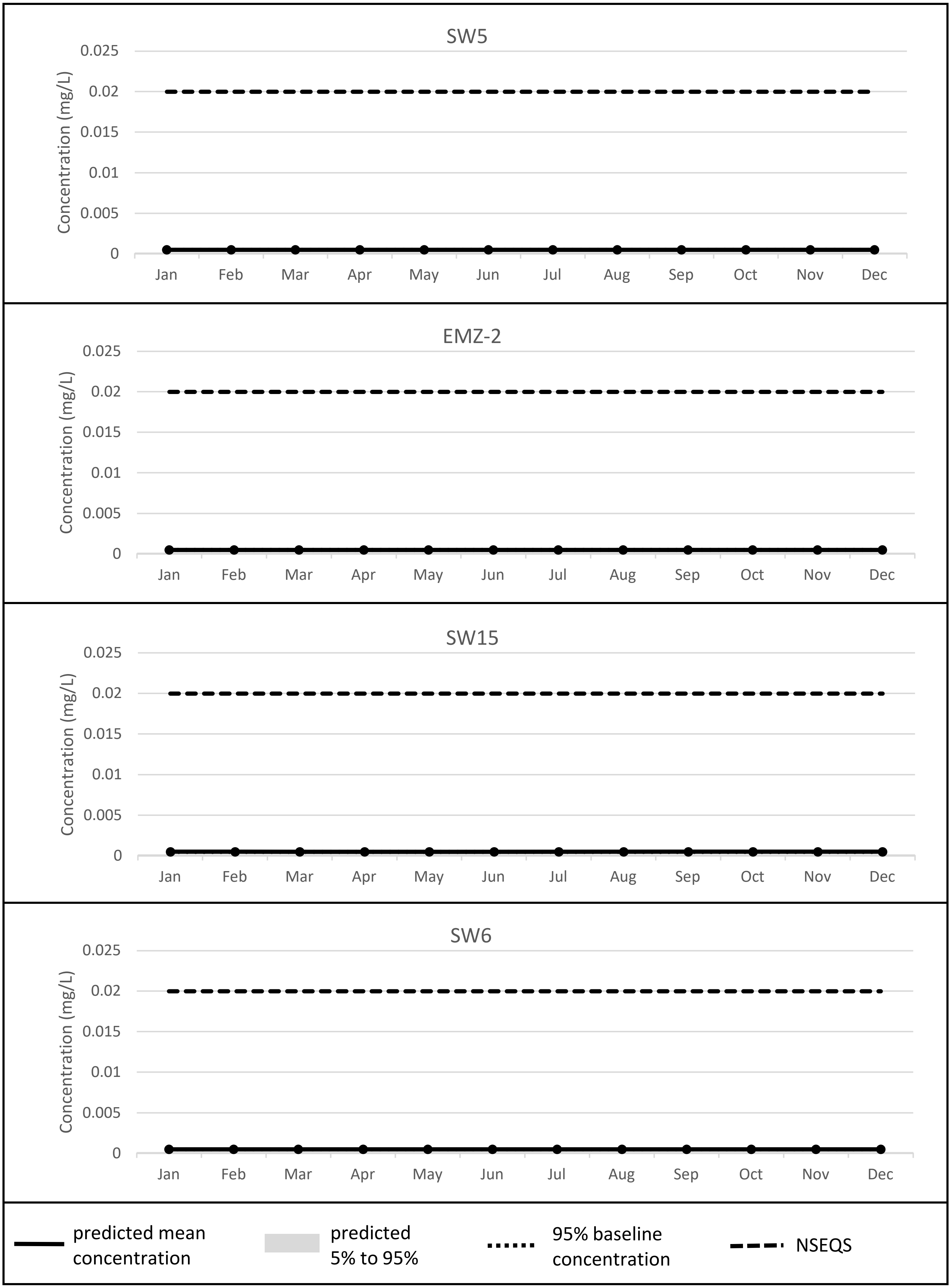


FIGURE B-25: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ARSENIC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

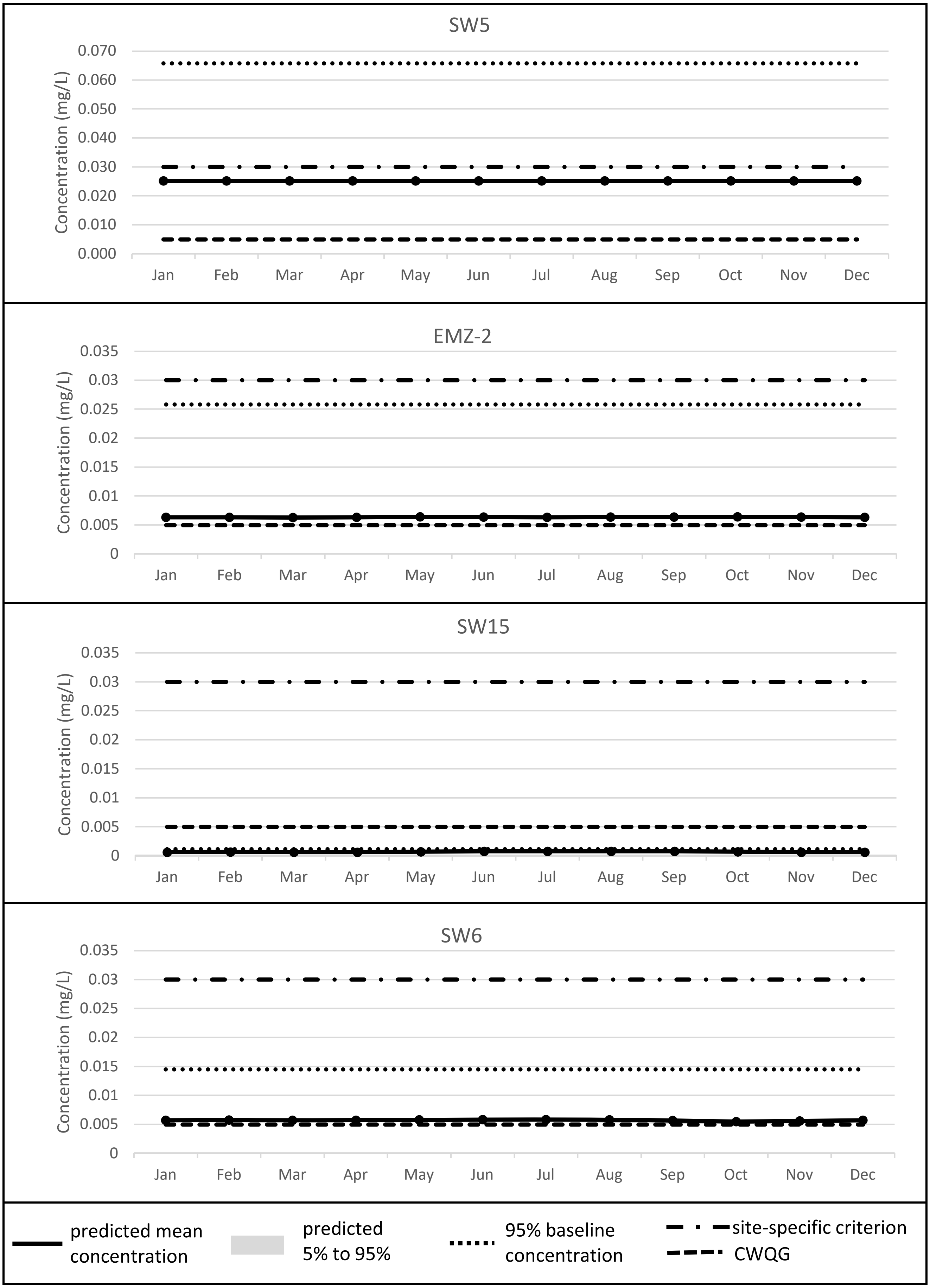


FIGURE B-26: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED BORON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

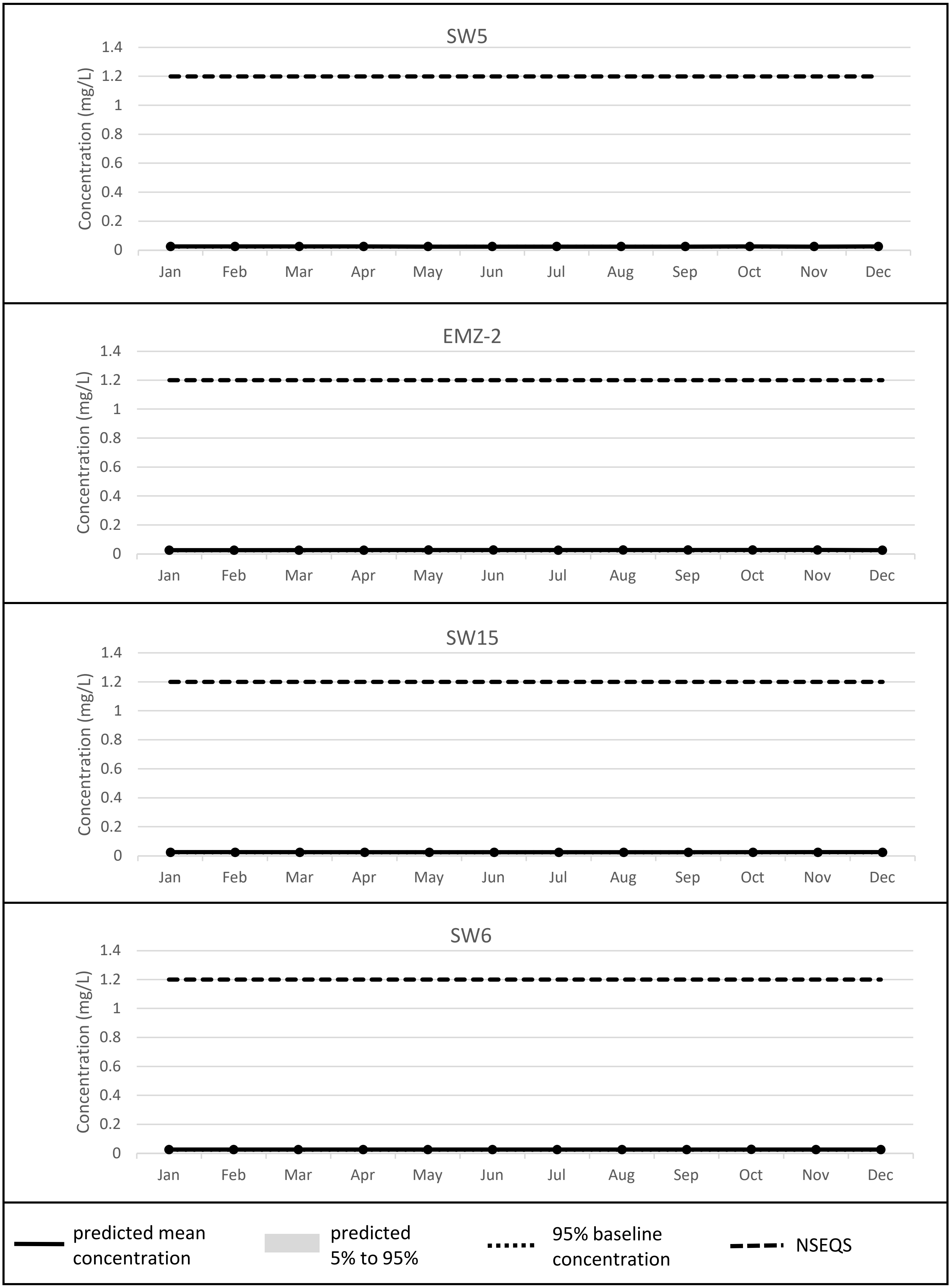


FIGURE B-27: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED CADMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

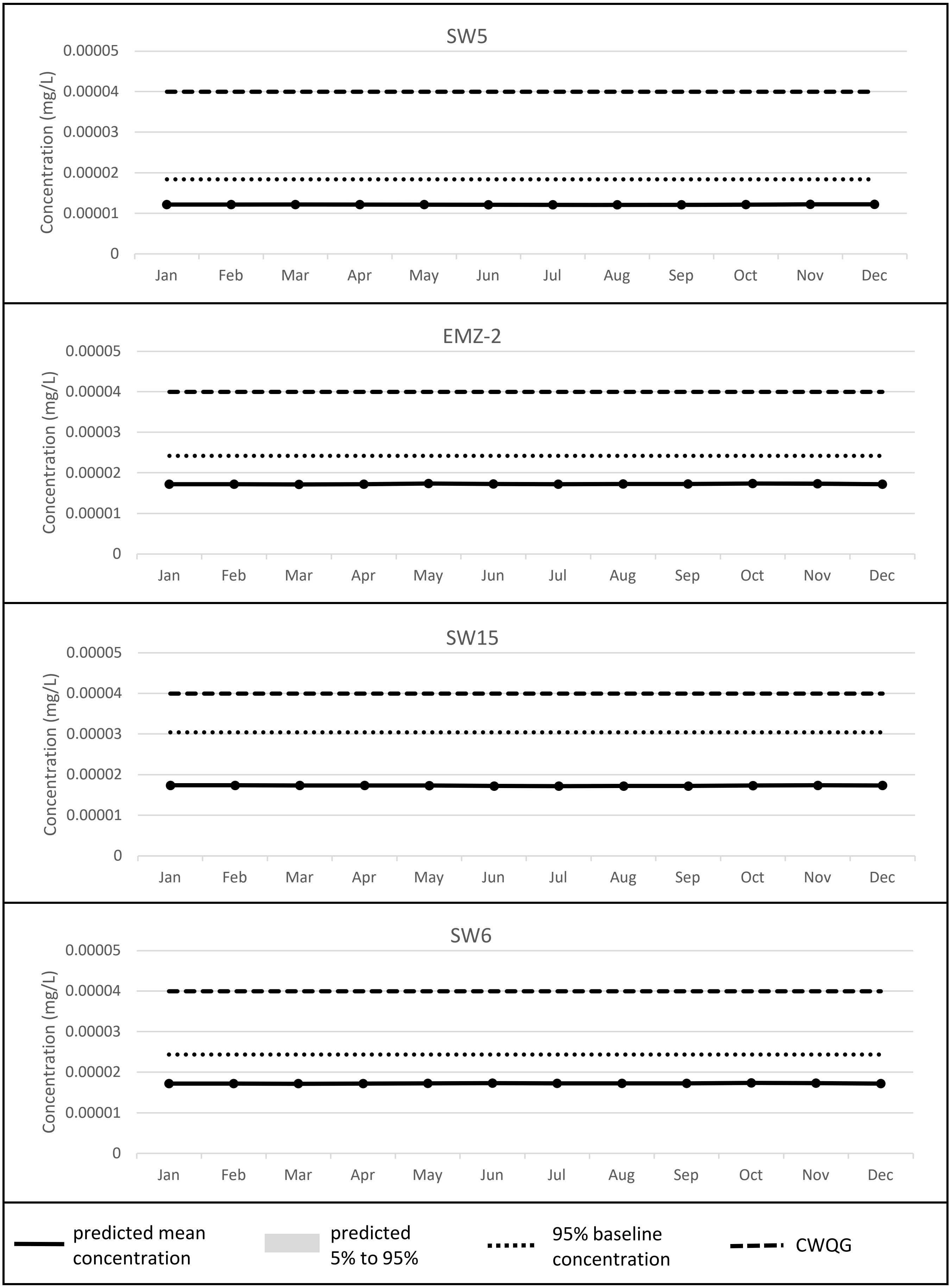


FIGURE B-28: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED CHROMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

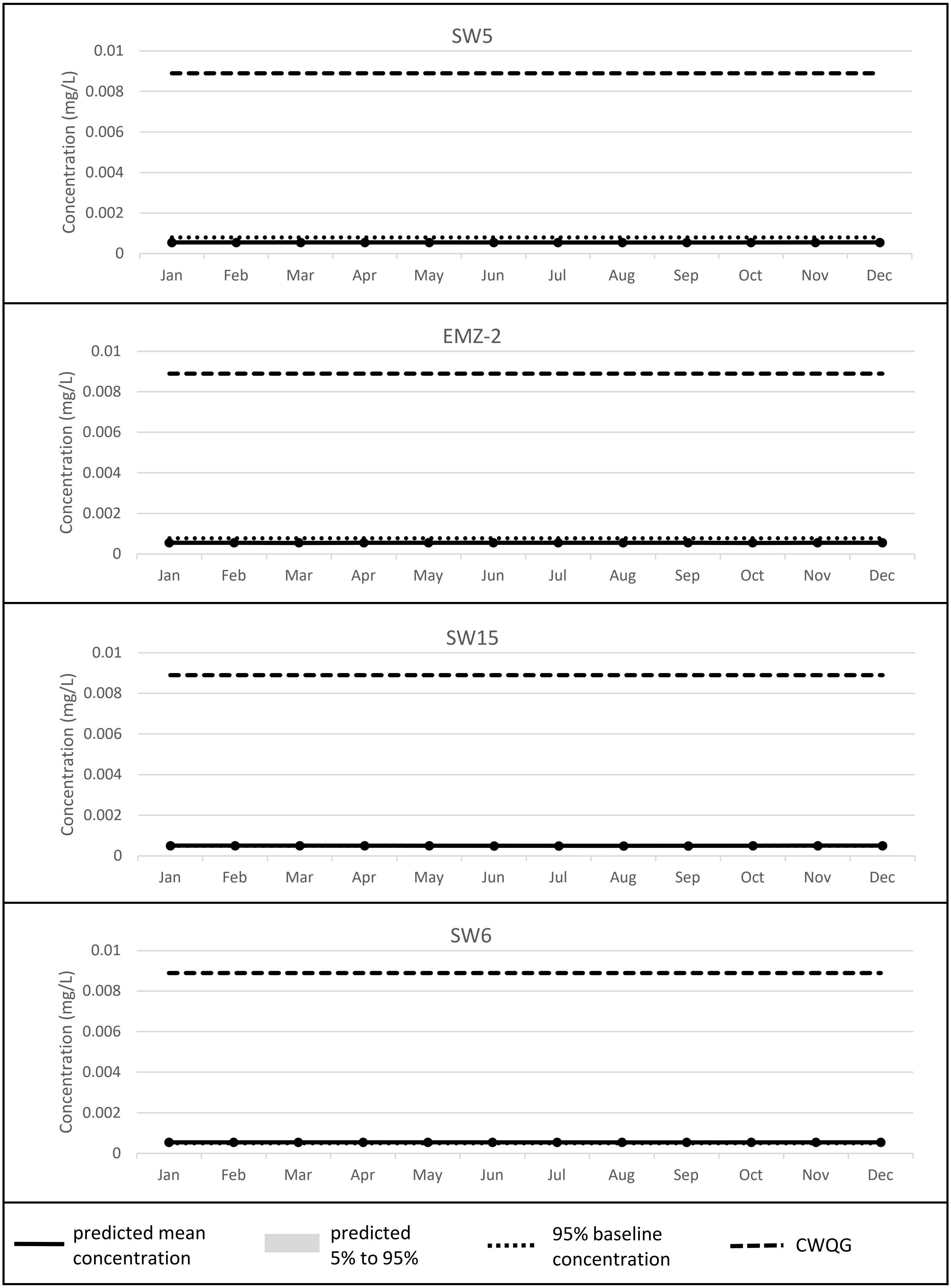


FIGURE B-29: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED COBALT CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

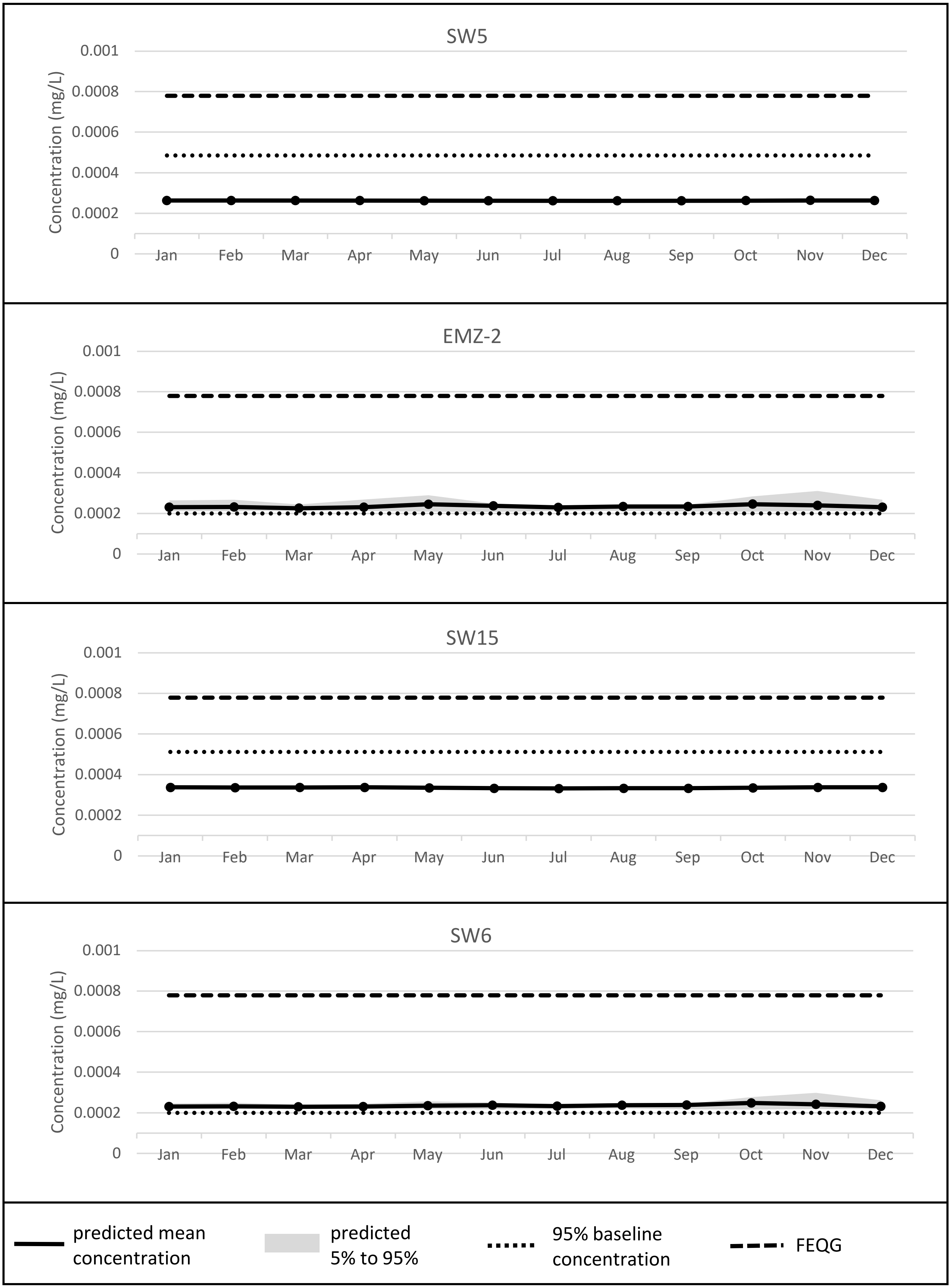
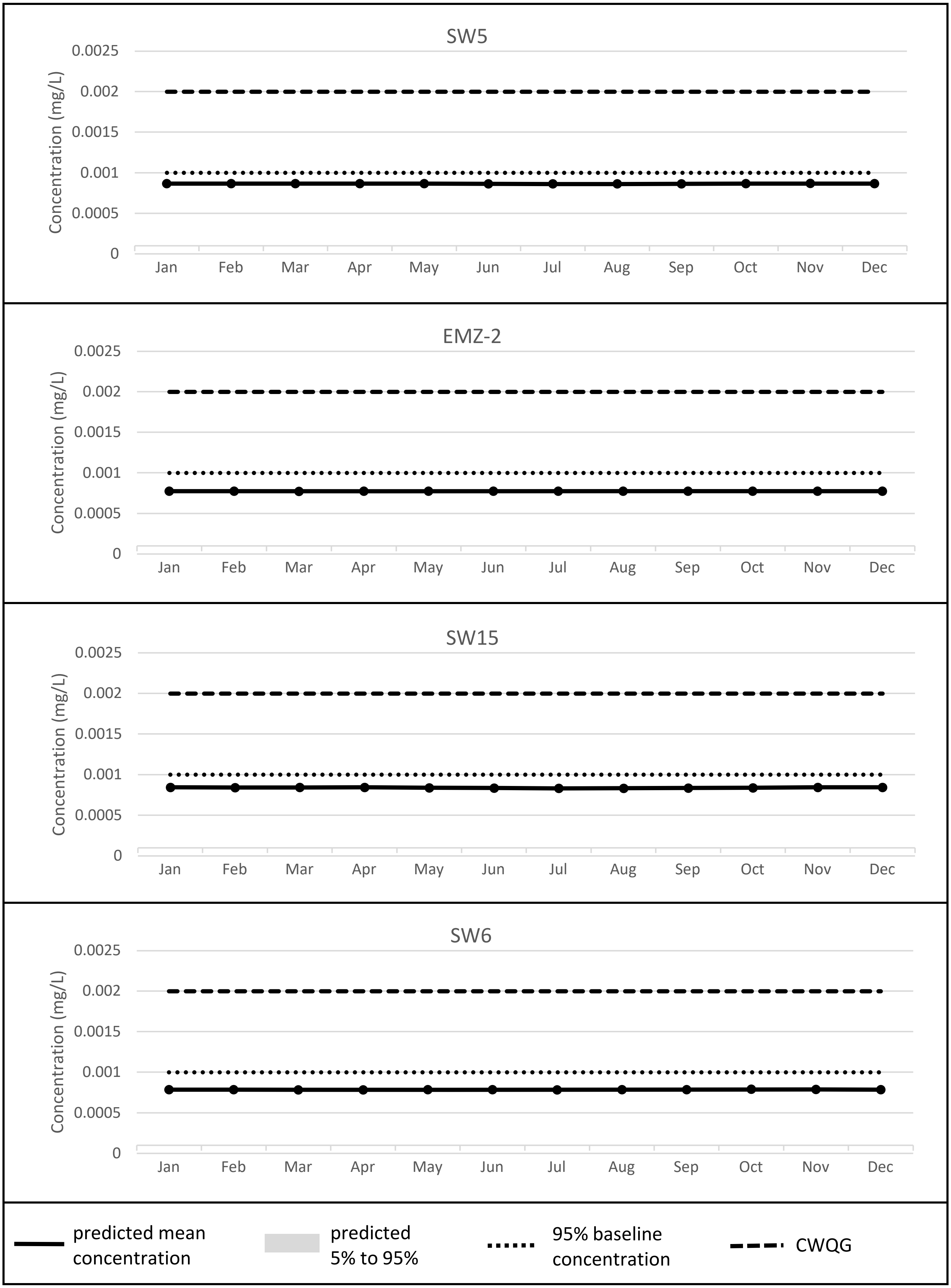


FIGURE B-30: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED COPPER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



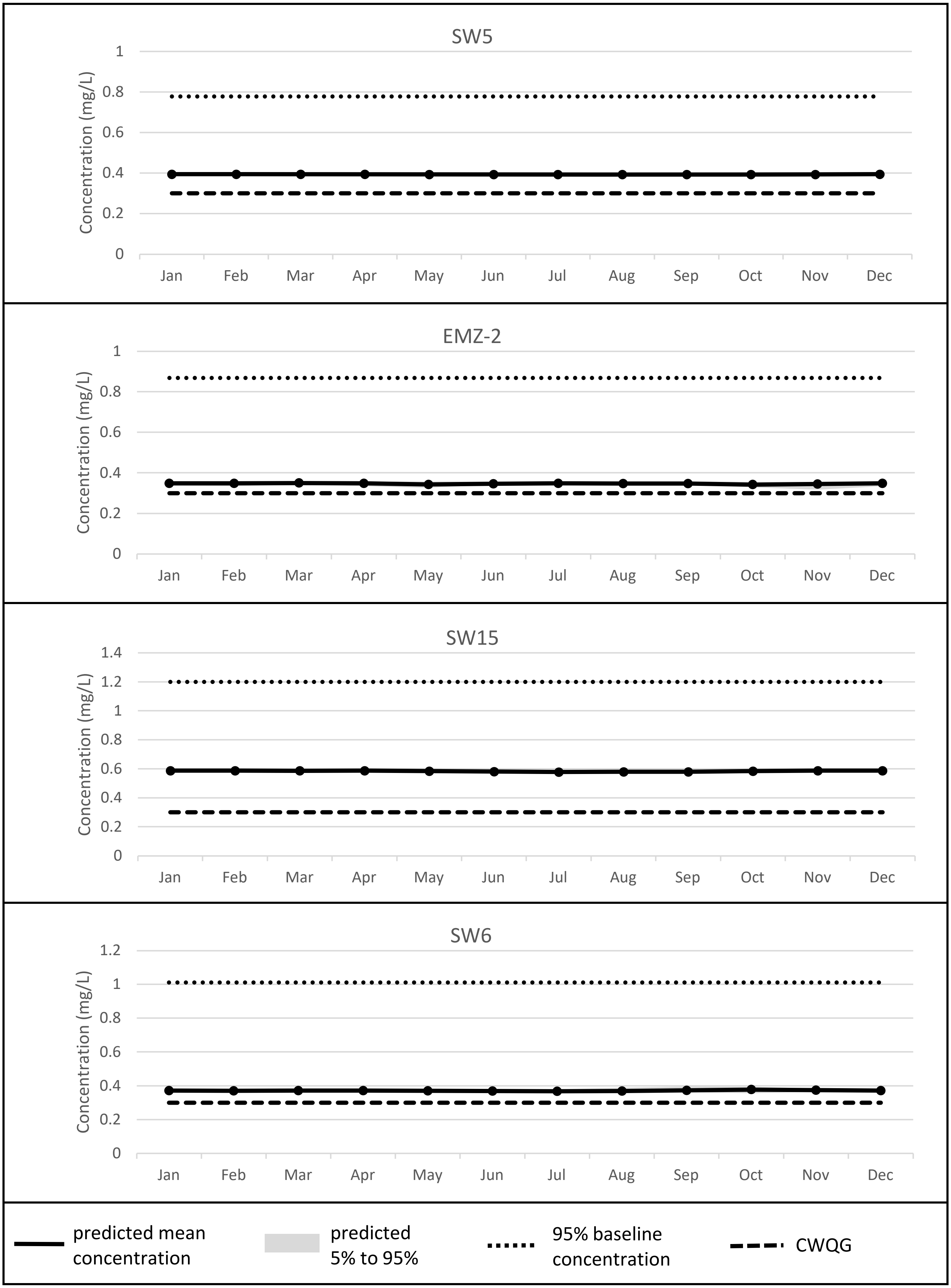

SW5
Concentration (mg/L)
0
0.2
0.4
0.6
0.8
1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
EMZ-2
Concentration (mg/L)
SW15
Concentration (mg/L)
1.2
1.4
SW6
Concentration (mg/L)
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
CWQG

FIGURE B-32: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED LEAD CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

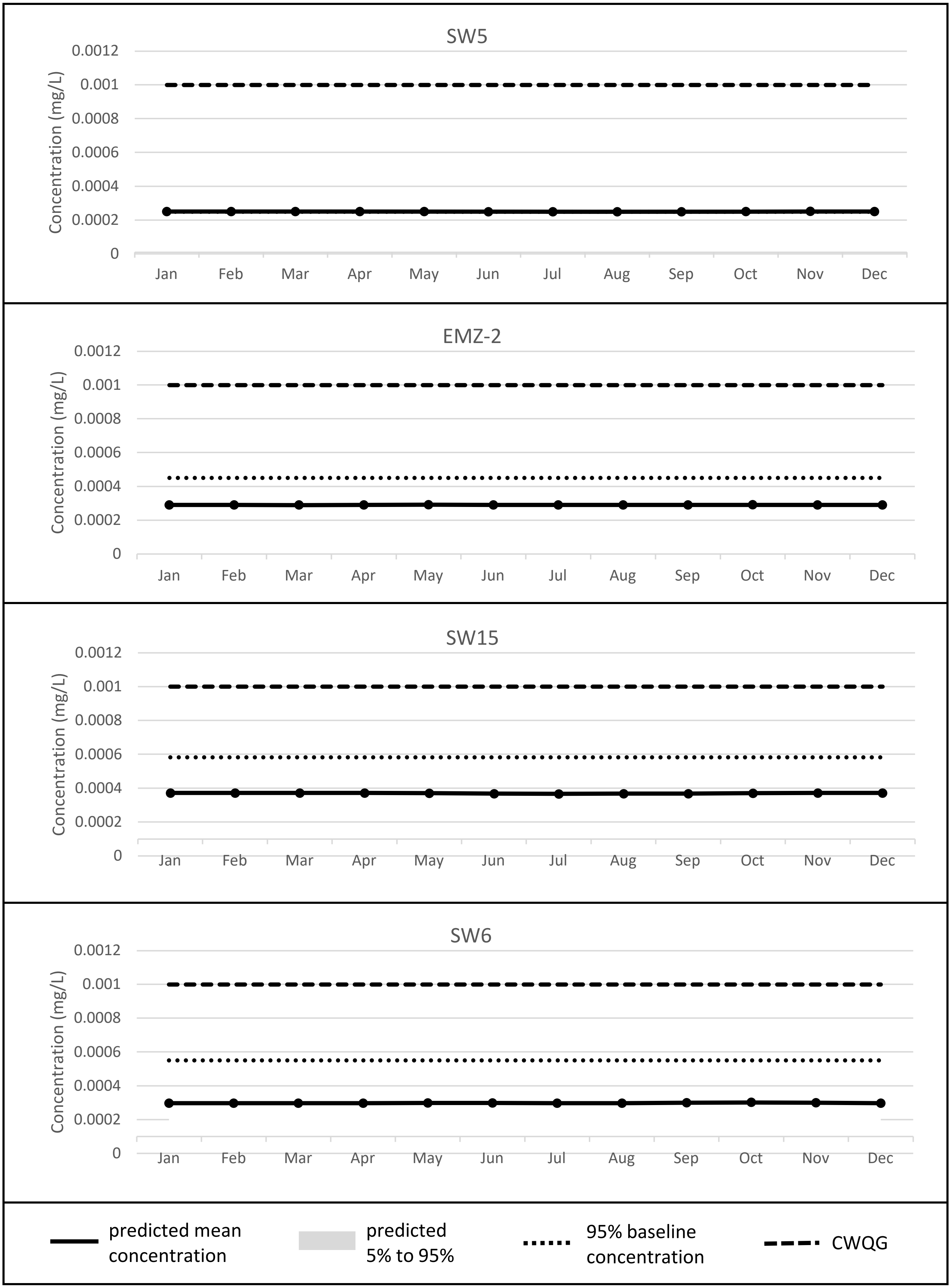


FIGURE B-33: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED MANGANESE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

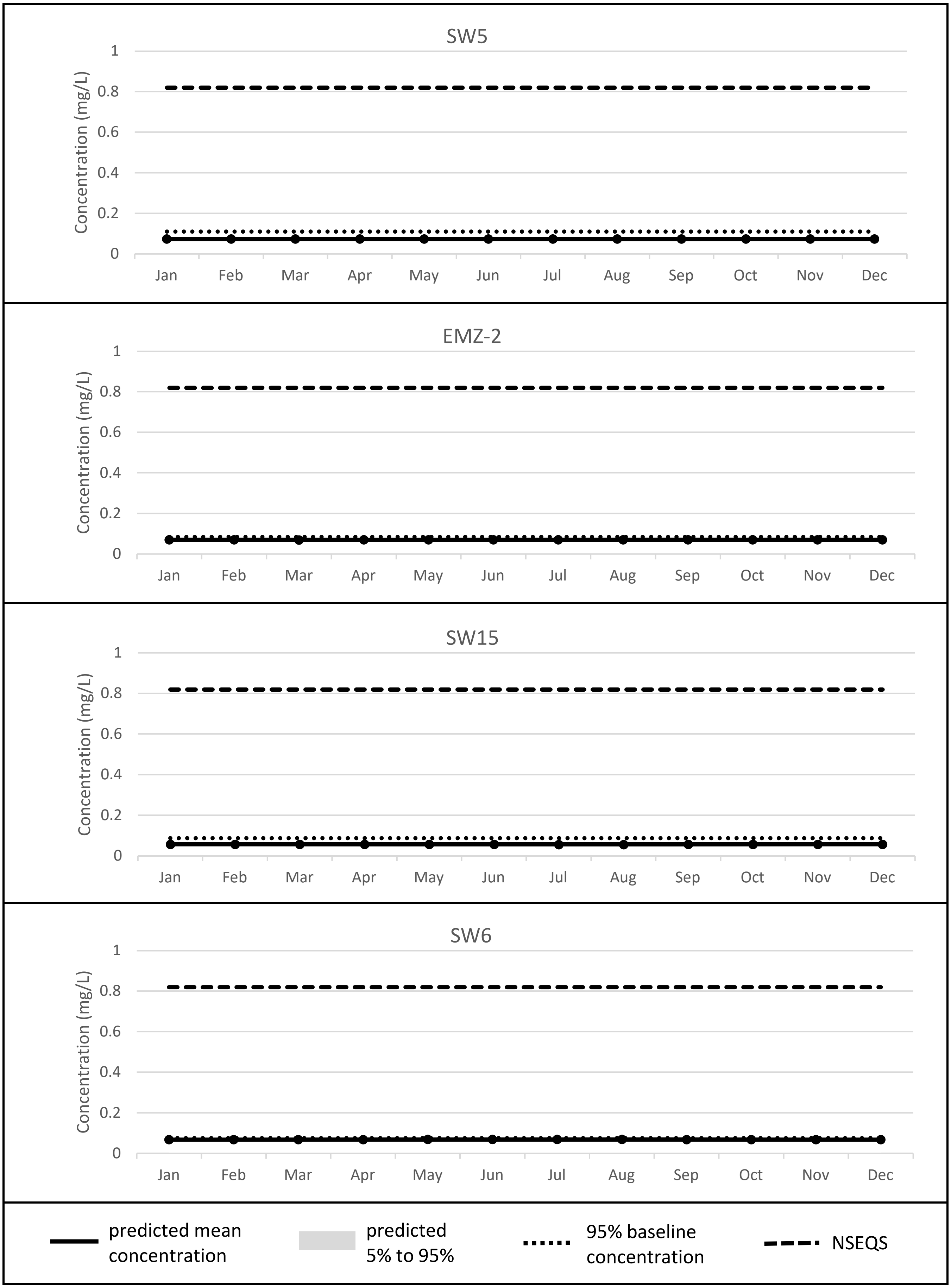


FIGURE B-34: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED MERCURY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

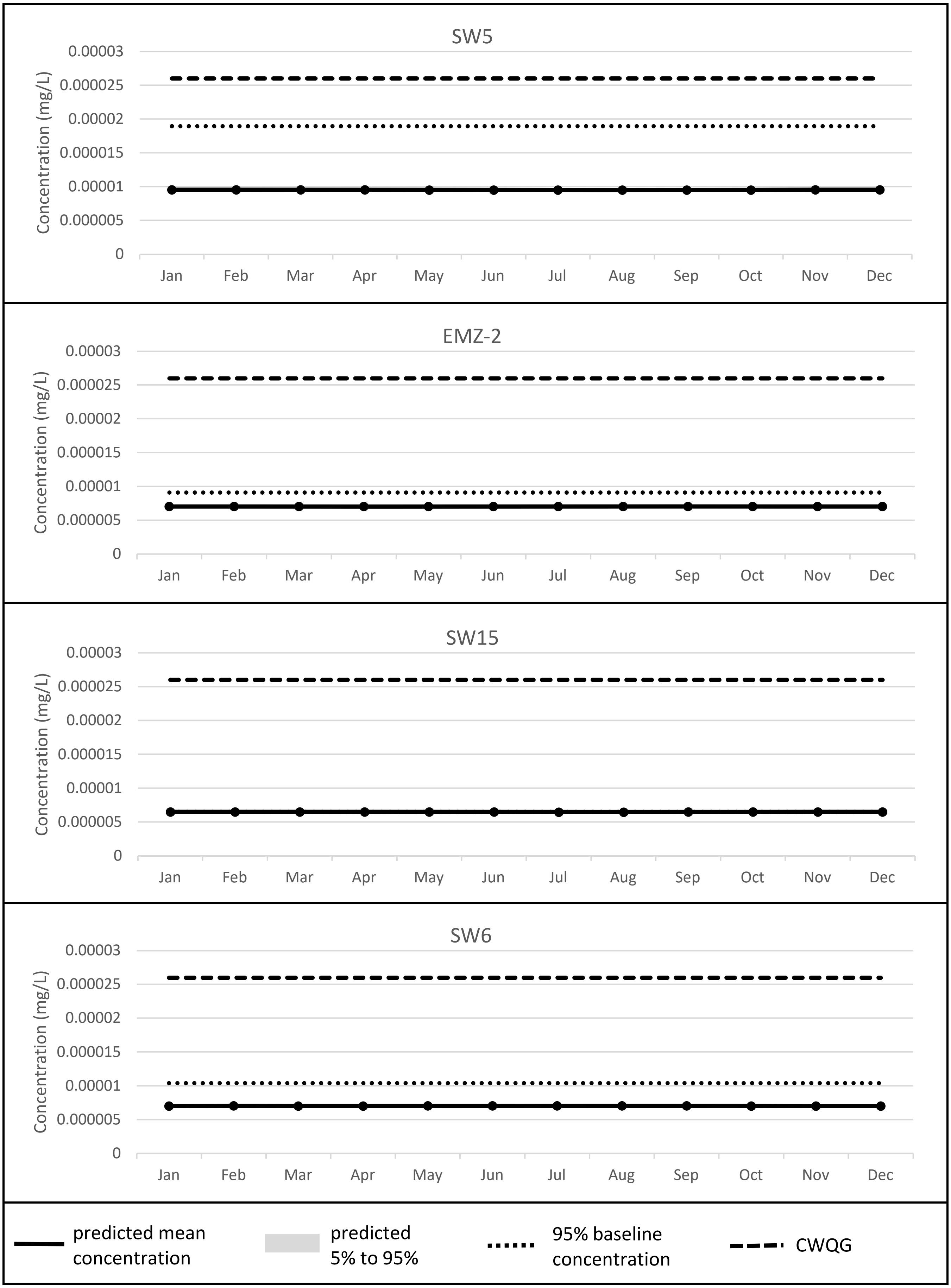


FIGURE B-35: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED MOLYBDENUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

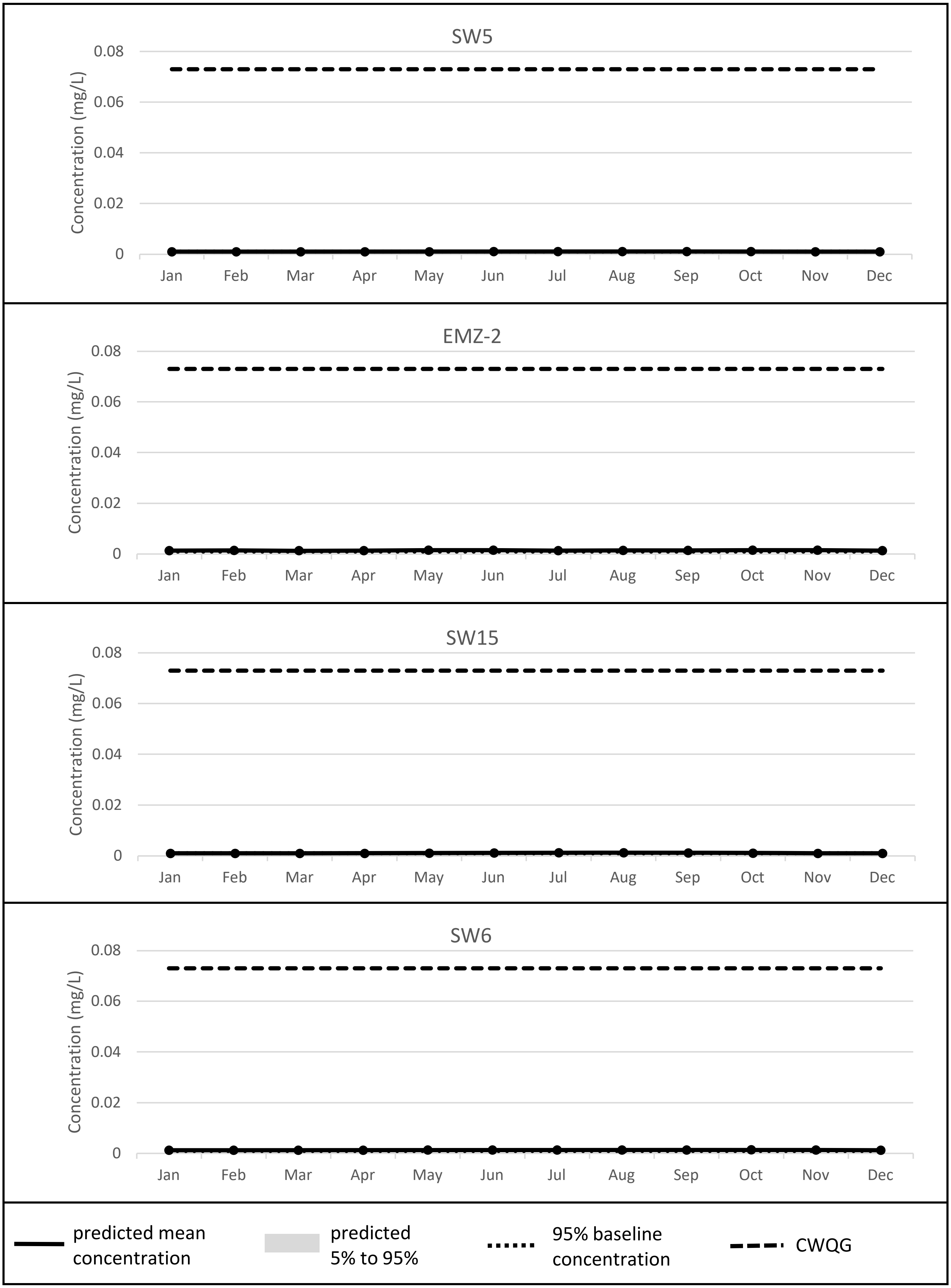


FIGURE B-36: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED NICKEL CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

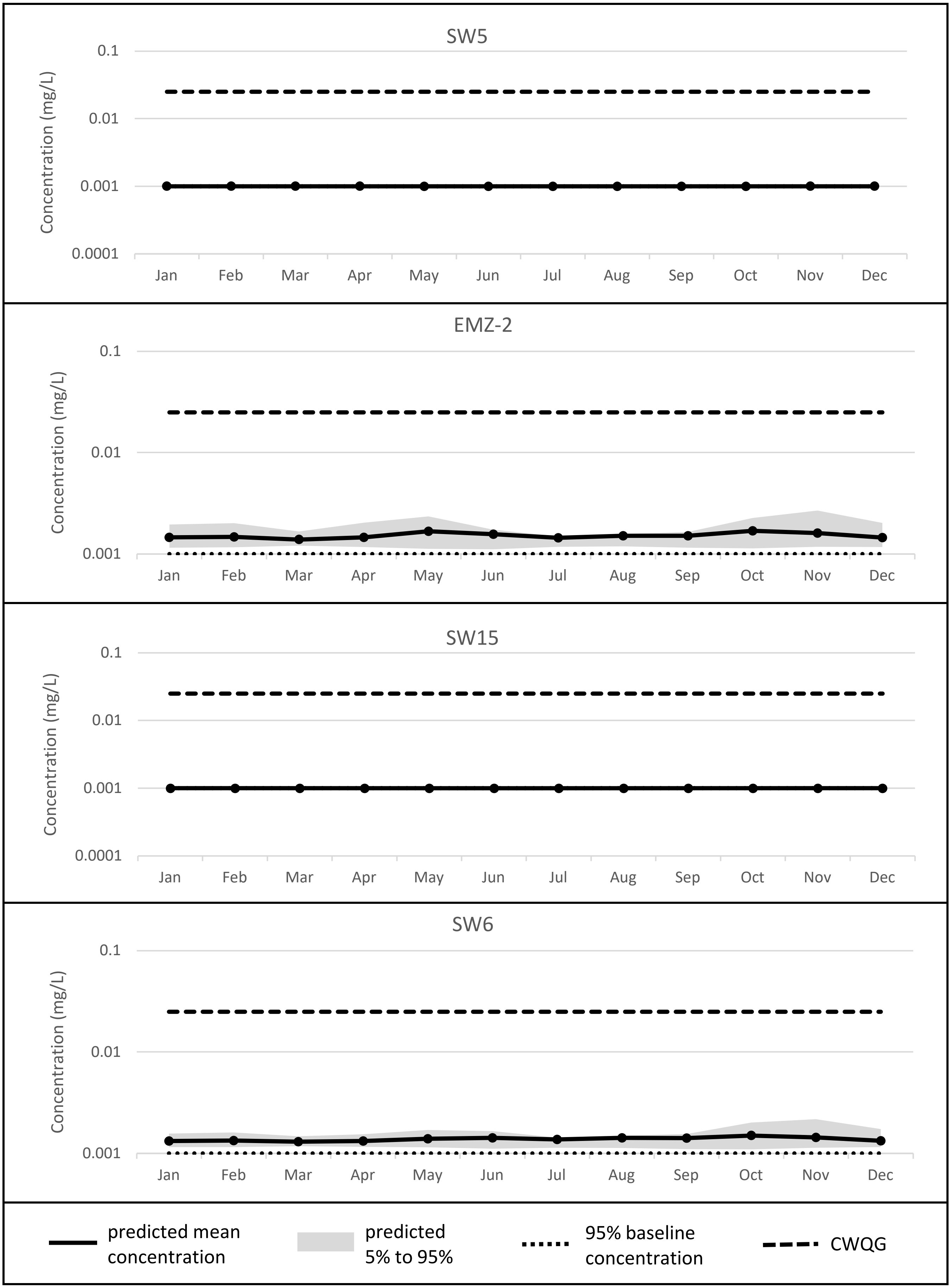


FIGURE B-37: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED NITRATE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

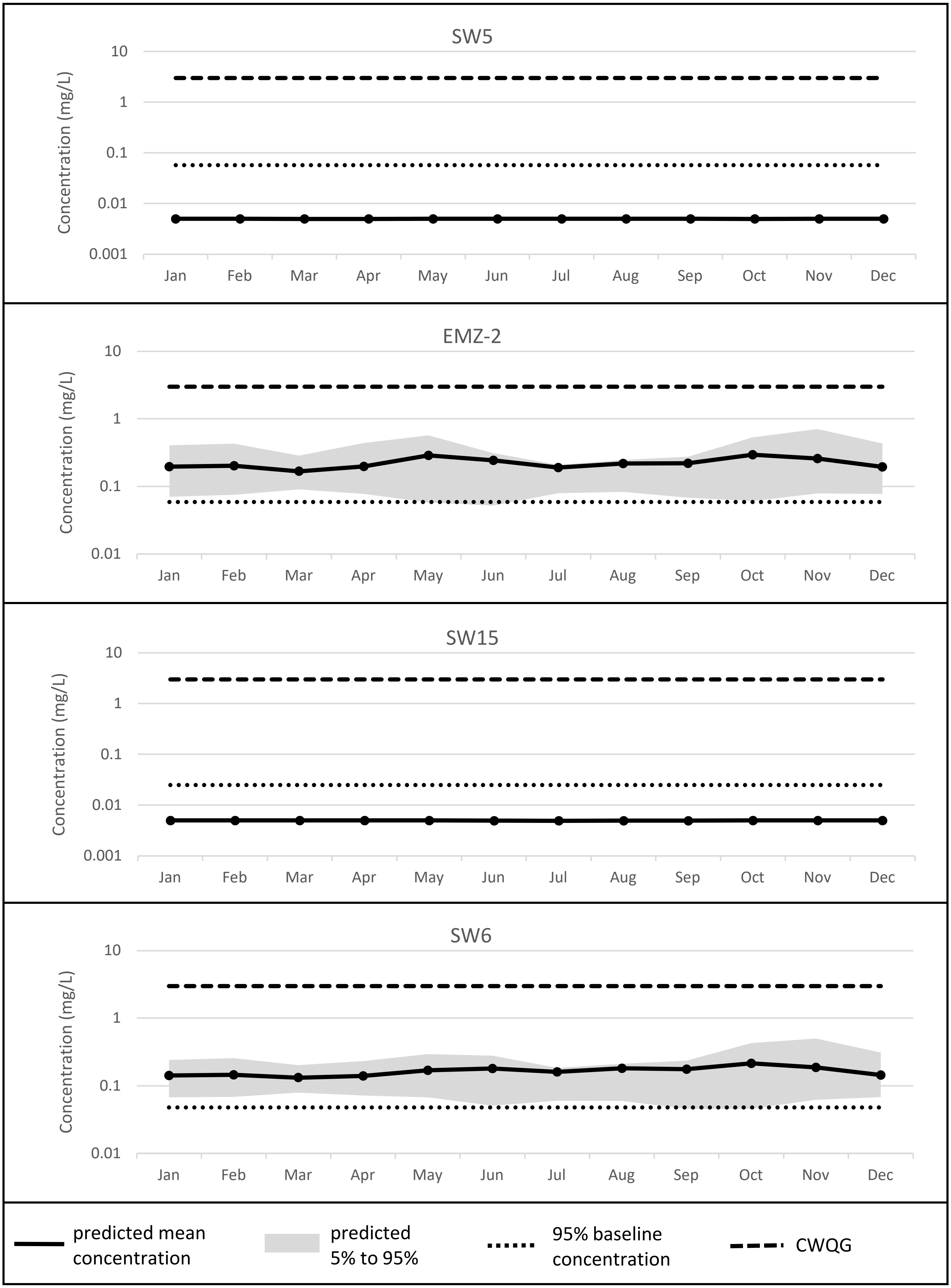


FIGURE B-38: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED NITRITE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

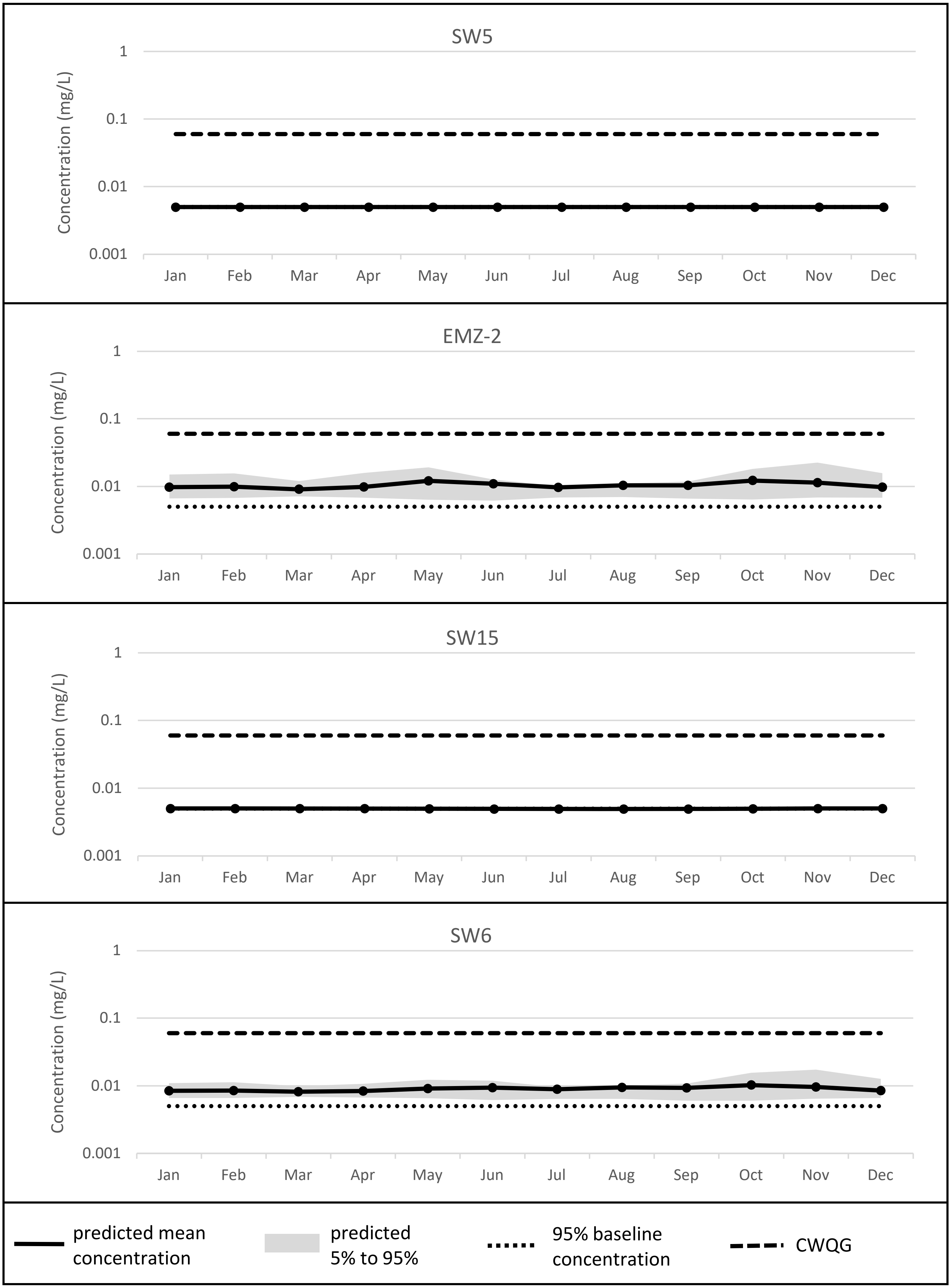
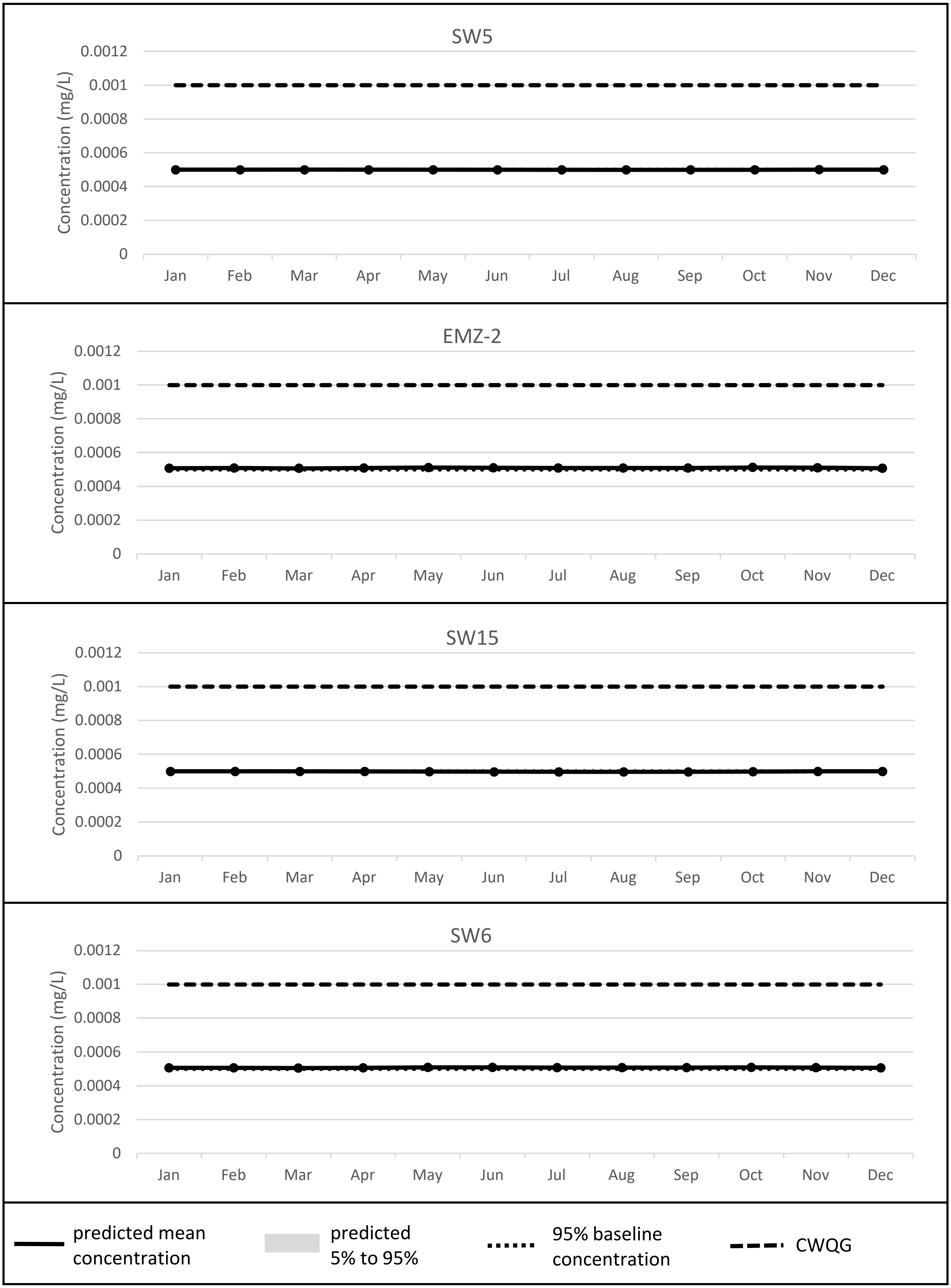
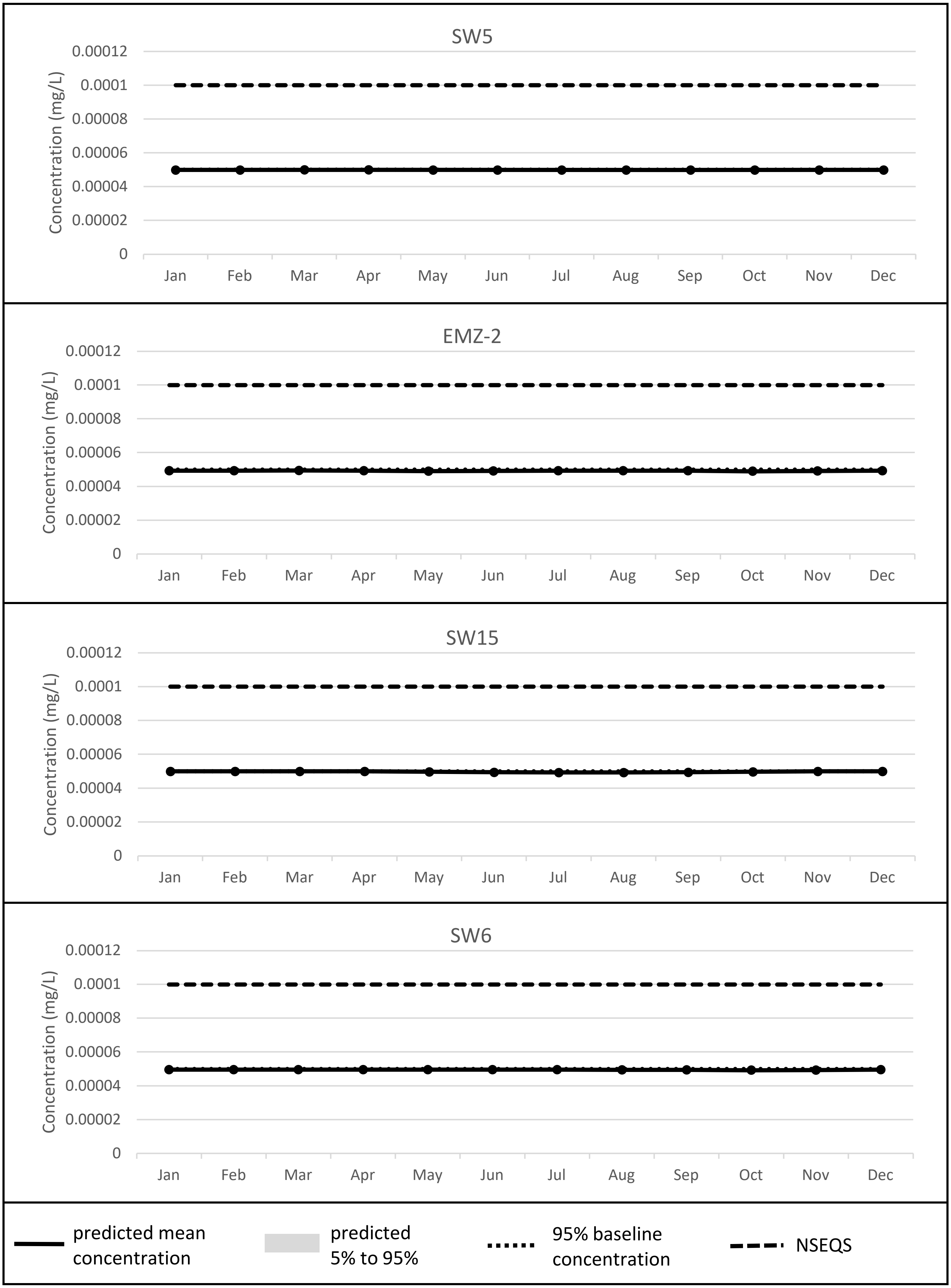


FIGURE B-39: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED SELENIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)





SW5
Concentration (mg/L)
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
EMZ-2
SW15
SW6
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
NSEQS

FIGURE B-41: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED THALLIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

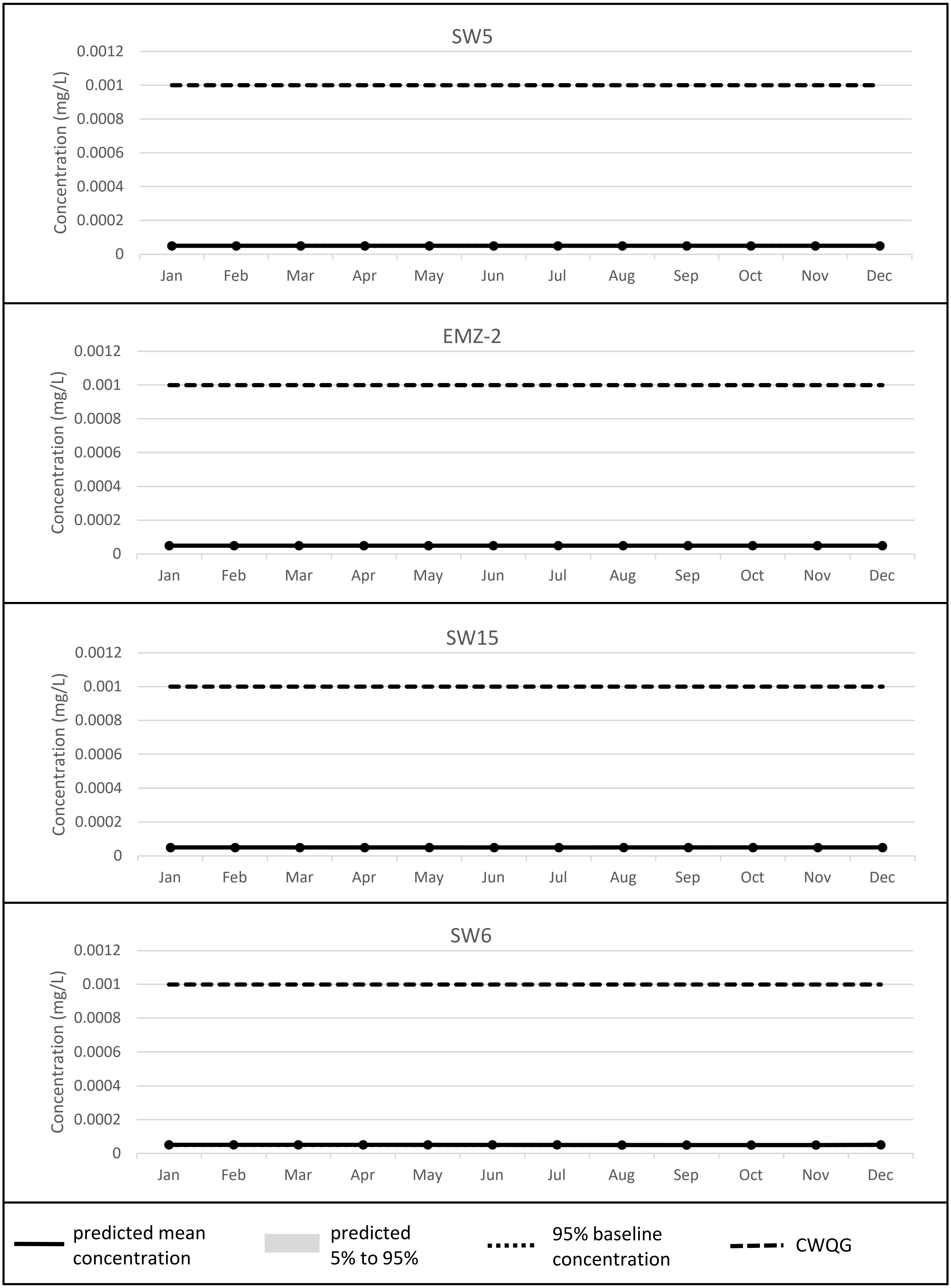


FIGURE B-42: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

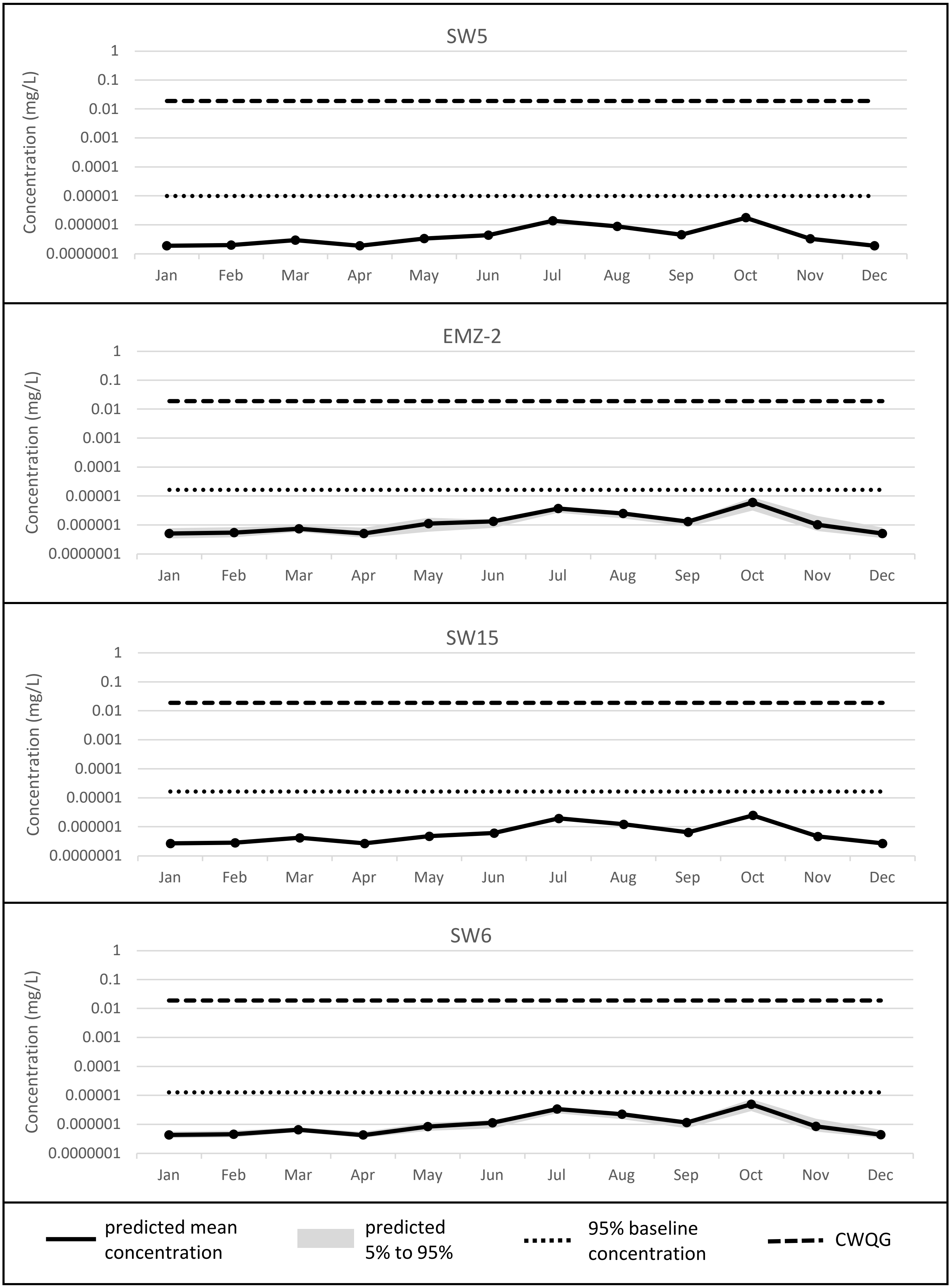


FIGURE B-43: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED URANIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

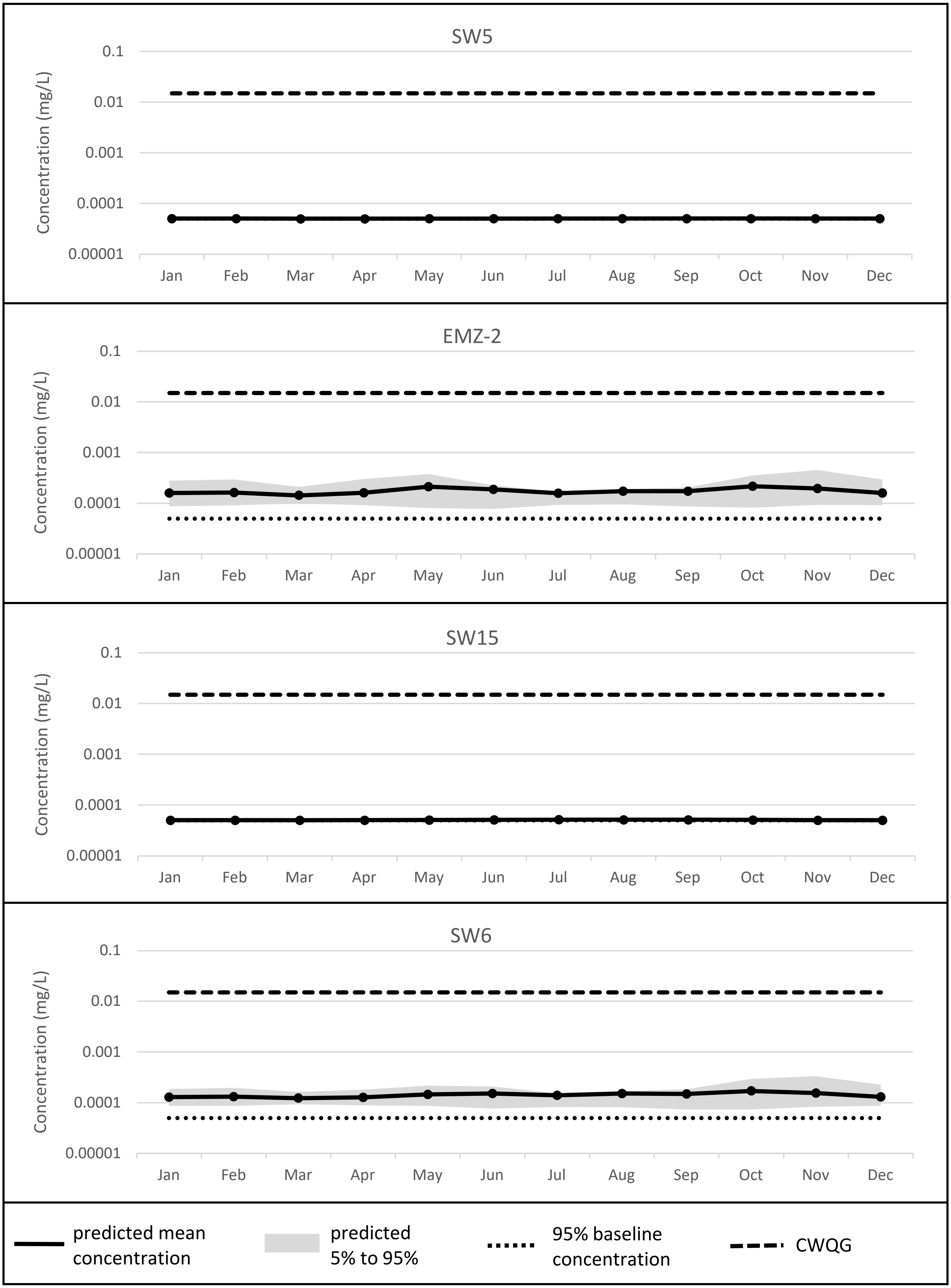


FIGURE B-44: WATER QUALITY MODELLING RESULTS - OPERATIONS PHASE PREDICTED ZINC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

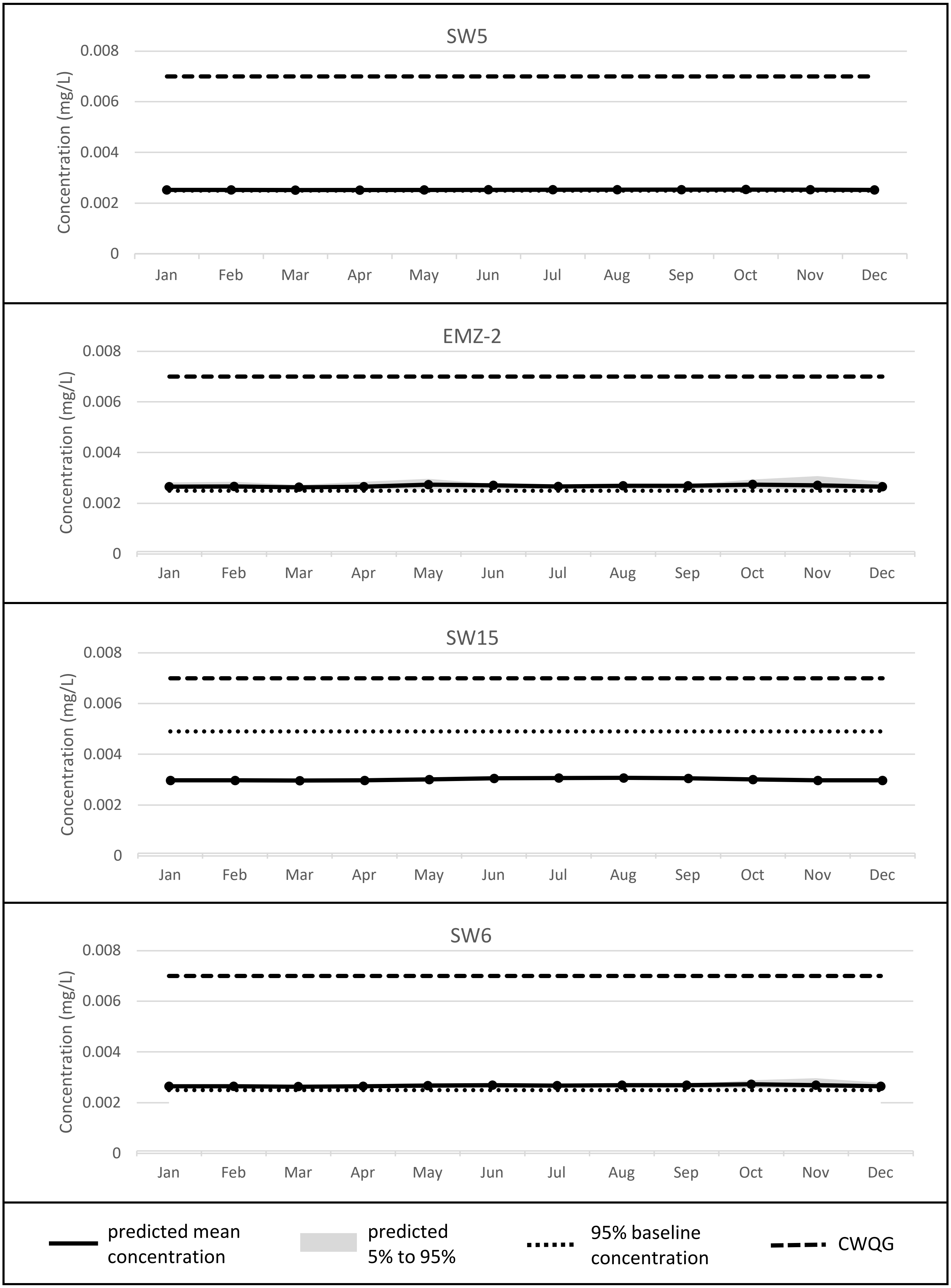


FIGURE B-45: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ALUMINUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

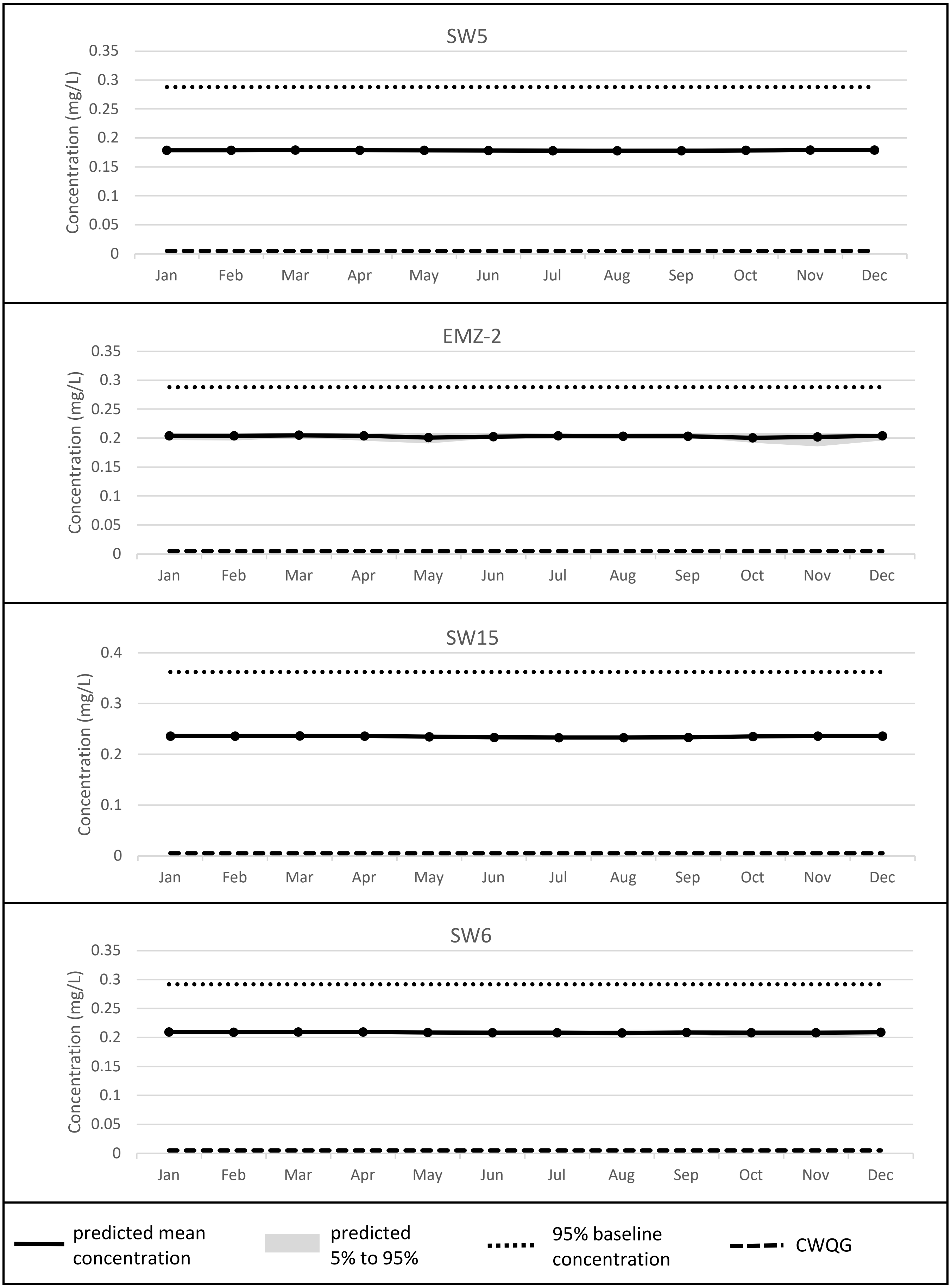


FIGURE B-46: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ANTIMONY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

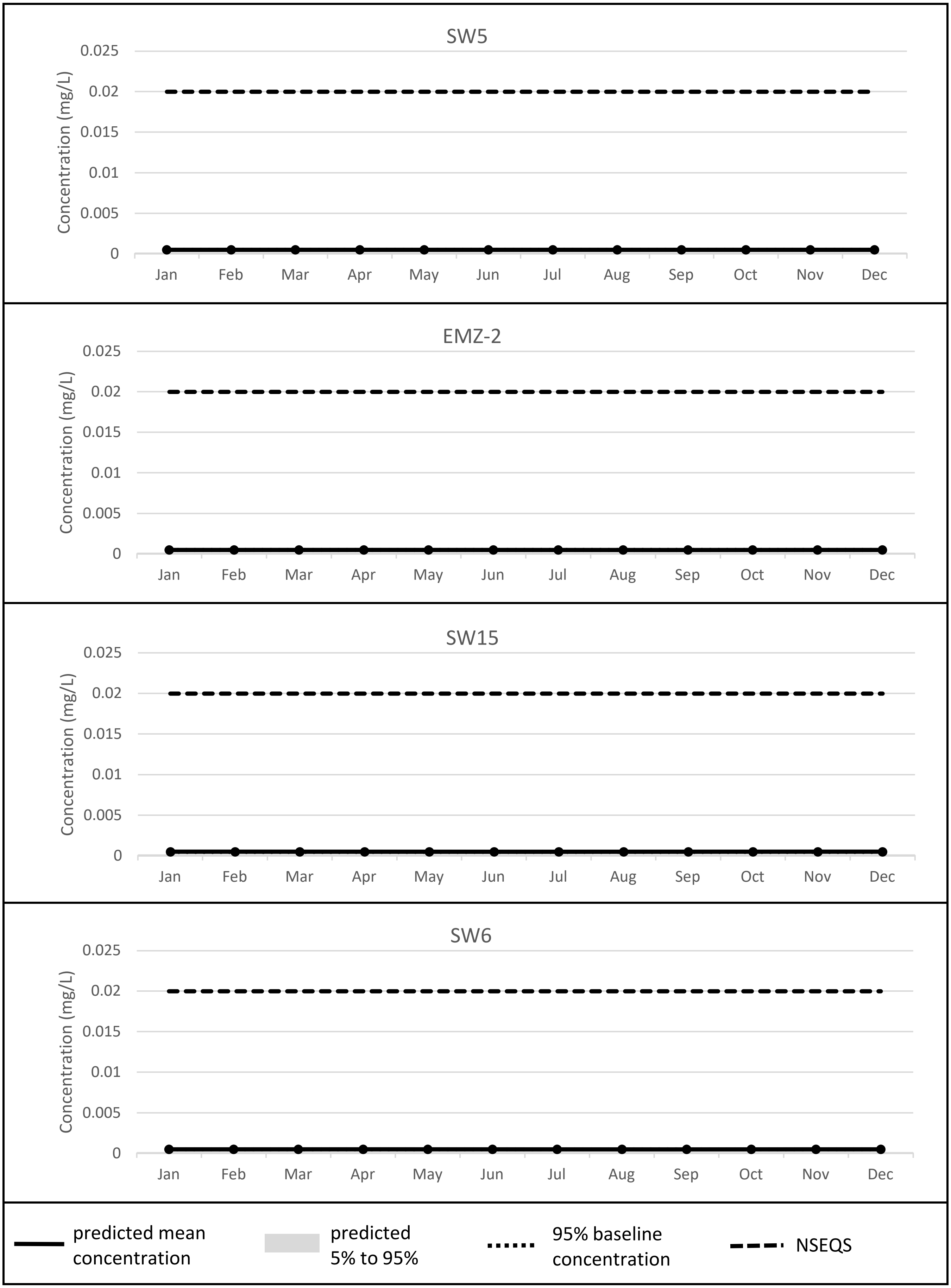


FIGURE B-47: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ARSENIC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

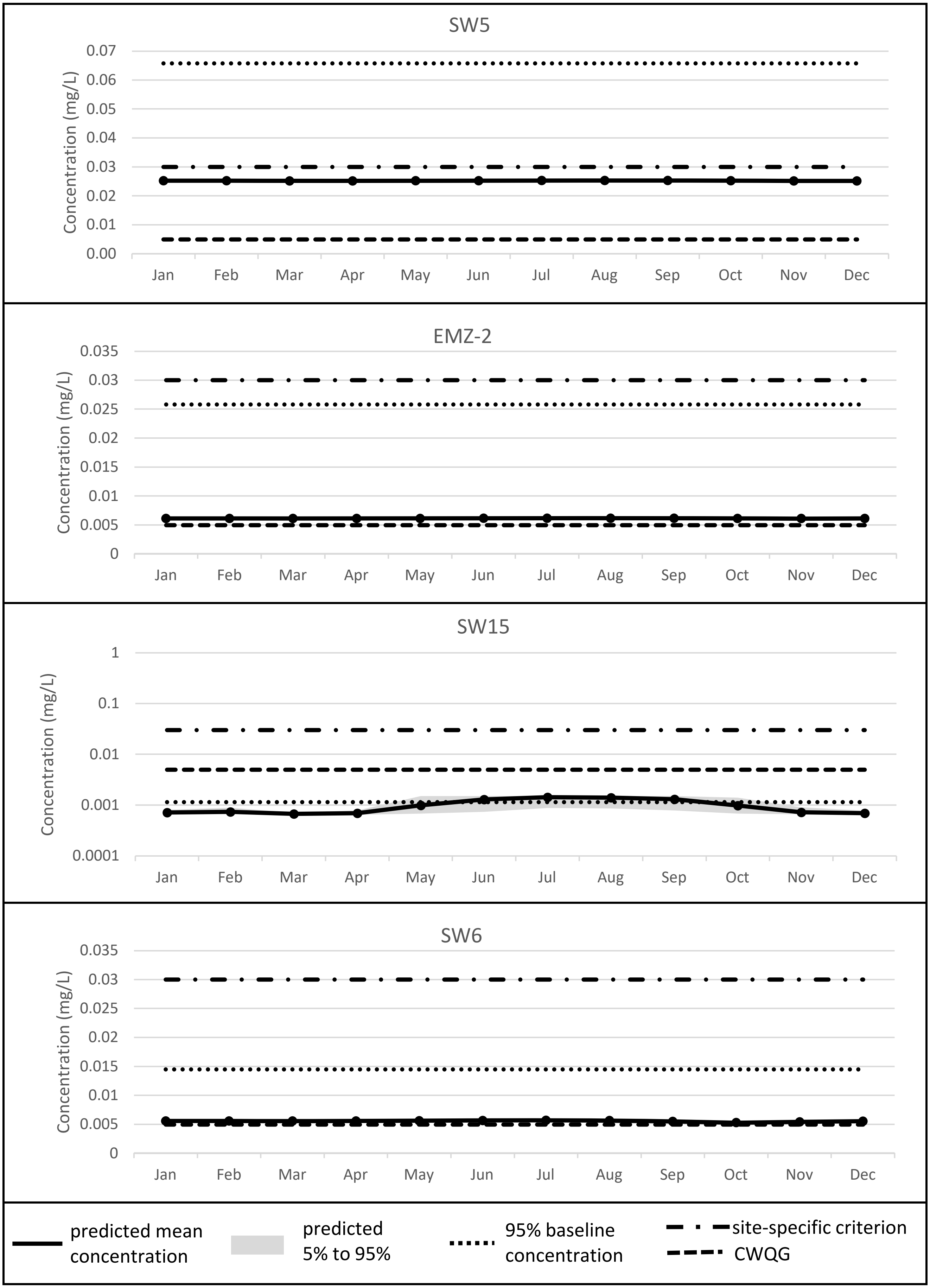


FIGURE B-48: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED BORON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

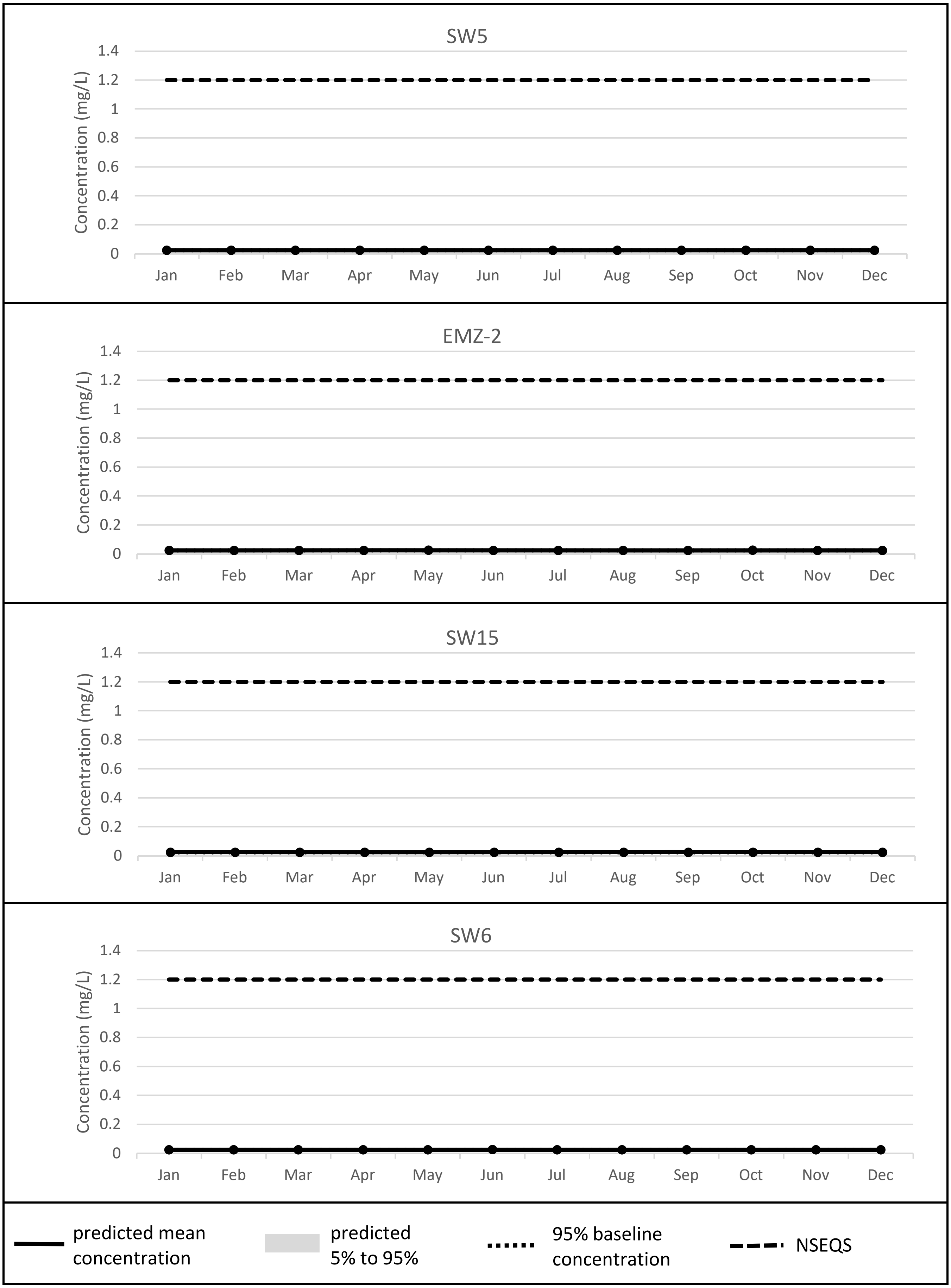


FIGURE B-49: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED CADMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

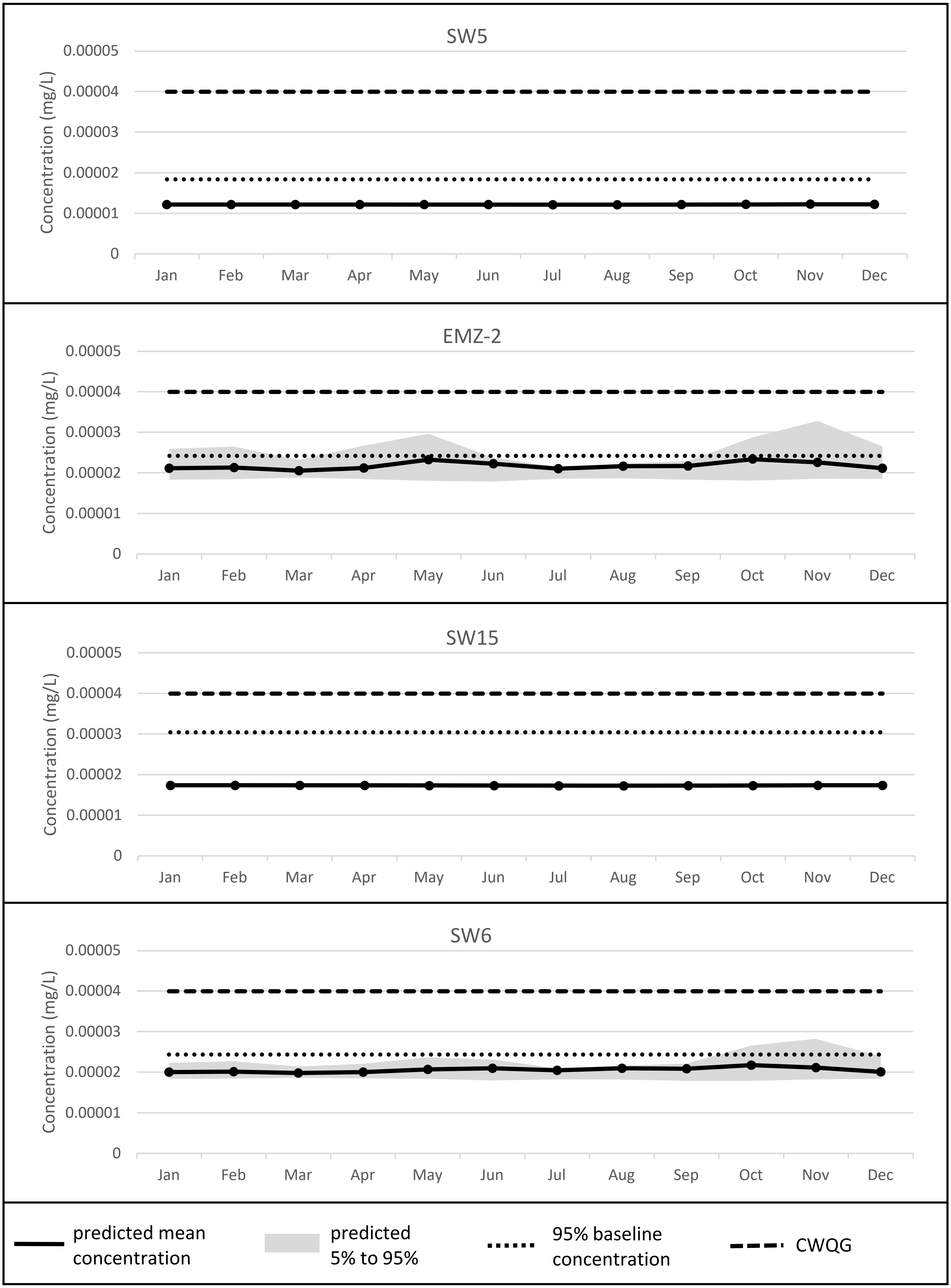


FIGURE B-50: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED CHROMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

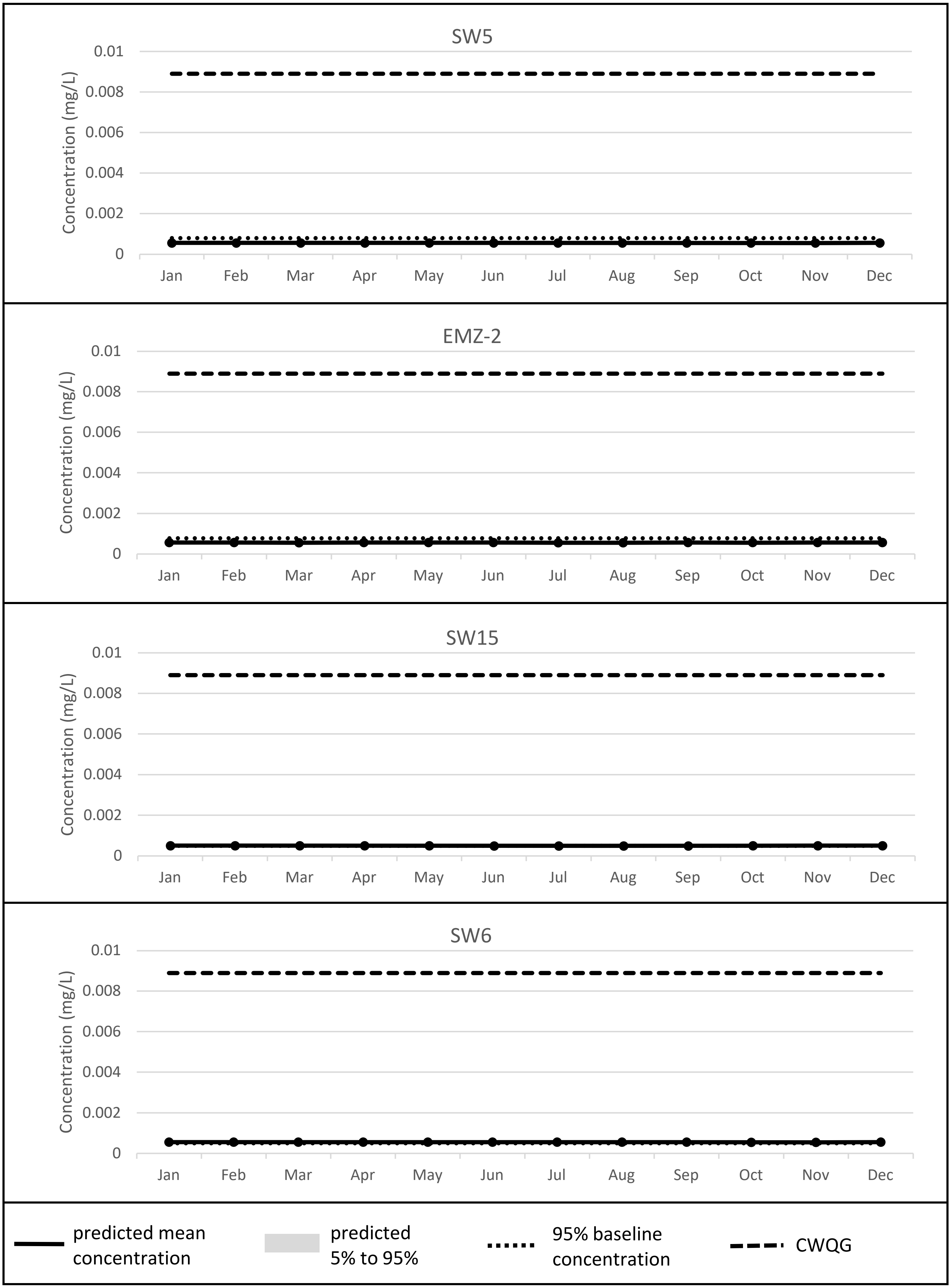


FIGURE B-51: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED COBALT CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

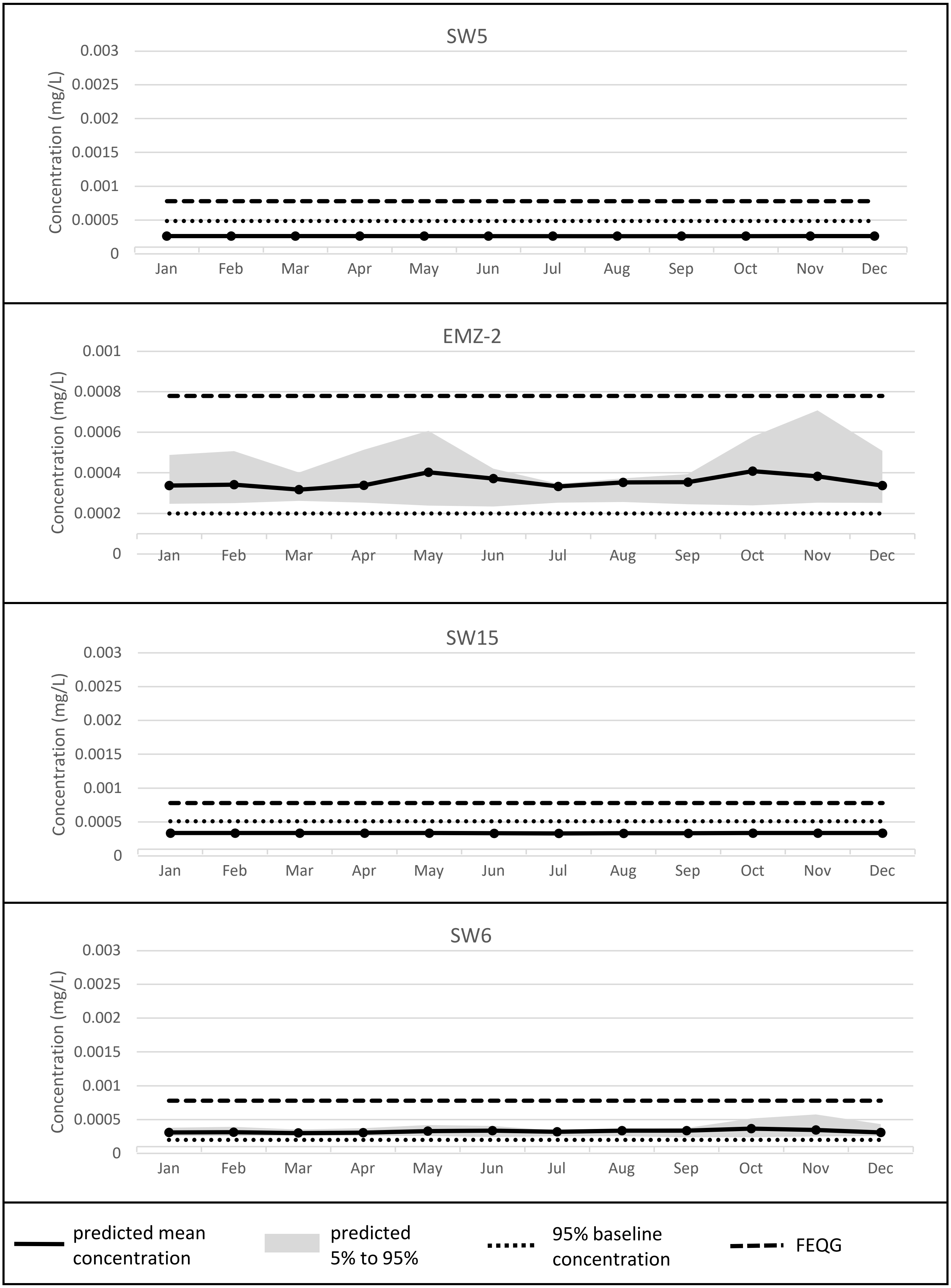


FIGURE B-52: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED COPPER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

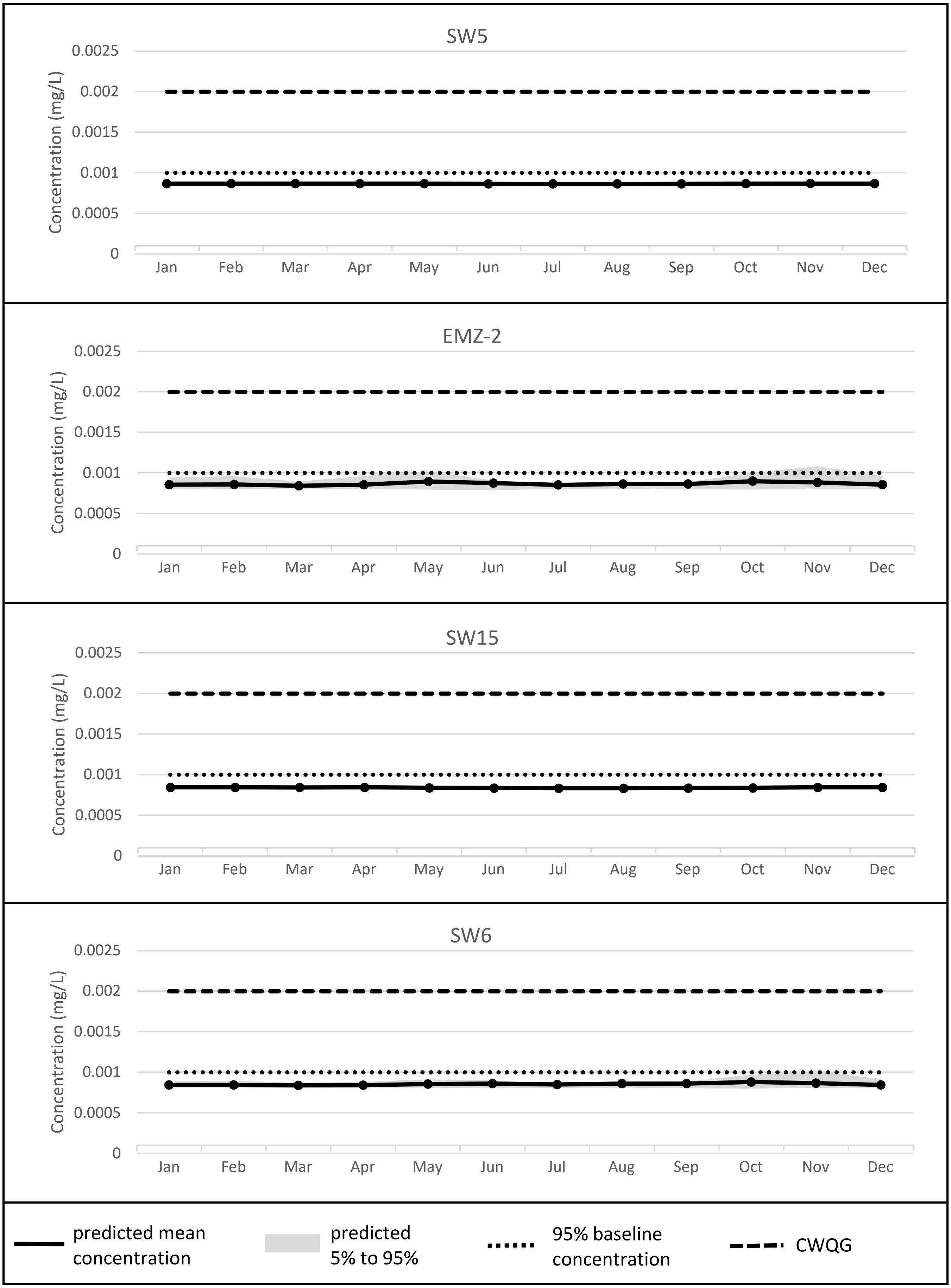


FIGURE B-53: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED IRON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

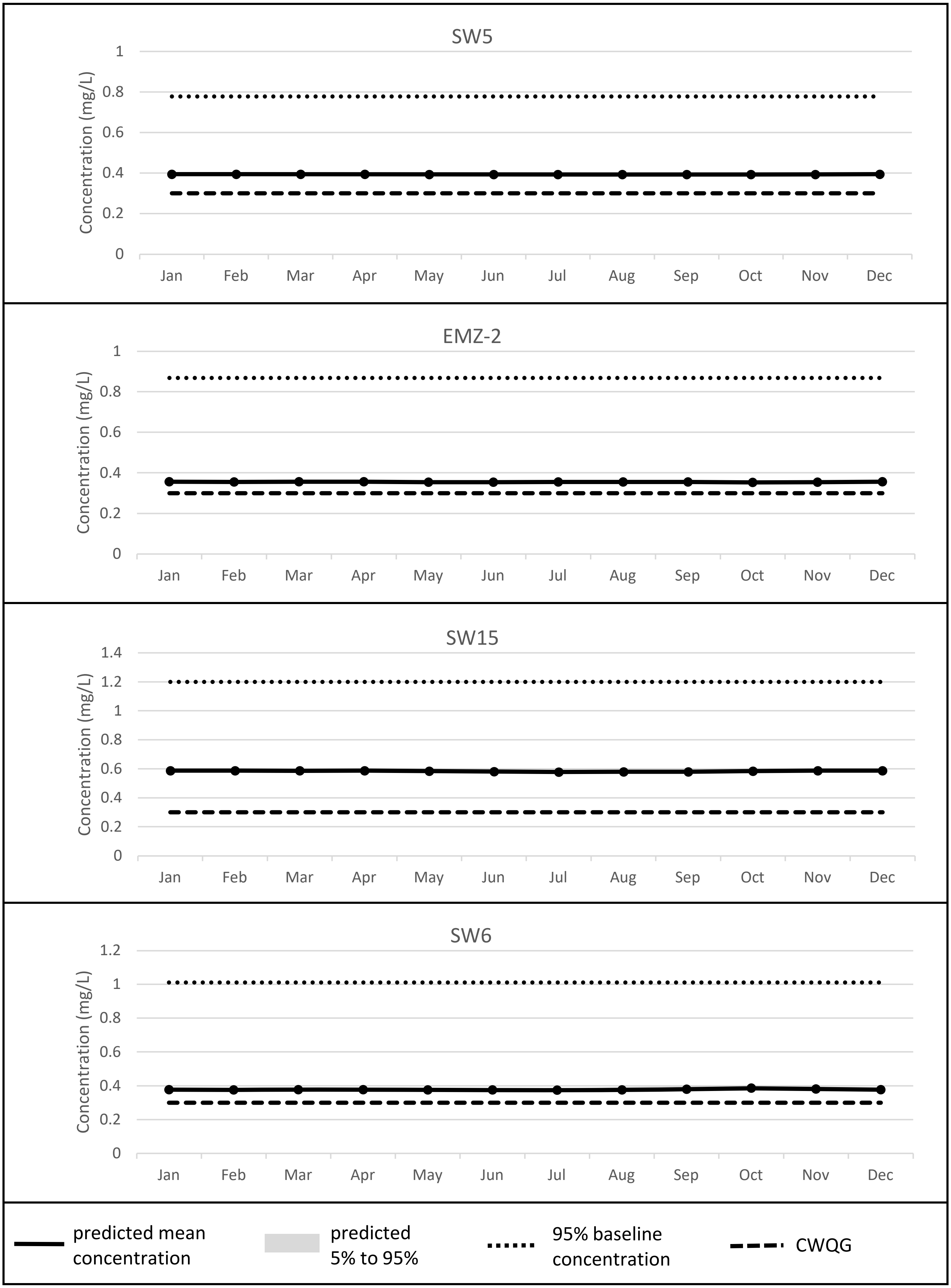


FIGURE B-54: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED LEAD CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

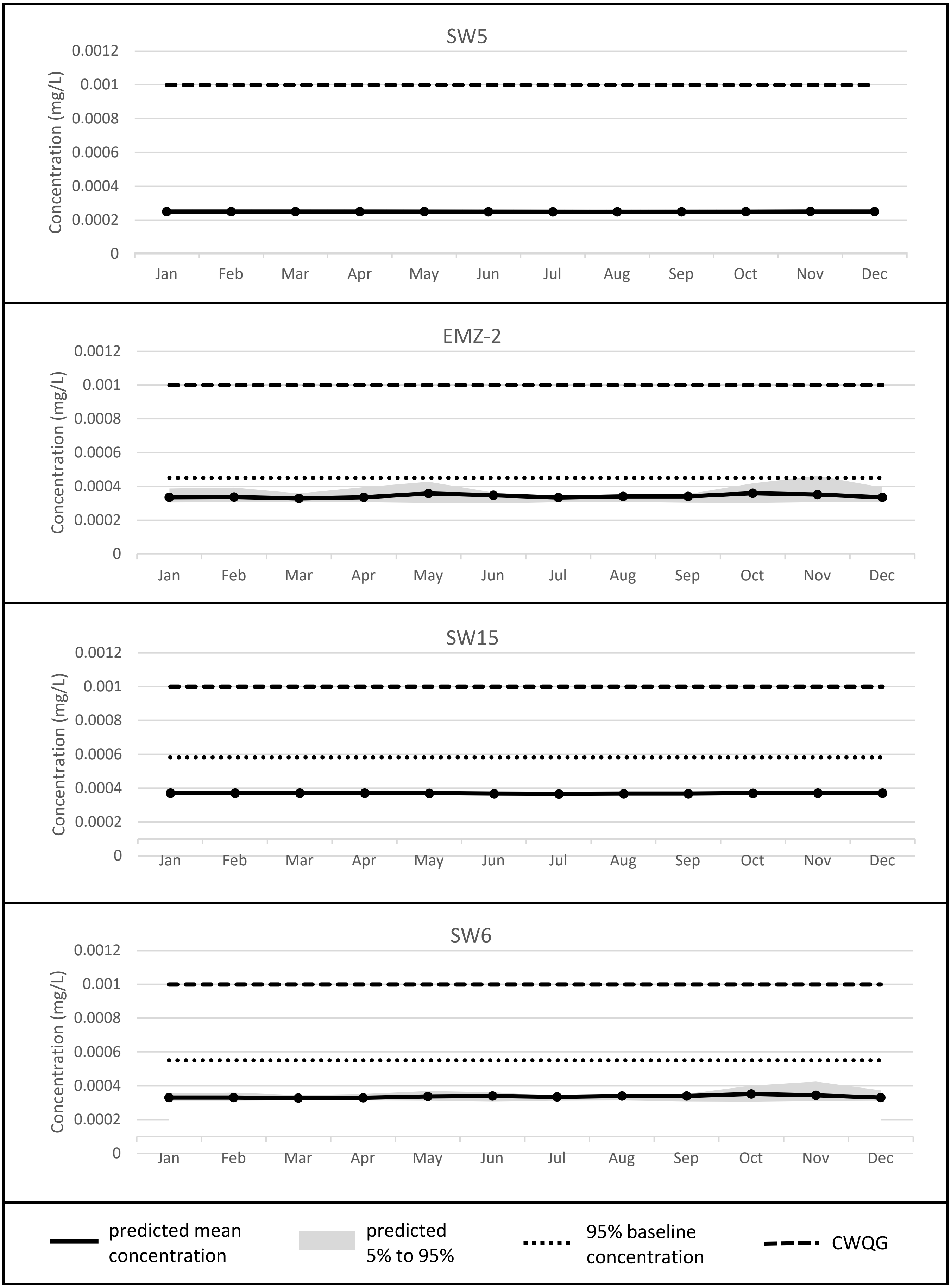


FIGURE B-55: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED MANGANESE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

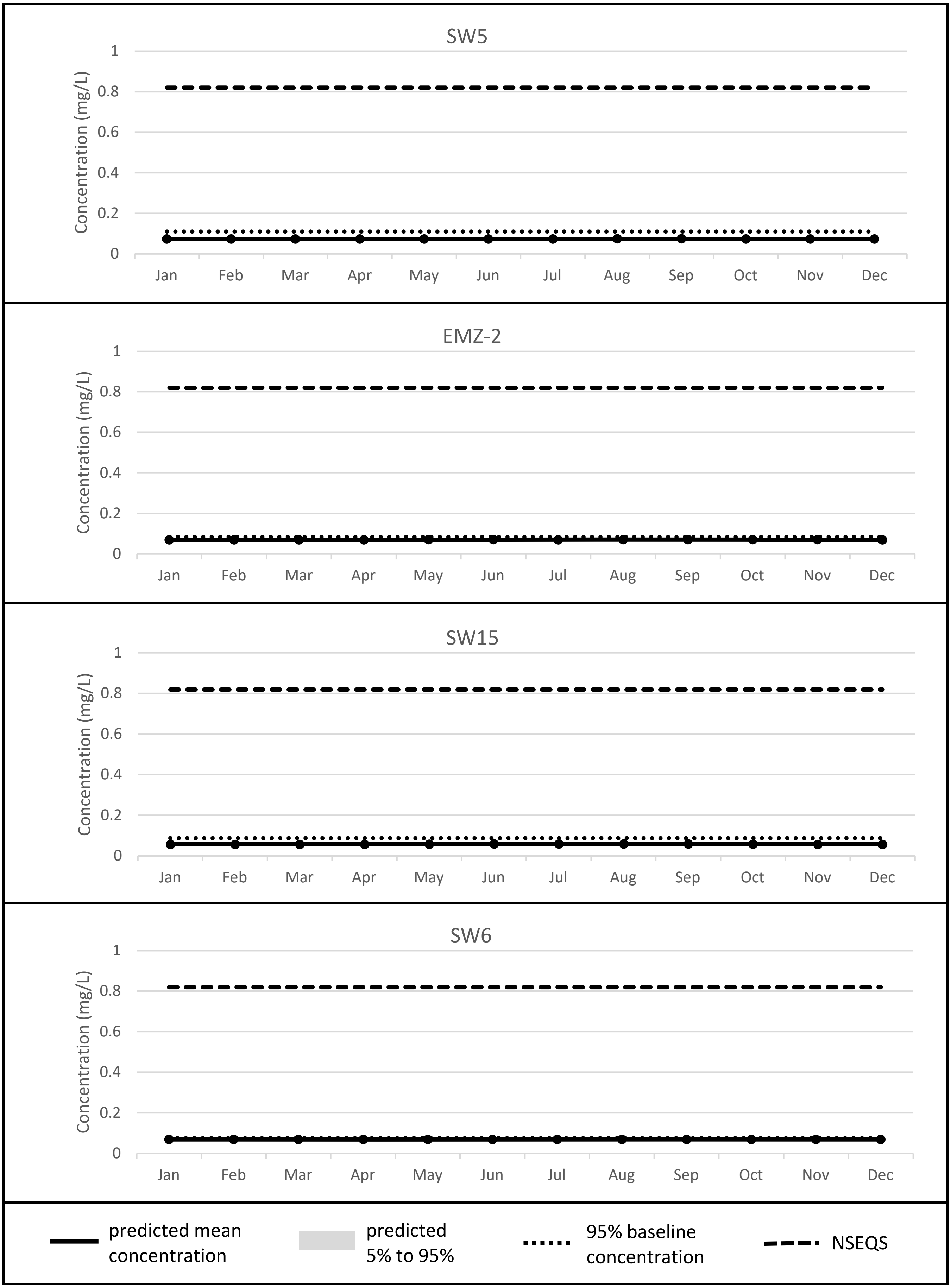


FIGURE B-56: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED MERCURY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

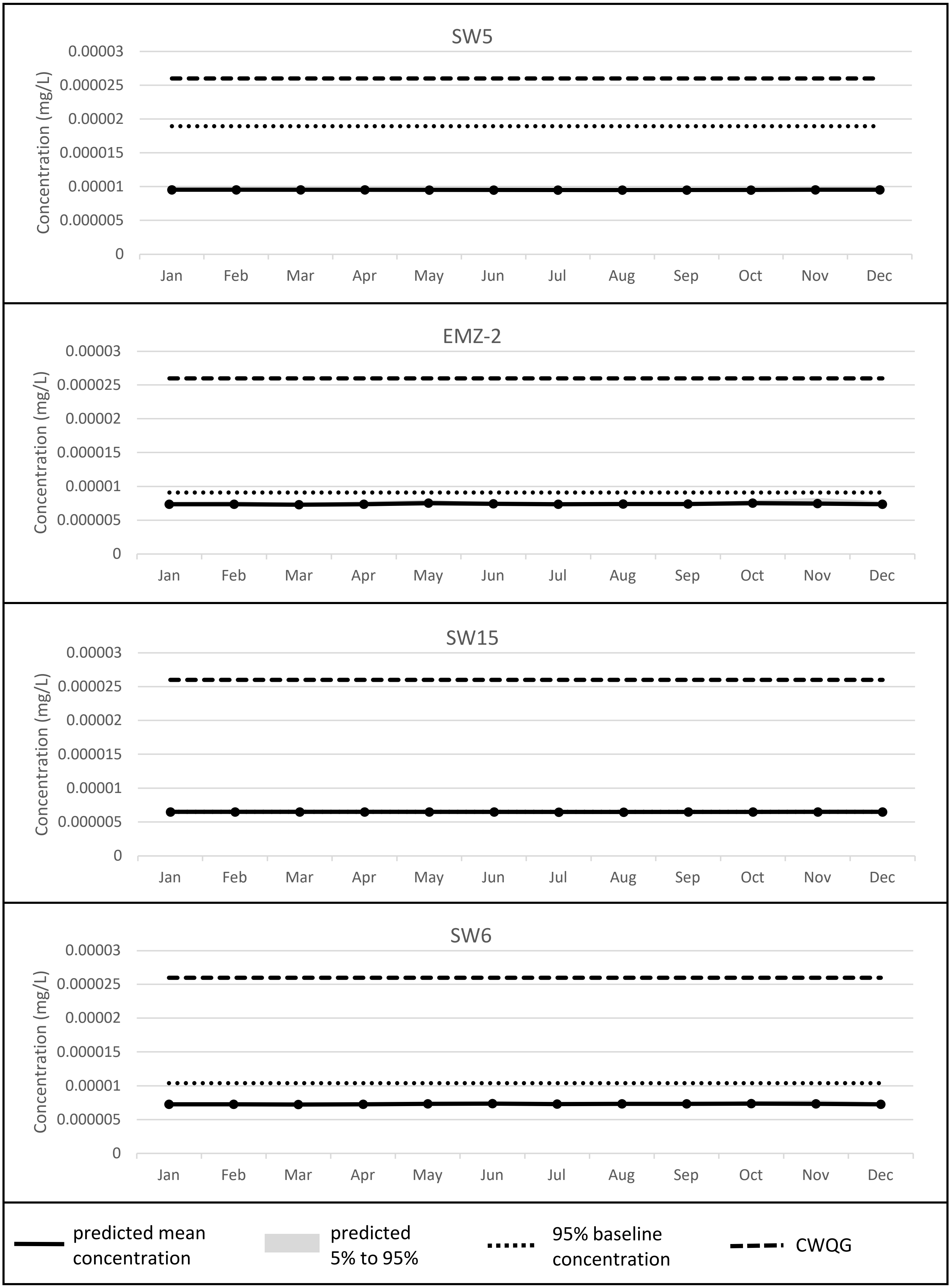


FIGURE B-57: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED MOLYBDENUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

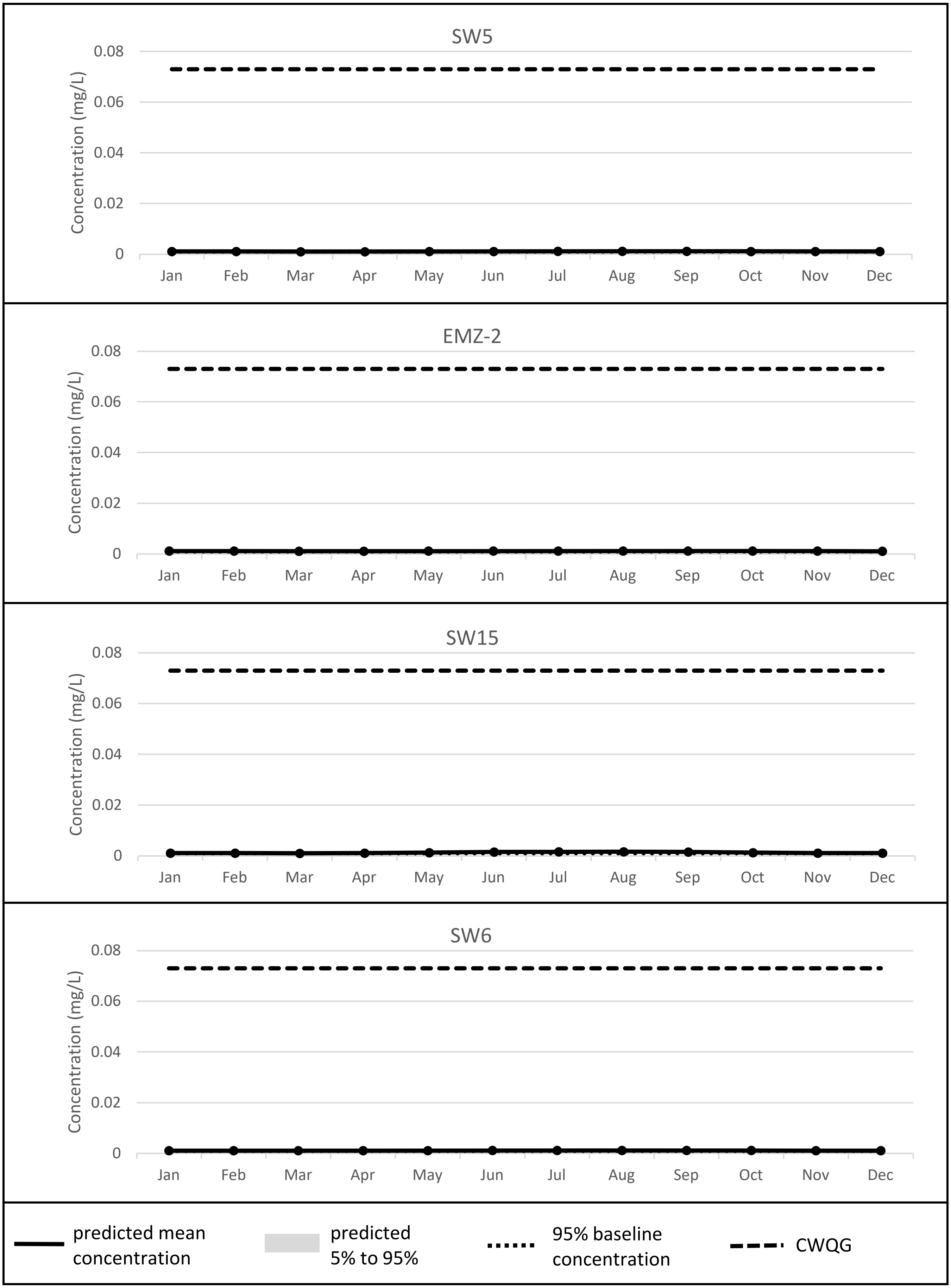


FIGURE B-58: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED NICKEL CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

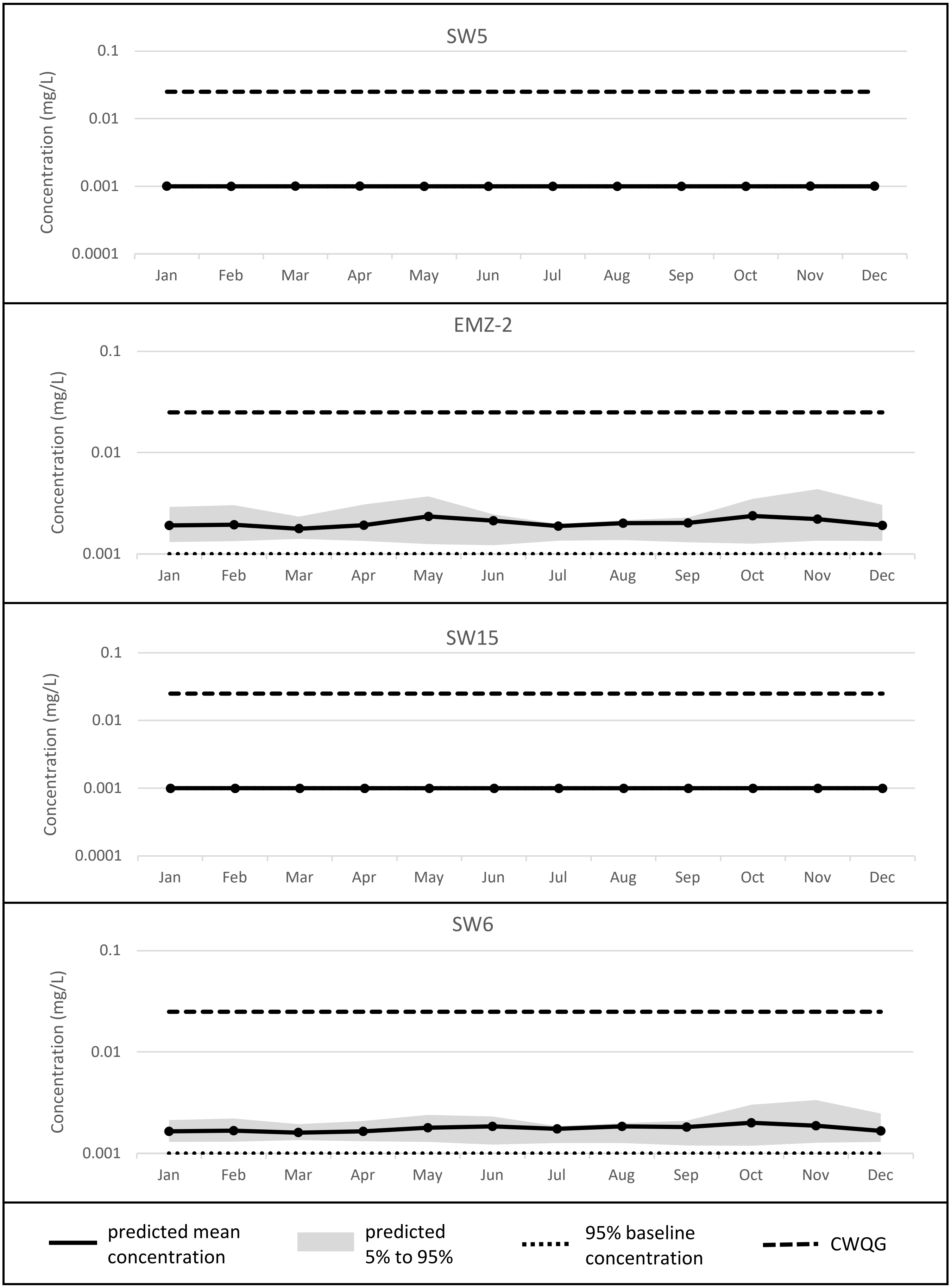


FIGURE B59: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED NITRATE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

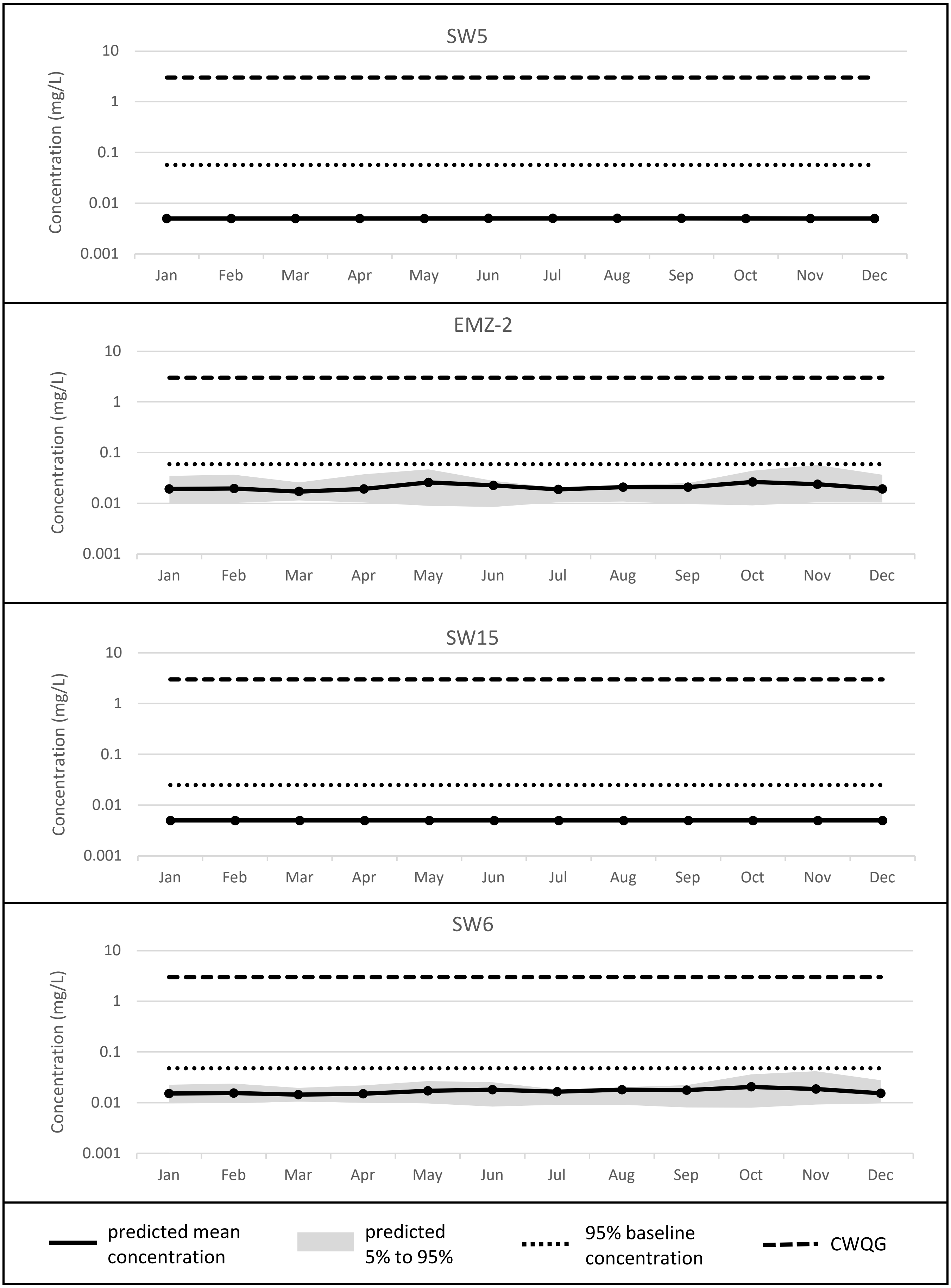


FIGURE B-60: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED NITRITE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

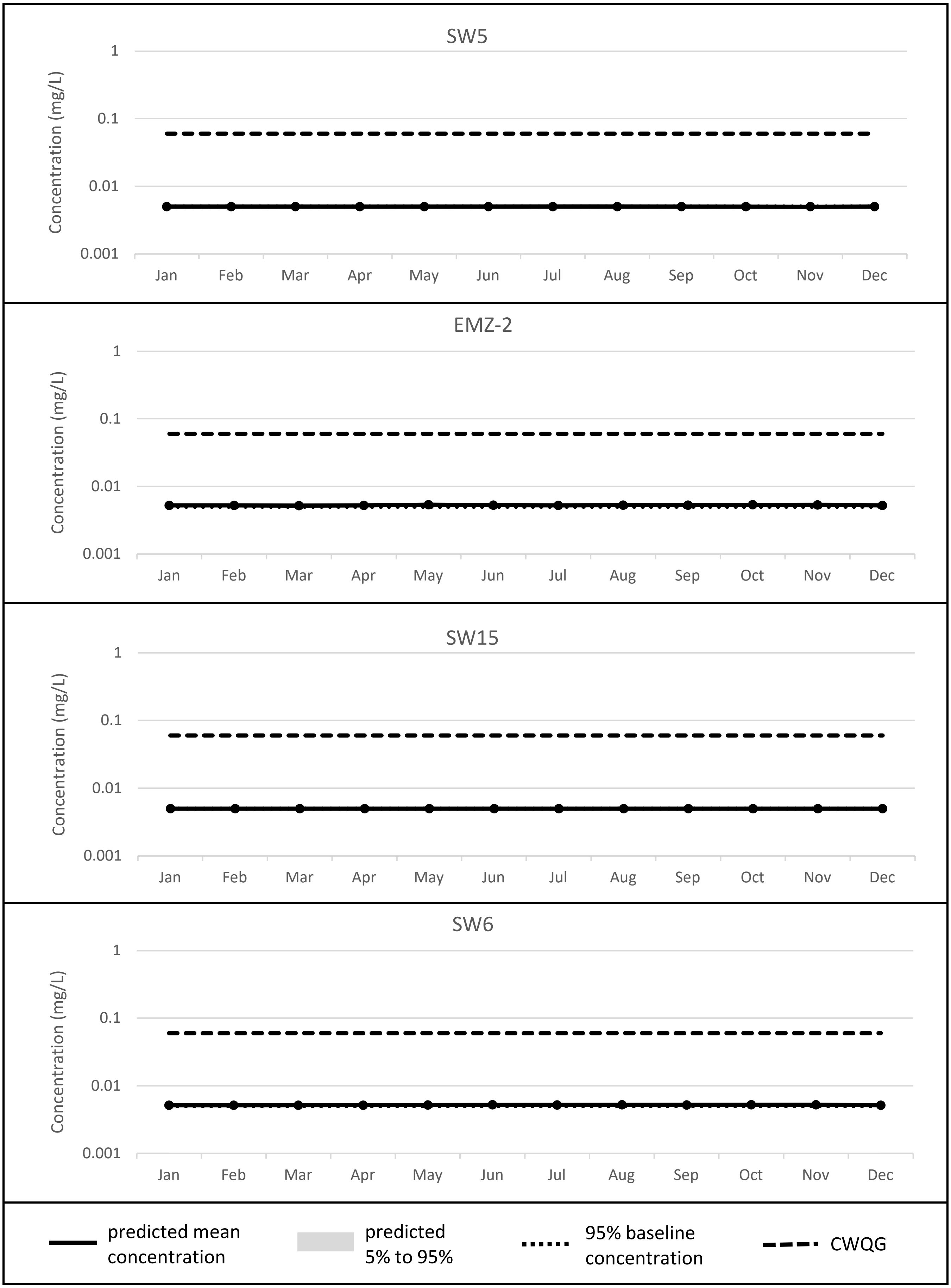


FIGURE B-61: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED SELENIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

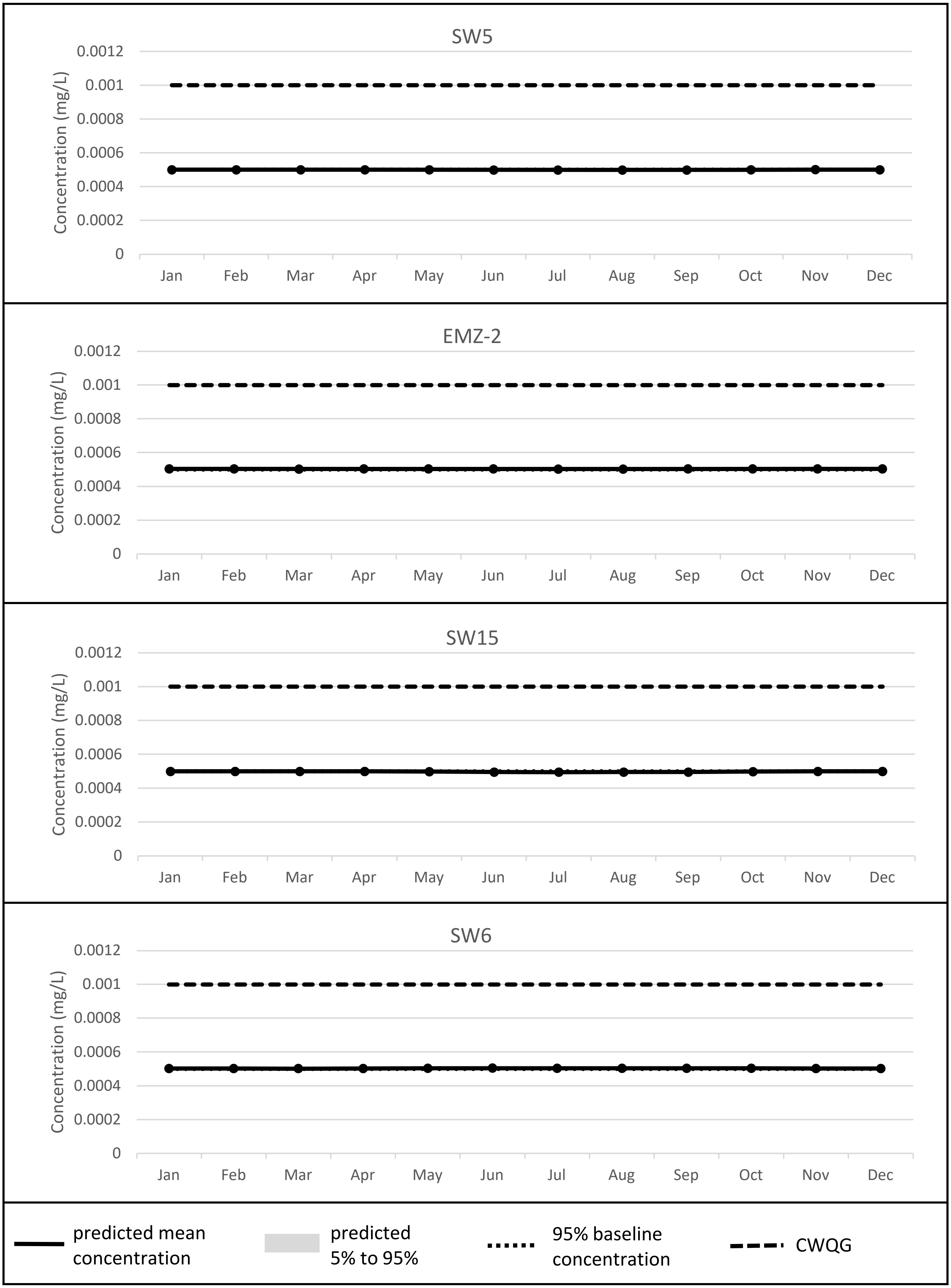


FIGURE B-62: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED SILVER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

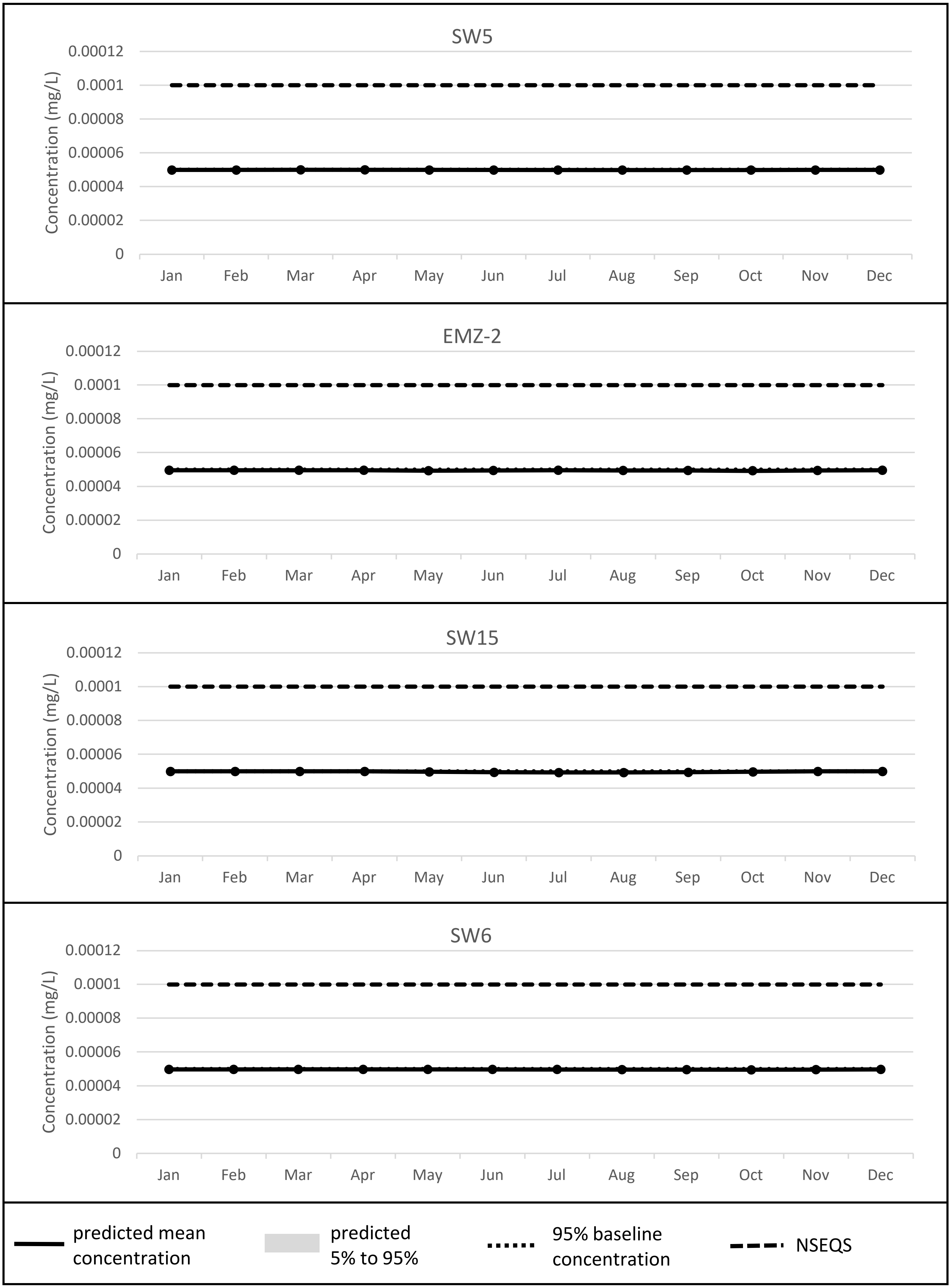


FIGURE B-63: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED THALLIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

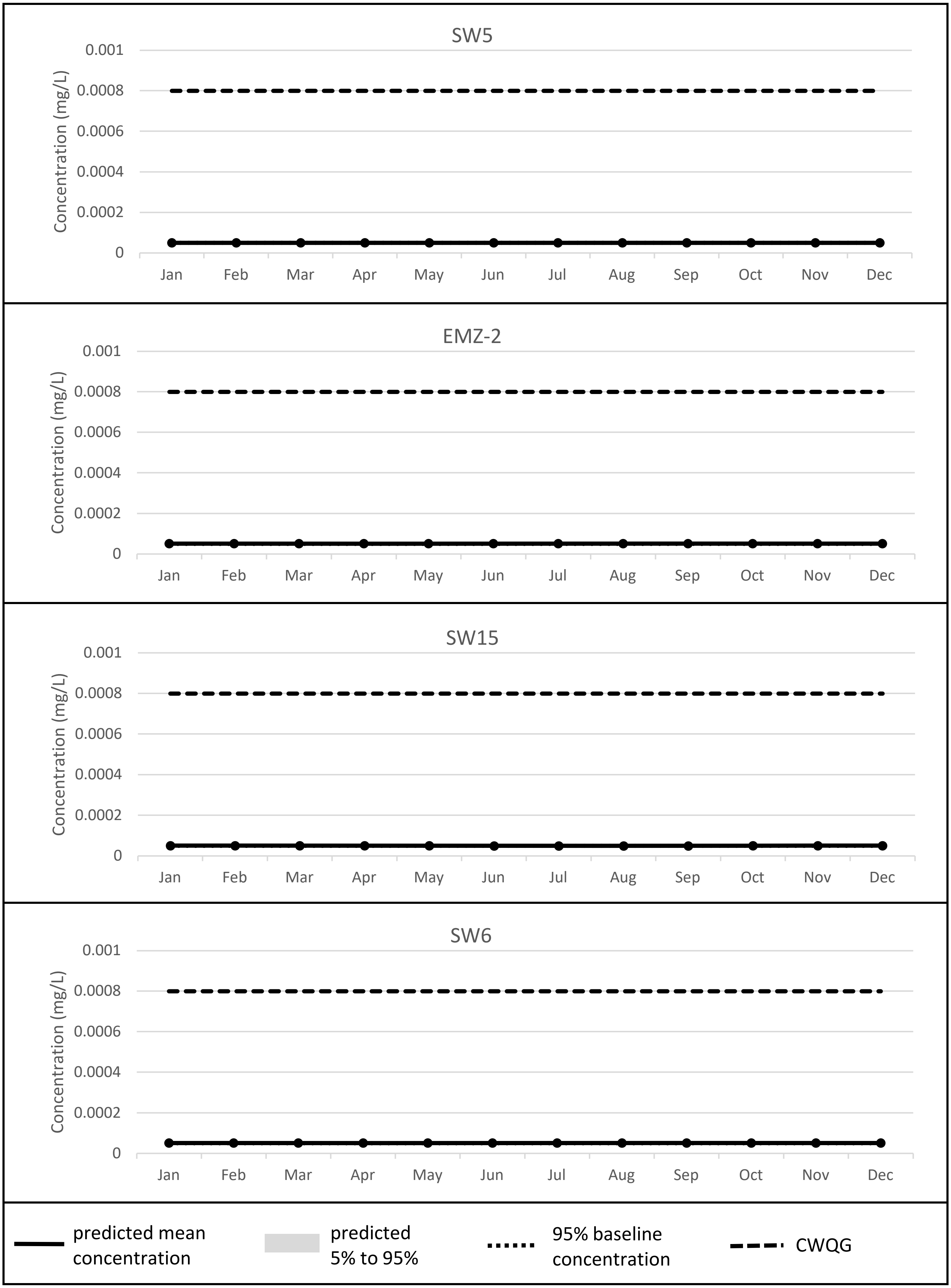


FIGURE B-64: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

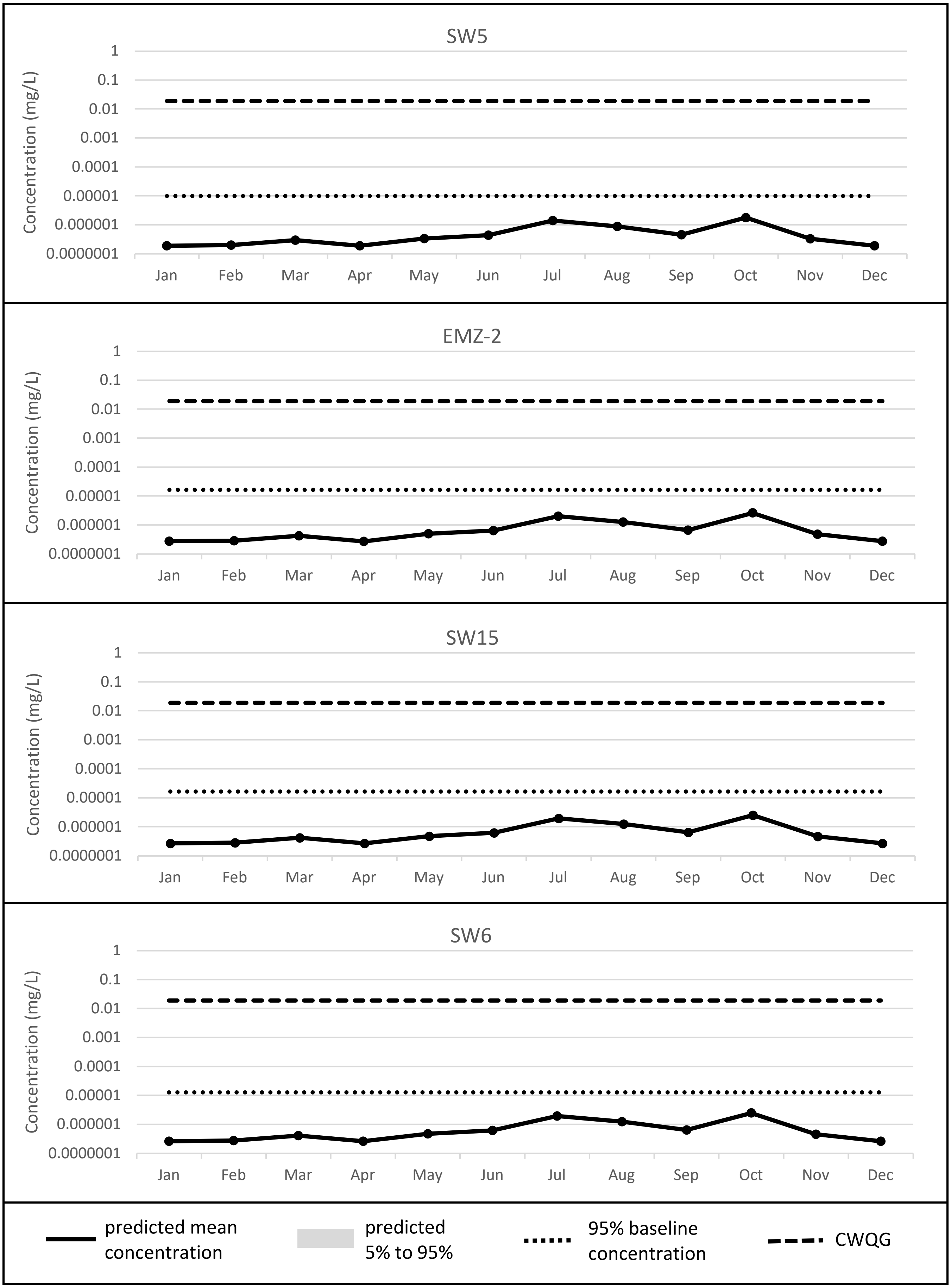


FIGURE B-65: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED URANIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

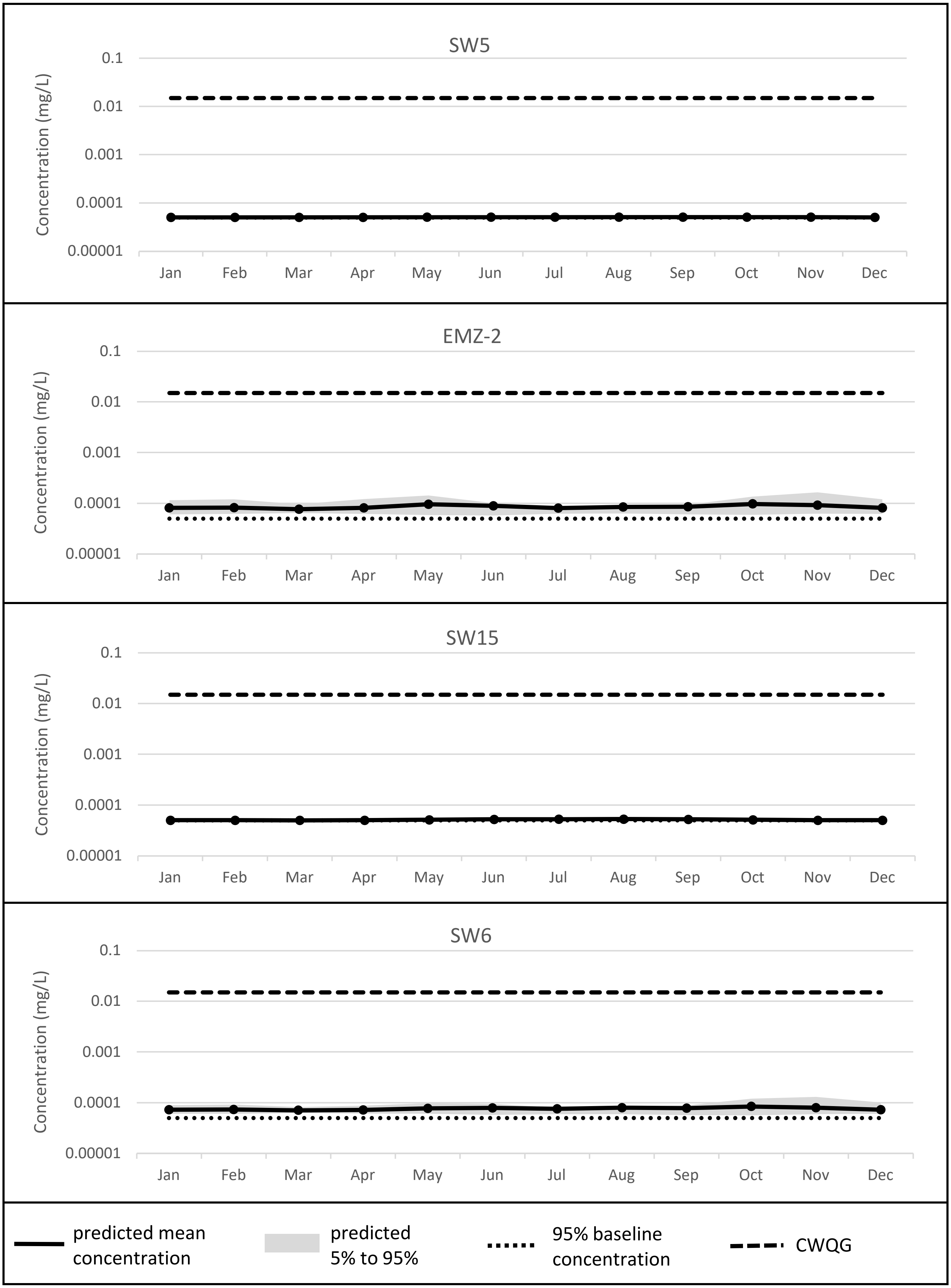


FIGURE B-66: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ZINC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

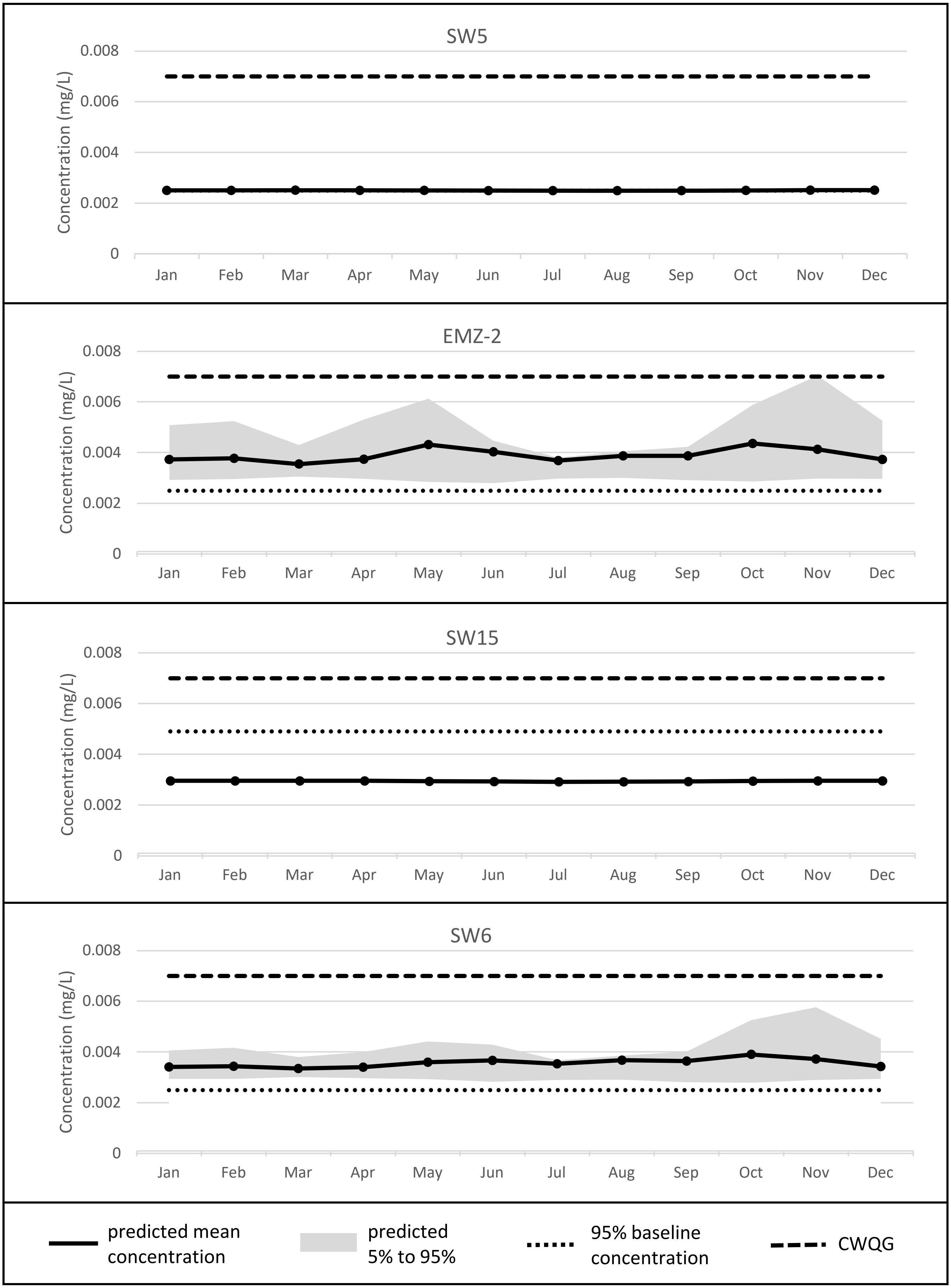
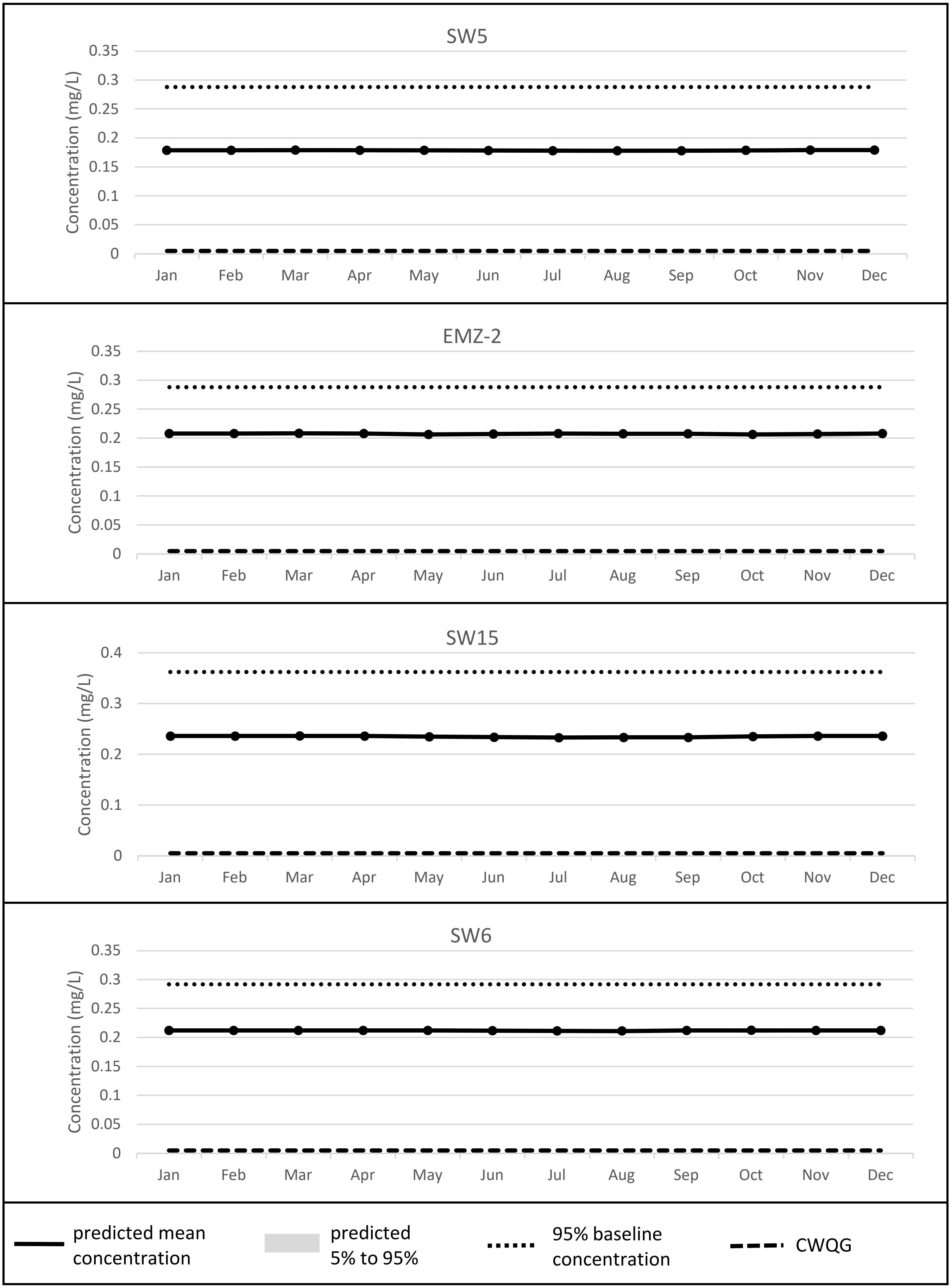


FIGURE B-67: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ALUMINUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



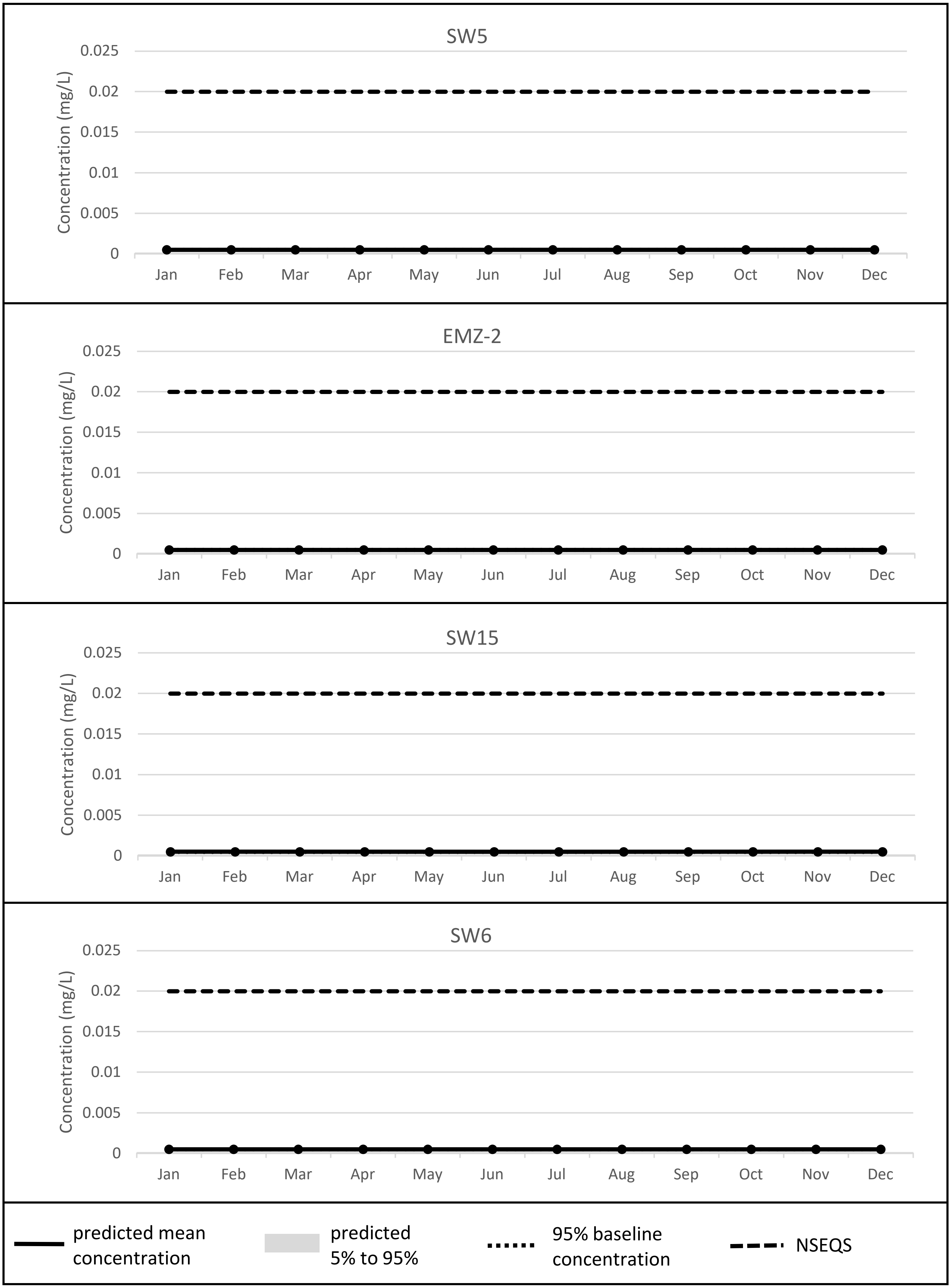

SW5
EMZ-2
SW15
SW6
Concentration (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
NSEQS

FIGURE B-69: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ARSENIC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

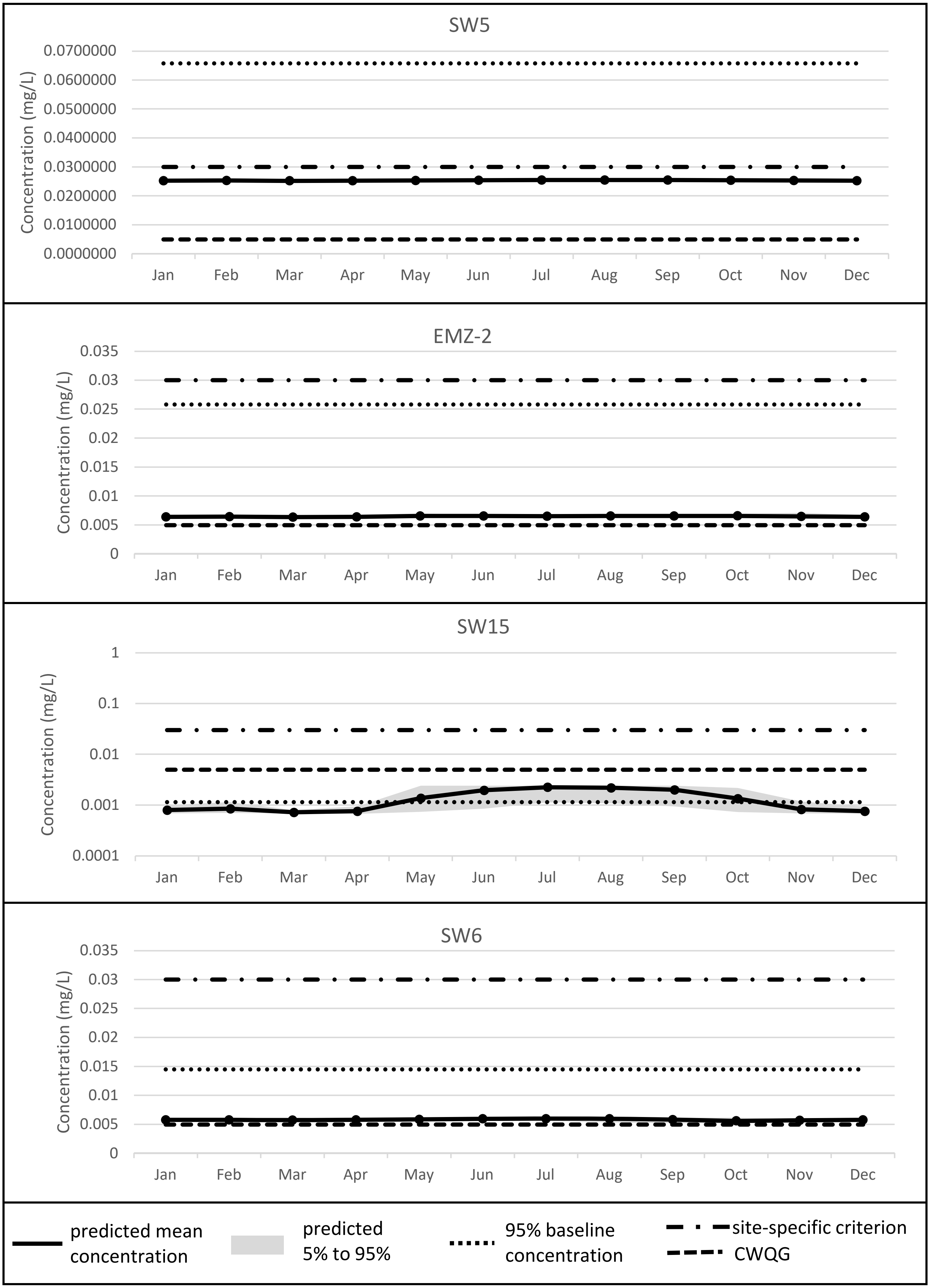


FIGURE B-70: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED BORON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

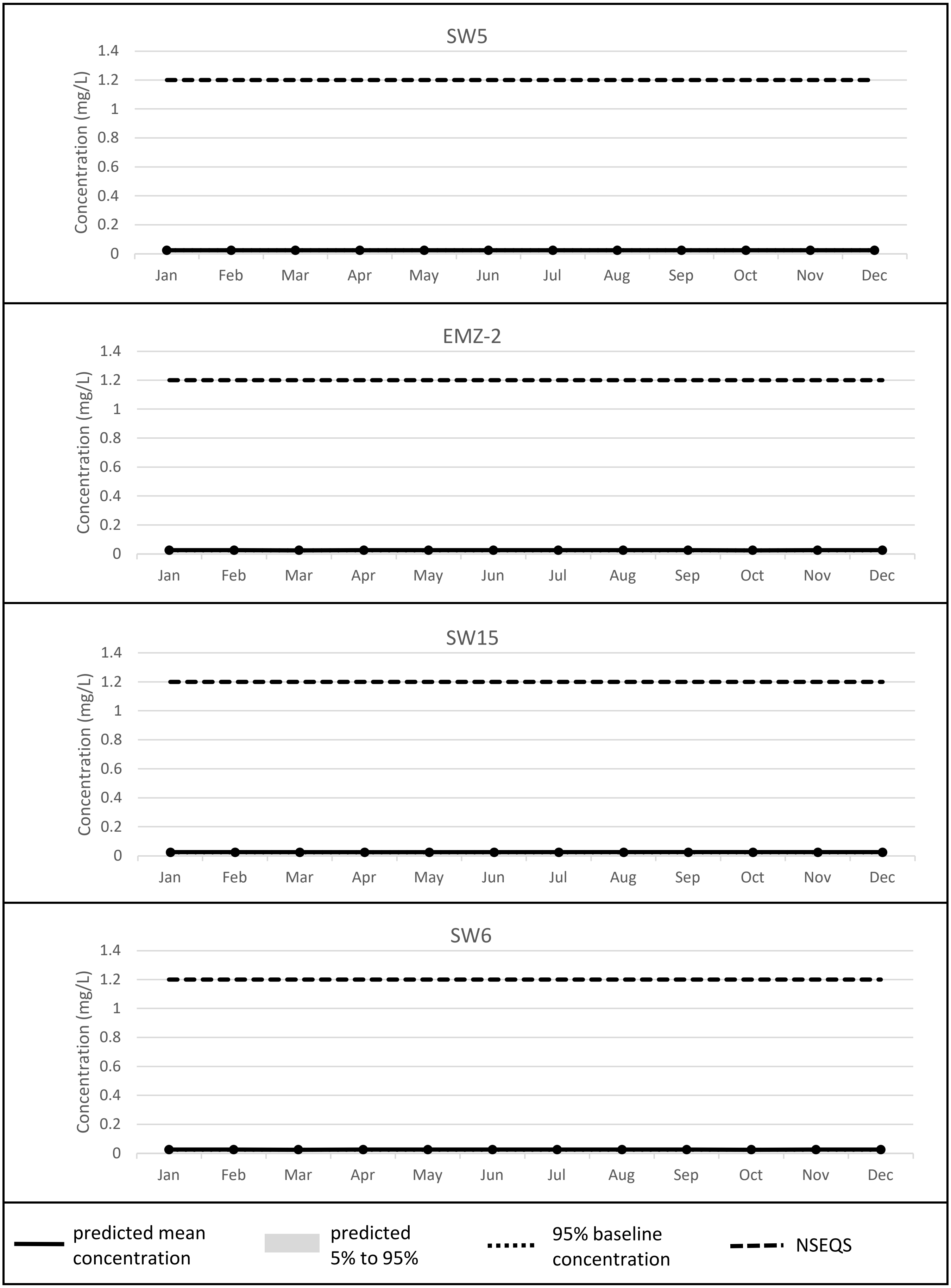
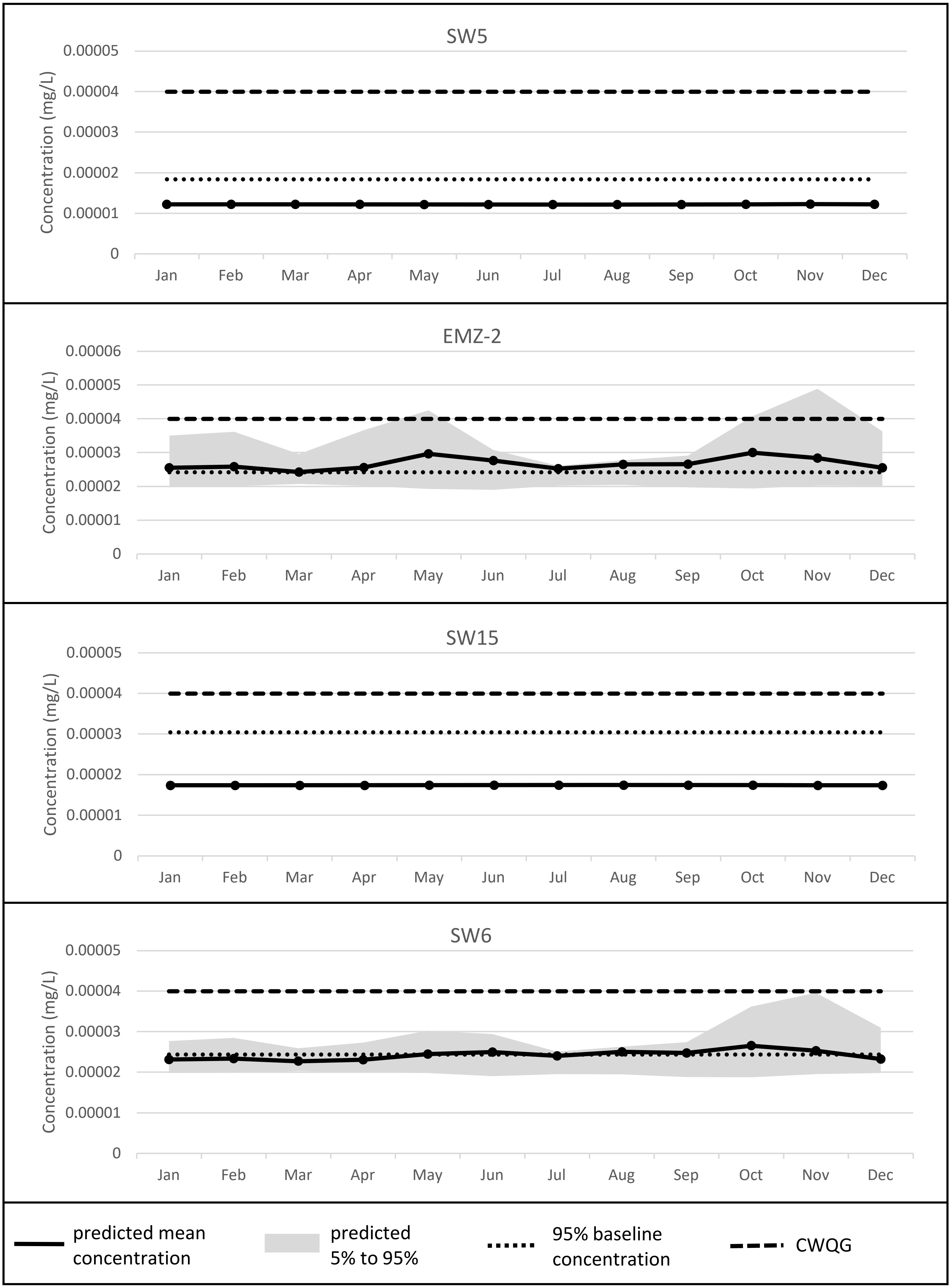
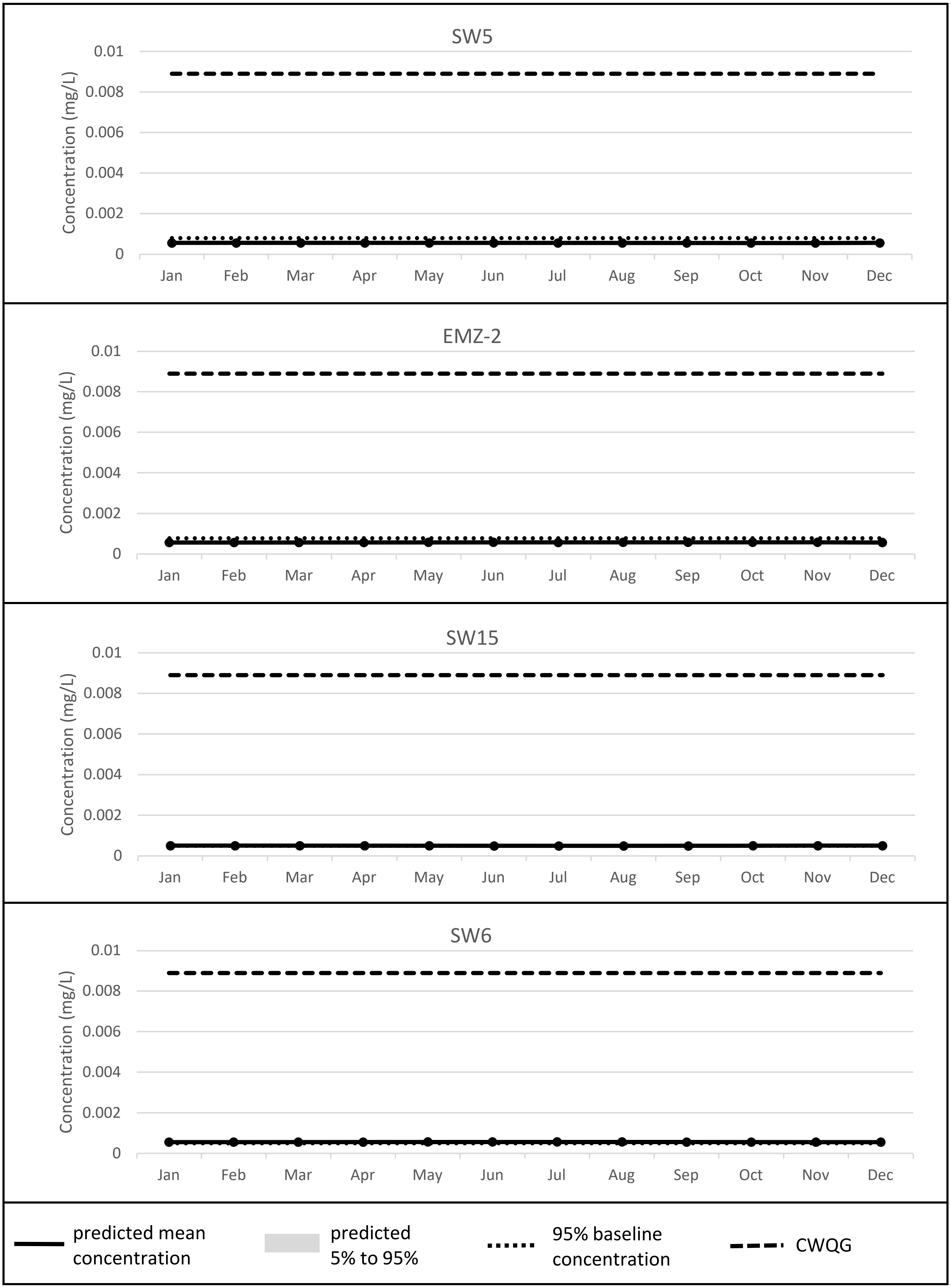


FIGURE B-71: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED CADMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)




SW5
EMZ-2
SW15
SW6
Concentration (mg/L)
0.01
0.008
0.006
0.004
0.002
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
CWQG

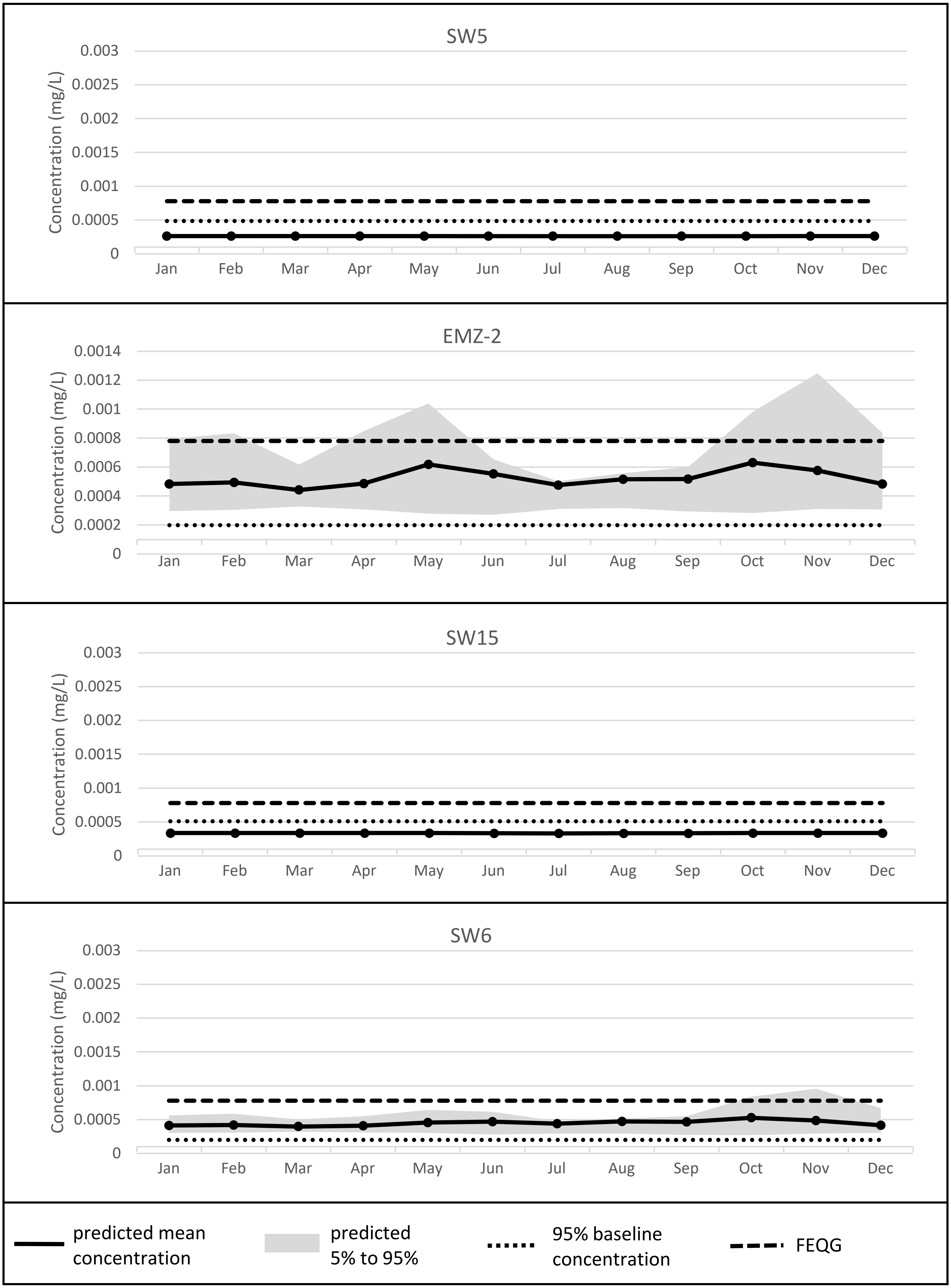

SW5
EMZ-2
SW15
SW6
Concentration (mg/L)
0
0.0005
0.001
0.0015
0.002
0.0025
0.003
0.0002
0.0004
0.0006
0.0008
0.0012
0.0014
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
FEQG

FIGURE B-74: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED COPPER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

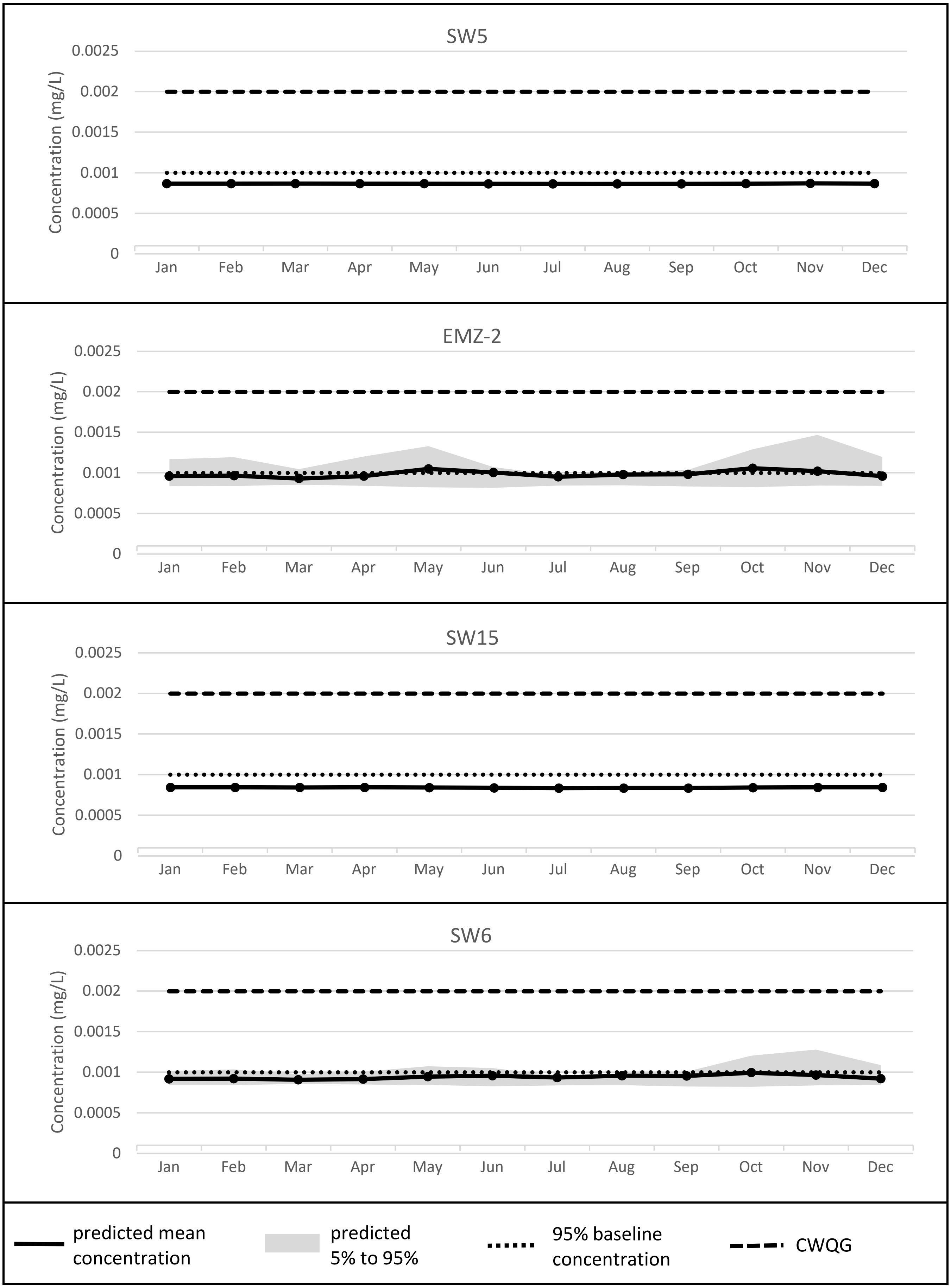


FIGURE B-75: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED IRON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

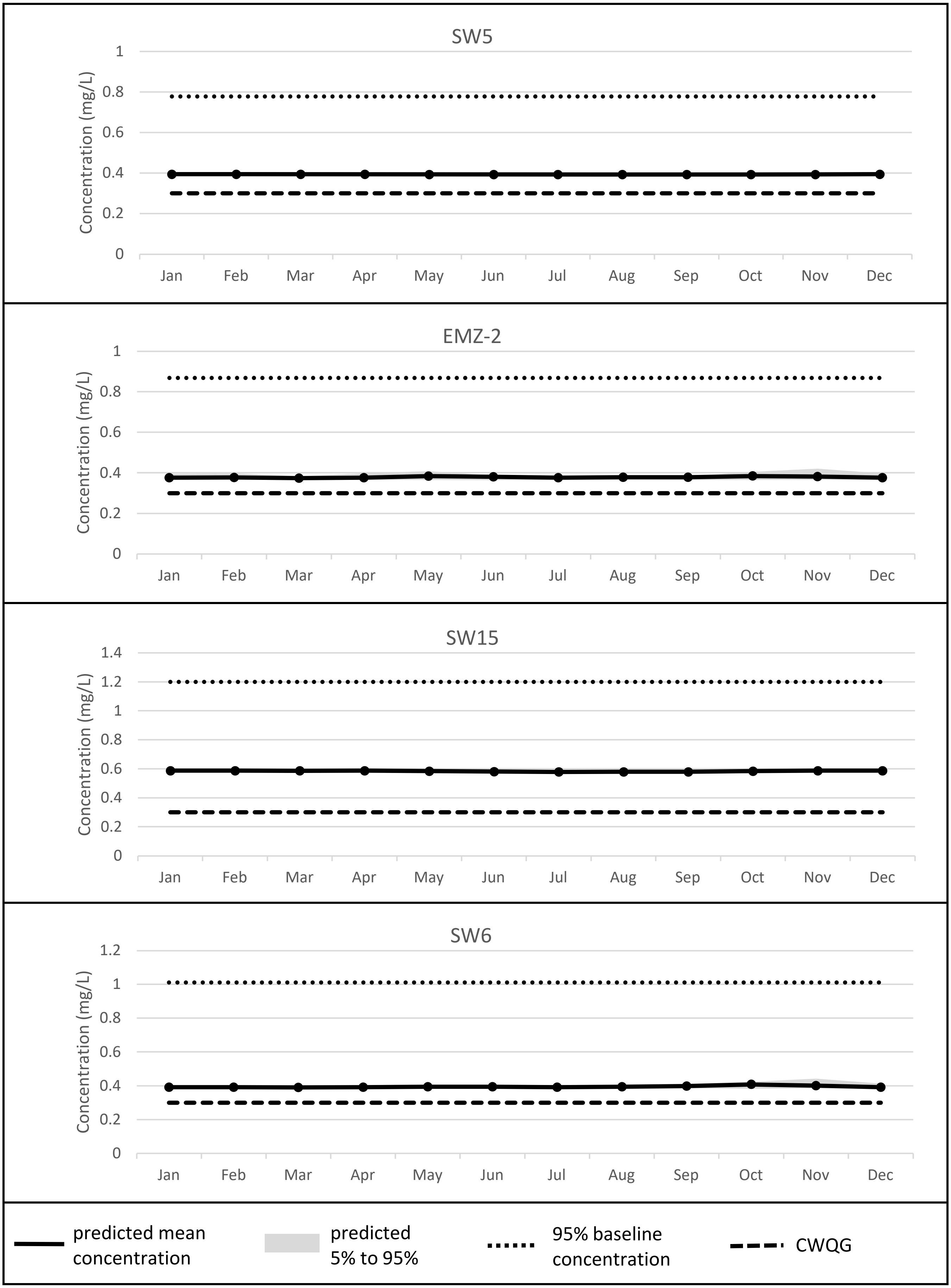


FIGURE B-76: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED LEAD CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

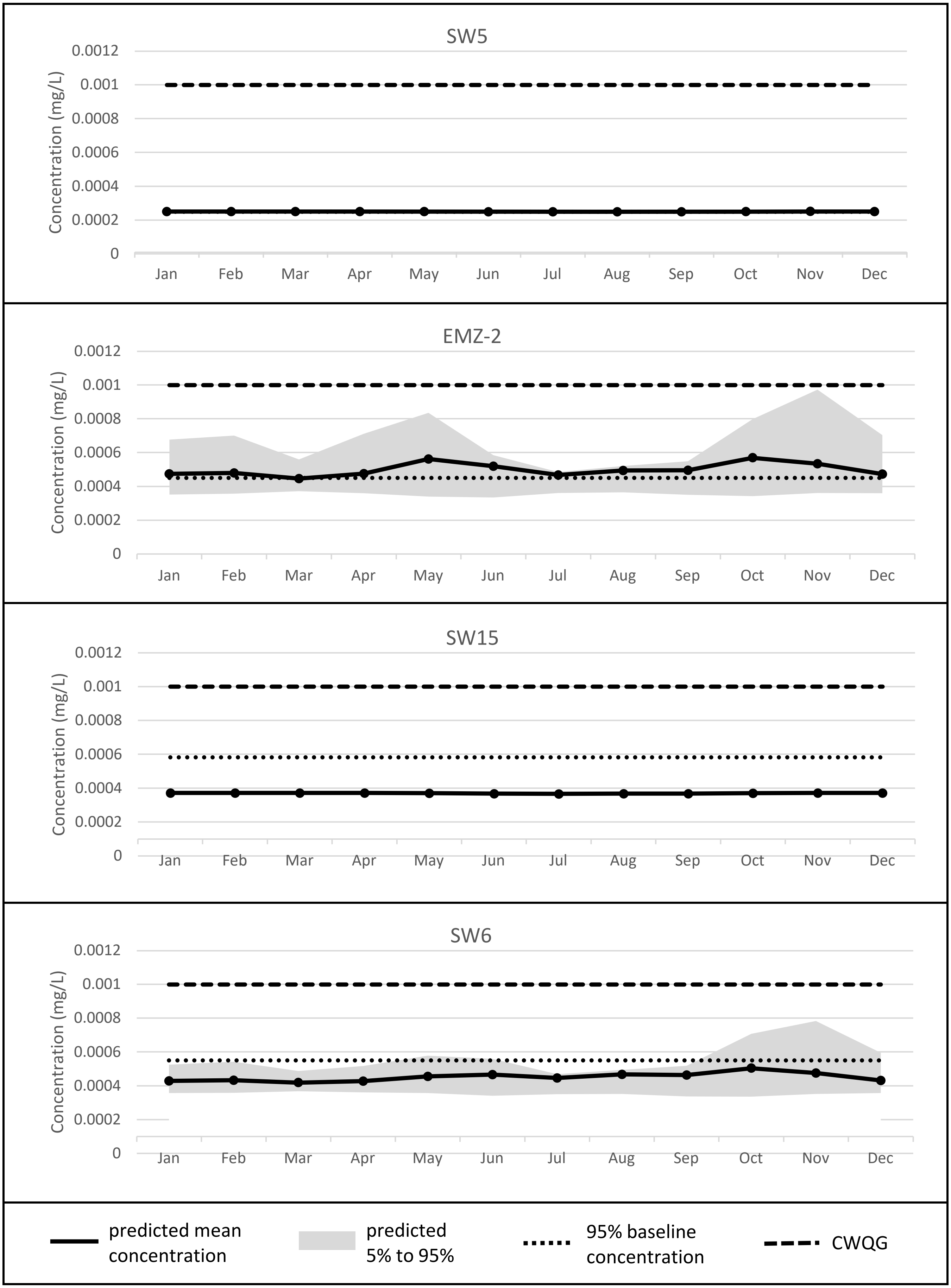


FIGURE B-77: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED MANGANESE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

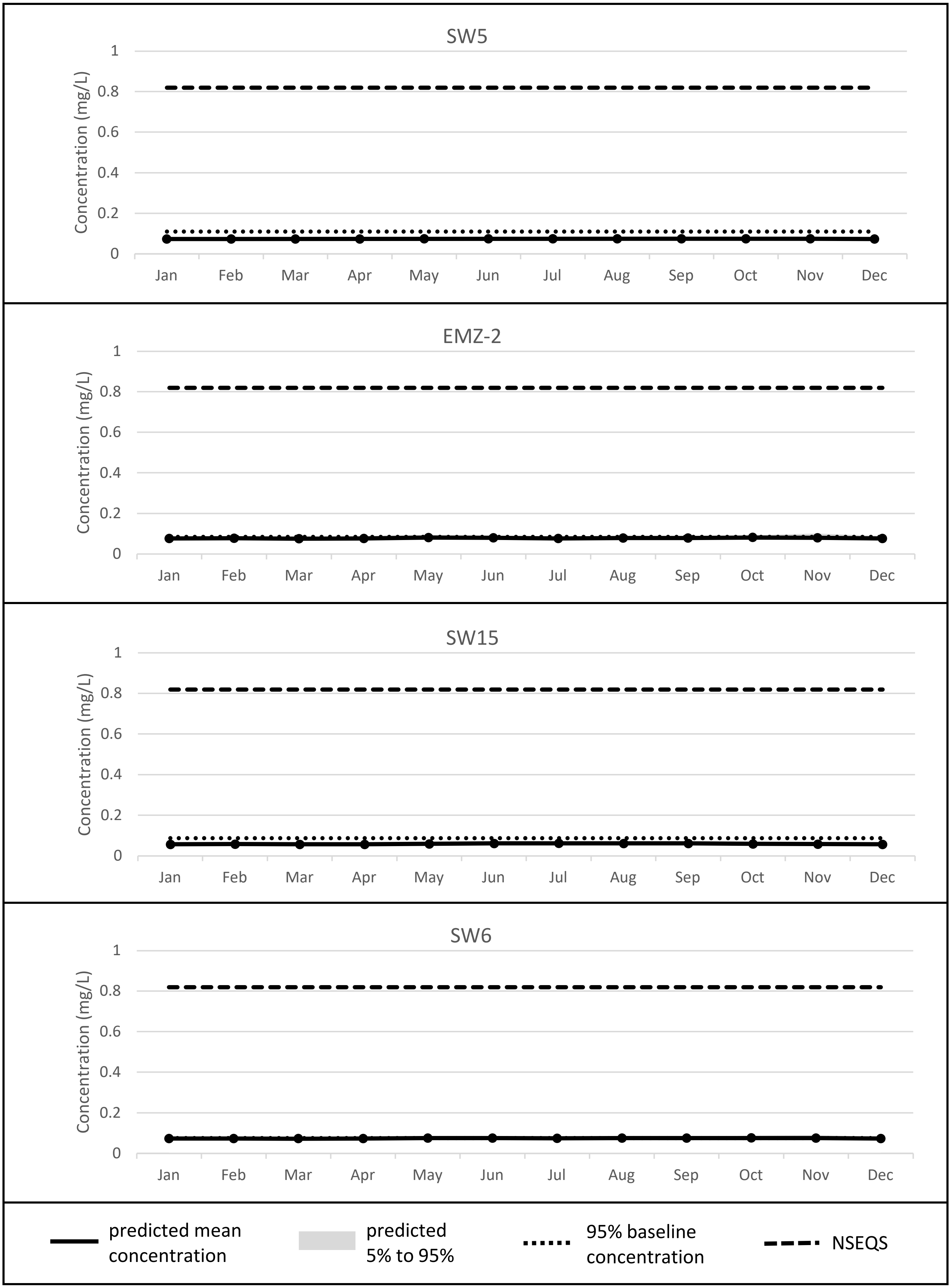


FIGURE B-78: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED MERCURY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

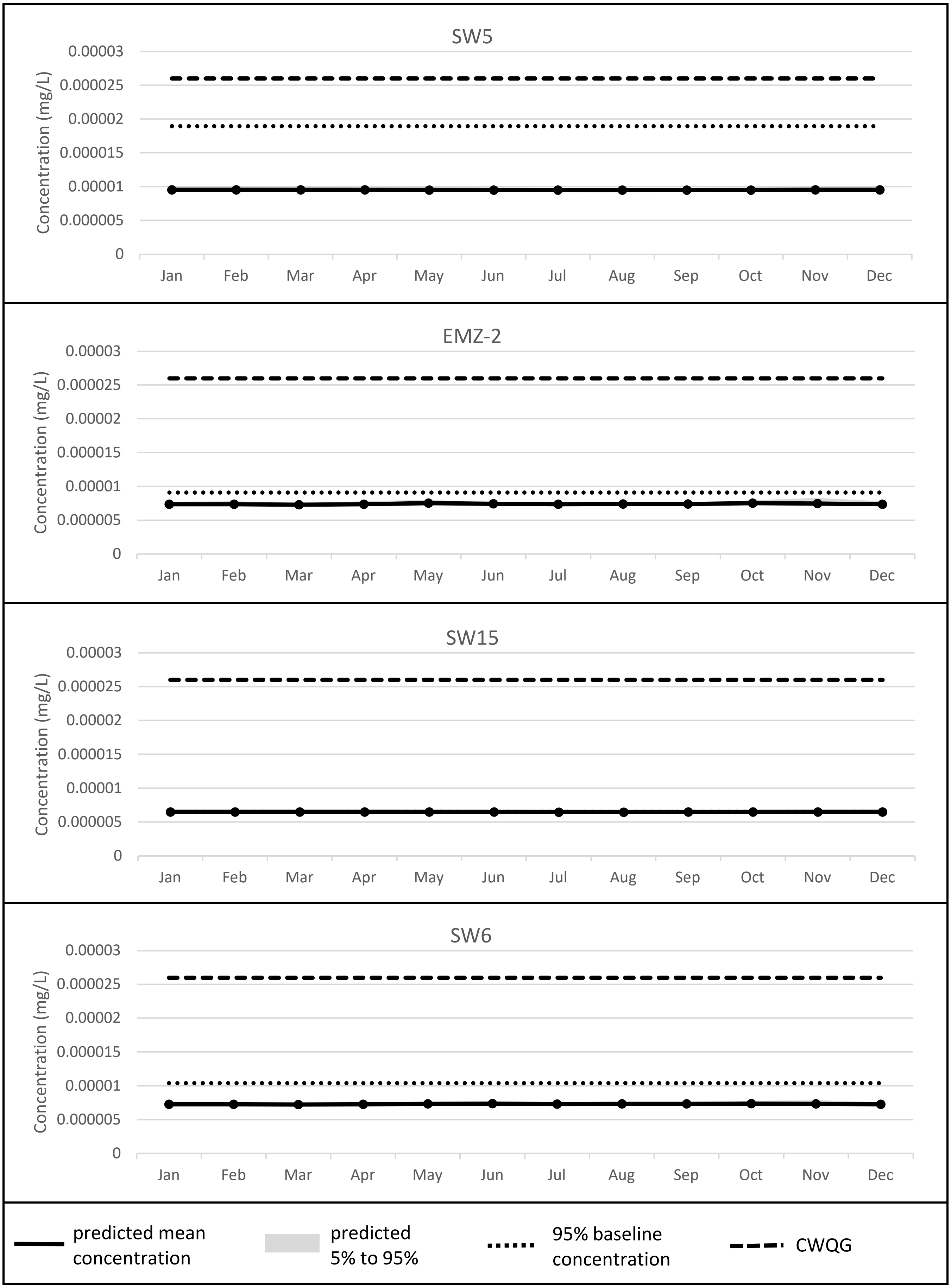


FIGURE B-79: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE
PREDICTED MOLYBDENUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

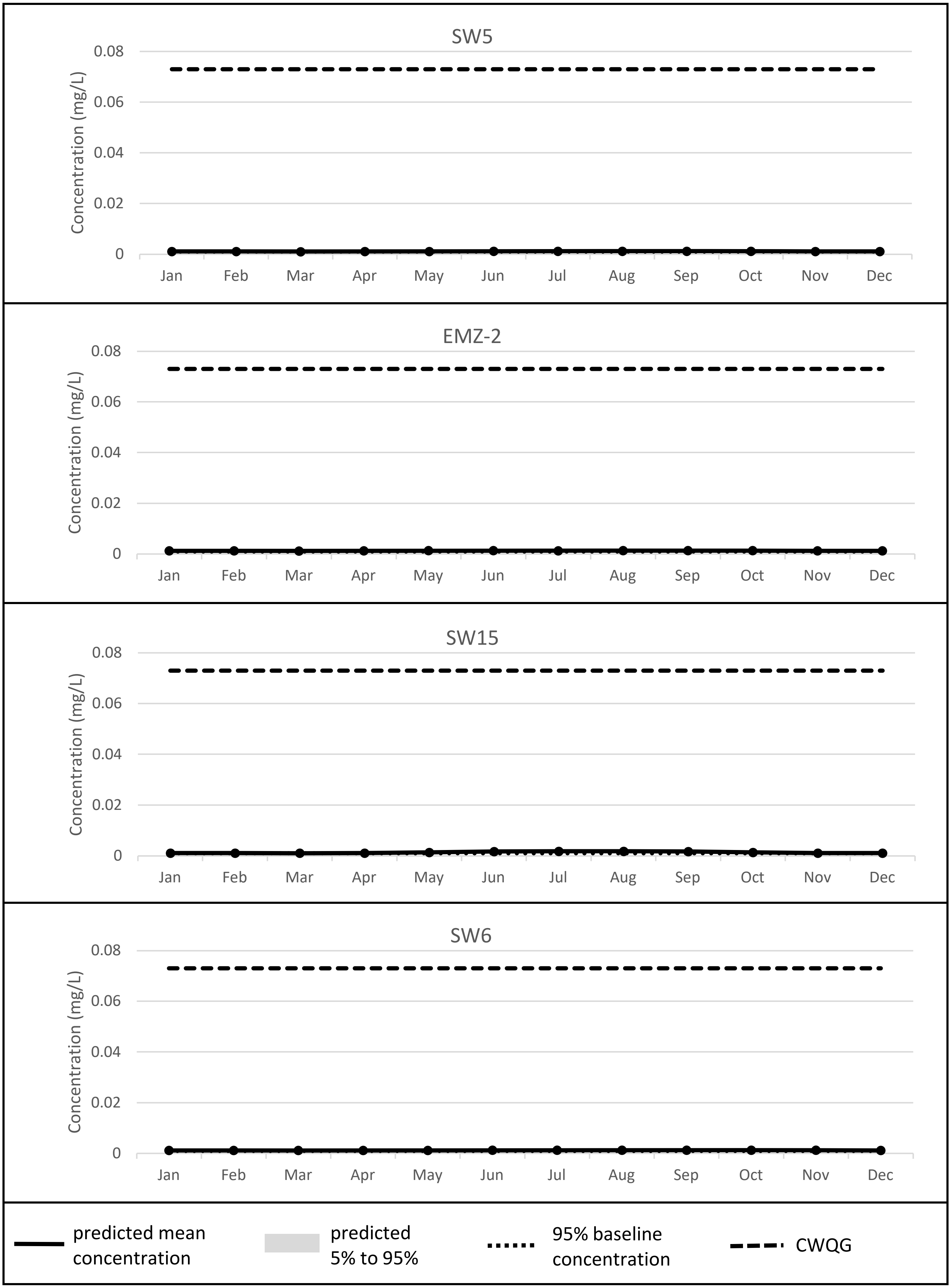


FIGURE B-80: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED NICKEL CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

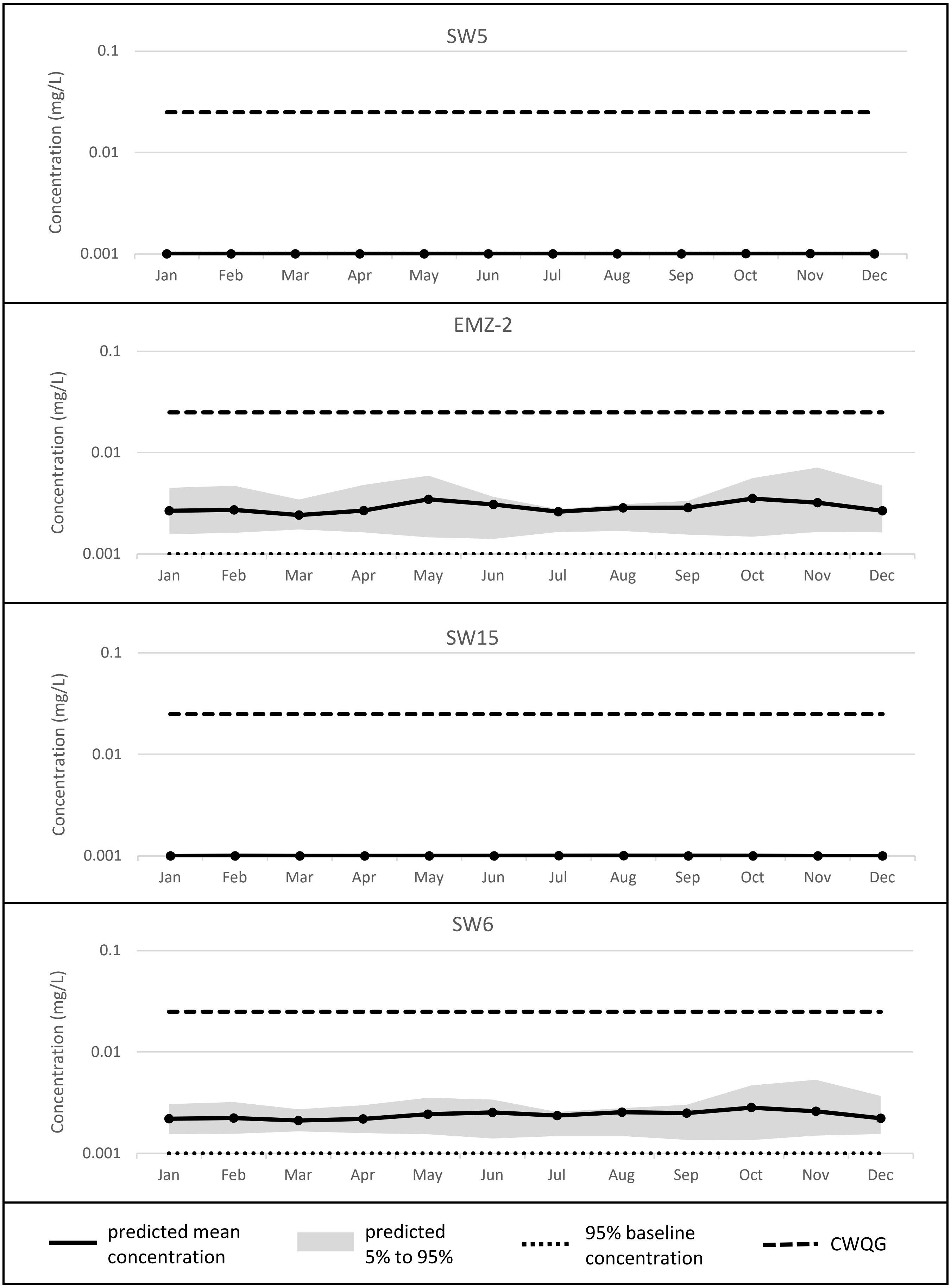


FIGURE B-81: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED NITRATE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

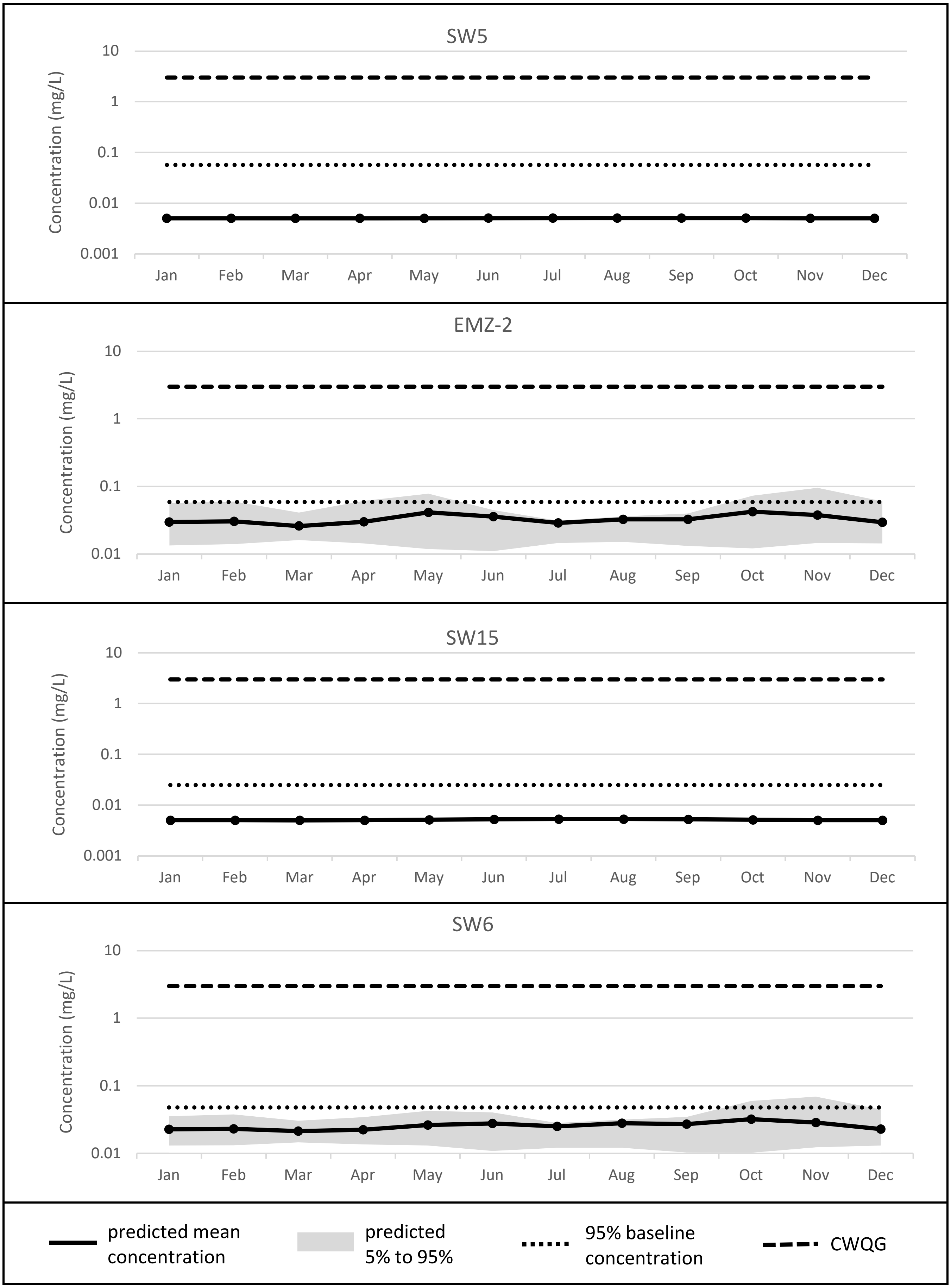


FIGURE B-82: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED NITRITE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

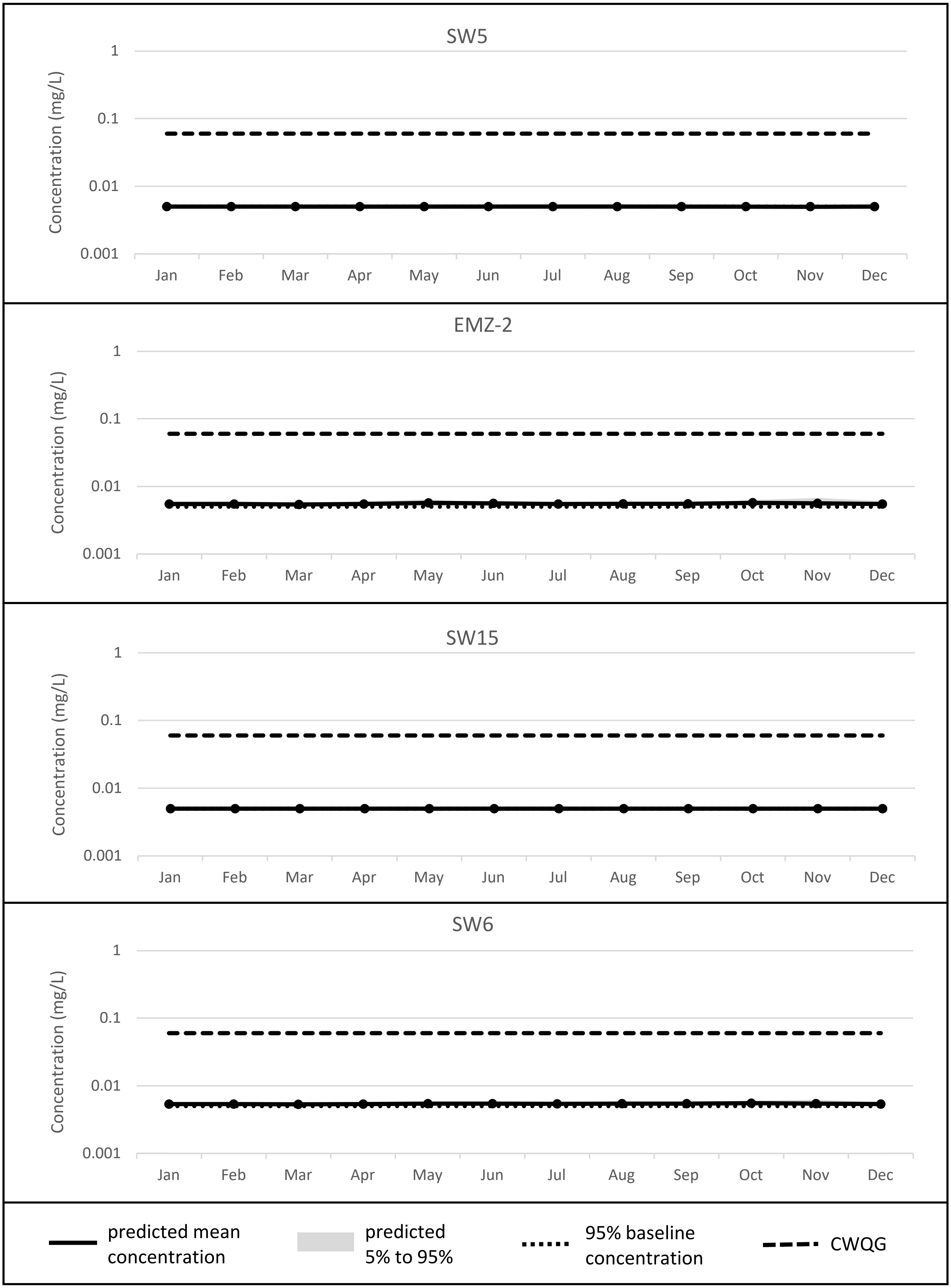


FIGURE B-83: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED SELENIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

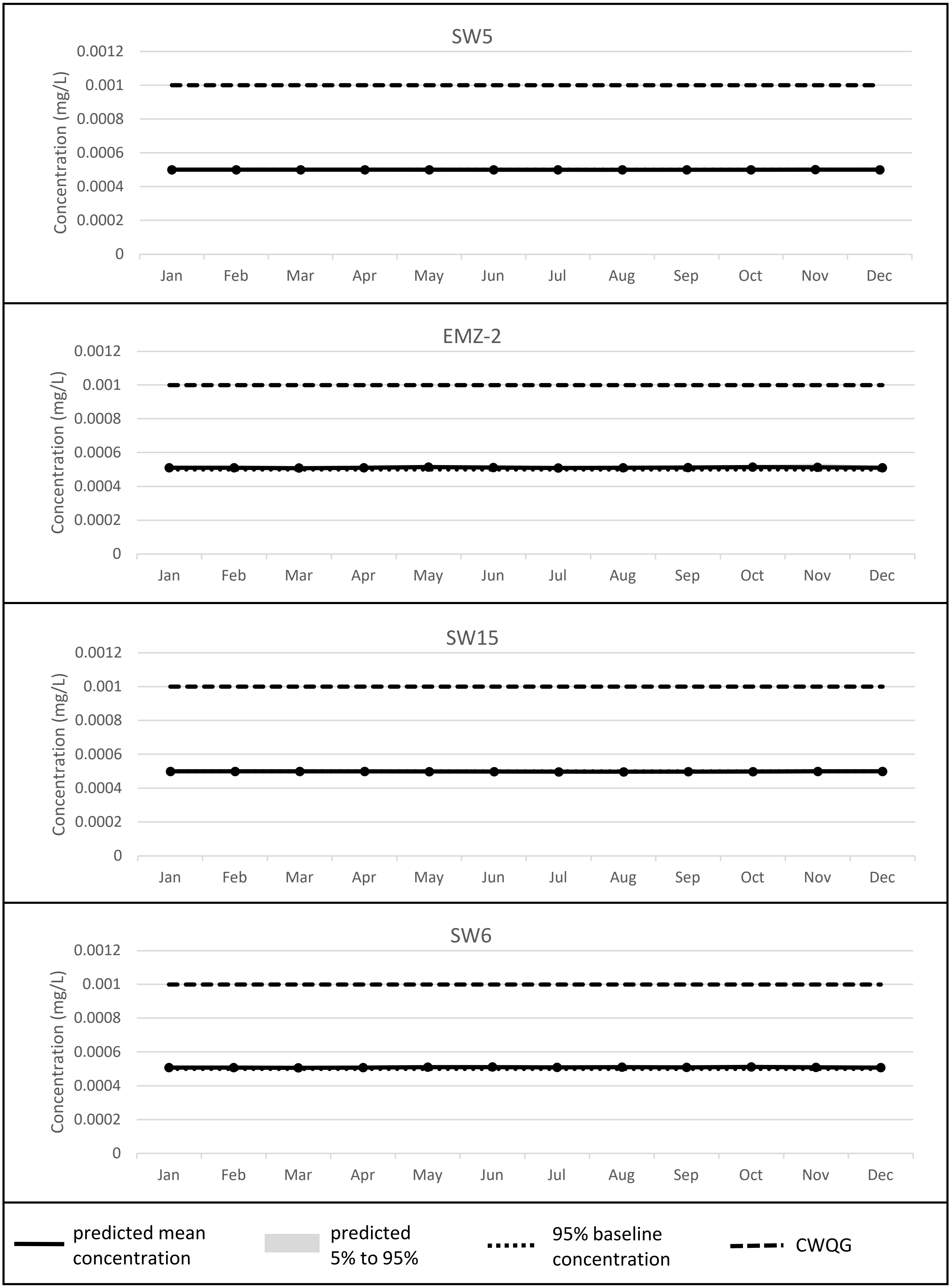


FIGURE B-84: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED SILVER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

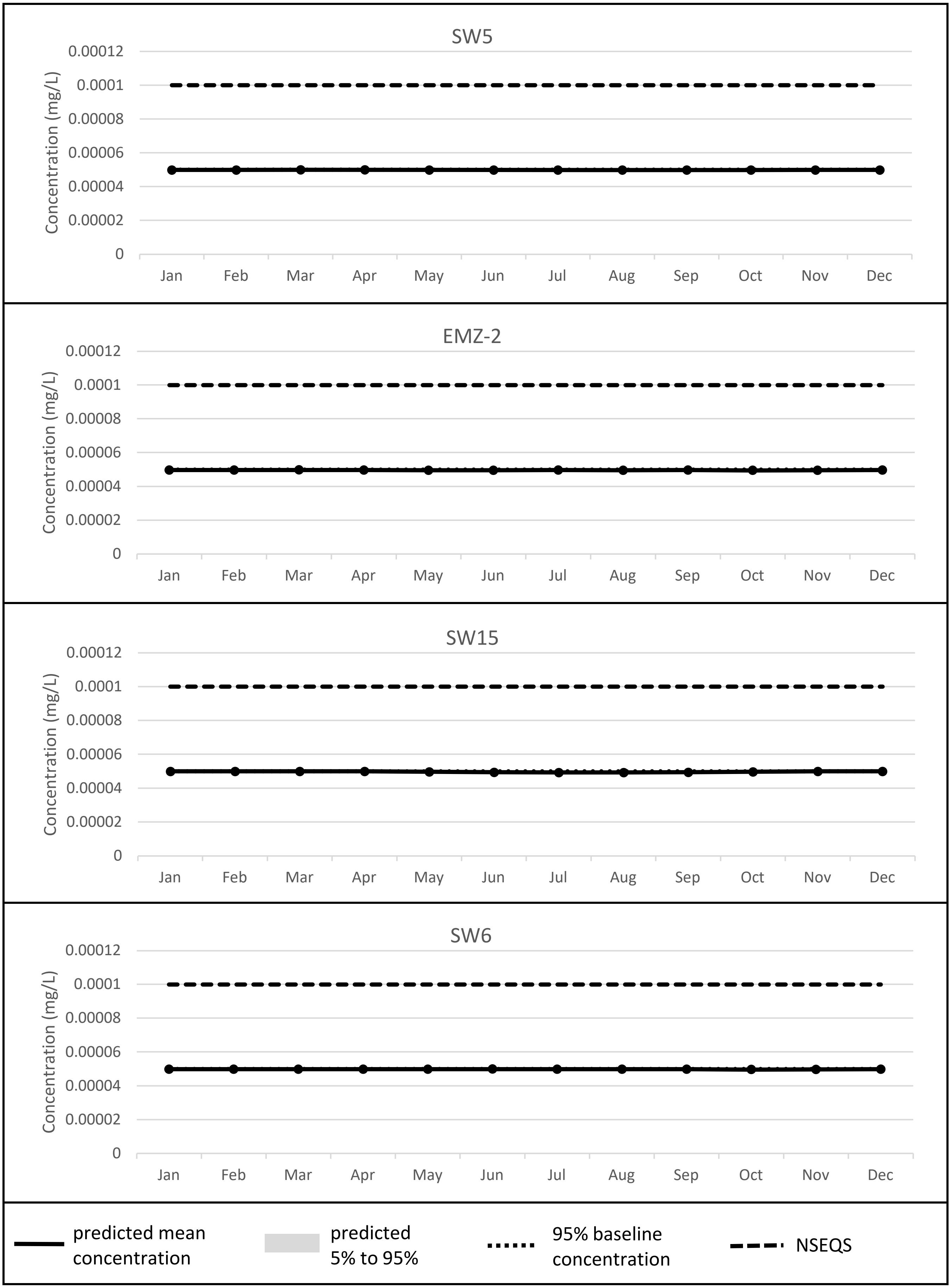


FIGURE B-85: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED THALLIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

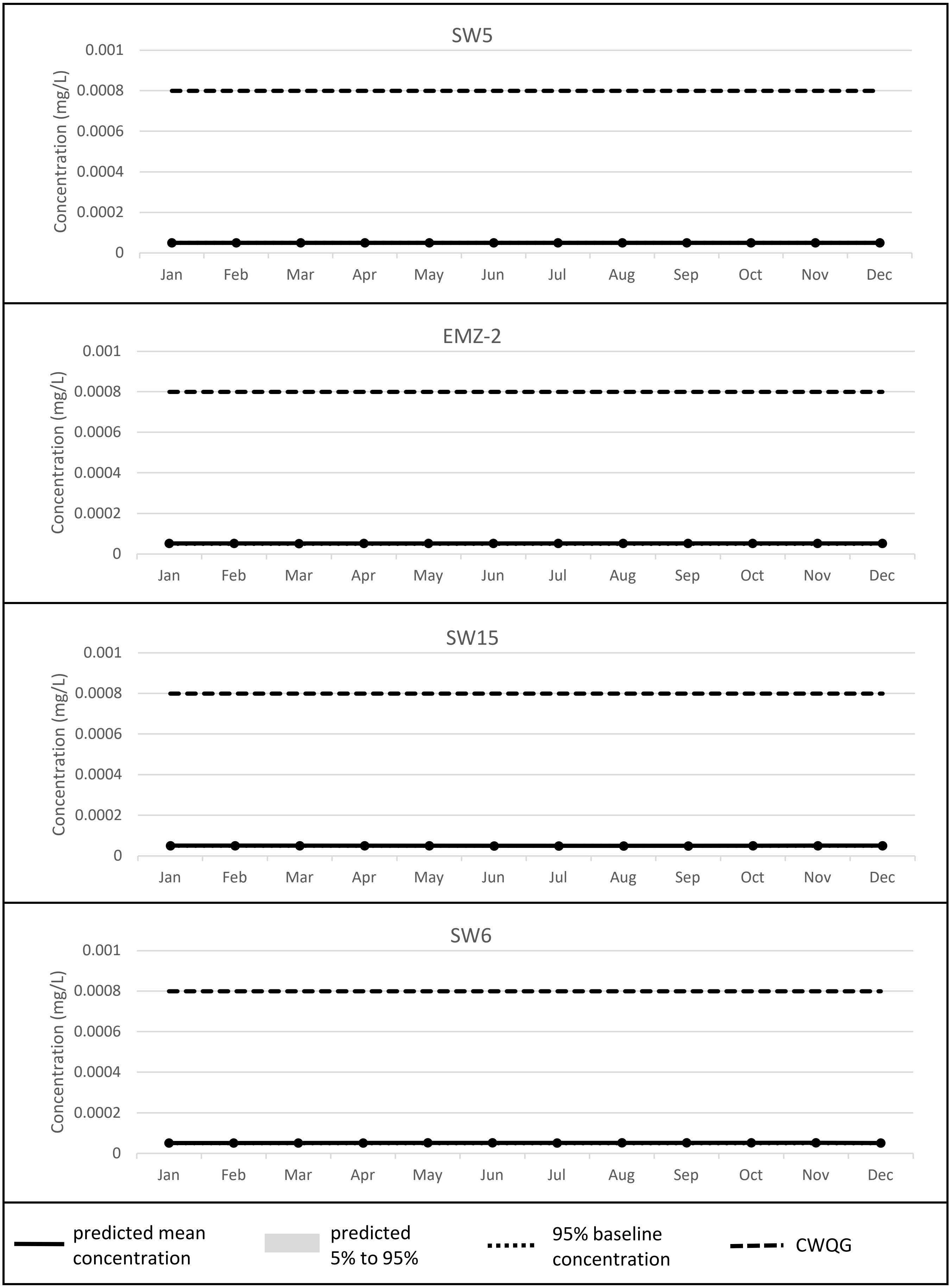
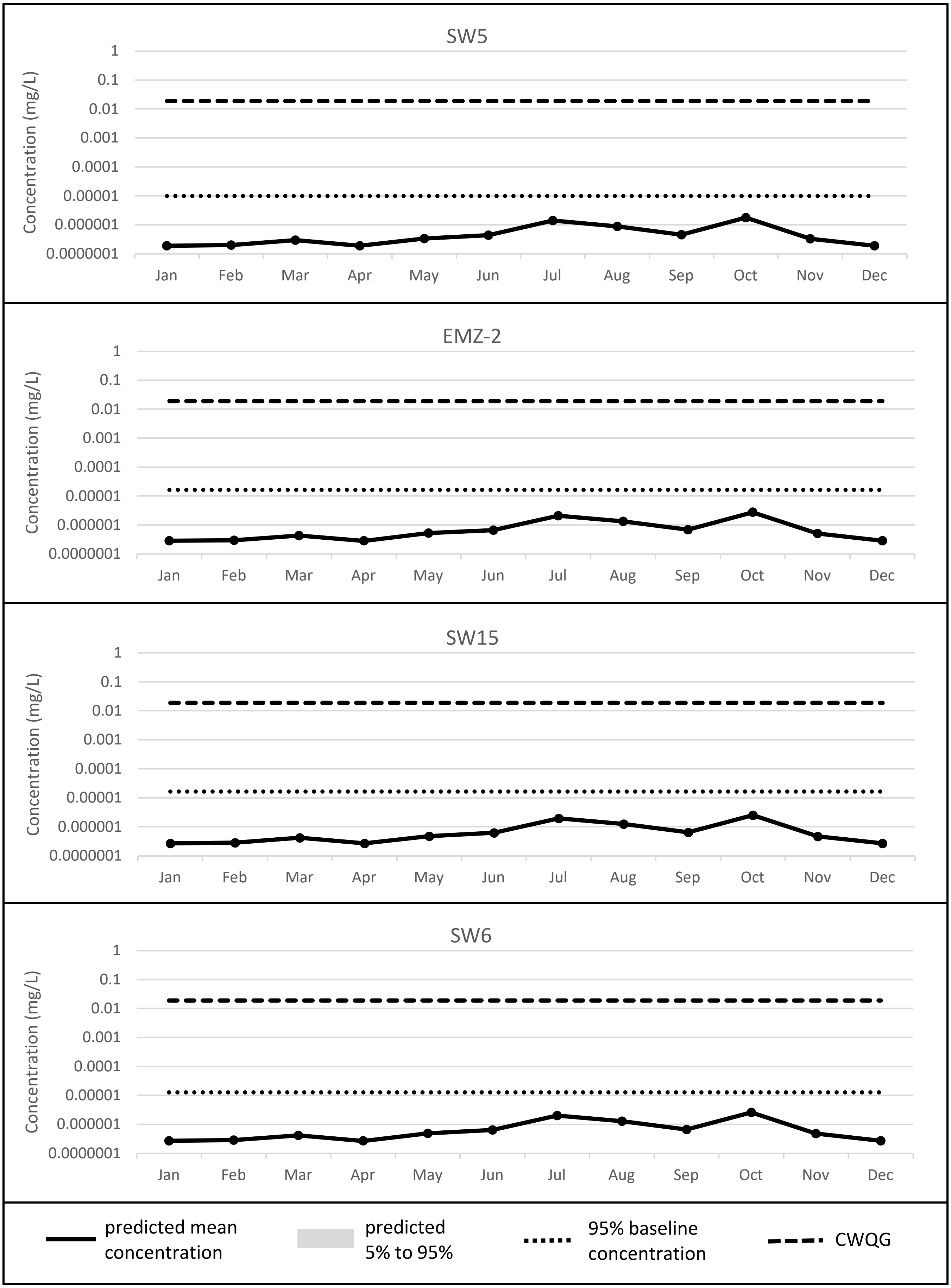


FIGURE B-86: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE
PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



2020-09-14 **FIGURE B-87: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED URANIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)** 1895674

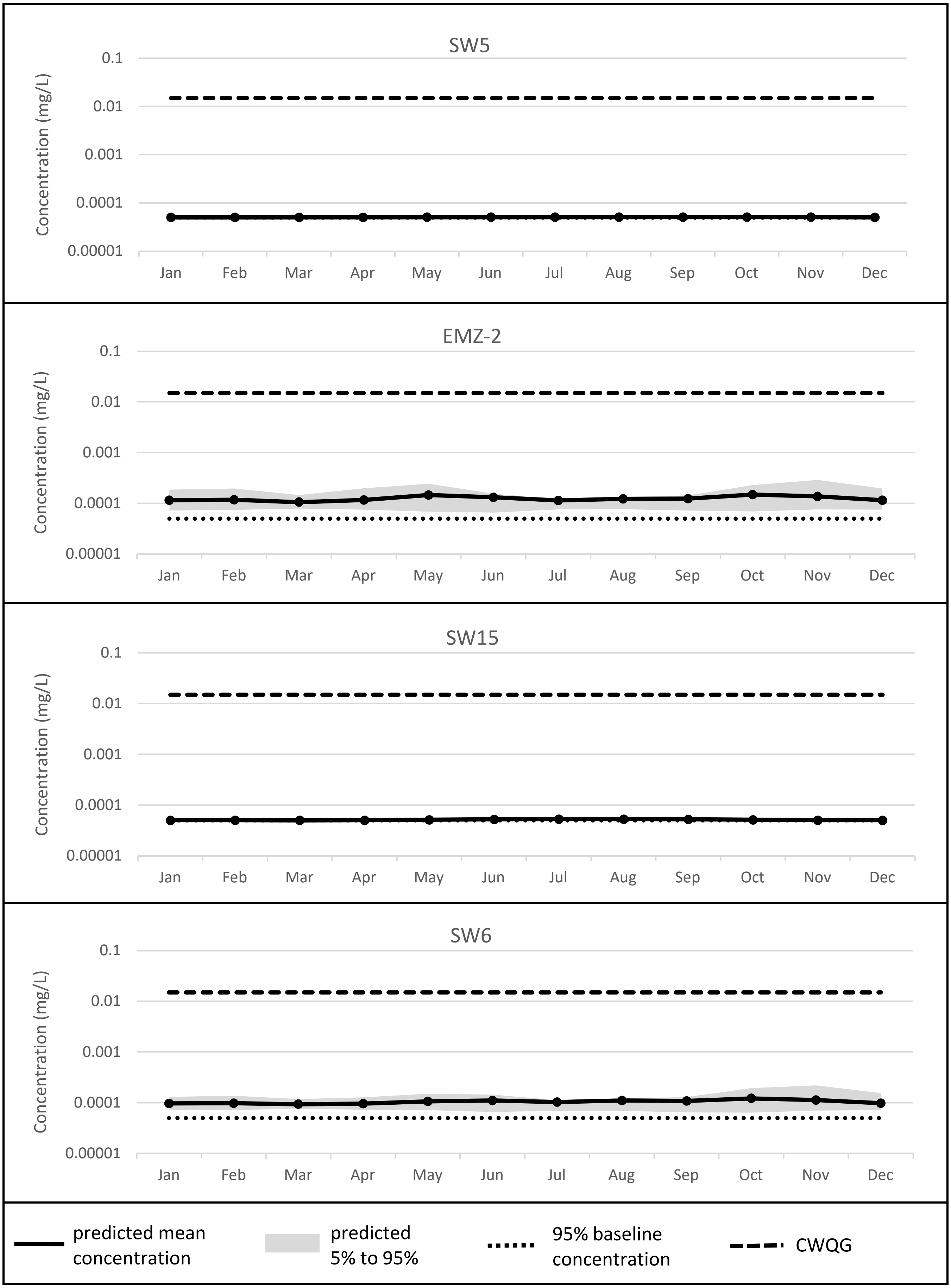
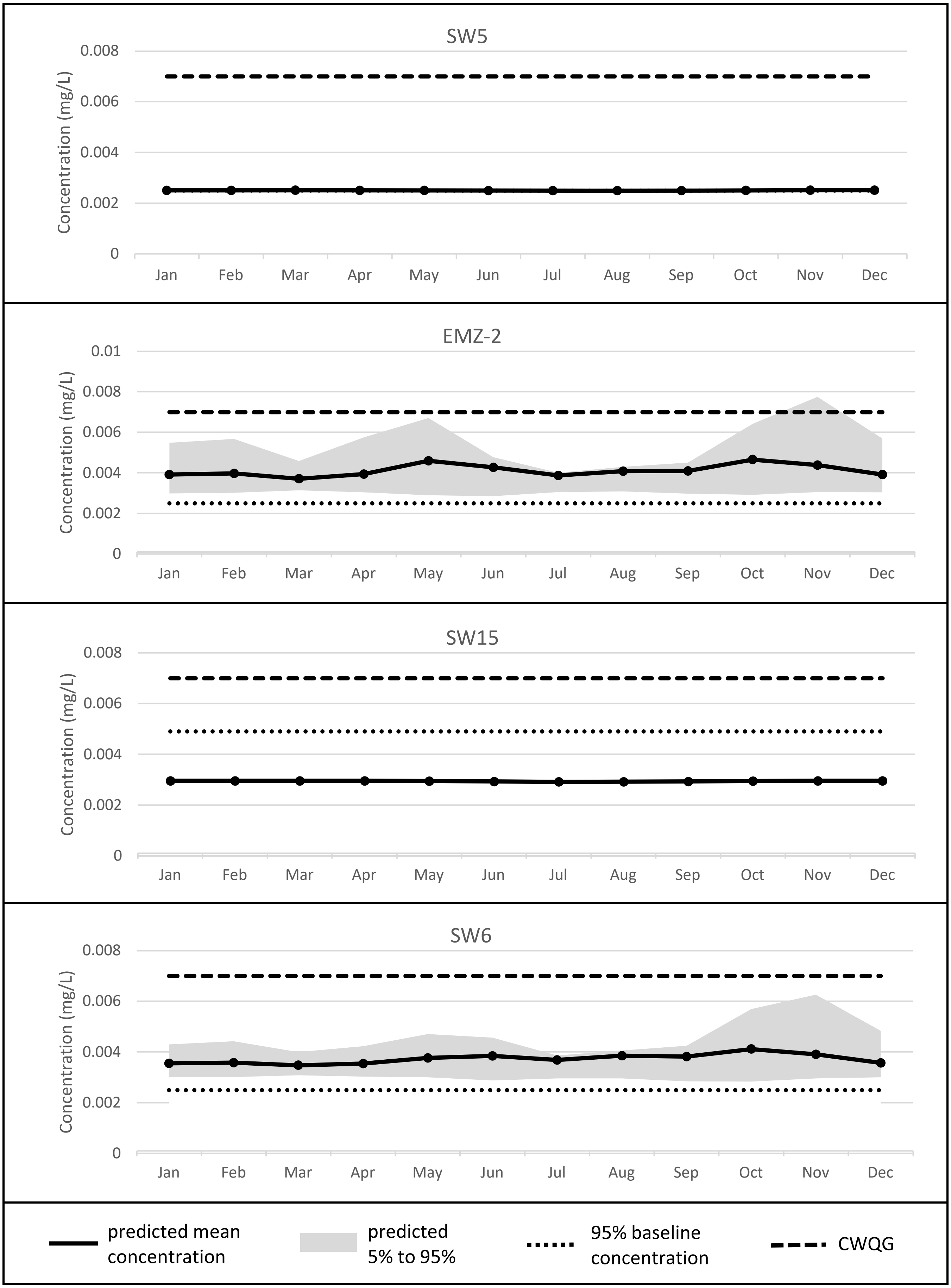


FIGURE B-88: WATER QUALITY MODELLING RESULTS - POST-CLOSURE PHASE PREDICTED ZINC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



APPENDIX C

Water Quality Modelling Results – Sensitivity Analysis

POST-CLOSURE PHASE - PREDICTED OPEN PIT EFFLUENT QUALITY (USING BASE CASE SOURCE TERMS)

Parameter	MDMER (mg/L) (1)	Open Pit Effluent Concentration (mg/L) (2)			
		PAG in TMF Embankment		PAG in NAG WRSA	
		1% PAG	2% PAG	1% PAG	2% PAG
Aluminum		0.036	0.036	0.036	0.036
Ammonia (total)		0.073	0.073	0.073	0.073
Ammonia (un-ionized) (3)	0.5	0.000029	0.000029	0.000029	0.000029
Antimony		0.00028	0.00027	0.00029	0.00029
Arsenic	0.1	0.0055	0.0055	0.0055	0.0056
Boron		0.040	0.040	0.029	0.029
Cadmium		0.00015	0.00015	0.00015	0.00015
Calcium		15	15	17	17
Chromium		0.00069	0.00069	0.00056	0.00056
Cobalt		0.0043	0.0049	0.0043	0.0049
Copper	0.1	0.0031	0.0031	0.0023	0.0023
Iron		0.25	0.25	0.25	0.25
Lead	0.08	0.0016	0.0016	0.0016	0.0016
Magnesium		2.3	2.3	2.6	2.6
Manganese		0.11	0.11	0.13	0.13
Mercury		0.000016	0.000016	0.000016	0.000016
Molybdenum		0.0031	0.0031	0.0030	0.0030
Nickel	0.25	0.028	0.031	0.028	0.031
Nitrate		0.37	0.37	0.37	0.37
Nitrite		0.011	0.011	0.011	0.011
Potassium		4.1	4.1	3.7	3.7
Selenium		0.00060	0.00061	0.00057	0.00058
Silver		0.000039	0.000039	0.000037	0.000037
Sodium		11	11	11	11
Sulphate		195	197	137	139
Thallium		0.000072	0.000072	0.000059	0.000059
Uranium		0.00090	0.00091	0.00086	0.00088
Zinc	0.4	0.038	0.040	0.038	0.040

Notes:

0.1 − Denotes a value that is greater than (or outside of the range of) the applicable MDMER effluent limits.

(1) Maximum monthly mean concentrations for new mines, as per the Metal and Diamond Mining Effluent Regulations (MDMER), Canada Fisheries Act. 2018.

(2) The effluent concentration in the flooded open pit was calculated based on the site water balance (Knight Piesold 2019) and the base case geochemical source terms (Lorax, pers. comm., 2019).

(3) For the purposes of comparing effluent quality to MDMER, a temperature of 20°C and a pH of 6 was assumed for calculation of un-ionized ammonia. Receiver un-ionized ammonia is predicted in the GoldSim model for each timestep based on effluent total ammonia concentrations and seasonal field pH and field temperature.

TABLE C-2: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS)

POST-CLOSURE PHASE - PREDICTED OPEN PIT EFFLUENT QUALITY (USING UPPER CASE SOURCE TERMS)

Parameter	MDMER (mg/L) (1)	Open Pit Effluent Concentration (mg/L) (2)			
		PAG in TMF Embankment		PAG in NAG WRSA	
		1% PAG	2% PAG	1% PAG	2% PAG
Aluminum		0.14	0.14	0.14	0.14
Ammonia (total)		0.11	0.11	0.11	0.11
Ammonia (un-ionized) (3)	0.5	0.000043	0.000043	0.000043	0.000043
Antimony		0.00036	0.00036	0.00040	0.00041
Arsenic	0.1	0.012	0.012	0.012	0.012
Boron		0.055	0.055	0.040	0.040
Cadmium		0.00031	0.00032	0.00031	0.00032
Calcium		21	21	25	25
Chromium		0.00099	0.00099	0.00089	0.00089
Cobalt		0.0083	0.0091	0.0083	0.0092
Copper	0.1	0.0059	0.0059	0.0045	0.0045
Iron		0.79	0.79	0.79	0.79
Lead	0.08	0.0053	0.0053	0.0052	0.0052
Magnesium		3.4	3.4	4.0	4.0
Manganese		0.25	0.26	0.31	0.31
Mercury		0.000016	0.000016	0.000016	0.000016
Molybdenum		0.0060	0.0060	0.0056	0.0056
Sodium	0.25	12	12	12	12
Nickel		0.050	0.055	0.050	0.056
Nitrate		0.64	0.64	0.64	0.64
Nitrite		0.017	0.017	0.017	0.017
Potassium		4.6	4.6	4.4	4.4
Selenium		0.00075	0.00076	0.00075	0.00076
Silver		0.000040	0.000040	0.000042	0.000042
Sulphate		241	244	174	176
Thallium		0.000096	0.000096	0.000083	0.000083
Uranium		0.0015	0.0015	0.0017	0.0018
Zinc	0.4	0.043	0.046	0.043	0.047

Notes:

0.1 − Denotes a value that is greater than (or outside of the range of) the applicable MDMER effluent limits.

(1) Maximum monthly mean concentrations for new mines, as per the Metal and Diamond Mining Effluent Regulations (MDMER), Canada Fisheries Act. 2018.

(2) The effluent concentration in the flooded open pit was calculated based on the site water balance (Knight Piesold 2019) and the upper case geochemical source terms (Lorax, pers. comm., 2019).

(3) For the purposes of comparing effluent quality to MDMER, a temperature of 20°C and a pH of 6 was assumed for calculation of un-ionized ammonia. Receiver un-ionized ammonia is predicted in the GoldSim model for each timestep based on effluent total ammonia concentrations and seasonal field pH and field temperature.

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.20**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.20**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.036	0.035	0.037	0.035	0.035	0.035	0.035	0.034	0.036
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000081	0.00000078	0.00000083	0.00000079	0.00000078	0.00000079	0.00000078	0.00000075	0.00000080
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00048	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0061**	**0.0061**	**0.0062**	0.0010	0.00071	0.0011	**0.0056**	**0.0054**	**0.0057**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000023	0.000019	0.000027	0.000017	0.000017	0.000017	0.000021	0.000018	0.000024
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.5	0.95	2.1	1.0	0.84	1.2	1.3	0.92	1.7
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00056	0.00056	0.00056	0.00050	0.00050	0.00050	0.00055	0.00054	0.00055
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00038	0.00026	0.00054	0.00034	0.00033	0.00034	0.00034	0.00026	0.00044
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00087	0.00080	0.00095	0.00084	0.00084	0.00084	0.00085	0.00081	0.00090
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.35**	**0.36**	**0.58**	**0.58**	**0.59**	**0.38**	**0.37**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00035	0.00031	0.00040	0.00037	0.00037	0.00037	0.00034	0.00031	0.00037
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.46	0.39	0.55	0.39	0.36	0.41	0.43	0.38	0.49
Manganese	-	0.820	-	-	0.110	0.085	0.087	0.076	0.073	0.073	0.074	0.070	0.068	0.072	0.058	0.057	0.058	0.068	0.067	0.070
Mercury	0.000026	0.000026	-	-	0.0000190	0.0000091	0.0000065	0.000010	0.000010	0.0000095	0.000010	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0010	0.0011	0.0011	0.0010	0.0012	0.0013	0.0011	0.0014	0.0011	0.0010	0.0011
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0022	0.0014	0.0032	0.0010	0.0010	0.0010	0.0019	0.0013	0.0025
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.021	0.010	0.034	0.0050	0.0050	0.0050	0.017	0.0092	0.025
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0053	0.0051	0.0055	0.0050	0.0050	0.0050	0.0052	0.0051	0.0053
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.37	0.32	0.41	0.45	0.33	0.59	0.48	0.29	0.62	0.40	0.32	0.49
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.6	2.8	2.4	3.1	3.1	2.9	3.3
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.2	1.7	7.2	3.1	12	2.5	1.4	3.2	5.6	2.8	8.9
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000051	0.000050	0.000050	0.000050	0.000051	0.000050	0.000051
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000086	0.000061	0.00012	0.000051	0.000050	0.000052	0.000076	0.000059	0.000095
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0041	0.0030	0.0054	0.0029	0.0029	0.0030	0.0037	0.0029	0.0045

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.
(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).
(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).
(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).
(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).
(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mean, 5th percentile and 95th percentile.
(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.
(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.
(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.
(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.
(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.
(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.
(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE C-4: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA), POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING BASE CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.20**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.20**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.036	0.035	0.037	0.035	0.035	0.035	0.035	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000081	0.00000078	0.00000083	0.00000079	0.00000078	0.00000079	0.00000078	0.00000075	0.00000080
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00048	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0061**	**0.0061**	**0.0062**	0.0010	0.00071	0.0011	**0.0056**	**0.0054**	**0.0057**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000023	0.000019	0.000027	0.000017	0.000017	0.000017	0.000021	0.000018	0.000024
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.5	0.95	2.1	1.0	0.84	1.2	1.3	0.92	1.7
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00055	0.00055	0.00055	0.00050	0.00050	0.00050	0.00054	0.00054	0.00055
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00038	0.00026	0.00053	0.00034	0.00033	0.00034	0.00034	0.00026	0.00044
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00084	0.00079	0.00090	0.00084	0.00084	0.00084	0.00083	0.00080	0.00087
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.35**	**0.36**	**0.58**	**0.58**	**0.59**	**0.38**	**0.37**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00035	0.00031	0.00040	0.00037	0.00037	0.00037	0.00034	0.00031	0.00037
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.46	0.39	0.55	0.39	0.36	0.41	0.43	0.38	0.49
Manganese	-	0.820	-	-	0.110	0.085	0.087	0.076	0.073	0.073	0.074	0.070	0.068	0.072	0.058	0.057	0.058	0.068	0.067	0.070
Mercury	0.000026	0.000026	-	-	0.000019	0.000009	0.000007	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0010	0.0011	0.0011	0.0010	0.0012	0.0013	0.0011	0.0014	0.0011	0.0010	0.0011
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0022	0.0014	0.0032	0.0010	0.0010	0.0010	0.0019	0.0013	0.0025
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.021	0.010	0.034	0.0050	0.0050	0.0050	0.017	0.0092	0.025
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0053	0.0051	0.0055	0.0050	0.0050	0.0050	0.0052	0.0051	0.0053
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.37	0.32	0.41	0.45	0.33	0.59	0.48	0.29	0.62	0.40	0.32	0.49
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	5.0E-05	5.0E-05	5.0E-05	4.9E-05	4.9E-05	5.0E-05	5.0E-05	5.0E-05	5.0E-05	5.0E-05	4.9E-05	5.0E-05
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.6	2.8	2.4	3.1	3.1	2.9	3.3
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.2	1.7	7.3	3.1	12	2.5	1.4	3.2	5.7	2.8	9.0
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000086	0.000061	0.00012	0.000051	0.000050	0.000052	0.000077	0.000060	0.000096
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0041	0.0030	0.0054	0.0029	0.0029	0.0030	0.0037	0.0029	0.0045

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mean, 5th percentile and 95th percentile.

(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE C-5: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS), POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING BASE CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.20**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.20**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.036	0.035	0.037	0.035	0.035	0.035	0.035	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000081	0.00000078	0.00000083	0.00000079	0.00000078	0.00000079	0.00000078	0.00000075	0.00000080
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00048	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0061**	**0.0061**	**0.0062**	0.0010	0.0007	0.0011	**0.0056**	**0.0054**	**0.0057**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.026	0.025	0.025	0.025	0.026	0.025	0.026
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000023	0.000019	0.000027	0.000017	0.000017	0.000017	0.000021	0.000018	0.000024
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.4	0.92	1.9	1.0	0.84	1.2	1.2	0.90	1.6
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00056	0.00056	0.00056	0.00050	0.00050	0.00050	0.00055	0.00054	0.00055
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00041	0.00026	0.00058	0.00034	0.00033	0.00034	0.00036	0.00026	0.00047
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00087	0.00080	0.0010	0.00084	0.00084	0.00084	0.00086	0.00081	0.00091
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.35**	**0.36**	**0.58**	**0.58**	**0.59**	**0.38**	**0.37**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00035	0.00031	0.00040	0.00037	0.00037	0.00037	0.00034	0.00031	0.00037
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.45	0.38	0.52	0.39	0.36	0.41	0.42	0.38	0.47
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.073	0.073	0.074	0.070	0.068	0.071	0.058	0.057	0.058	0.068	0.067	0.069
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0010	0.0011	0.0011	0.0010	0.0012	0.0013	0.0011	0.0014	0.0011	0.0010	0.0011
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0023	0.0014	0.0035	0.0010	0.0010	0.0010	0.0020	0.0014	0.0027
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.021	0.010	0.034	0.0050	0.0050	0.0050	0.017	0.0092	0.025
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0053	0.0051	0.0055	0.0050	0.0050	0.0050	0.0052	0.0051	0.0053
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.37	0.32	0.41	0.47	0.33	0.62	0.48	0.29	0.62	0.41	0.32	0.51
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.6	2.8	2.4	3.1	3.1	2.9	3.3
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.2	1.7	10	3.9	17	2.5	1.4	3.2	7.7	3.5	12
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000052	0.000050	0.000050	0.000050	0.000051	0.000050	0.000051
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000088	0.000062	0.00012	0.000051	0.000050	0.000052	0.000078	0.000060	0.000099
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0041	0.0030	0.0055	0.0029	0.0029	0.0030	0.0037	0.0030	0.0046

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mean, 5th percentile and 95th percentile.

(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE C-6: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA), POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING BASE CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L)(5)				Predicted Concentration (mg/L)(6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.20**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.20**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.036	0.035	0.037	0.035	0.035	0.035	0.035	0.034	0.036
Ammonia (un-ionized)	0.019	-	-	-	0.0000100	0.0000164	0.0000167	0.0000129	0.00000056	0.00000056	0.00000056	0.00000081	0.00000078	0.00000083	0.00000079	0.00000078	0.00000079	0.00000078	0.00000075	0.00000080
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00048	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.006**	**0.0061**	**0.0062**	0.0010	0.00071	0.0011	**0.0056**	**0.0054**	**0.0057**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000023	0.000019	0.000027	0.000017	0.000017	0.000017	0.000021	0.000018	0.000024
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.5	0.95	2.1	1.0	0.84	1.2	1.3	0.92	1.7
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00055	0.00055	0.00055	0.00050	0.00050	0.00050	0.00054	0.00054	0.00055
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00041	0.00026	0.00058	0.00034	0.00033	0.00034	0.00036	0.00026	0.00047
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00086	0.00086	0.00087	0.00084	0.00079	0.00090	0.00084	0.00084	0.00084	0.00083	0.00080	0.00087
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.35**	**0.35**	**0.36**	**0.58**	**0.58**	**0.59**	**0.38**	**0.37**	**0.38**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00035	0.00031	0.00040	0.00037	0.00037	0.00037	0.00034	0.00031	0.00037
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.46	0.39	0.55	0.39	0.36	0.41	0.43	0.38	0.49
Manganese	-	0.820	-	-	0.110	0.085	0.087	0.076	0.073	0.073	0.074	0.070	0.068	0.073	0.058	0.057	0.058	0.068	0.067	0.070
Mercury	0.000026	0.000026	-	-	0.0000190	0.0000091	0.0000065	0.0000104	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0010	0.0011	0.0011	0.0010	0.0012	0.0013	0.0011	0.0014	0.0011	0.0010	0.0011
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0023	0.0014	0.0035	0.0010	0.0010	0.0010	0.0020	0.0014	0.0027
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0050	0.021	0.010	0.034	0.0050	0.0050	0.0050	0.017	0.0092	0.025
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0053	0.0051	0.0055	0.0050	0.0050	0.0050	0.0052	0.0051	0.0053
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.37	0.32	0.41	0.45	0.33	0.59	0.48	0.29	0.62	0.40	0.32	0.49
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.6	2.8	2.4	3.1	3.1	2.9	3.3
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.2	1.7	7.4	3.1	13	2.5	1.4	3.2	5.8	2.8	9.1
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000087	0.000061	0.000118	0.000051	0.000050	0.000052	0.000077	0.000060	0.000097
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0041	0.0030	0.0055	0.0029	0.0029	0.0030	0.0037	0.0030	0.0046

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mea th percentile and 95th percentile.

(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 9th percentile baseline concentration

TABLE C-7: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS),
POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.21**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.21**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.038	0.035	0.040	0.035	0.035	0.035	0.036	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.0000100	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000084	0.00000079	0.00000089	0.00000079	0.00000078	0.00000079	0.00000081	0.00000076	0.00000085
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0065**	**0.0062**	**0.0067**	0.0013	0.00080	0.0017	**0.0058**	**0.0055**	**0.0060**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.027	0.025	0.025	0.025	0.026	0.025	0.027
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000030	0.000021	**0.000041**	0.000017	0.000017	0.000017	0.000027	0.000020	0.000034
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.6	1.0	2.4	1.1	0.84	1.2	1.4	1.0	1.9
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00057	0.00056	0.00059	0.00050	0.00050	0.00050	0.00056	0.00055	0.00057
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00056	0.00031	**0.00086**	0.0003	0.0003	0.0003	0.00047	0.00030	0.00067
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00087	0.00086	0.00087	0.0010	0.00084	0.0012	0.00084	0.00084	0.00084	0.00095	0.00084	0.0011
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.38**	**0.37**	**0.39**	**0.58**	**0.58**	**0.59**	**0.39**	**0.39**	**0.41**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00051	0.00036	0.00070	0.00037	0.00037	0.00037	0.00046	0.00036	0.00058
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.50	0.40	0.61	0.39	0.36	0.42	0.46	0.39	0.54
Manganese	-	0.820	-	-	0.110	0.085	0.087	0.076	0.074	0.073	0.074	0.076	0.070	0.083	0.059	0.057	0.060	0.073	0.069	0.077
Mercury	0.000026	0.000026	-	-	0.0000190	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0012	0.0013	0.0011	0.0015	0.0014	0.0011	0.0015	0.0012	0.0011	0.0013
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0032	0.0017	0.0050	0.0010	0.0010	0.0010	0.0026	0.0016	0.0038
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0051	0.033	0.014	0.056	0.0051	0.0050	0.0052	0.026	0.012	0.041
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0055	0.0052	0.0060	0.0050	0.0050	0.0050	0.0054	0.0051	0.0057
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.38	0.33	0.42	0.49	0.34	0.67	0.52	0.29	0.67	0.43	0.33	0.55
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00050	0.00051	0.00050	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.7	2.8	2.4	3.1	3.2	2.9	3.4
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.3	1.8	12	4.6	21	2.6	1.4	3.4	9.1	4.0	15
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000052	0.000051	0.000054	0.000050	0.000050	0.000050	0.000052	0.000051	0.000053
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.00011	0.000070	0.00017	0.000051	0.000050	0.000052	0.000097	0.000067	0.00013
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0043	0.0031	0.0058	0.0029	0.0029	0.0030	0.0038	0.0030	0.0048

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mean, 5th percentile and 95th percentile.

(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.

0.1 Grey shading indicates a concentration greater than the NSEQS.

0.1 Double outline indicates a concentration greater than the FEQG.

0.1 Bold outline indicates a concentration greater than the SSWQO.

0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE C-8: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA), POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.21**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.21**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.038	0.035	0.040	0.035	0.035	0.035	0.036	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000084	0.00000079	0.00000089	0.00000079	0.00000078	0.00000079	0.00000081	0.00000076	0.00000085
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0065**	**0.0063**	**0.0067**	0.0013	0.0008	0.0017	**0.0058**	**0.0055**	**0.0060**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.026	0.025	0.025	0.025	0.026	0.025	0.026
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000030	0.000021	**0.000041**	0.000017	0.000017	0.000017	0.000027	0.000020	0.000034
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.8	1.1	2.7	1.1	0.84	1.2	1.5	1.0	2.1
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00057	0.00056	0.00058	0.00050	0.00050	0.00050	0.00056	0.00055	0.00056
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00056	0.00031	**0.00086**	0.00034	0.00033	0.00034	0.00047	0.00030	0.00067
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00087	0.00086	0.00087	0.00094	0.00082	0.0011	0.00084	0.00084	0.00084	0.00090	0.00083	0.00099
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.38**	**0.37**	**0.39**	**0.58**	**0.58**	**0.59**	**0.39**	**0.39**	**0.41**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00051	0.00036	0.00069	0.00037	0.00037	0.00037	0.00046	0.00035	0.00057
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.52	0.41	0.66	0.39	0.36	0.42	0.48	0.40	0.57
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.074	0.073	0.074	0.078	0.071	0.087	0.059	0.057	0.060	0.074	0.069	0.080
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0012	0.0012	0.0011	0.0014	0.0014	0.0011	0.0015	0.0012	0.0011	0.0013
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0032	0.0017	0.0049	0.0010	0.0010	0.0010	0.0026	0.0016	0.0037
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0051	0.033	0.014	0.056	0.0051	0.0050	0.0052	0.026	0.012	0.041
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0055	0.0052	0.0060	0.0050	0.0050	0.0050	0.0054	0.0051	0.0057
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.38	0.33	0.42	0.48	0.34	0.65	0.52	0.29	0.67	0.43	0.32	0.54
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.7	2.8	2.4	3.1	3.2	2.9	3.4
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.3	1.8	9.0	3.6	15	2.6	1.4	3.4	6.9	3.2	11
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000053	0.000050	0.000050	0.000050	0.000051	0.000050	0.000052
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.00012	0.000073	0.00019	0.000051	0.000050	0.000052	0.00010	0.000070	0.00015
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0043	0.0031	0.0058	0.0029	0.0029	0.0030	0.0039	0.0030	0.0048

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mean, 5th percentile and 95th percentile.

(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.

0.1 Grey shading indicates a concentration greater than the NSEQS.

0.1 Double outline indicates a concentration greater than the FEQG.

0.1 Bold outline indicates a concentration greater than the SSWQO.

0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE C-9: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS), POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
					SW5	EMZ-2 (7)	SW15 (8)	SW6	SW5			EMZ-2			SW15			SW6		
									mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.21**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.21**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.038	0.035	0.040	0.035	0.035	0.035	0.036	0.034	0.04
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000084	0.00000079	0.00000089	0.00000079	0.00000078	0.00000079	0.00000081	0.00000076	0.00000085
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0065**	**0.0062**	**0.0067**	0.0013	0.0008	0.0017	**0.0058**	**0.0055**	**0.0060**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.027	0.025	0.025	0.025	0.026	0.025	0.027
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000030	0.000021	**0.000042**	0.000017	0.000017	0.000017	0.000027	0.000020	0.000034
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.6	1.0	2.4	1.1	0.84	1.2	1.4	1.0	1.9
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00057	0.00056	0.00059	0.00050	0.00050	0.00050	0.00056	0.00055	0.00057
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00059	0.00032	**0.00092**	0.00034	0.00033	0.00034	0.00050	0.00031	0.00071
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.00087	0.00086	0.00087	0.0010	0.00084	0.0012	0.00084	0.00084	0.00084	0.00095	0.00084	0.0011
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.38**	**0.37**	**0.39**	**0.58**	**0.58**	**0.59**	**0.39**	**0.39**	**0.41**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00051	0.00036	0.00070	0.00037	0.00037	0.00037	0.00046	0.00036	0.00058
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.50	0.40	0.61	0.39	0.36	0.42	0.46	0.39	0.54
Manganese	-	0.820	-	-	0.110	0.085	0.087	0.076	0.074	0.073	0.074	0.076	0.070	0.083	0.059	0.057	0.060	0.073	0.069	0.077
Mercury	0.000026	0.000026	-	-	0.0000190	0.0000091	0.0000065	0.0000104	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0012	0.0013	0.0011	0.0015	0.0014	0.0011	0.0015	0.0012	0.0011	0.0013
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0034	0.0017	0.0054	0.0010	0.0010	0.0010	0.0028	0.0016	0.0041
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0051	0.033	0.014	0.056	0.0051	0.0050	0.0052	0.026	0.012	0.041
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0055	0.0052	0.0060	0.0050	0.0050	0.0050	0.0054	0.0051	0.0057
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.38	0.33	0.42	0.49	0.34	0.67	0.52	0.29	0.67	0.43	0.33	0.55
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.7	2.8	2.4	3.1	3.2	2.9	3.4
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.3	1.8	12	4.6	21	2.6	1.4	3.4	9.2	4.1	15
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000052	0.000051	0.000054	0.000050	0.000050	0.000050	0.000052	0.000051	0.000053
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.00012	0.000070	0.00017	0.000051	0.000050	0.000052	0.000098	0.000067	0.00013
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0044	0.0031	0.0061	0.0029	0.0029	0.0030	0.0040	0.0030	0.0050

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax, pers. comm., 2019); statistics presented are the mean, 5th percentile and 95th percentile.

(7) - Baseline water quality for EMZ-2 is derived from the available dataset for SW14 and SW6.

(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.

0.1 Grey shading indicates a concentration greater than the NSEQS.

0.1 Double outline indicates a concentration greater than the FEQG.

0.1 Bold outline indicates a concentration greater than the SSWQO.

0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

TABLE C-10: WATER QUALITY MODEL RESULTS (SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA), POST CLOSURE PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentrations (mg/L) (5)				Predicted Concentration (mg/L) (6)											
									SW5			EMZ-2			SW15			SW6		
					SW5	EMZ-2 (7)	SW15 (8)	SW6	mean	5%	95%	mean	5%	95%	mean	5%	95%	mean	5%	95%
Aluminum	0.0050 (9)	0.0050	-	-	**0.29**	**0.29**	**0.36**	**0.29**	**0.18**	**0.18**	**0.18**	**0.21**	**0.20**	**0.21**	**0.24**	**0.23**	**0.24**	**0.21**	**0.21**	**0.21**
Ammonia (total)	-	-	-	-	0.025	0.079	0.069	0.025	0.025	0.025	0.025	0.038	0.035	0.040	0.035	0.035	0.035	0.036	0.034	0.038
Ammonia (un-ionized)	0.019	-	-	-	0.000010	0.000016	0.000017	0.000013	0.00000056	0.00000056	0.00000056	0.00000084	0.00000079	0.00000089	0.00000079	0.00000078	0.00000079	0.00000081	0.00000076	0.00000085
Antimony	-	0.020	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Arsenic	0.0050	0.0050	-	0.03	**0.066**	**0.026**	0.0012	**0.015**	**0.025**	**0.025**	**0.025**	**0.0065**	**0.0063**	**0.0068**	0.0013	0.0008	0.0017	**0.0058**	**0.0055**	**0.0060**
Boron	1.5	1.20	-	-	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.025	0.026	0.025	0.025	0.025	0.026	0.025	0.026
Cadmium	0.000040 (10)	- (11)	-	-	0.000018	0.000024	0.000030	0.000024	0.000012	0.000012	0.000012	0.000030	0.000021	**0.000042**	0.000017	0.000017	0.000017	0.000027	0.000021	0.000034
Calcium	-	-	-	-	0.84	0.88	1.3	0.88	0.79	0.74	0.83	1.8	1.1	2.7	1.1	0.84	1.2	1.5	1.0	2.1
Chromium	0.0089	-	-	-	0.00080	0.00078	0.00050	0.00050	0.00056	0.00055	0.00056	0.00057	0.00056	0.00058	0.00050	0.00050	0.00050	0.00056	0.00055	0.00056
Cobalt	-	0.010	0.00078 (12)	-	0.00049	0.00020	0.00051	0.00020	0.00026	0.00026	0.00026	0.00060	0.00032	**0.00093**	0.00034	0.00033	0.00034	0.00050	0.00031	0.00071
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0010	0.0010	0.0010	0.0009	0.0009	0.0009	0.0009	0.0008	0.0011	0.00084	0.00084	0.00084	0.0009	0.0008	0.0010
Iron	0.30	0.30	-	-	**0.78**	**0.87**	**1.2**	**1.0**	**0.39**	**0.39**	**0.39**	**0.38**	**0.37**	**0.39**	**0.58**	**0.58**	**0.59**	**0.39**	**0.39**	**0.41**
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00045	0.000583	0.00055	0.00025	0.00025	0.00025	0.00051	0.00036	0.00069	0.00037	0.00037	0.00037	0.00046	0.00035	0.00057
Magnesium		-	-	-	0.36	0.44	0.49	0.45	0.35	0.34	0.35	0.52	0.41	0.66	0.39	0.36	0.42	0.48	0.40	0.57
Manganese	-	0.820	-	-	0.11	0.085	0.087	0.076	0.074	0.073	0.074	0.078	0.071	0.087	0.059	0.057	0.060	0.074	0.069	0.080
Mercury	0.000026	0.000026	-	-	0.000019	0.0000091	0.0000065	0.000010	0.0000095	0.0000095	0.0000095	0.0000074	0.0000071	0.0000077	0.0000065	0.0000065	0.0000065	0.0000073	0.0000071	0.0000075
Molybdenum	0.073	0.073	-	-	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0012	0.0012	0.0011	0.0014	0.0014	0.0011	0.0015	0.0012	0.0011	0.0013
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0034	0.0018	0.0054	0.0010	0.0010	0.0010	0.0028	0.0016	0.0041
Nitrate	13	-	-	-	0.057	0.059	0.025	0.048	0.0050	0.0050	0.0051	0.033	0.014	0.056	0.0051	0.0050	0.0052	0.026	0.012	0.041
Nitrite	0.060	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0055	0.0052	0.0060	0.0050	0.0050	0.0050	0.0054	0.0051	0.0057
Potassium	-	-	-	-	0.37	0.33	0.33	0.33	0.38	0.33	0.42	0.48	0.34	0.65	0.52	0.29	0.67	0.43	0.32	0.54
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052
Silver	0.00025	0.00010	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Sodium	-	-	-	-	2.5	3.4	2.9	3.4	2.4	2.3	2.5	3.3	3.0	3.7	2.8	2.4	3.1	3.2	2.9	3.4
Sulphate	-	-	-	-	1.0	2.1	1.0	2.6	1.5	1.3	1.8	9.1	3.7	16	2.6	1.4	3.4	7.0	3.3	11
Thallium	0.00080	0.00080	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.000050	0.000053	0.000050	0.000050	0.000050	0.000051	0.000050	0.000052
Uranium	0.015	0.30	-	-	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000051	0.00013	0.000073	0.00019	0.000051	0.000050	0.000052	0.00011	0.000070	0.00015
Zinc	0.007 (13)	0.030	-	-	0.0025	0.0025	0.0049	0.0025	0.0025	0.0025	0.0025	0.0045	0.0031	0.0061	0.0029	0.0029	0.0030	0.0040	0.0031	0.0050

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

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(8) - Baseline water quality for SW15 is derived form the available dataset for SW12.

(9) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(10) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(11) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(12) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(13) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1 Bolding indicates a concentration greater than the CCME CWQG.

0.1 Grey shading indicates a concentration greater than the NSEQS.

0.1 Double outline indicates a concentration greater than the FEQG.

0.1 Bold outline indicates a concentration greater than the SSWQO.

0.1 Underlining indicates a concentration greater than the 95th percentile baseline concentration.

FIGURE C-1: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED ALUMINUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

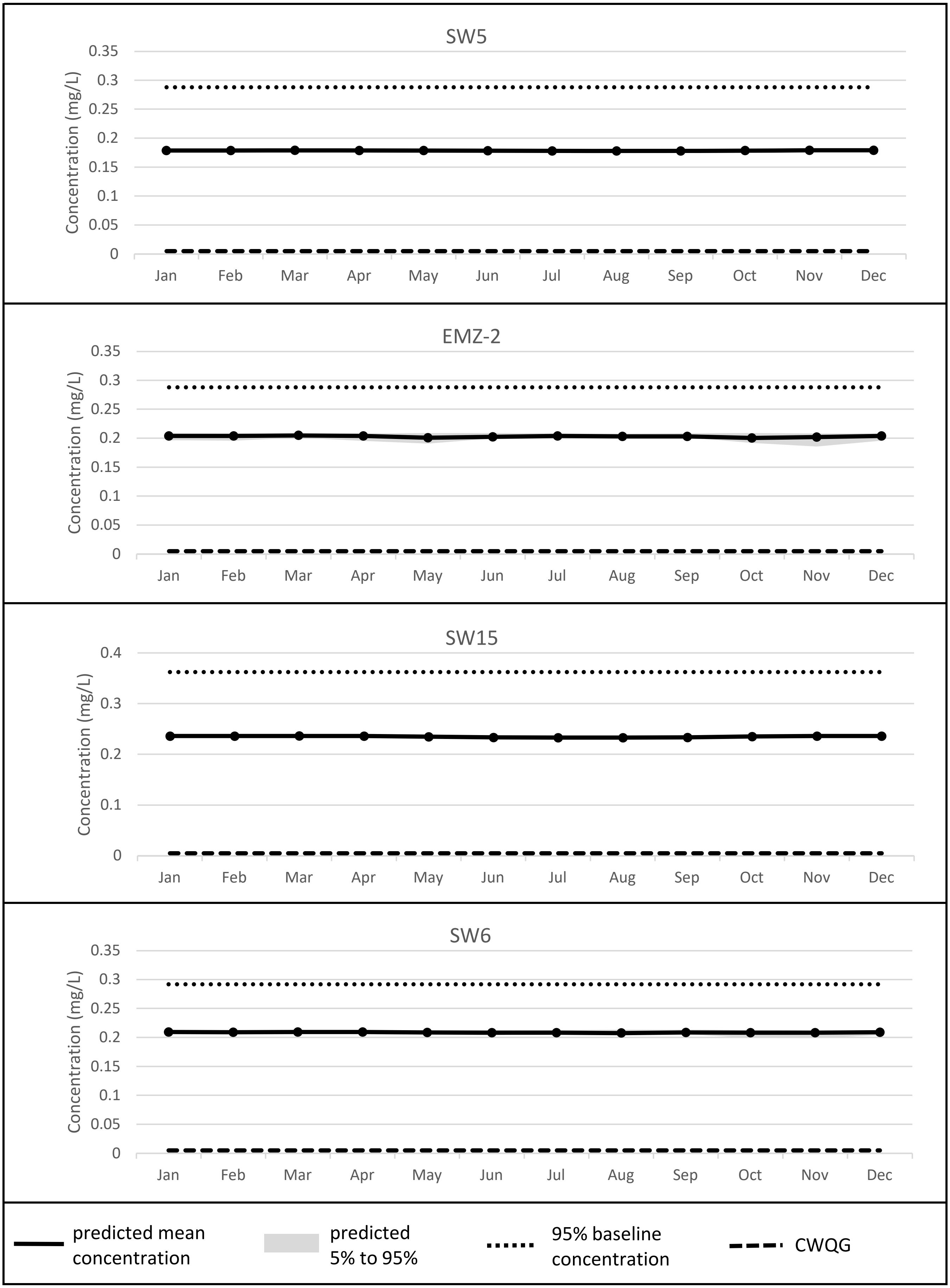


FIGURE C-2: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED ANTIMONY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

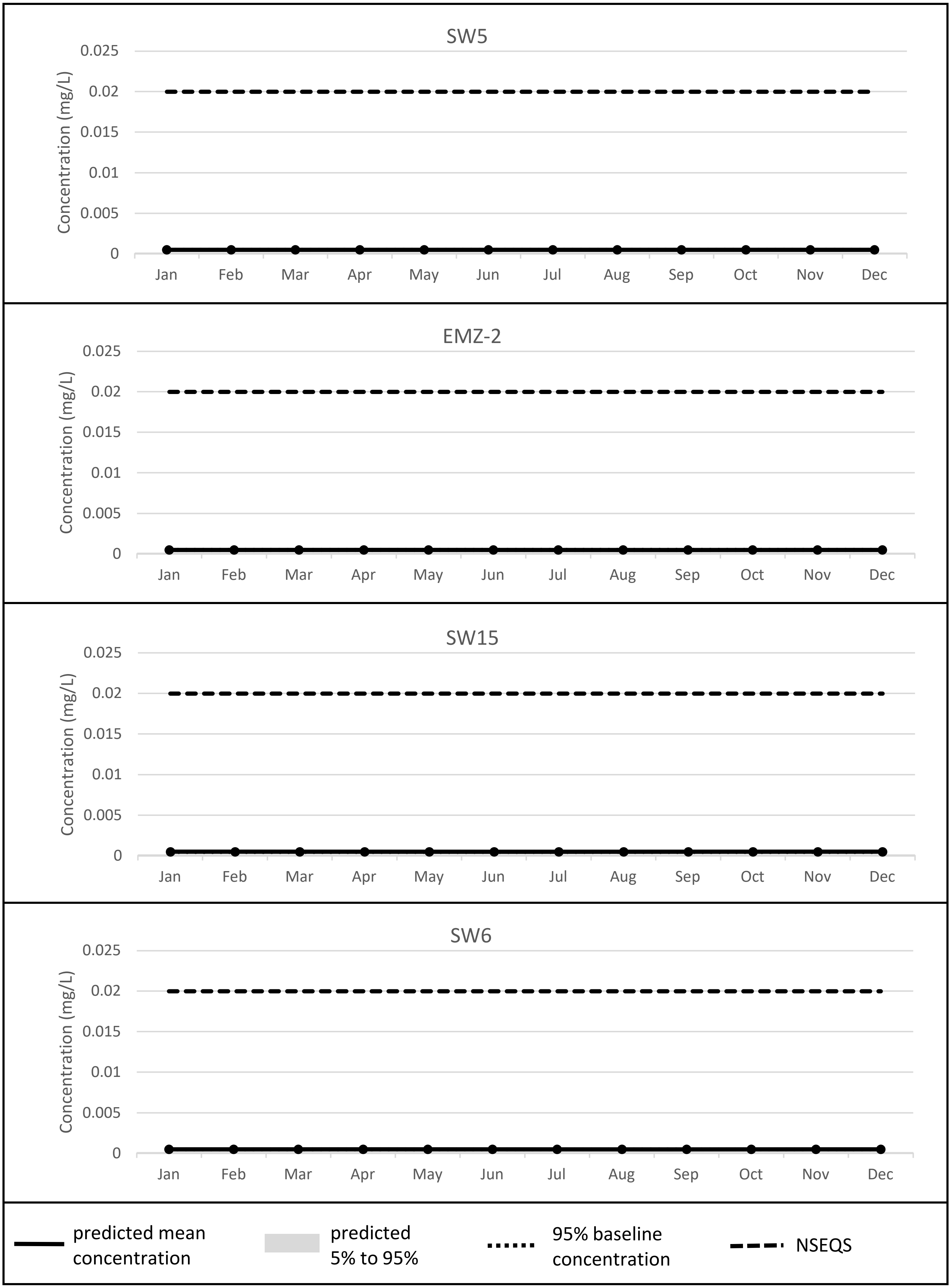


FIGURE C-3: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED ARSENIC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

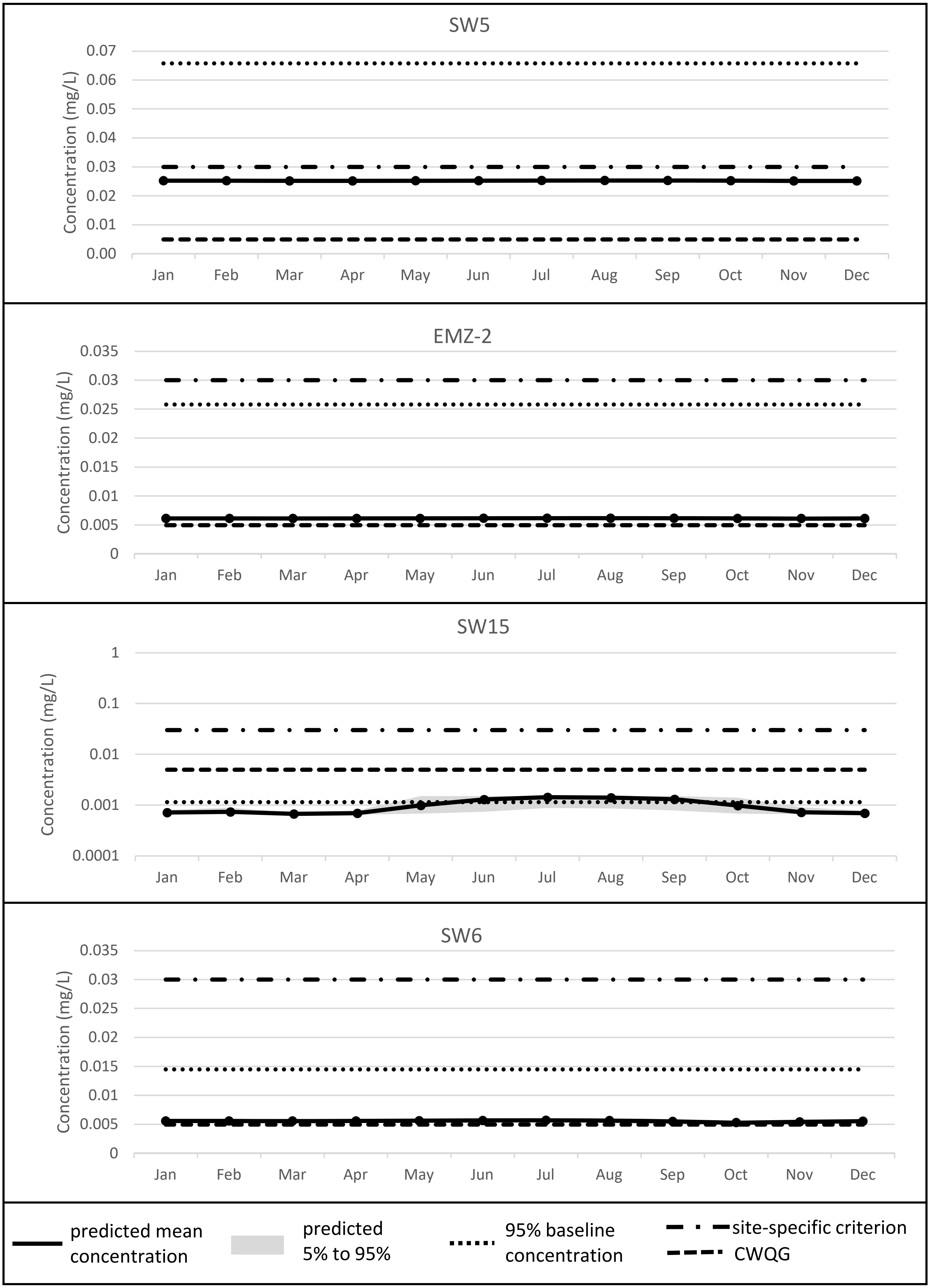


FIGURE C-4: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED BORON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

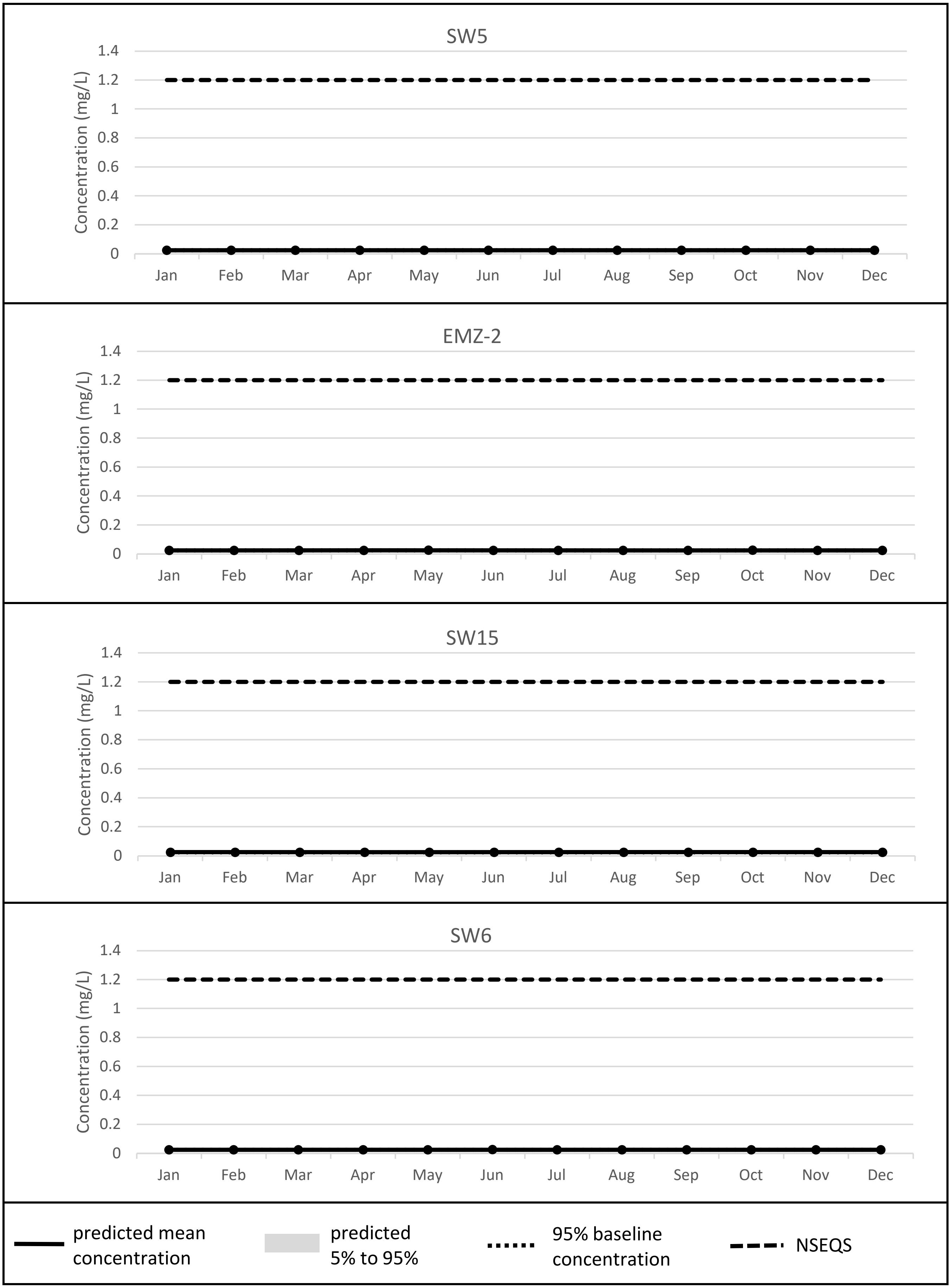


FIGURE C-5: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED CADMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

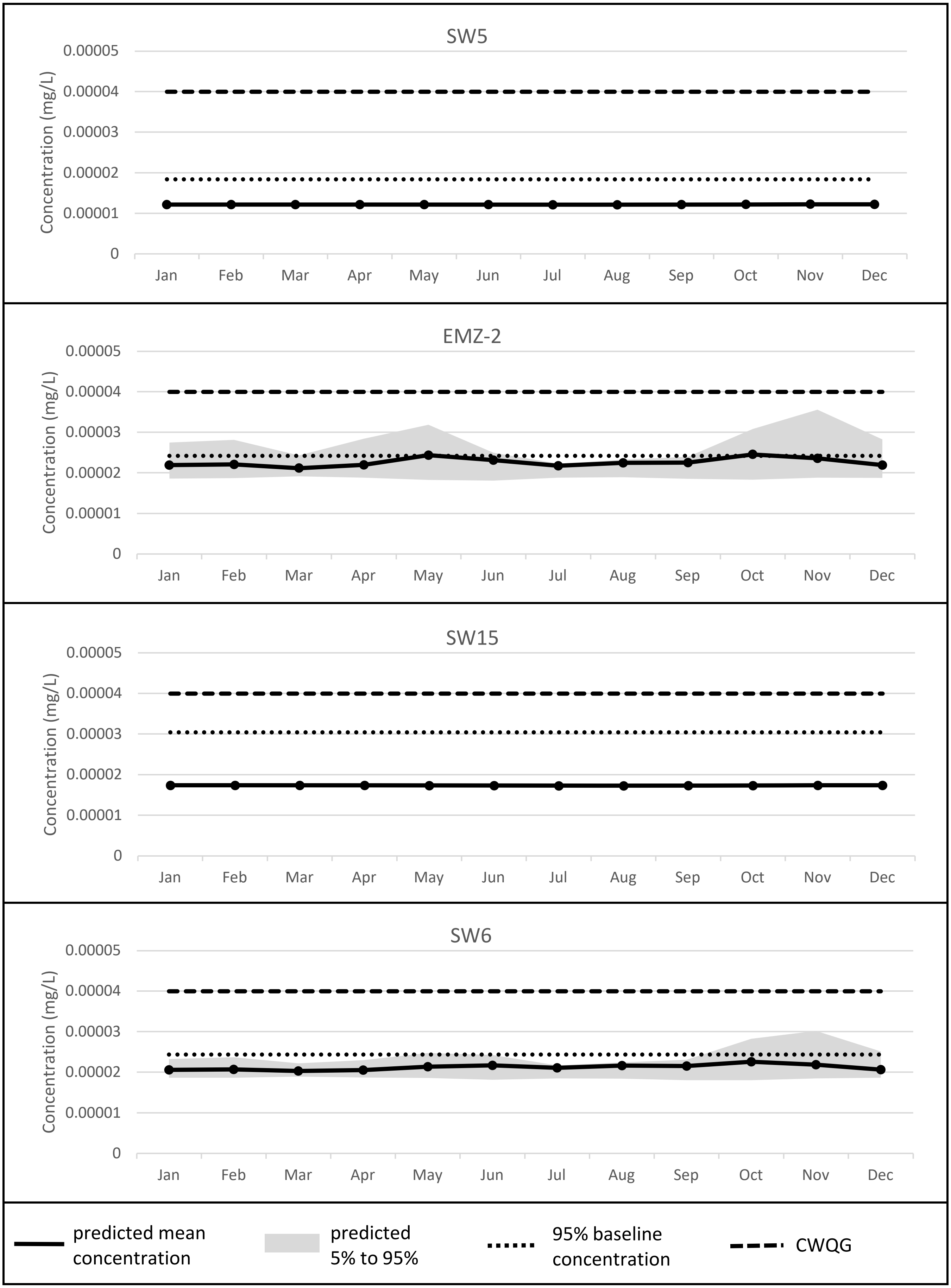


FIGURE C-6: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED CHROMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

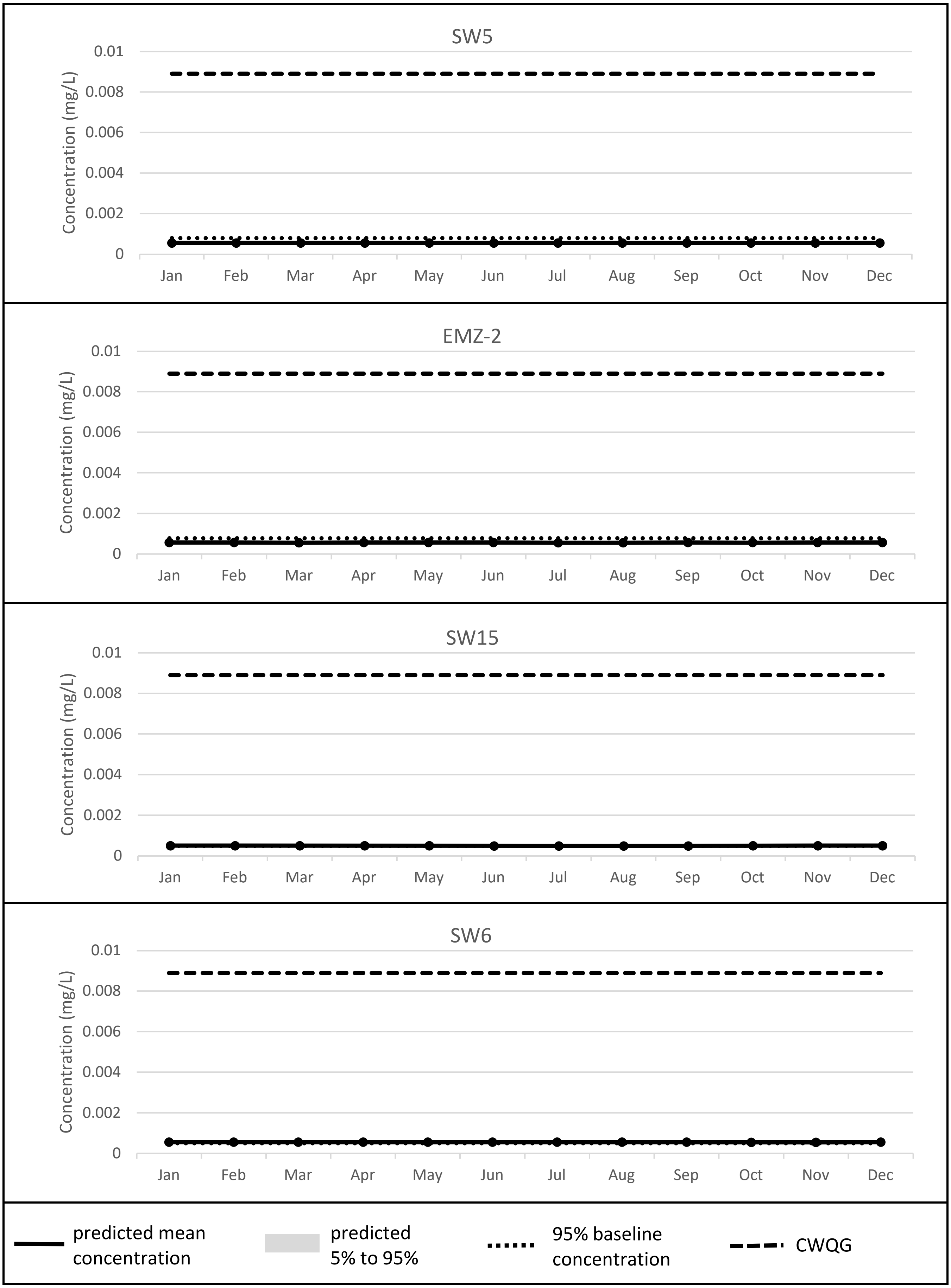


FIGURE C-7: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED COBALT CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

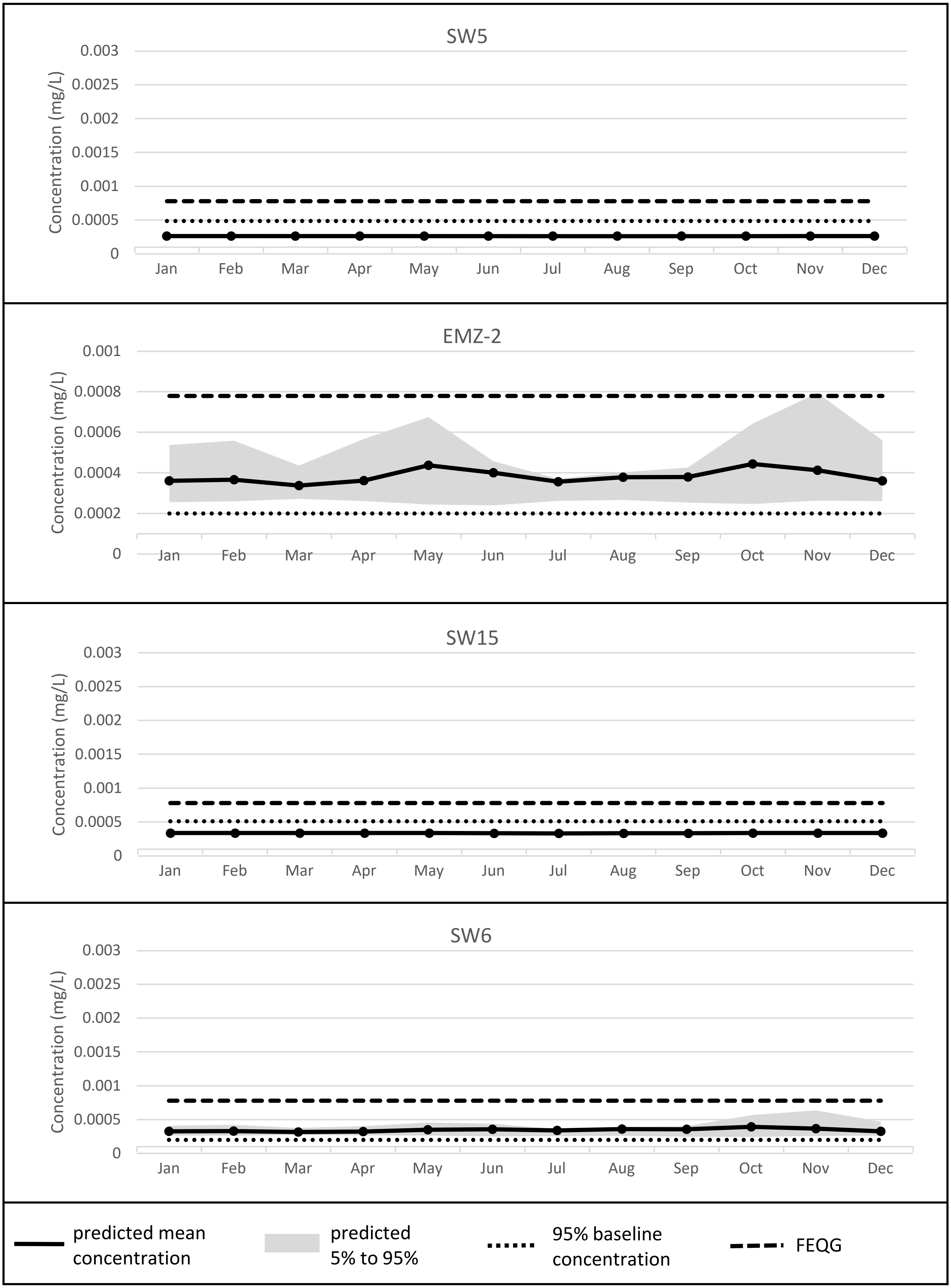


FIGURE C-8: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED COPPER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

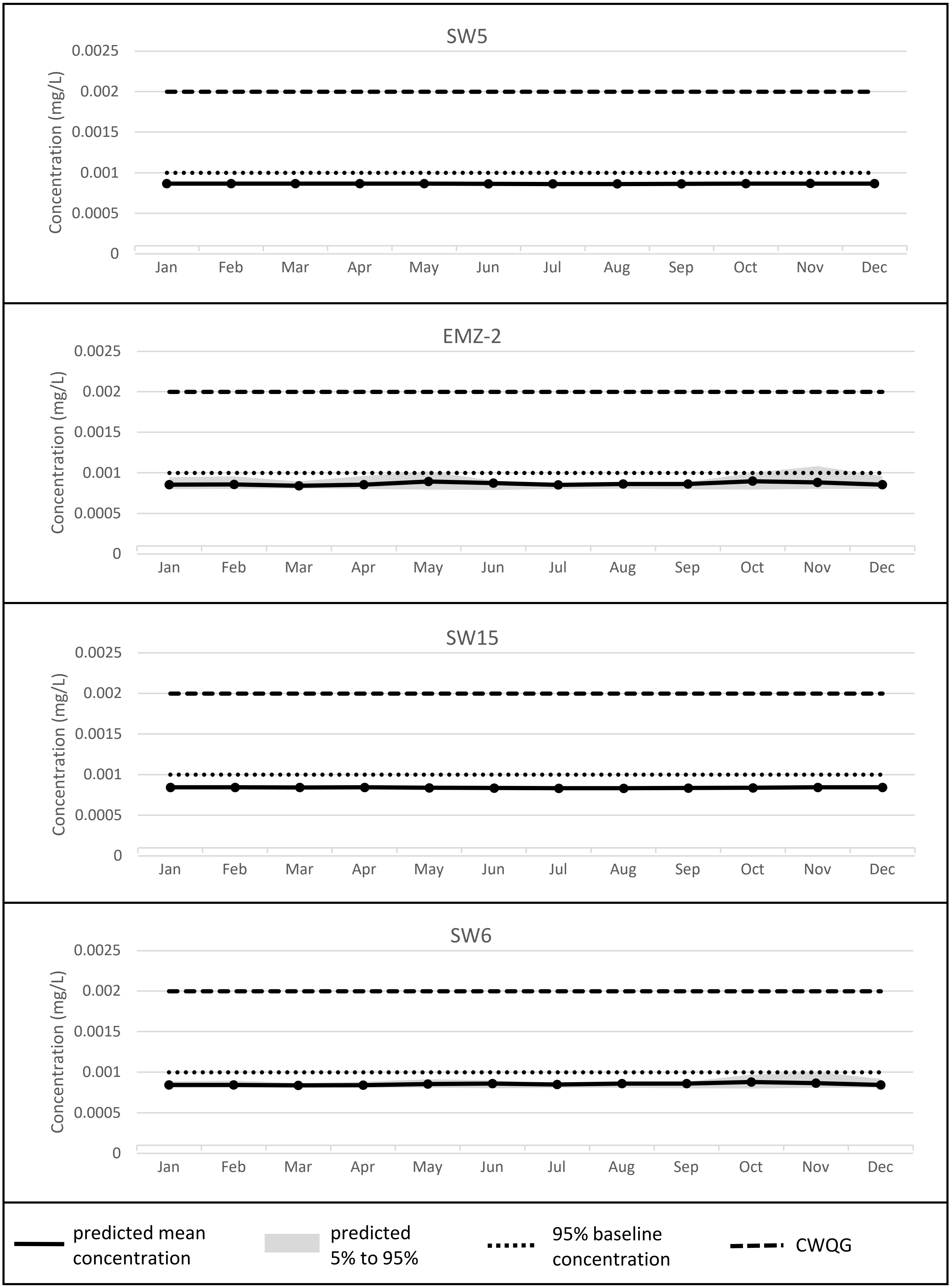


**FIGURE C-9: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED IRON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)**

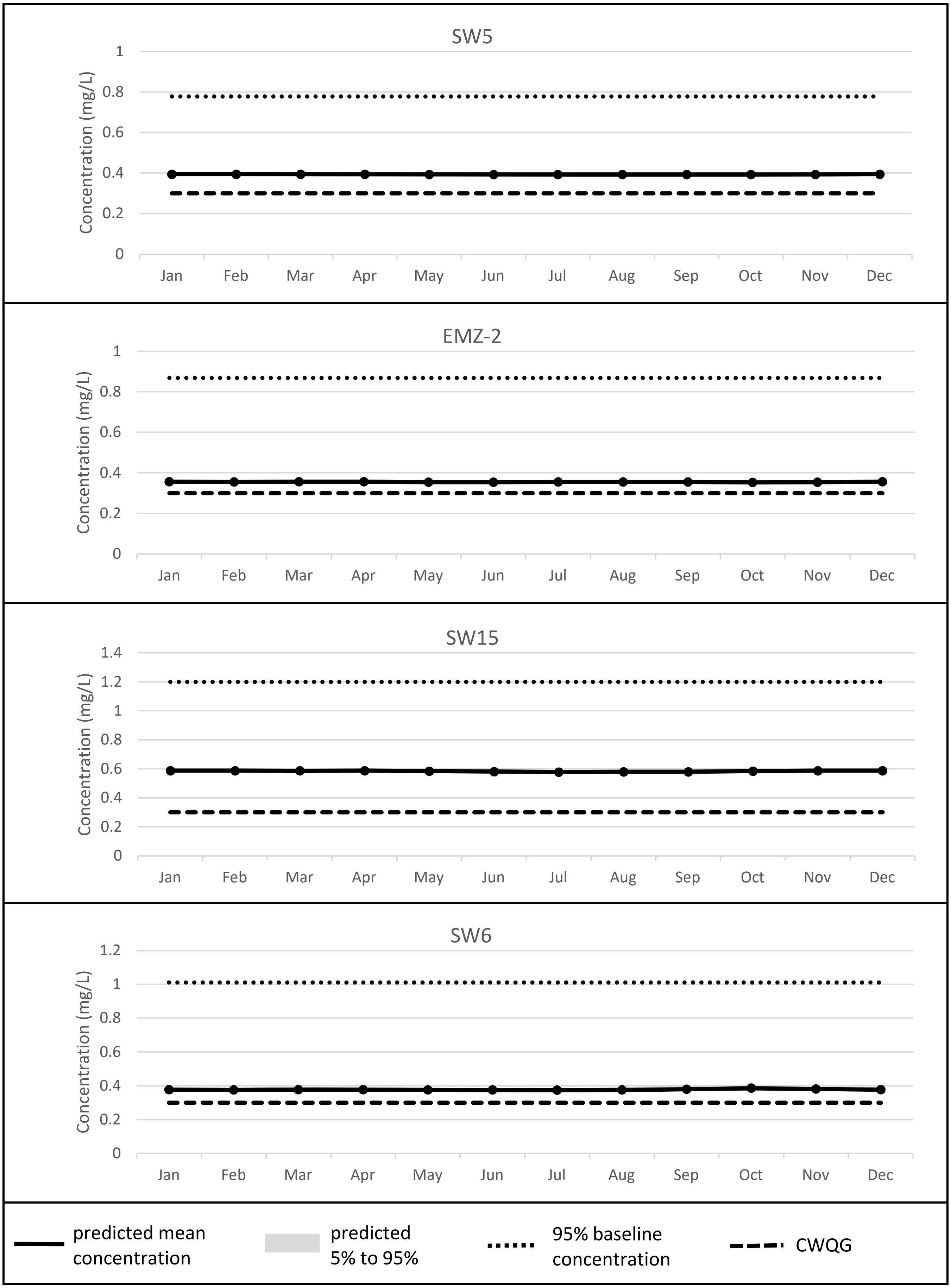


FIGURE C-10: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED LEAD CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

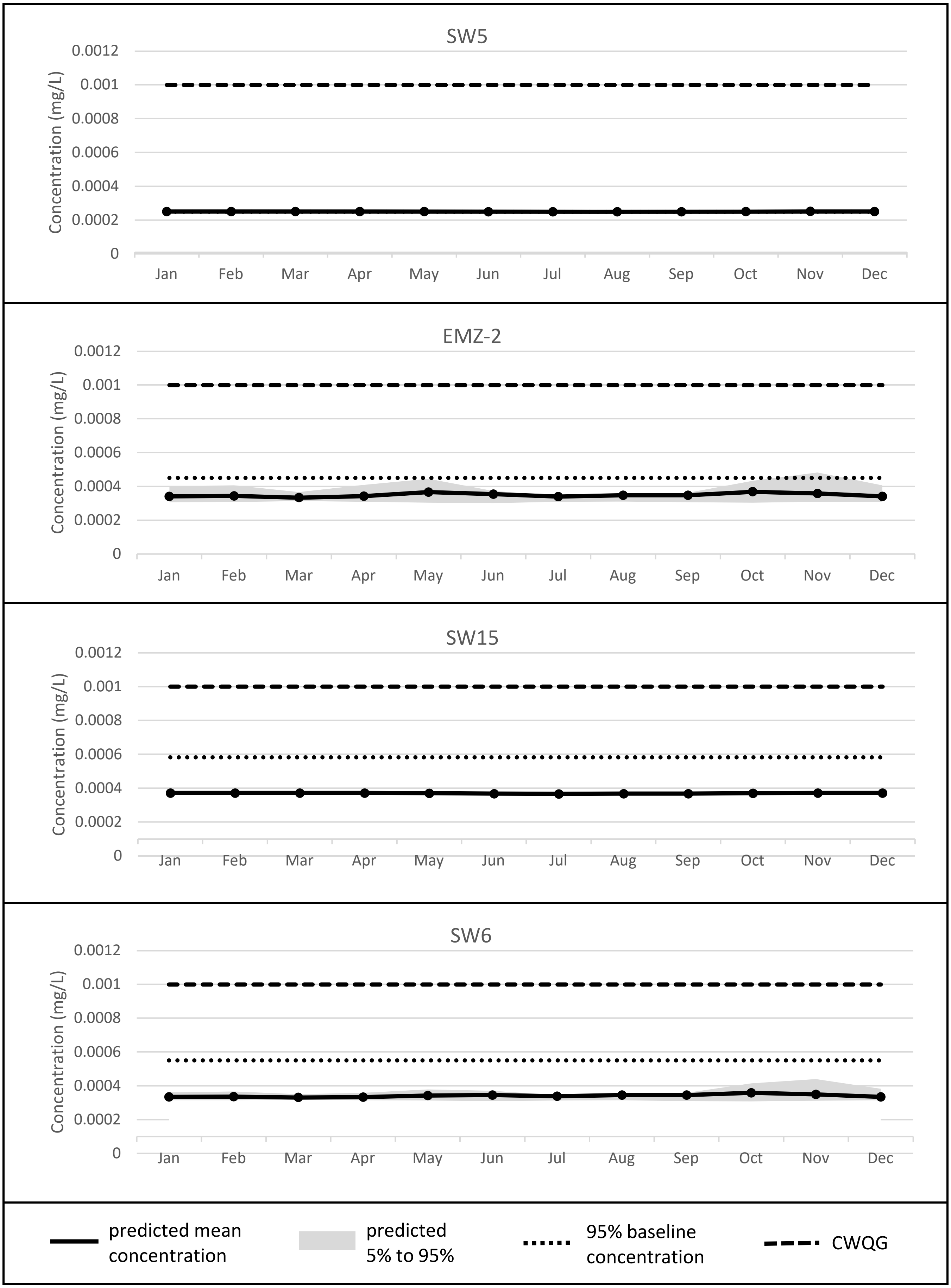


FIGURE C-11 SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED MANGANESE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

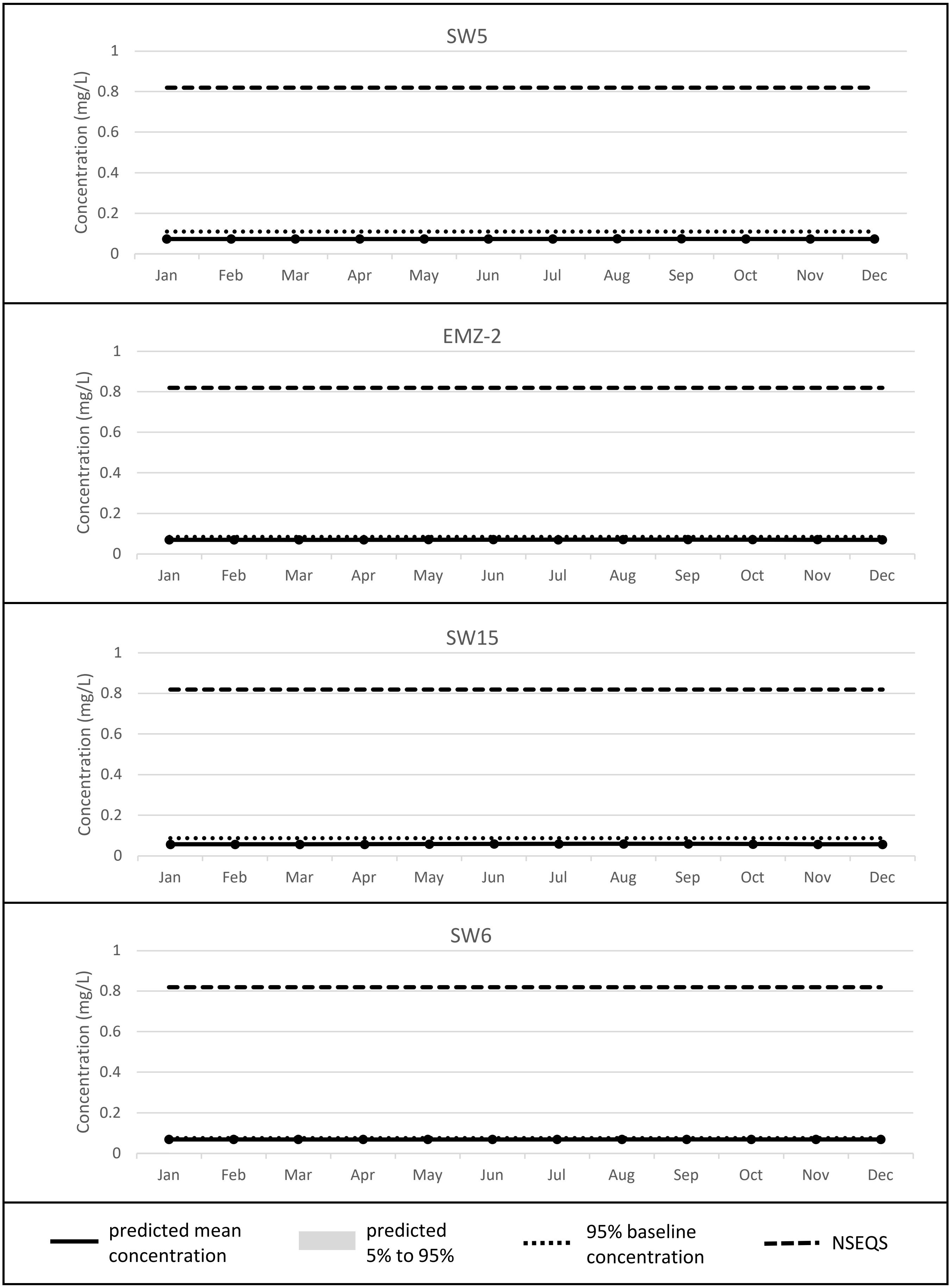


FIGURE C-12: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED MERCURY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

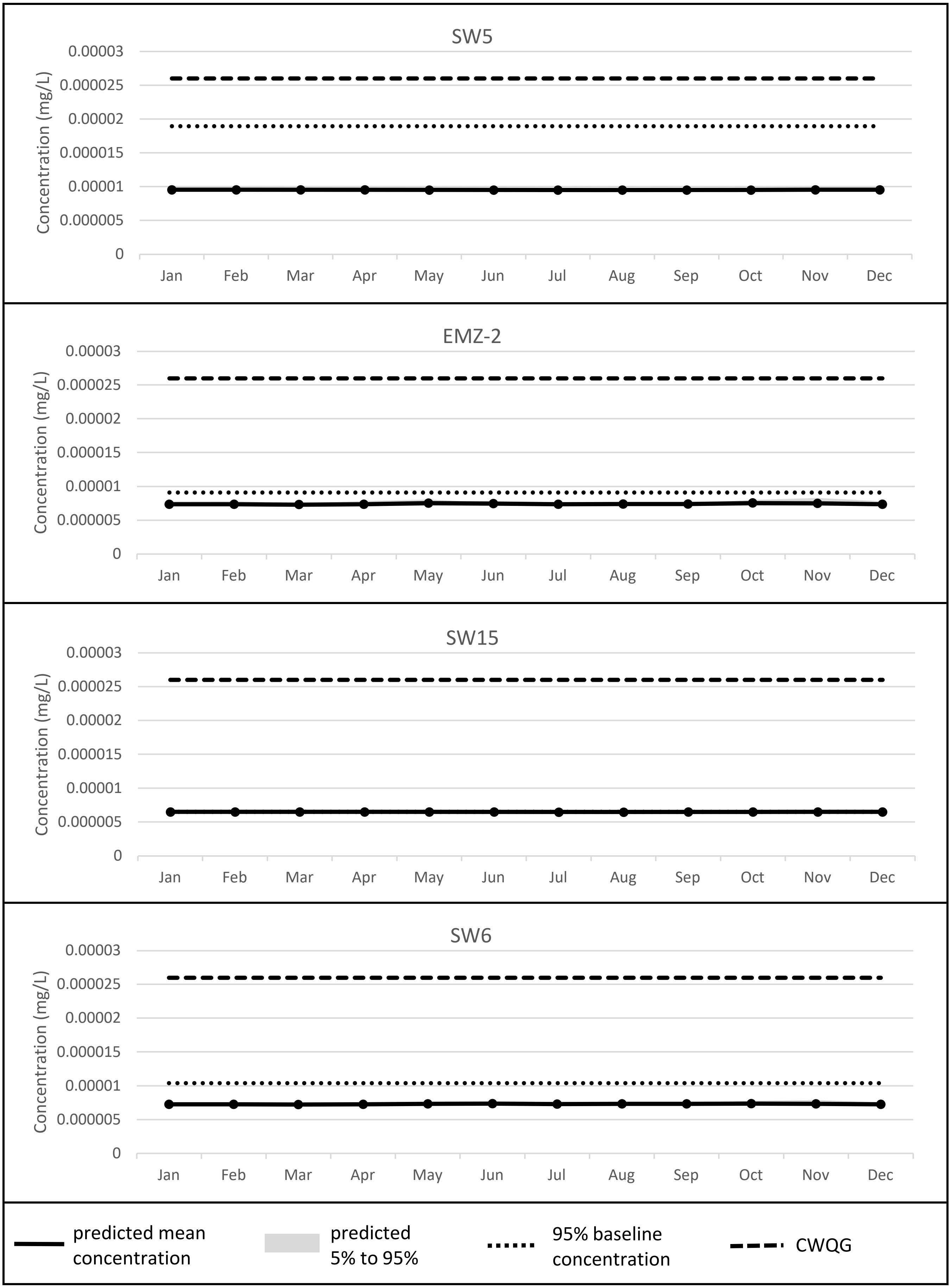


FIGURE C-13: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED MOLYBDENUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

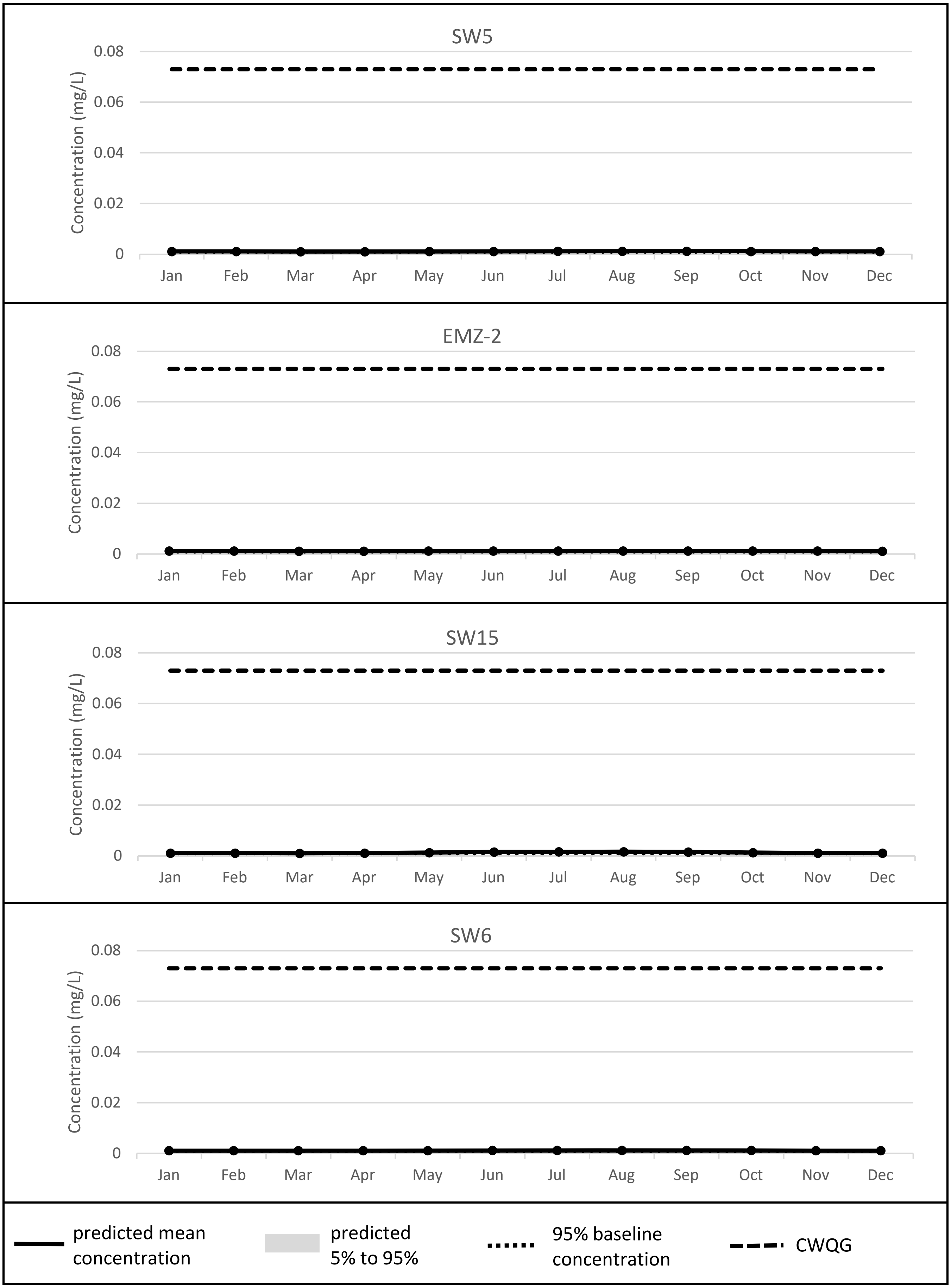


FIGURE C-14: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED NICKEL CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

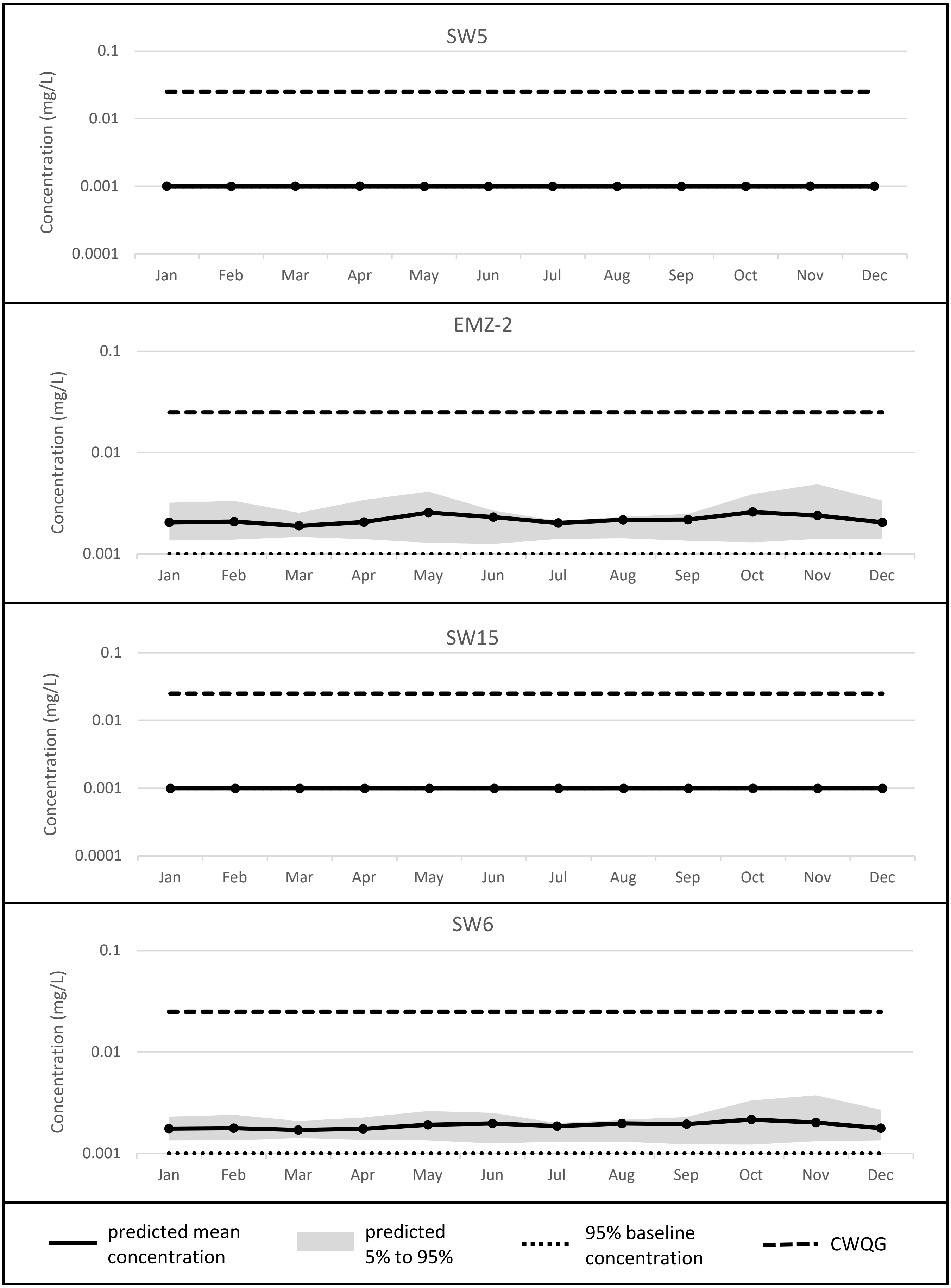


FIGURE C-15: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED NITRATE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

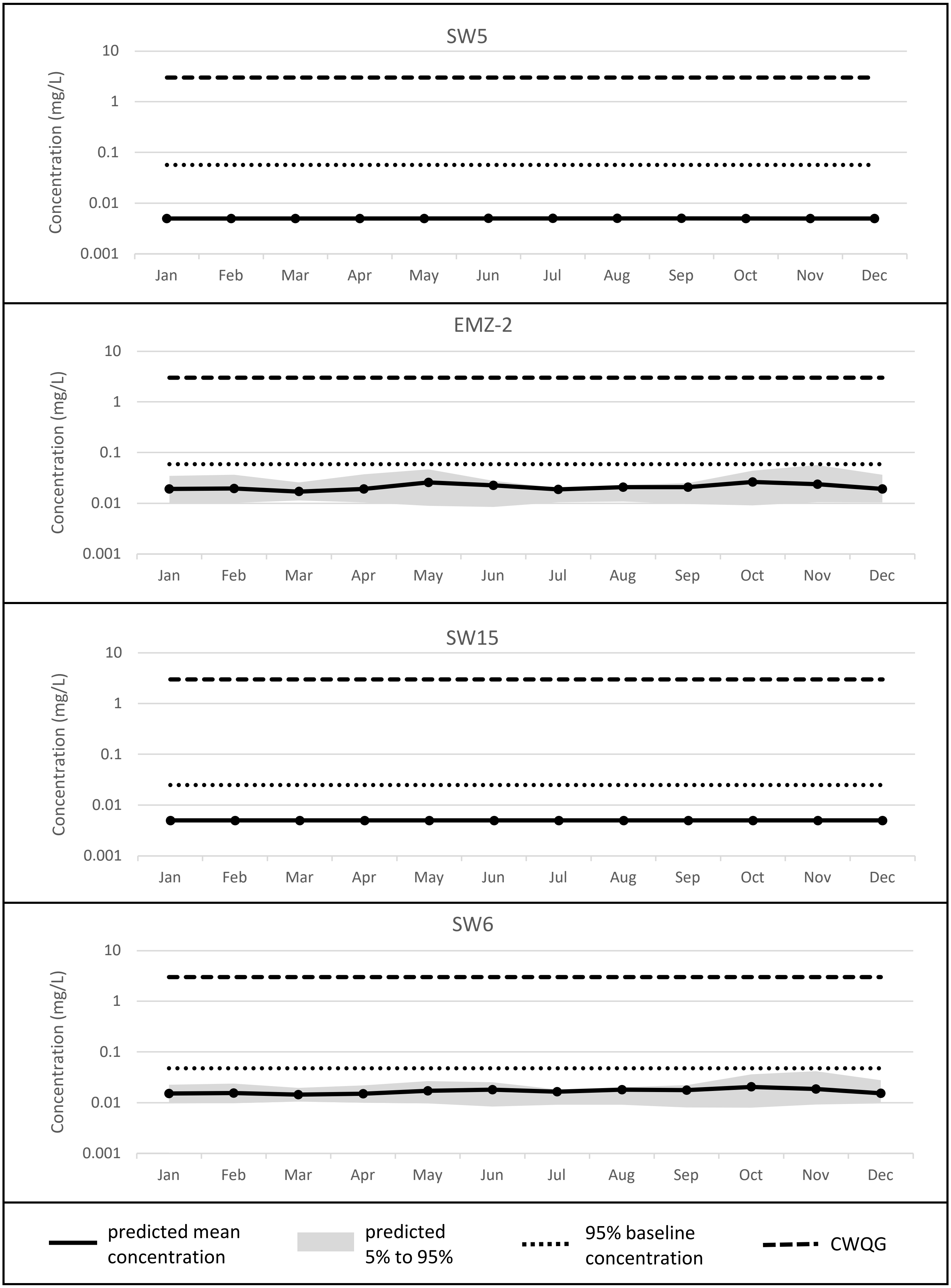
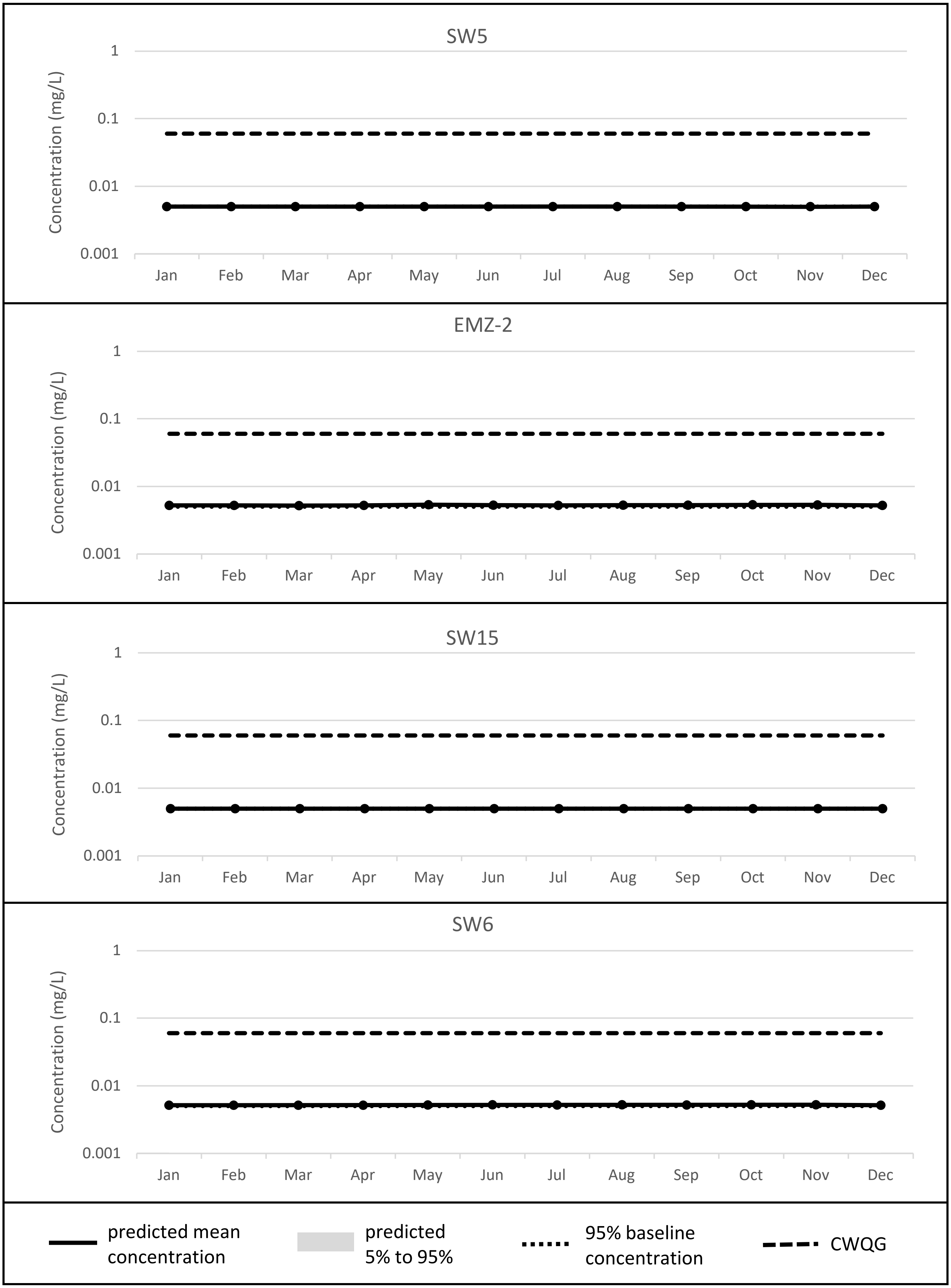


**FIGURE C-16: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED NITRITE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)**



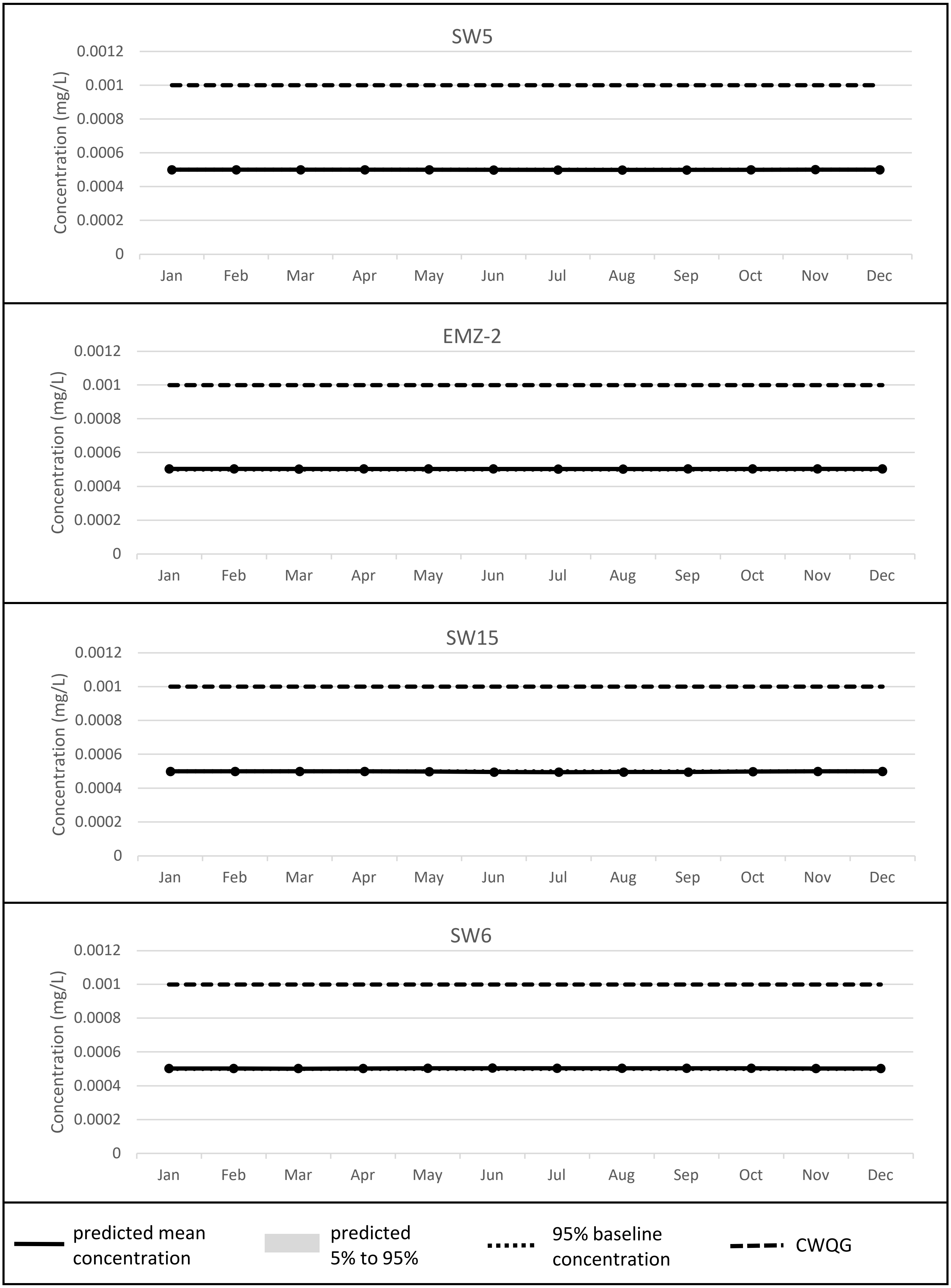

SW5
EMZ-2
SW15
SW6
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
CWQG

FIGURE C-18: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED SILVER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

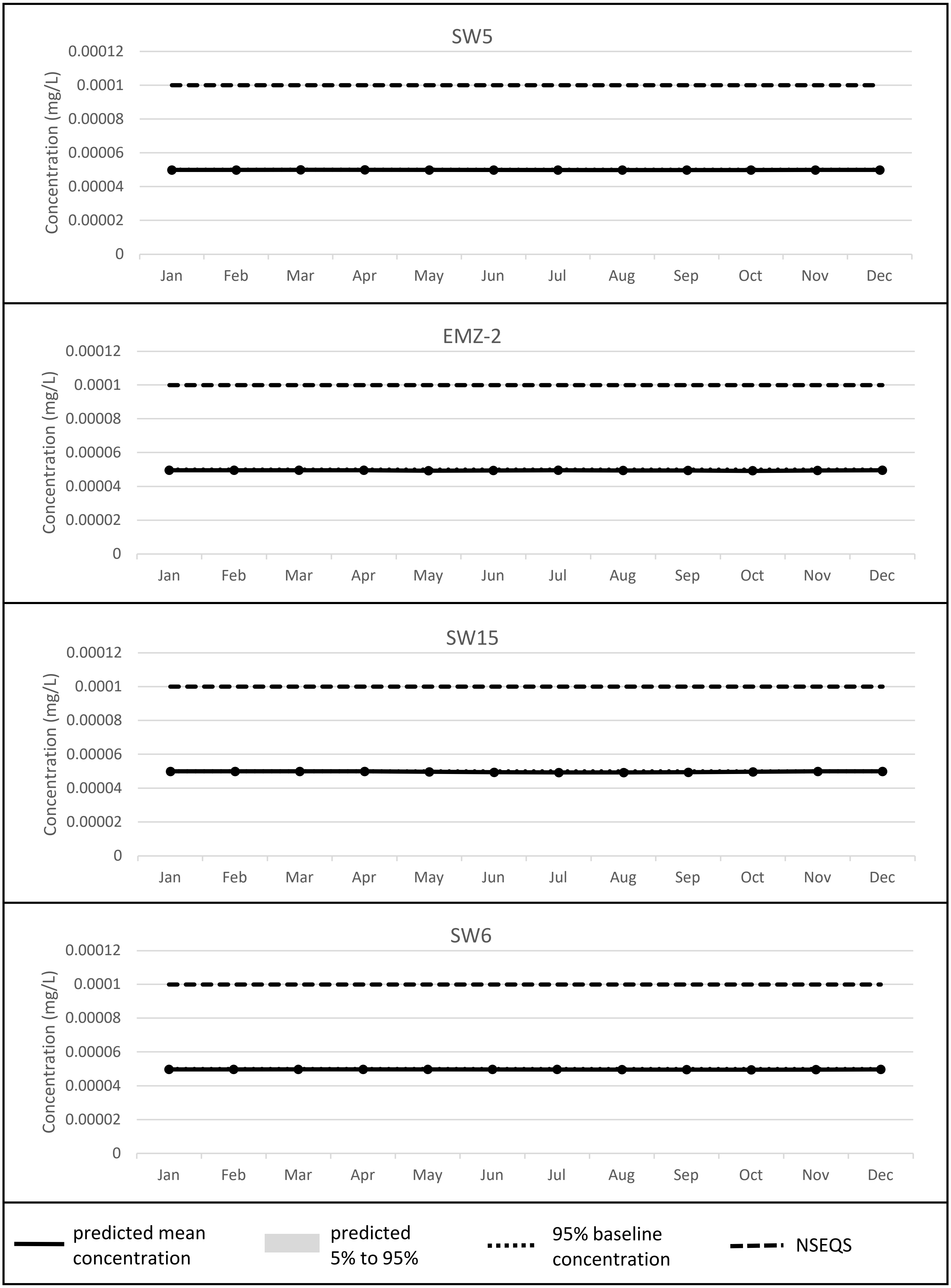


FIGURE C-19: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED THALLIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

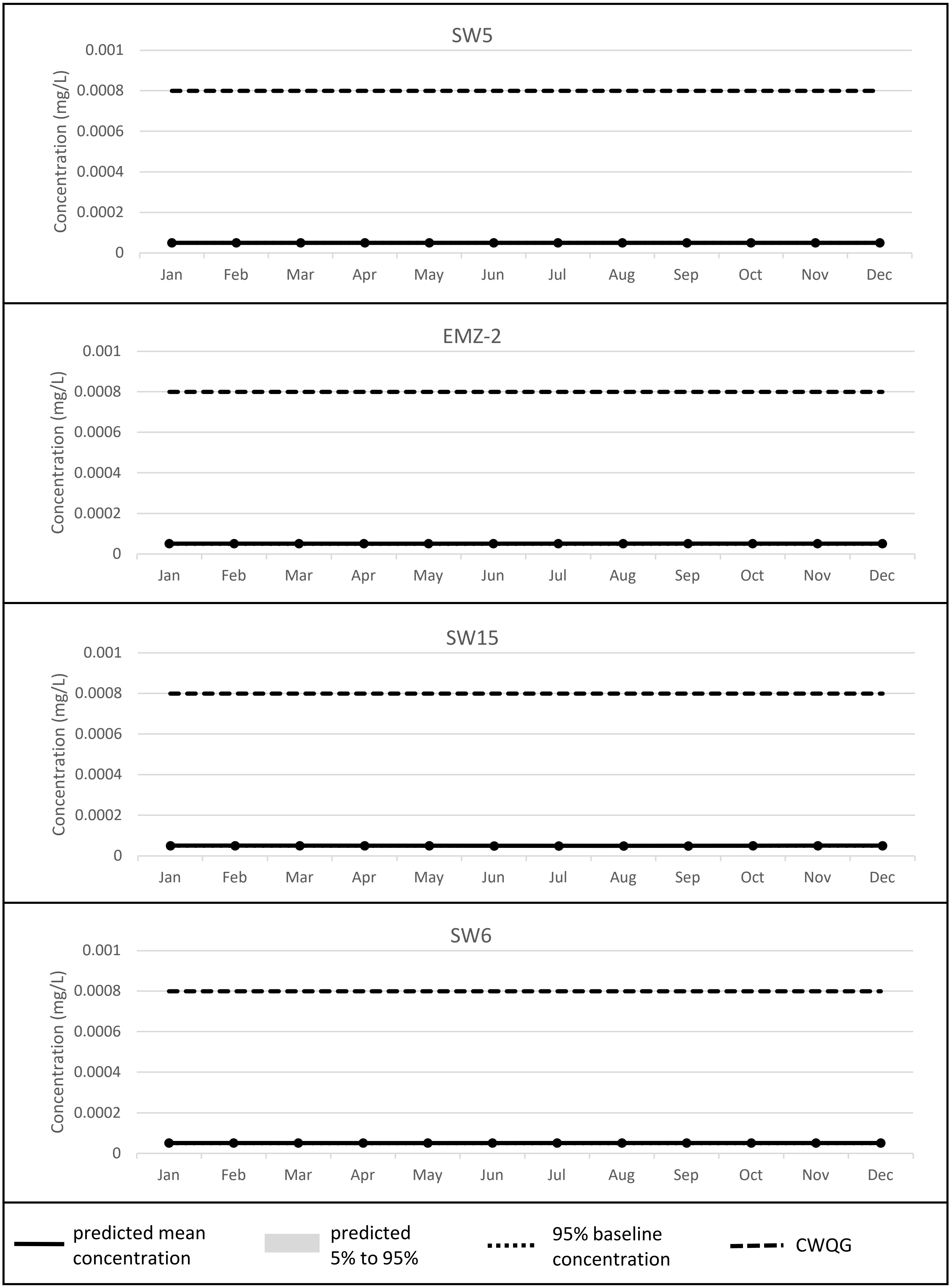


FIGURE C-20: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

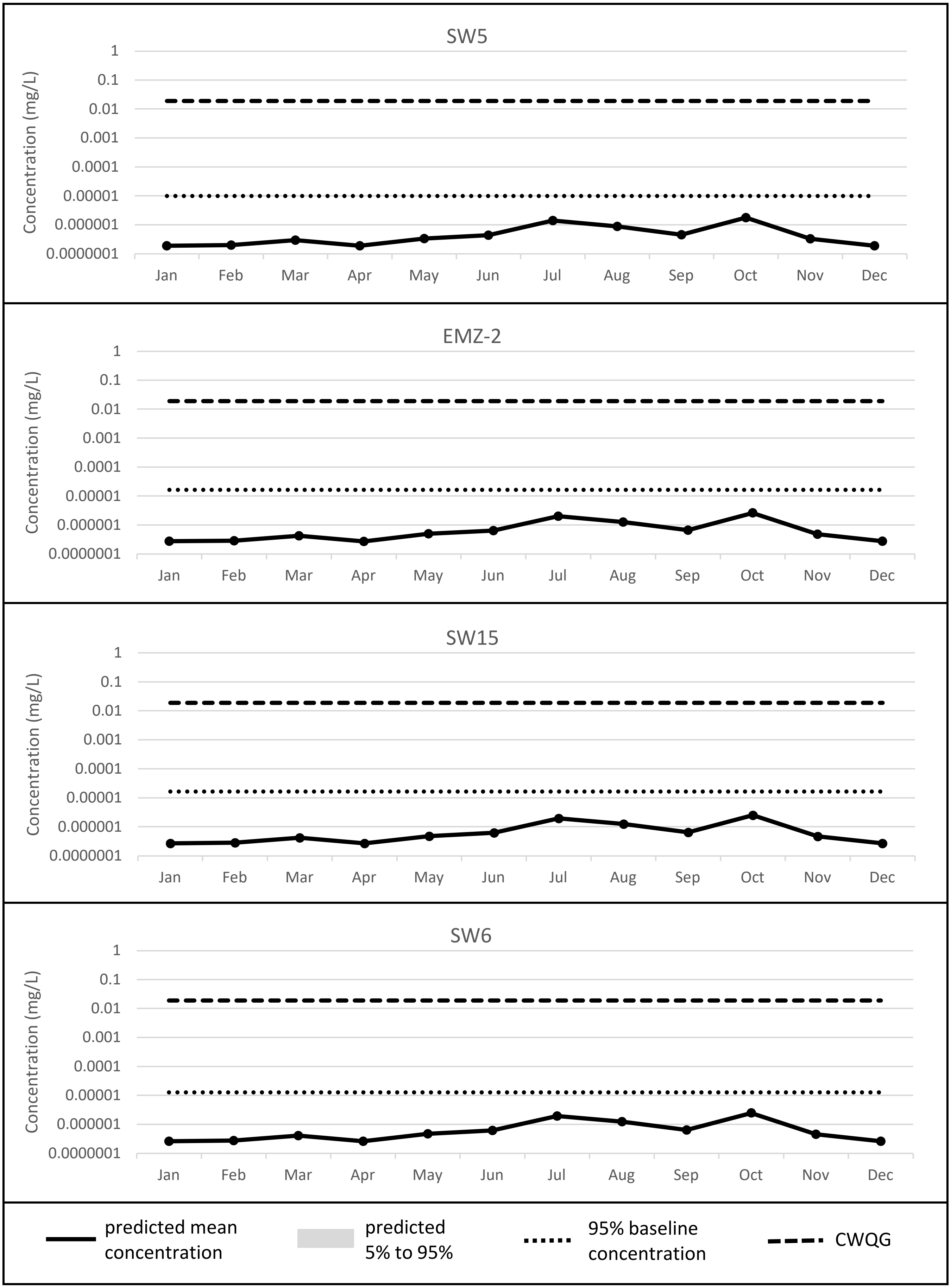


FIGURE C-21: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED URANIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

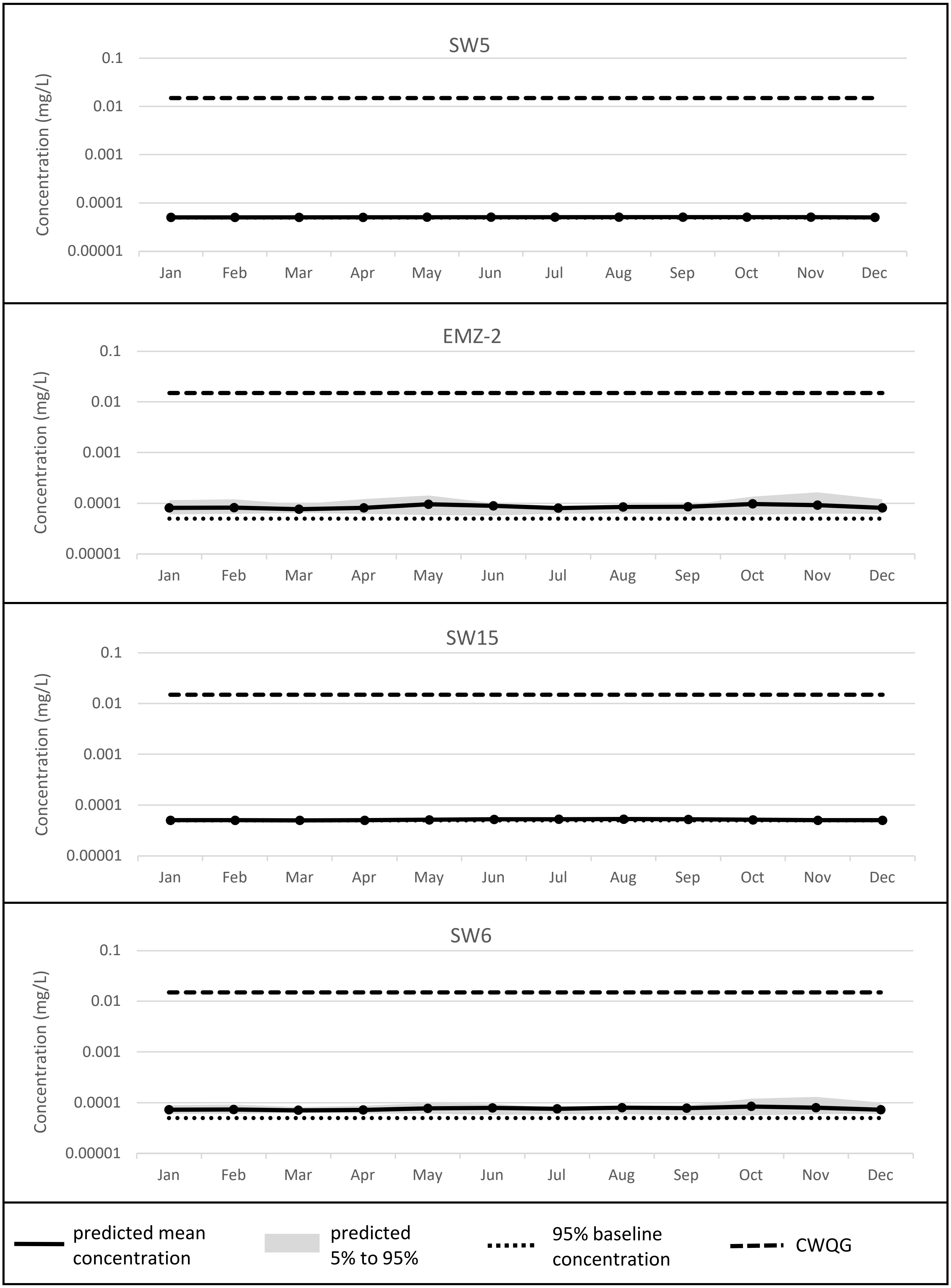


FIGURE C-22: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED ZINC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

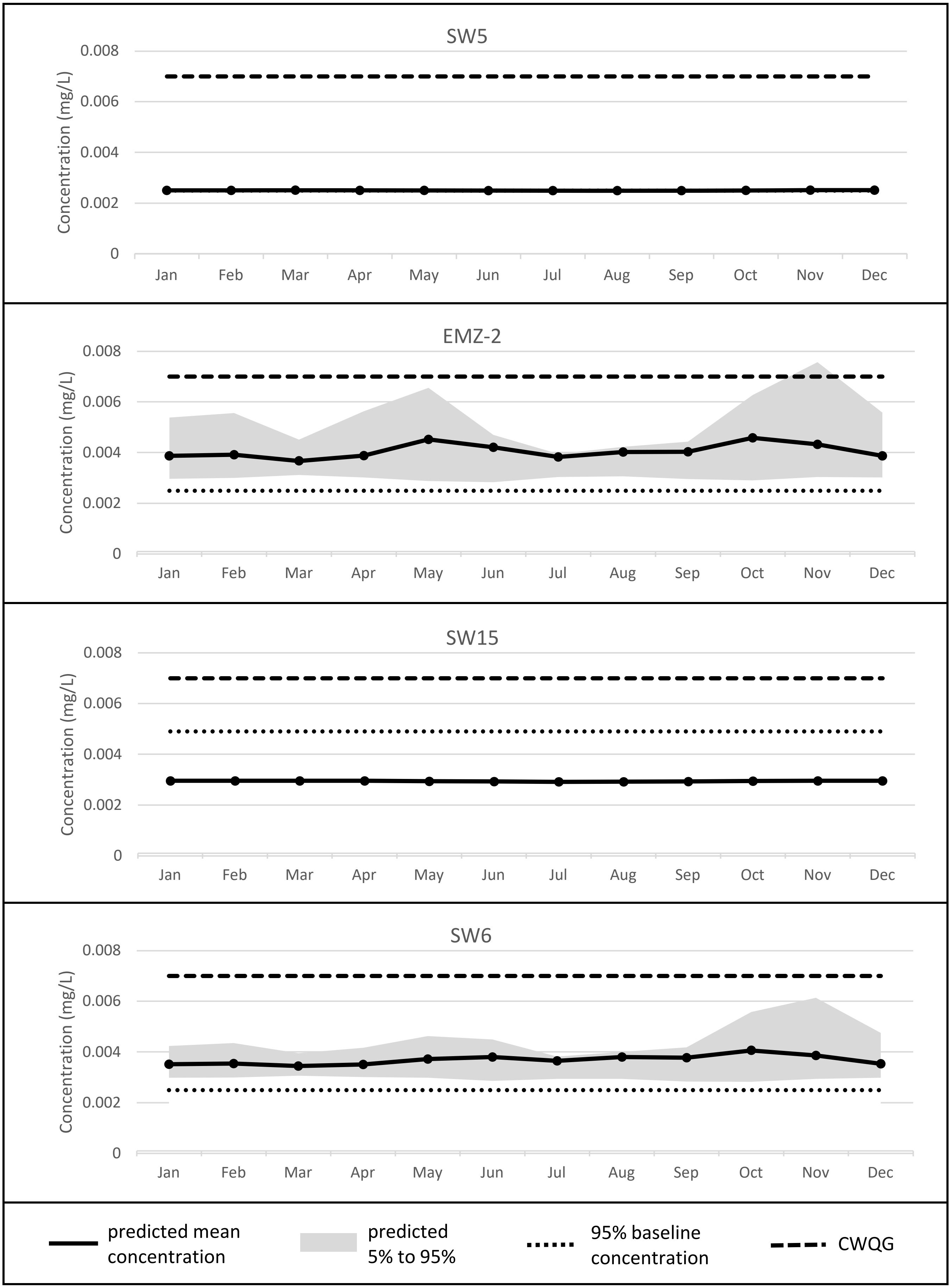


FIGURE C-23: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED ALUMINUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

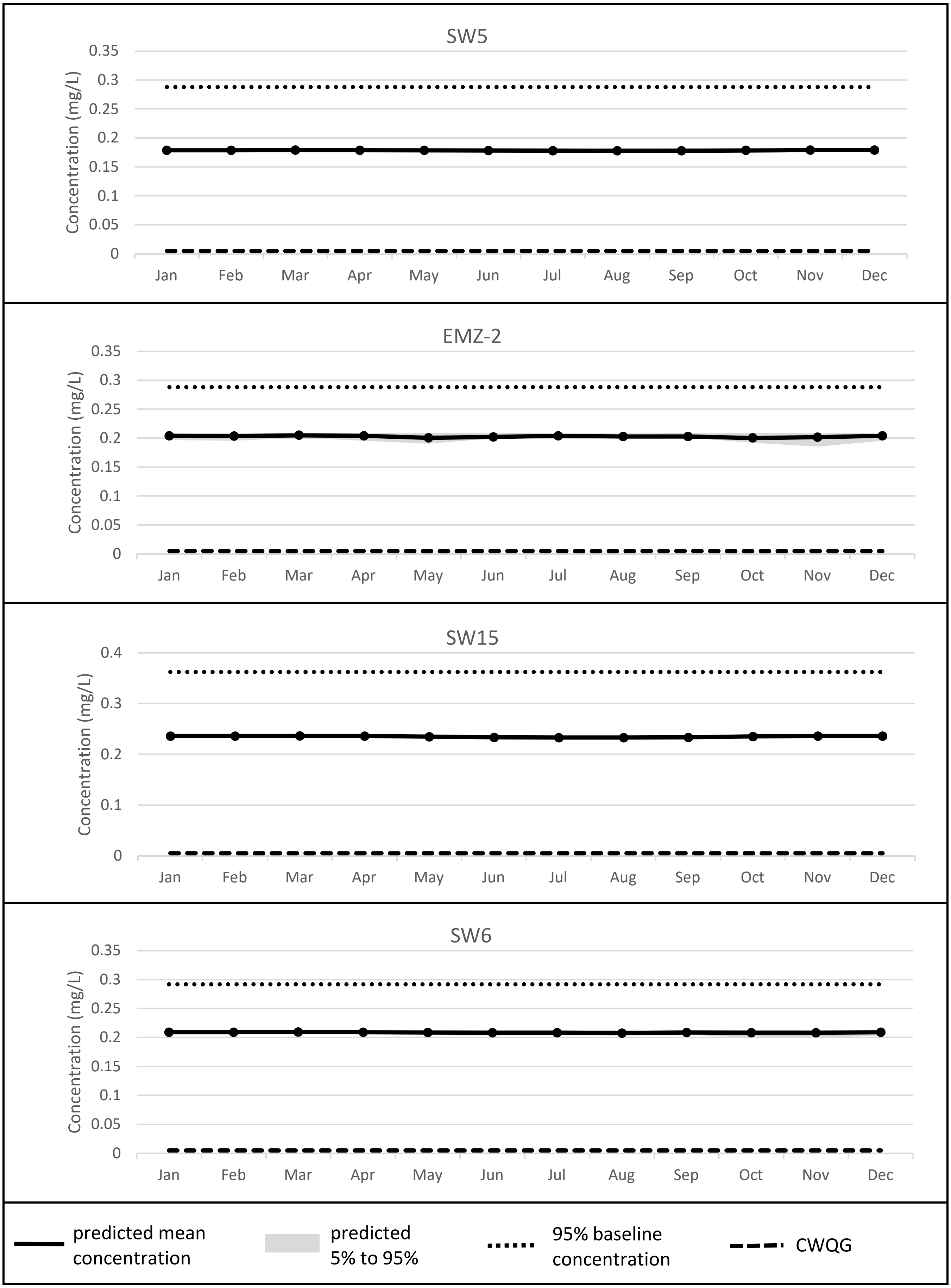


FIGURE C-24: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED ANTIMONY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

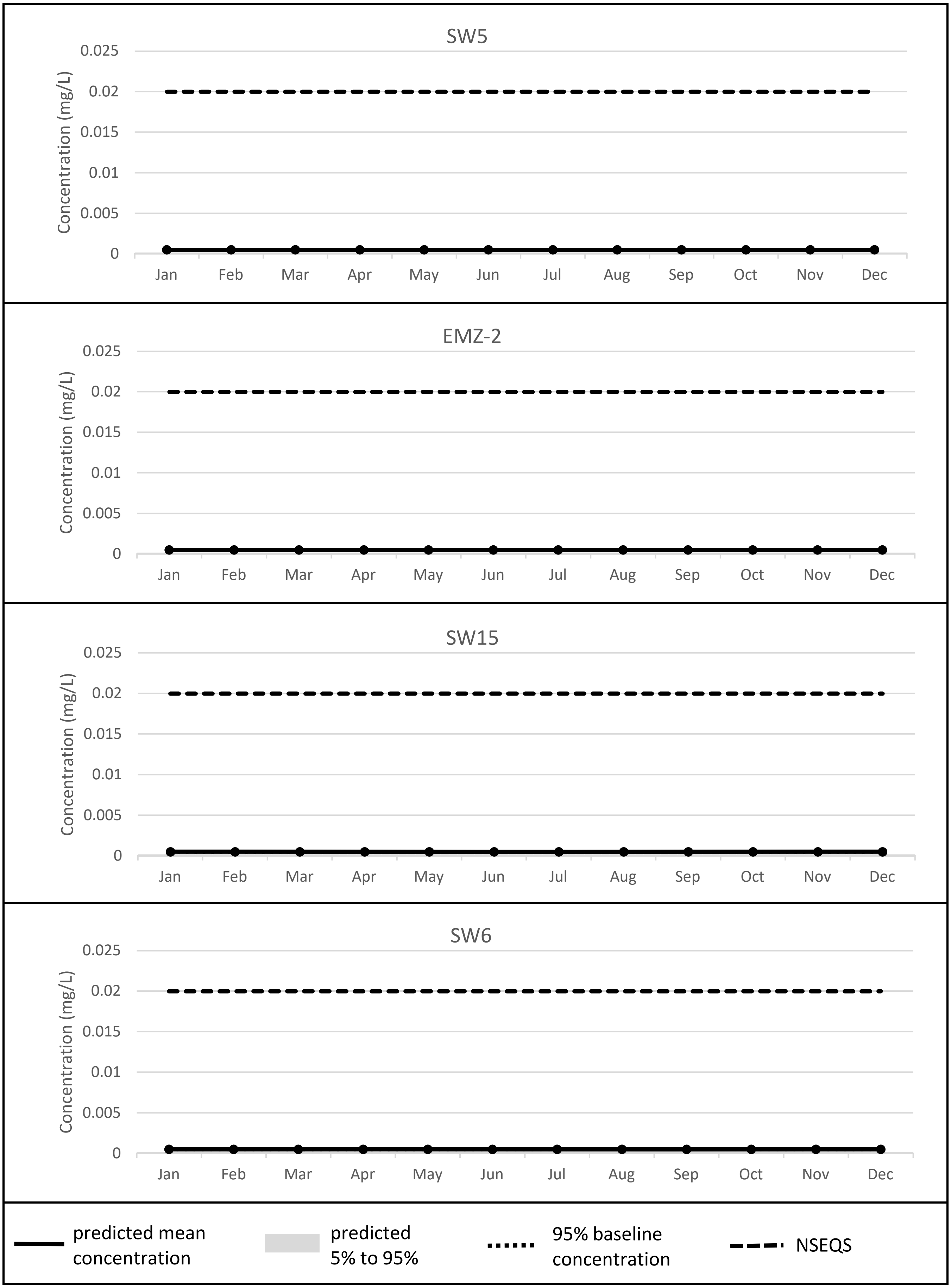


FIGURE C-25: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED ARSENIC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

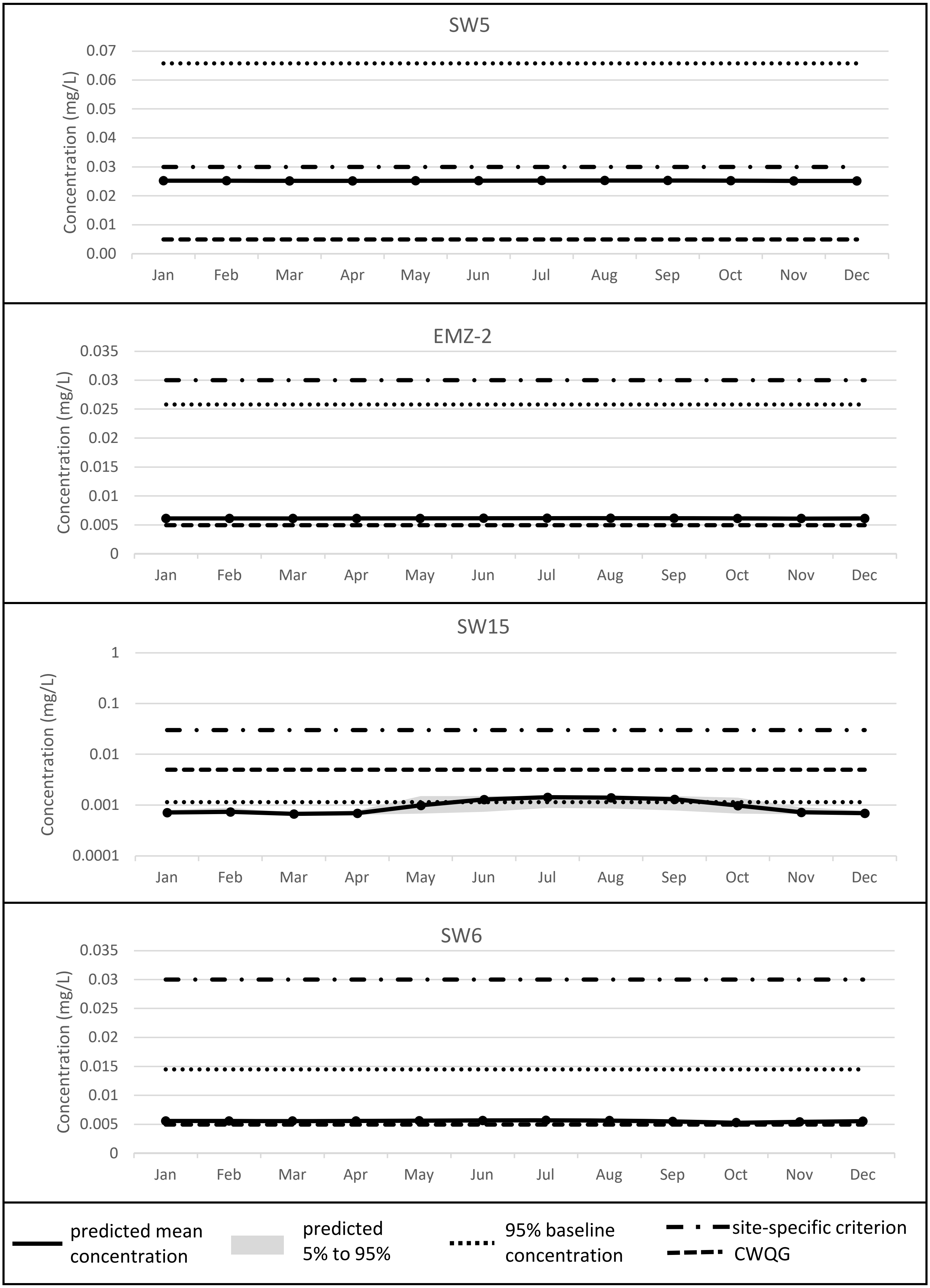


FIGURE C-26: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED BORON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

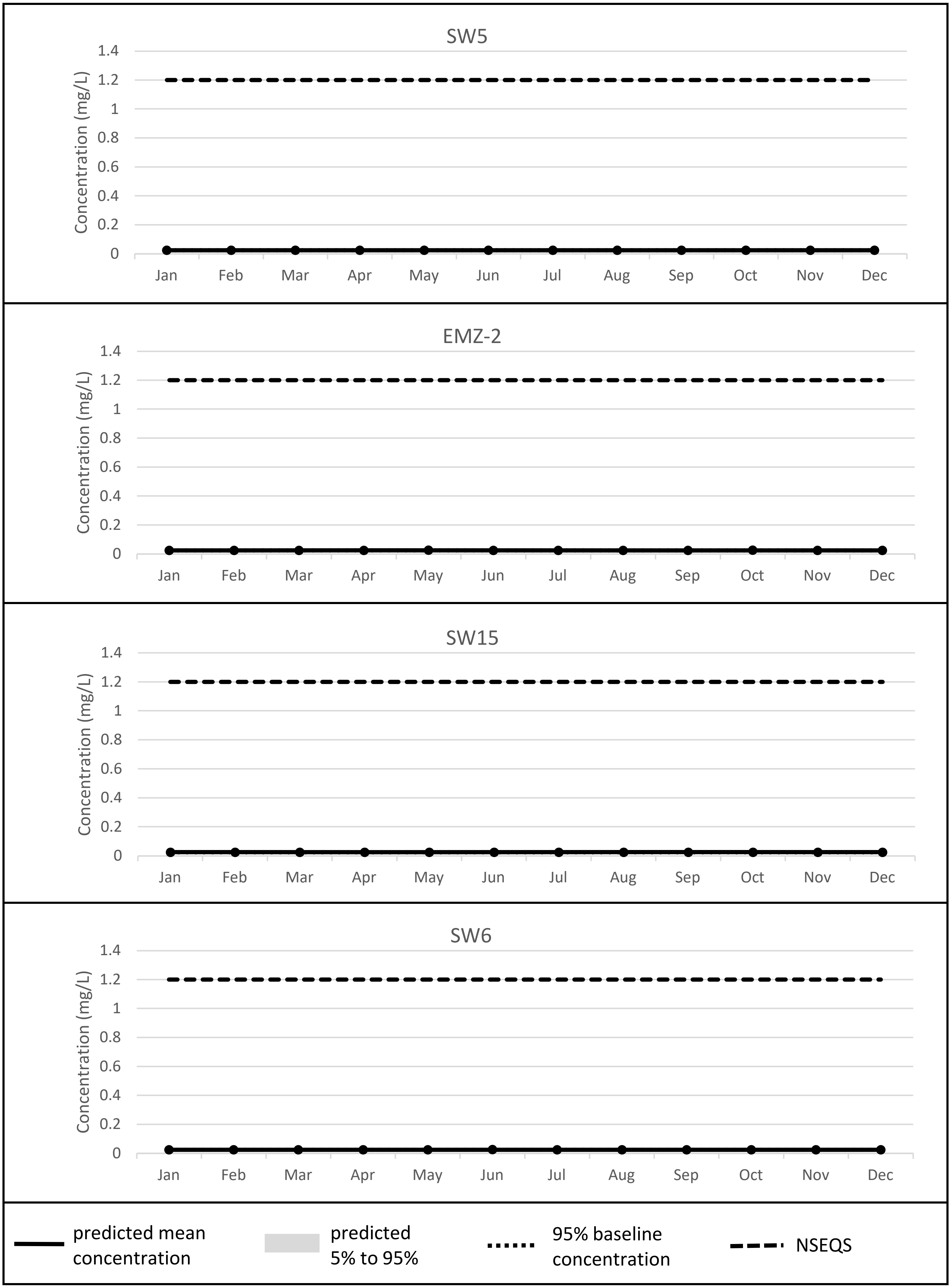


FIGURE C-27: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED CADMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

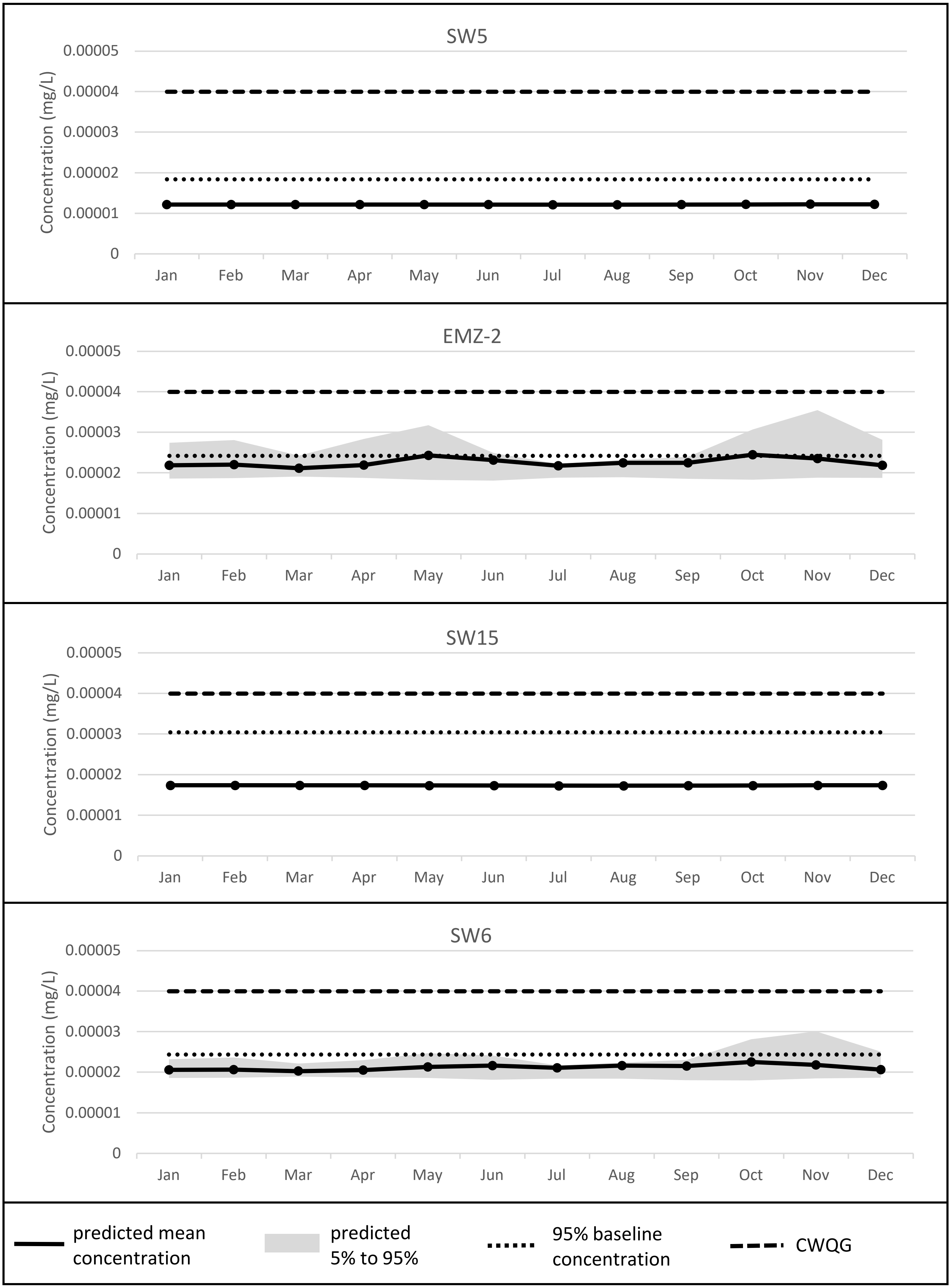


FIGURE C-28: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED CHROMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

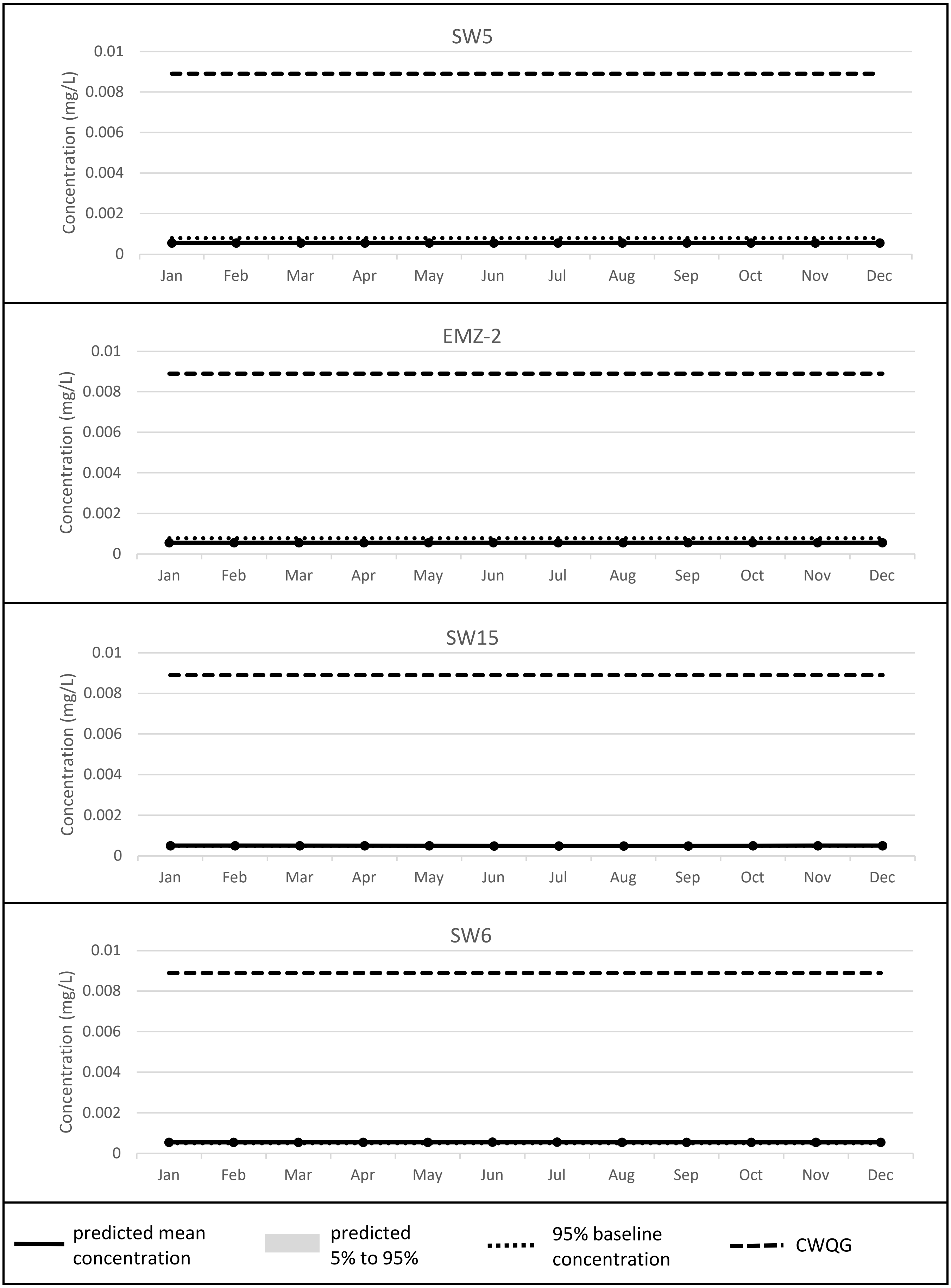


FIGURE C-29: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED COBALT CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

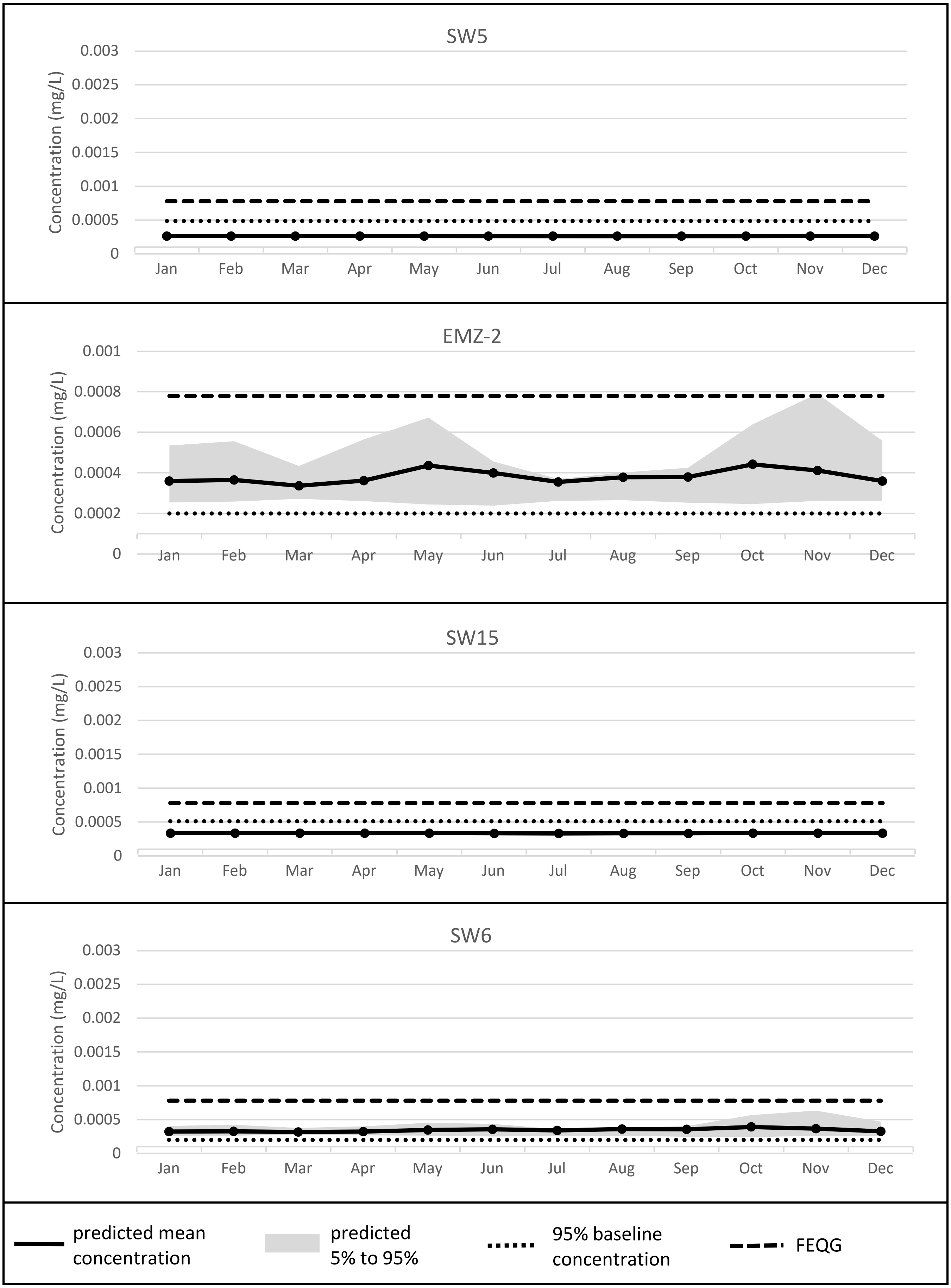


FIGURE C-30: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED COPPER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

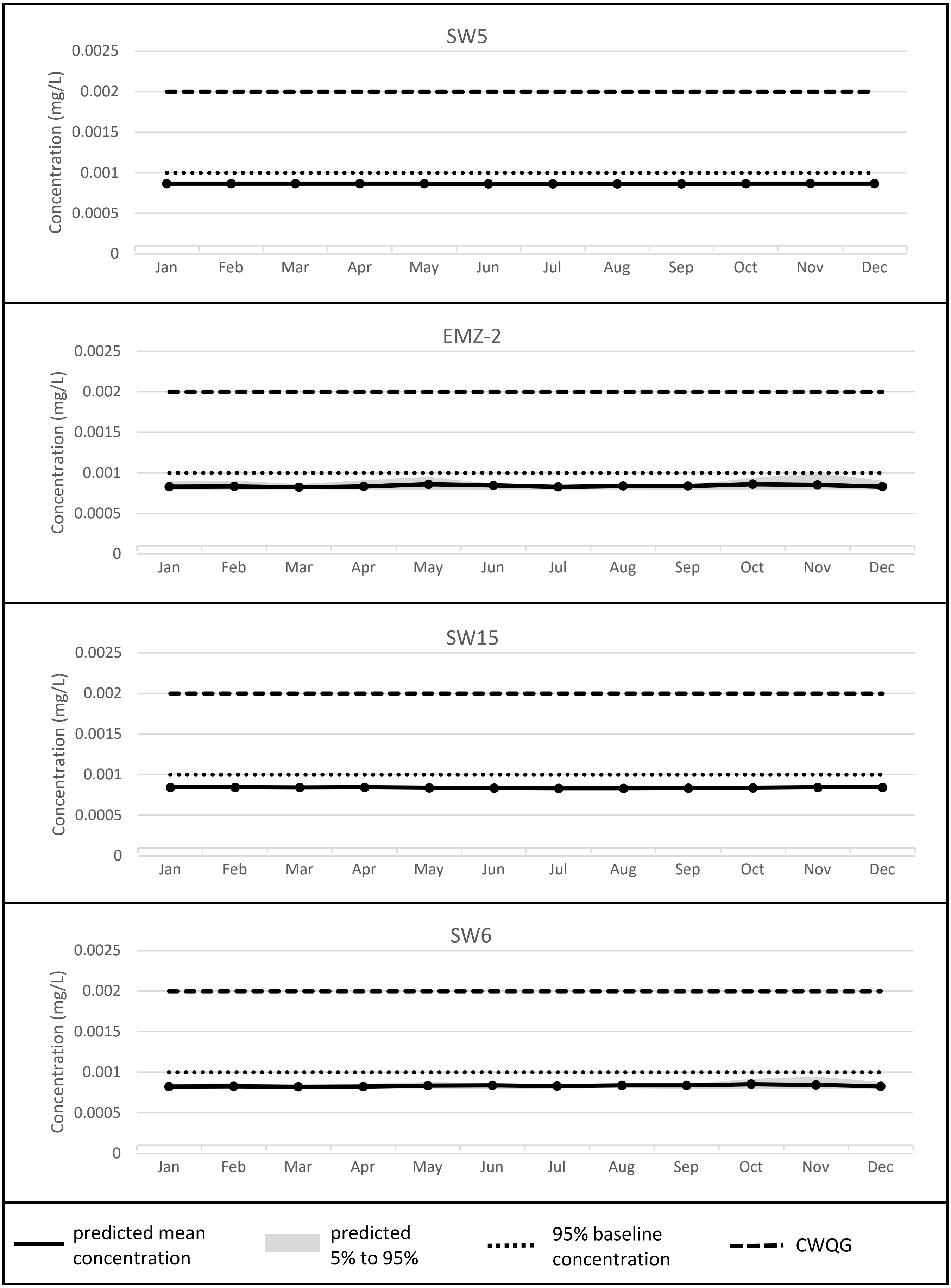
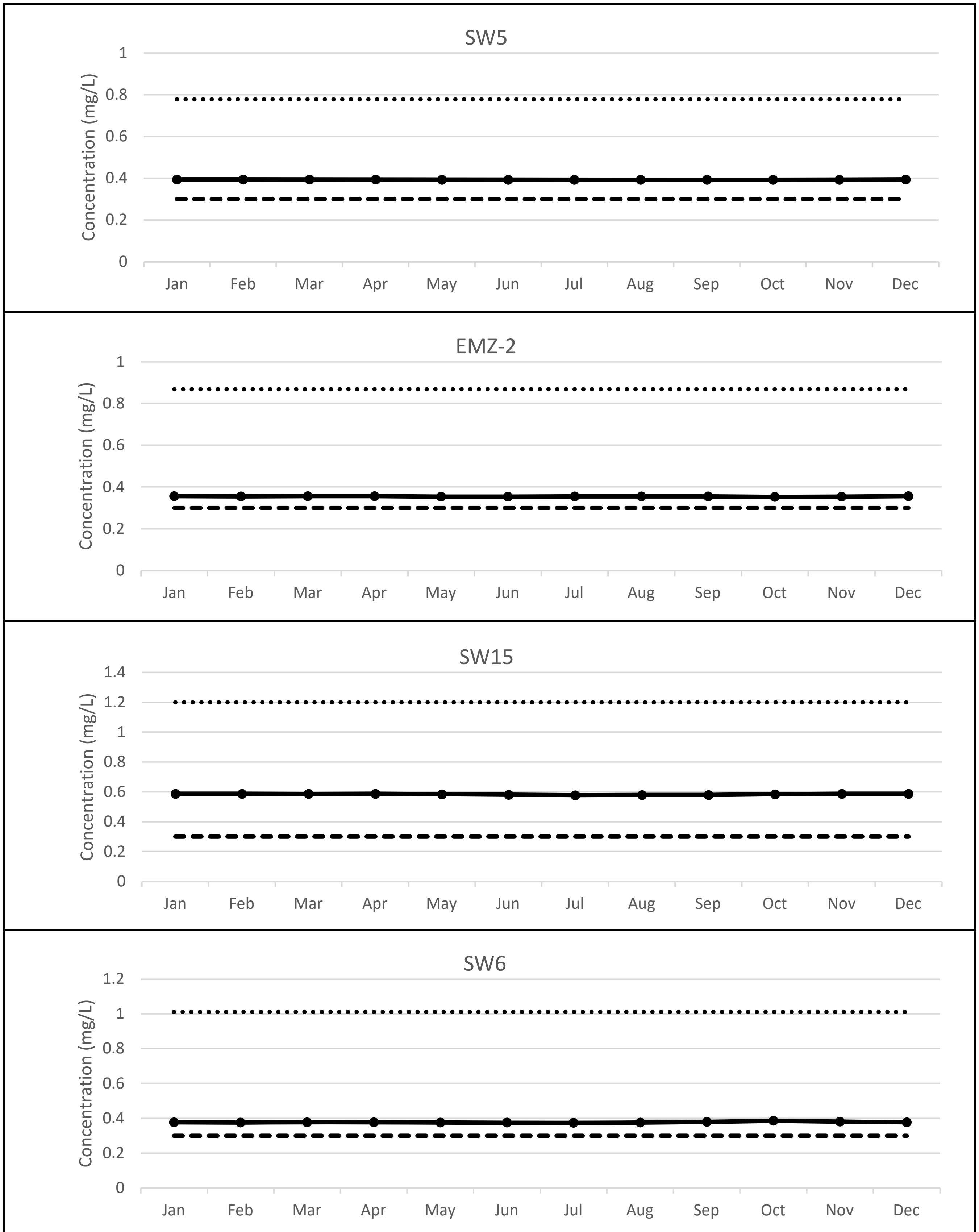


FIGURE C-31: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED IRON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)



predicted mean concentration — predicted 5% to 95% — 95% baseline concentration — CWQG

FIGURE C-32: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED LEAD CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

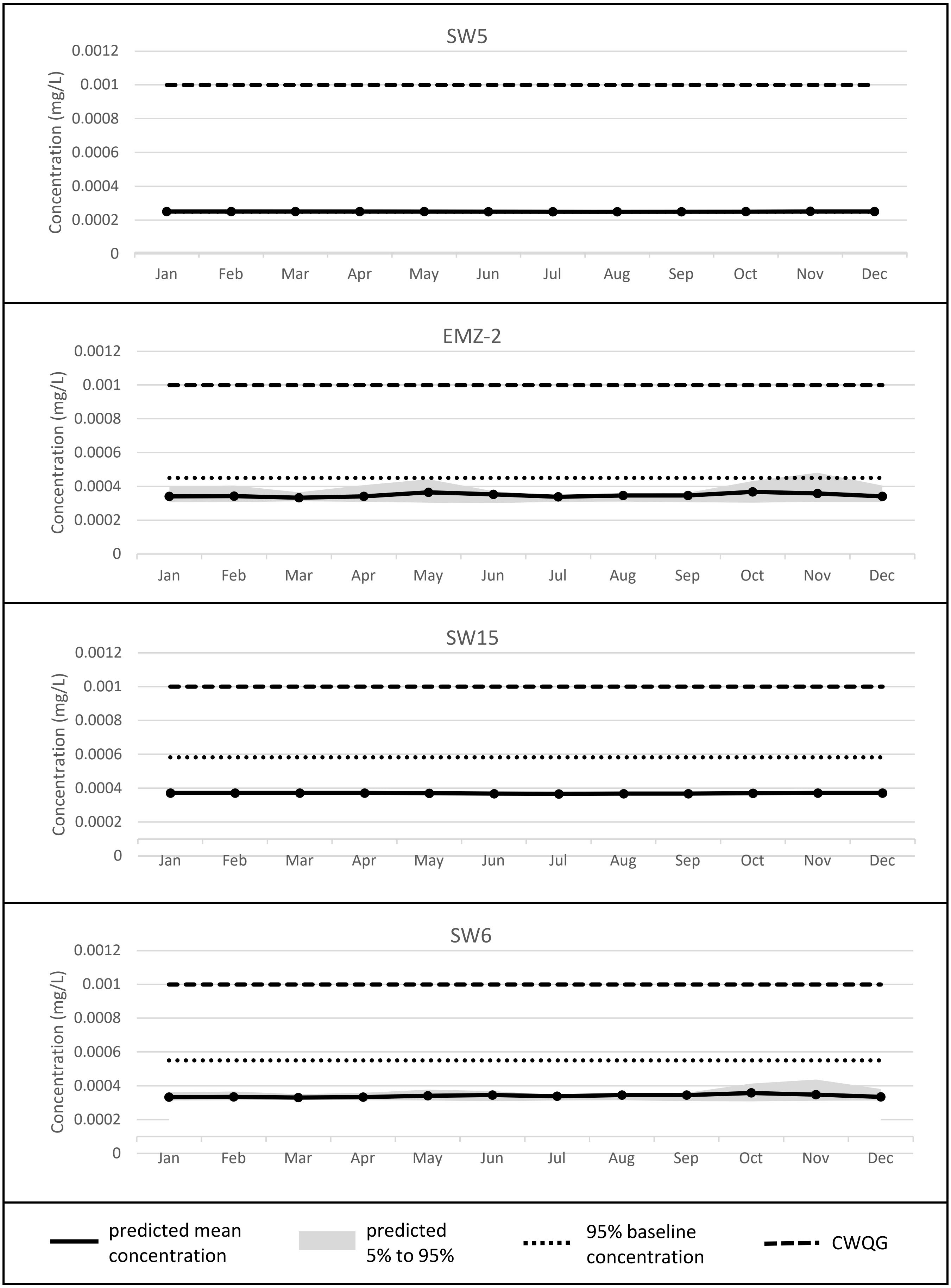


FIGURE C-33: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED MANGANESE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

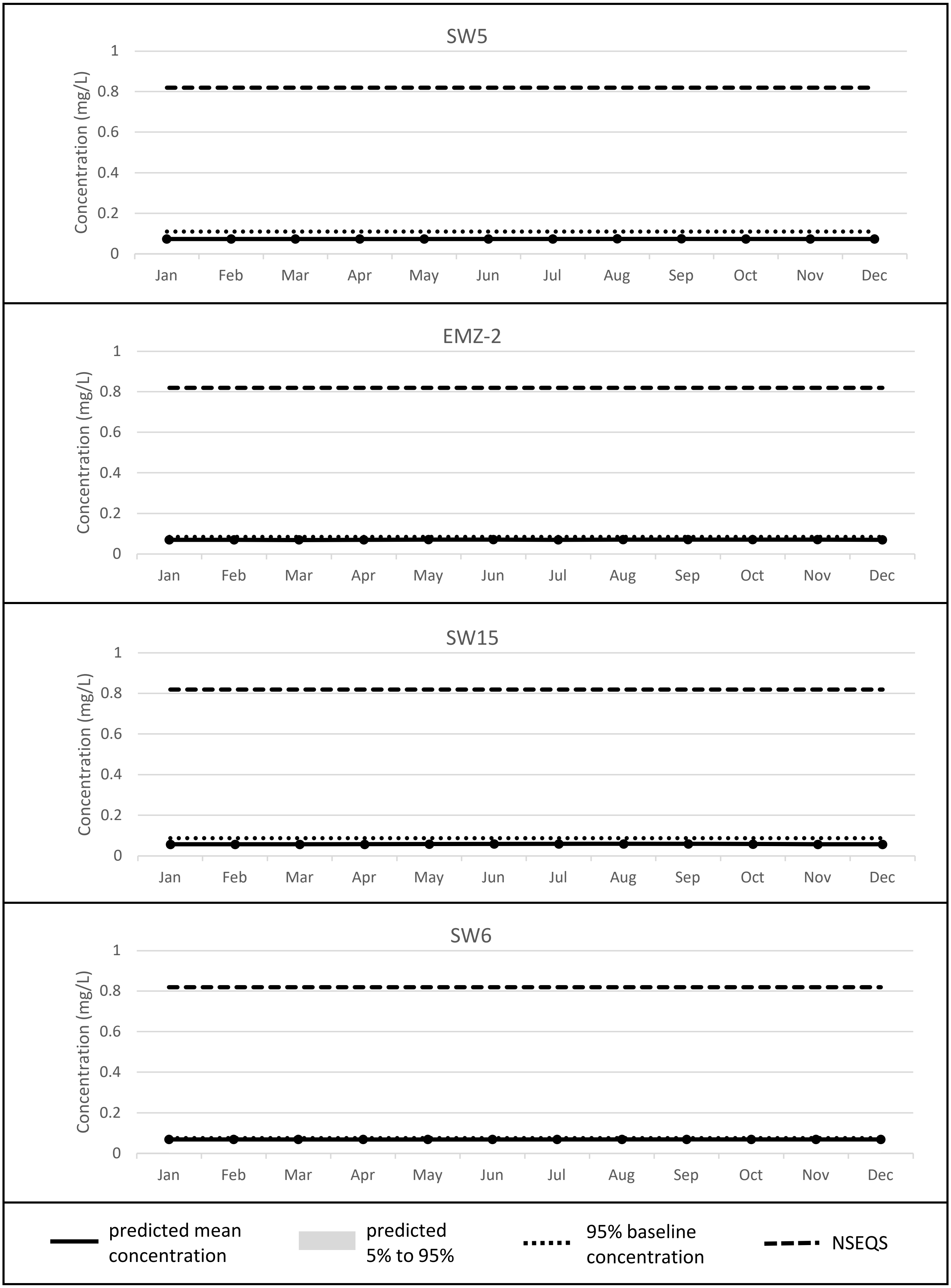


FIGURE C-34: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED MERCURY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

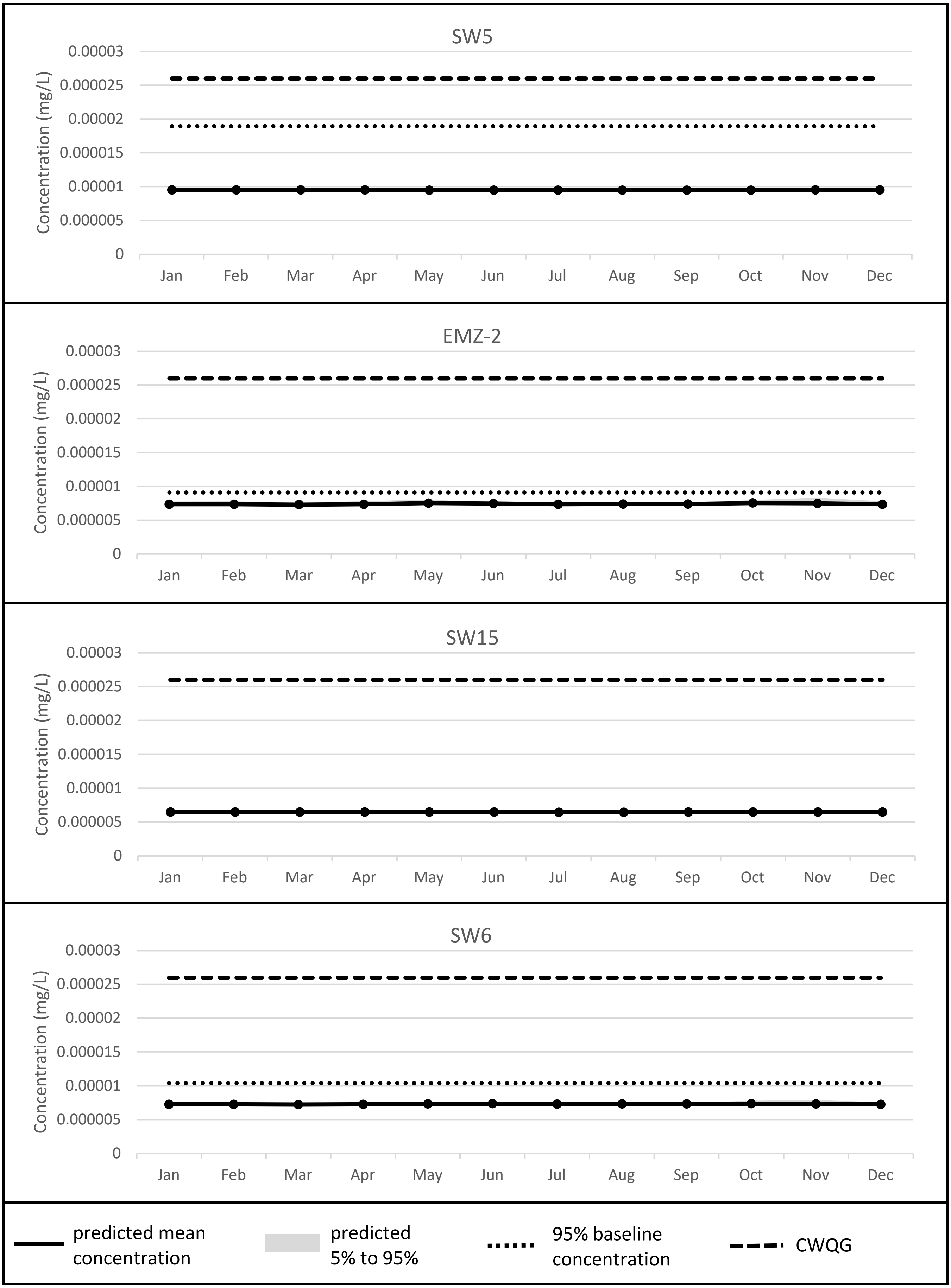


FIGURE C-35: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED MOLYBDENUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

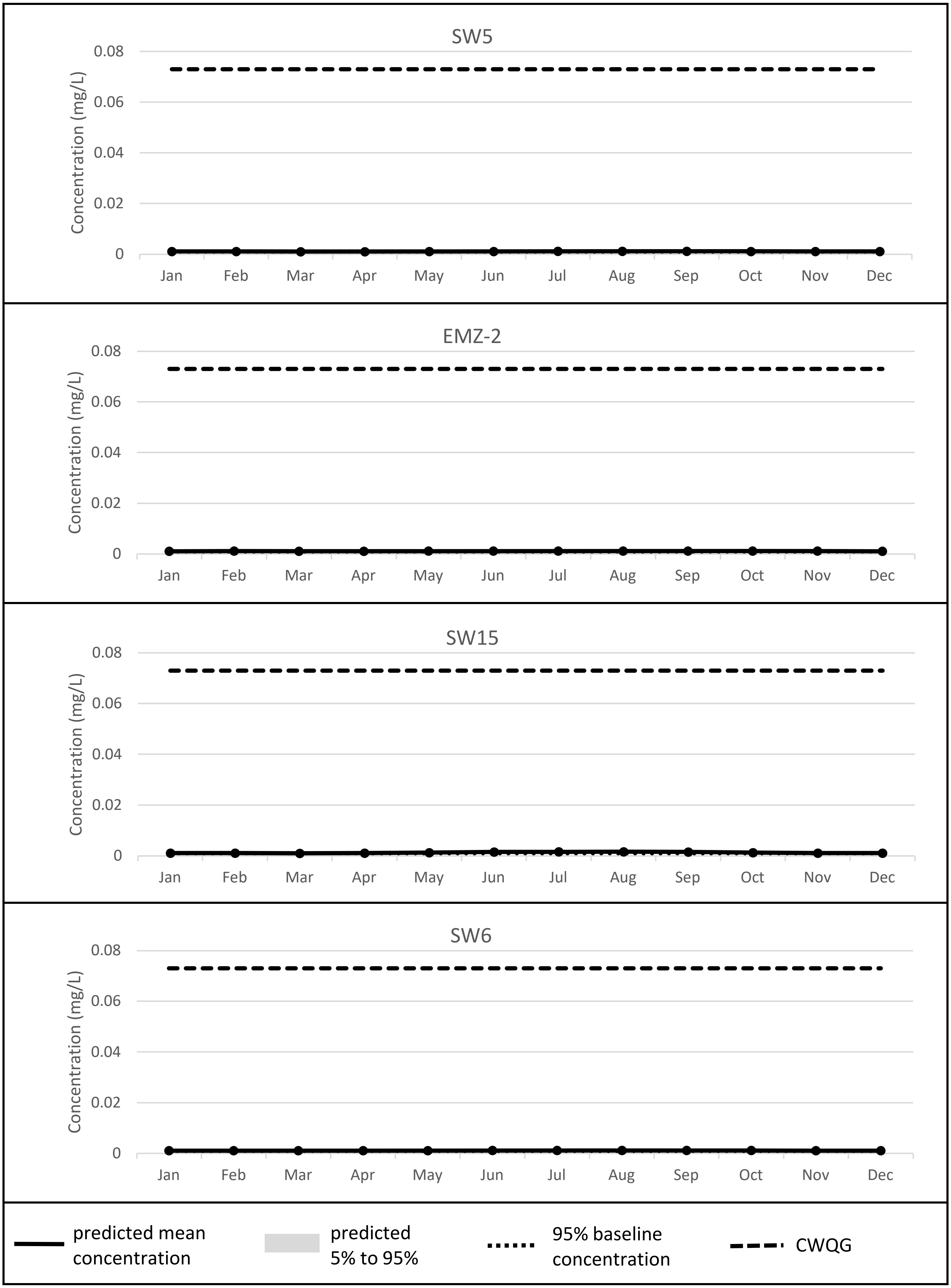


FIGURE C-36: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED NICKEL CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

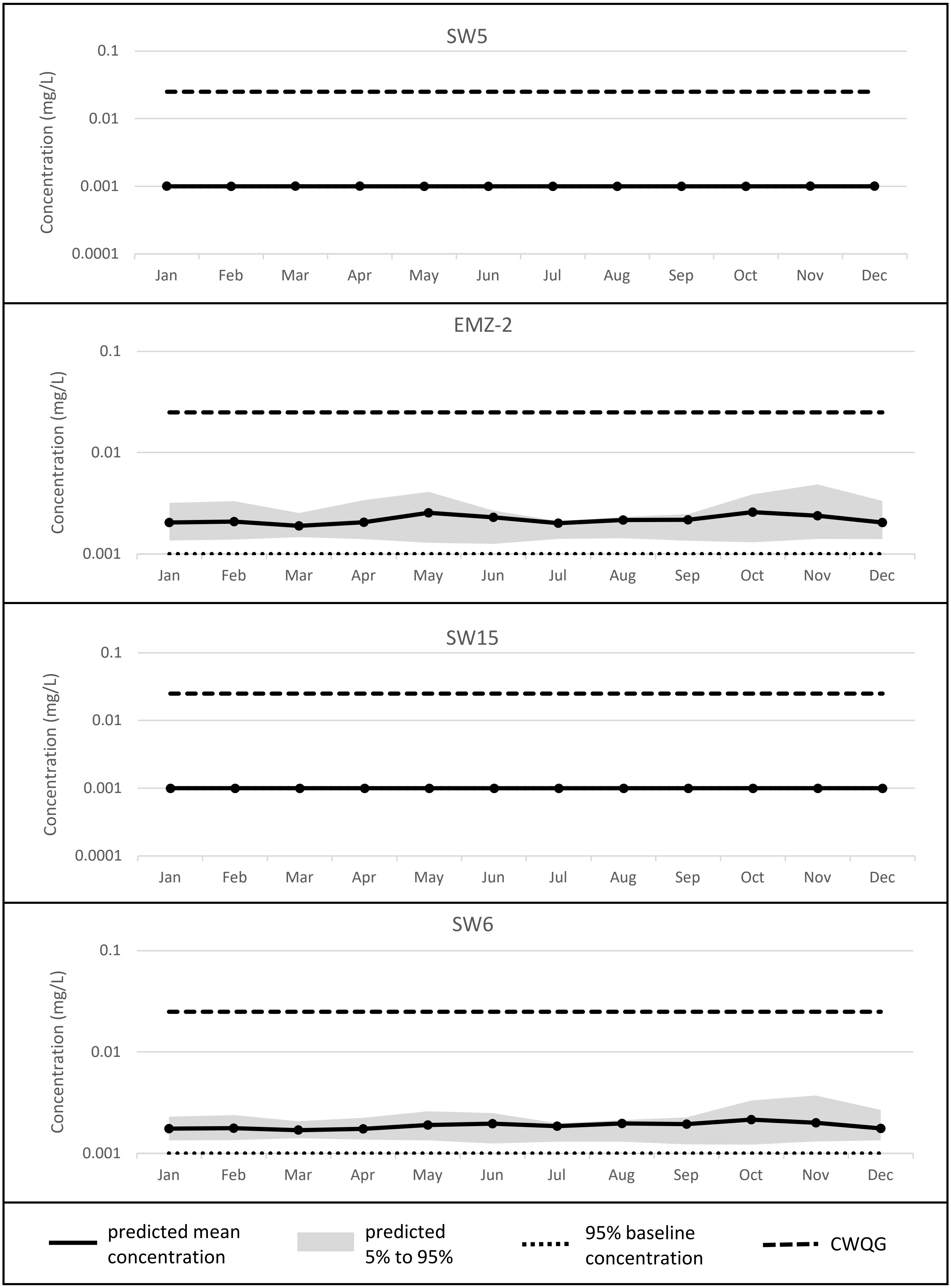


FIGURE C-37: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED NITRATE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

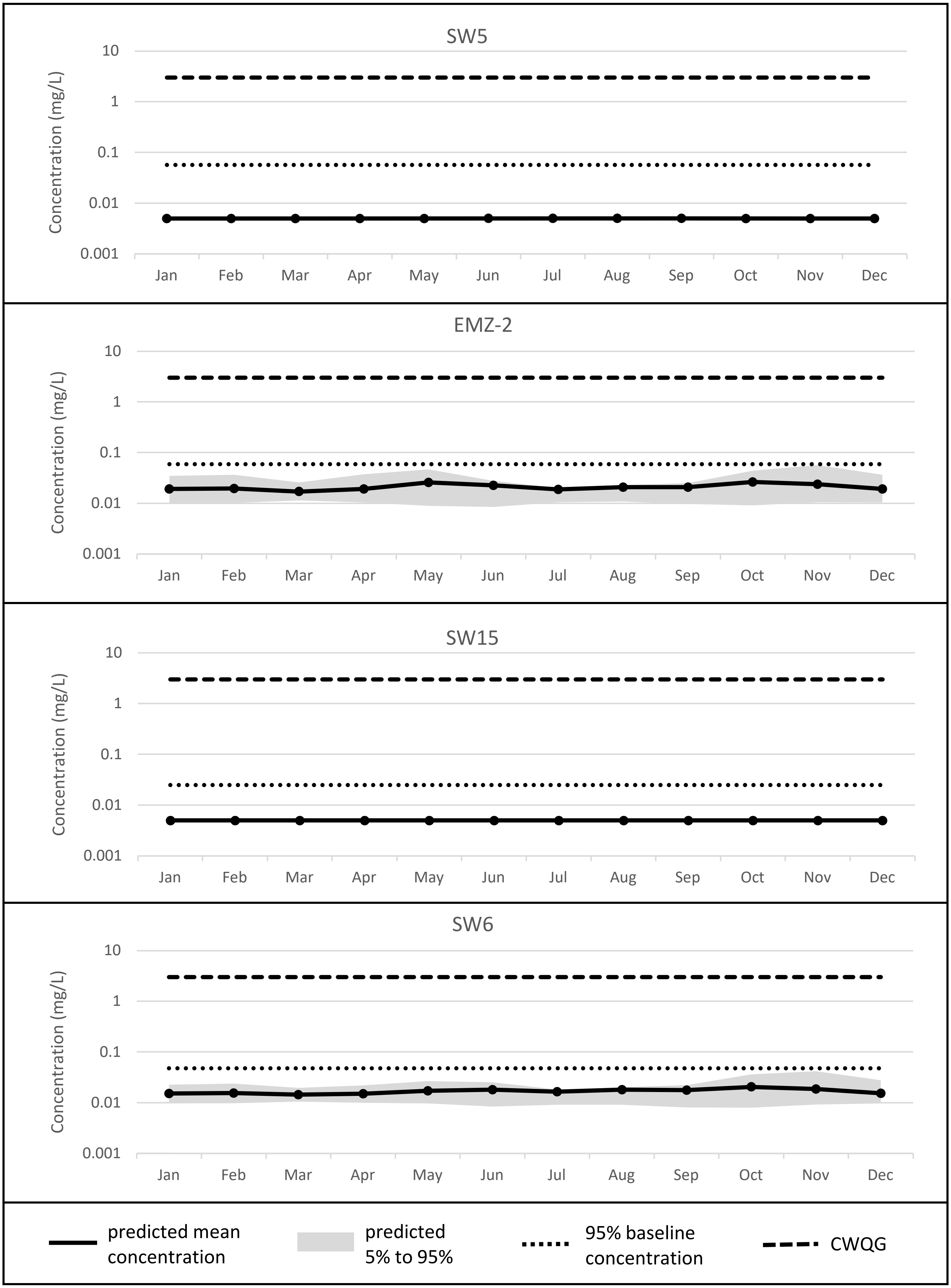


FIGURE C-38: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED NITRITE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

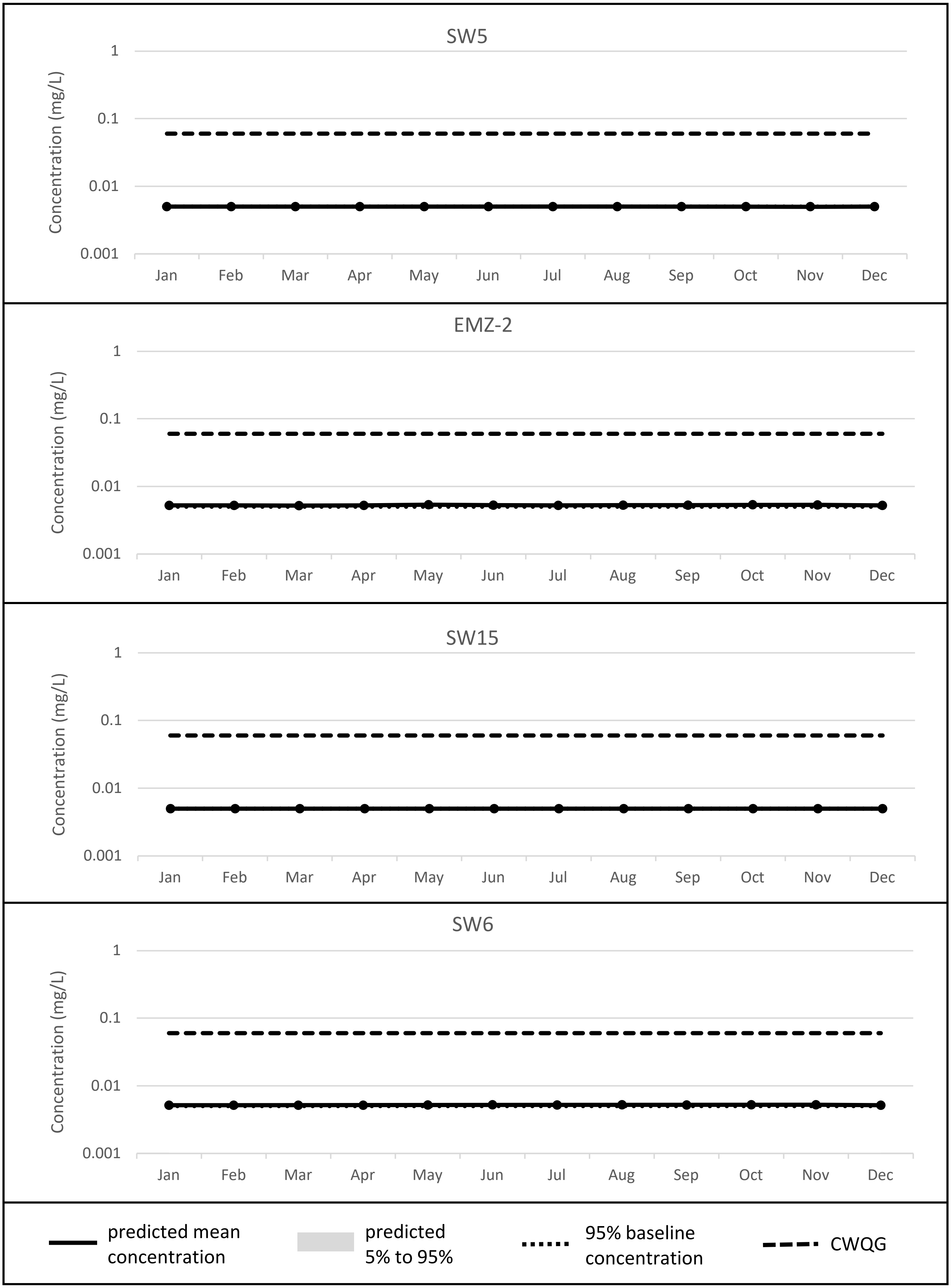


FIGURE C-39: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED SELENIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

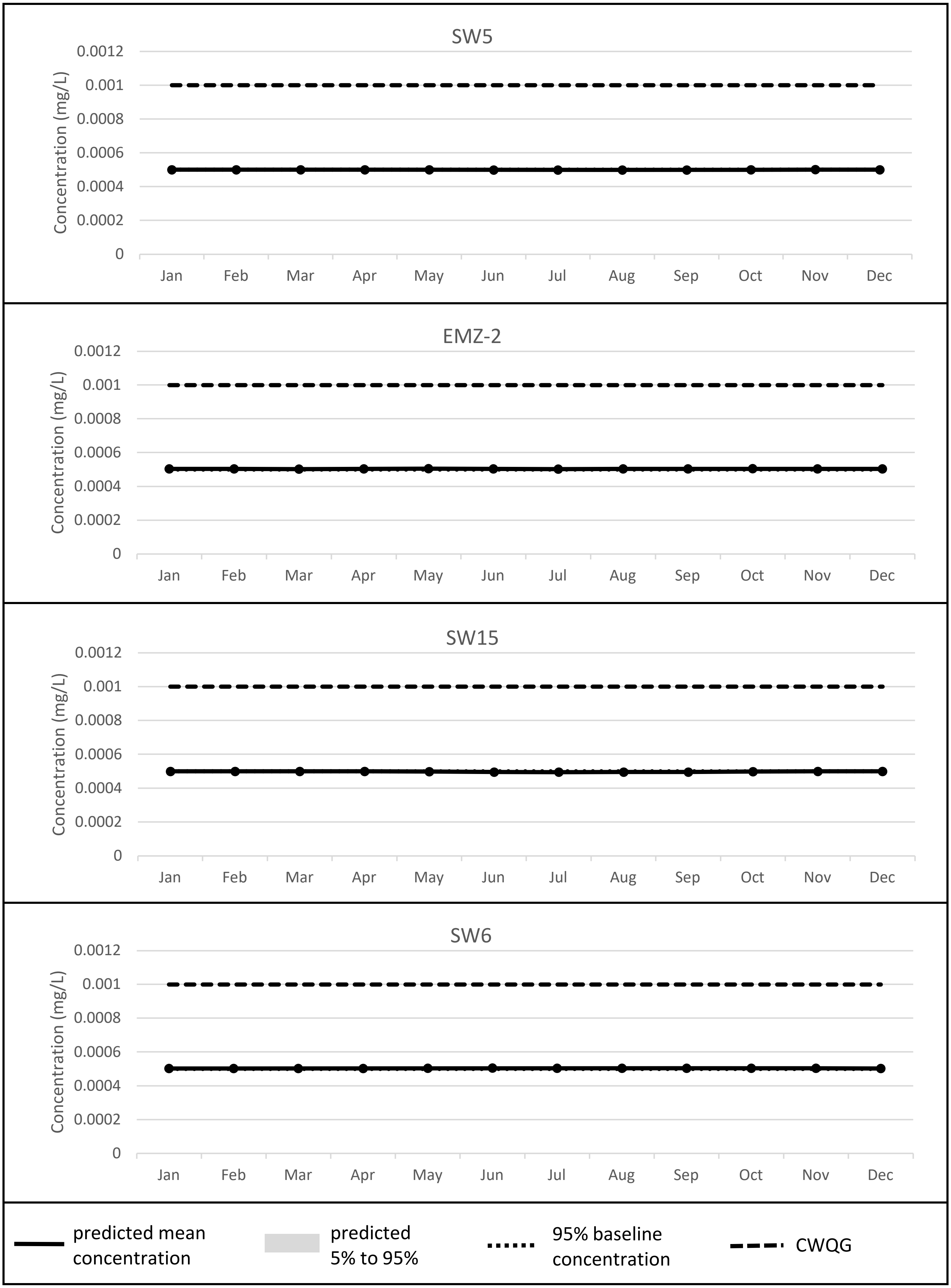


FIGURE C-40: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED SILVER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

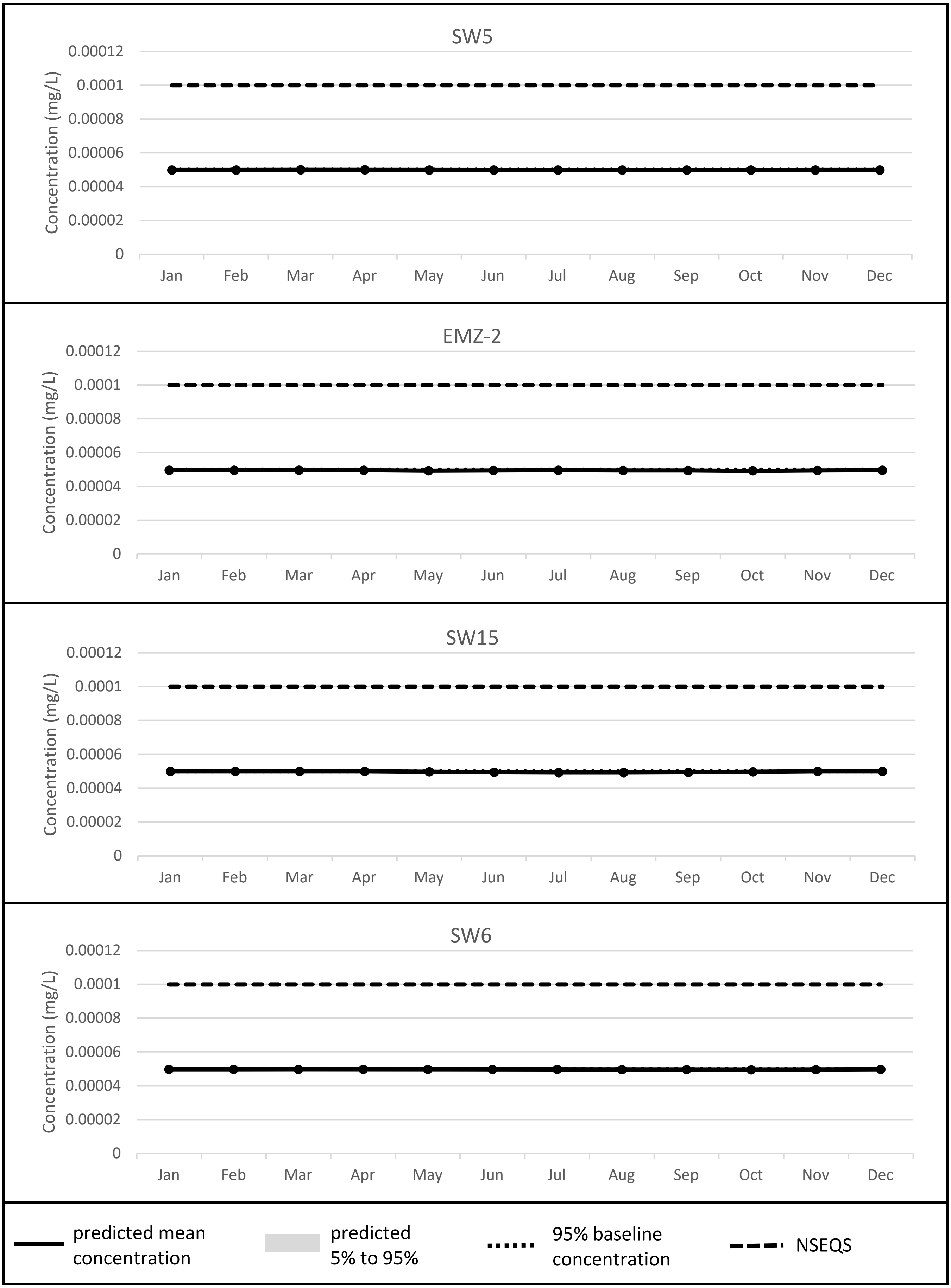


FIGURE C-41: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED THALLIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

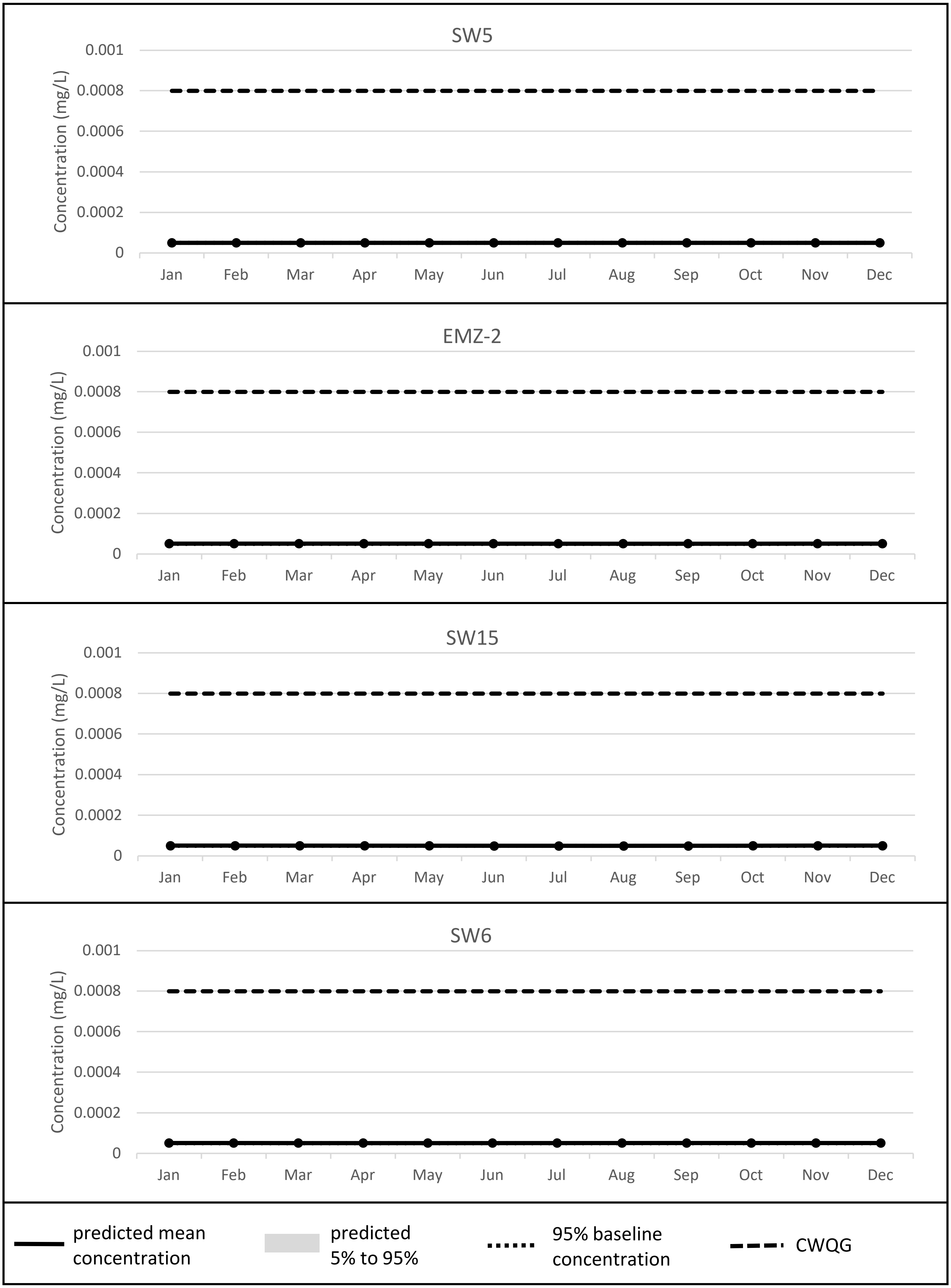


FIGURE C-42: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

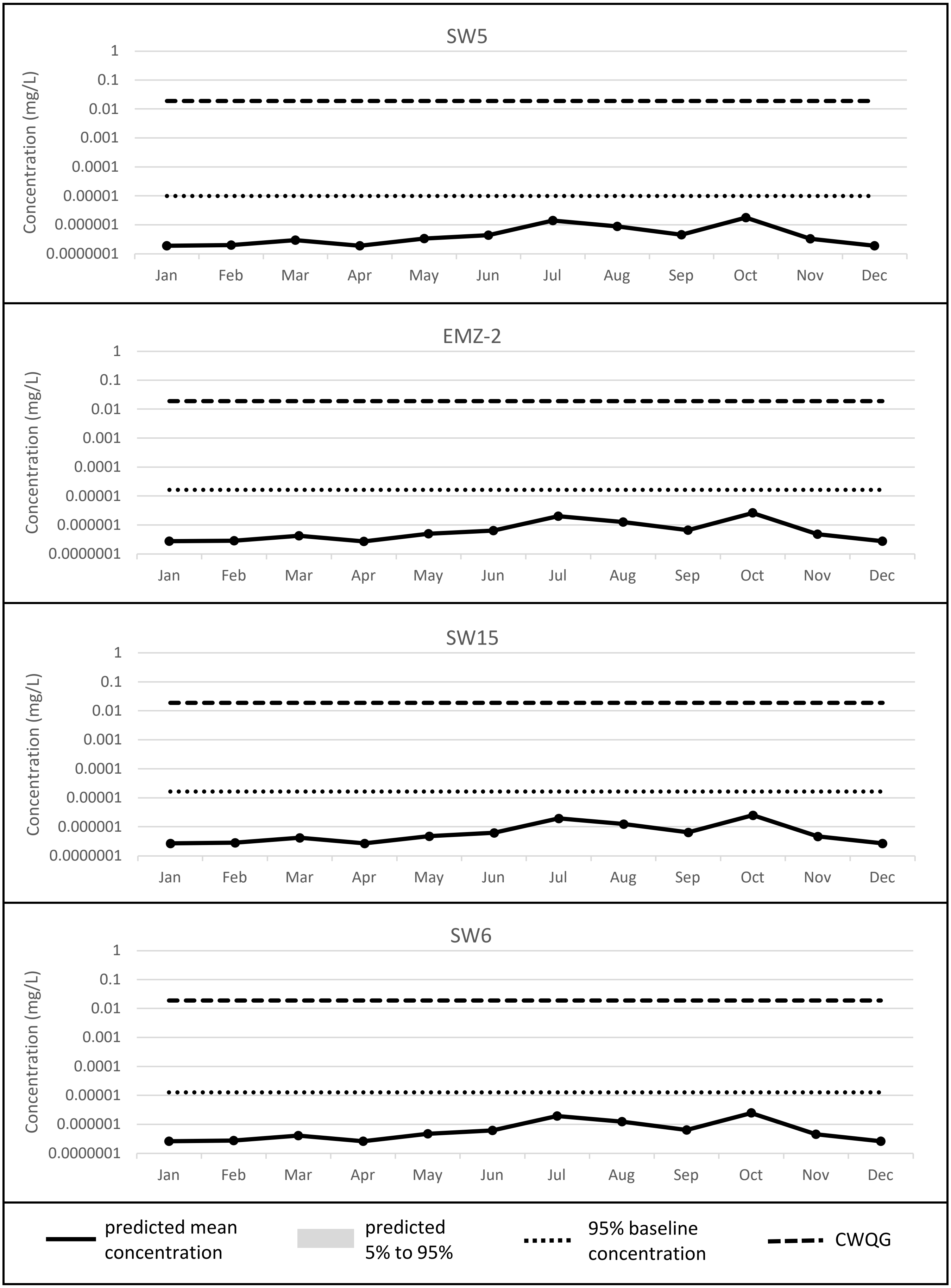


FIGURE C-43: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED URANIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

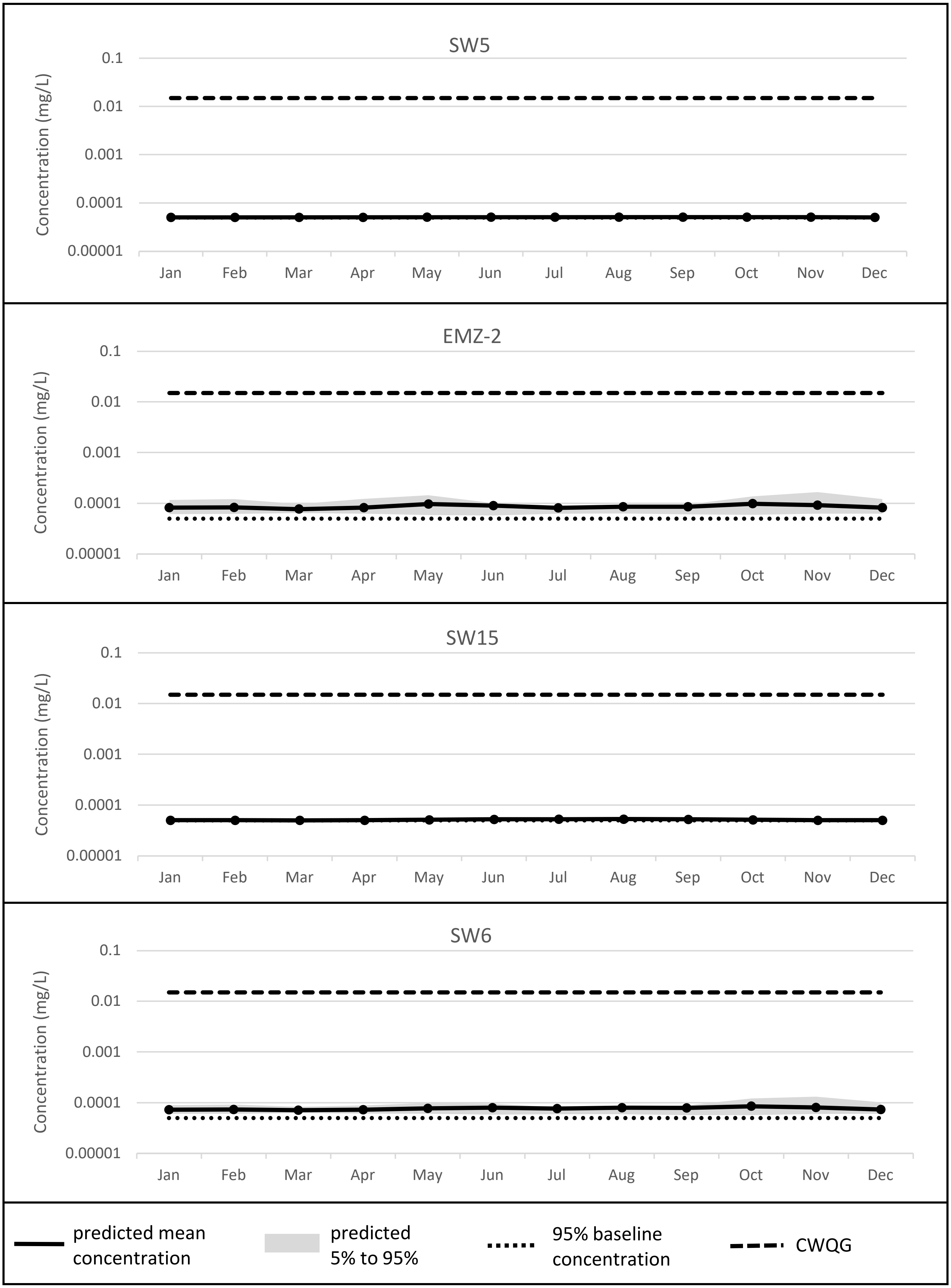


FIGURE C-44: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED ZINC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

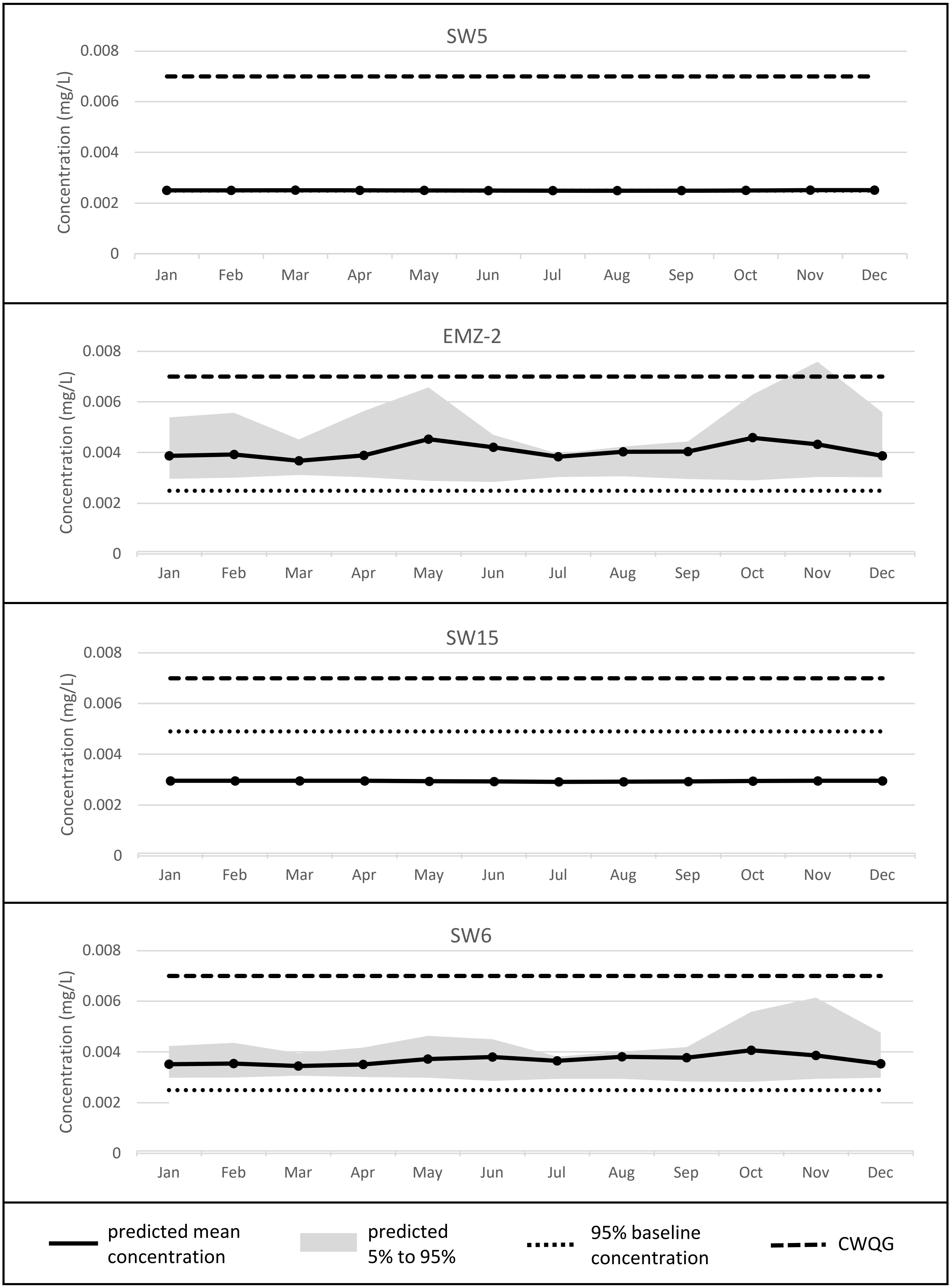


FIGURE C-45: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ALUMINUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

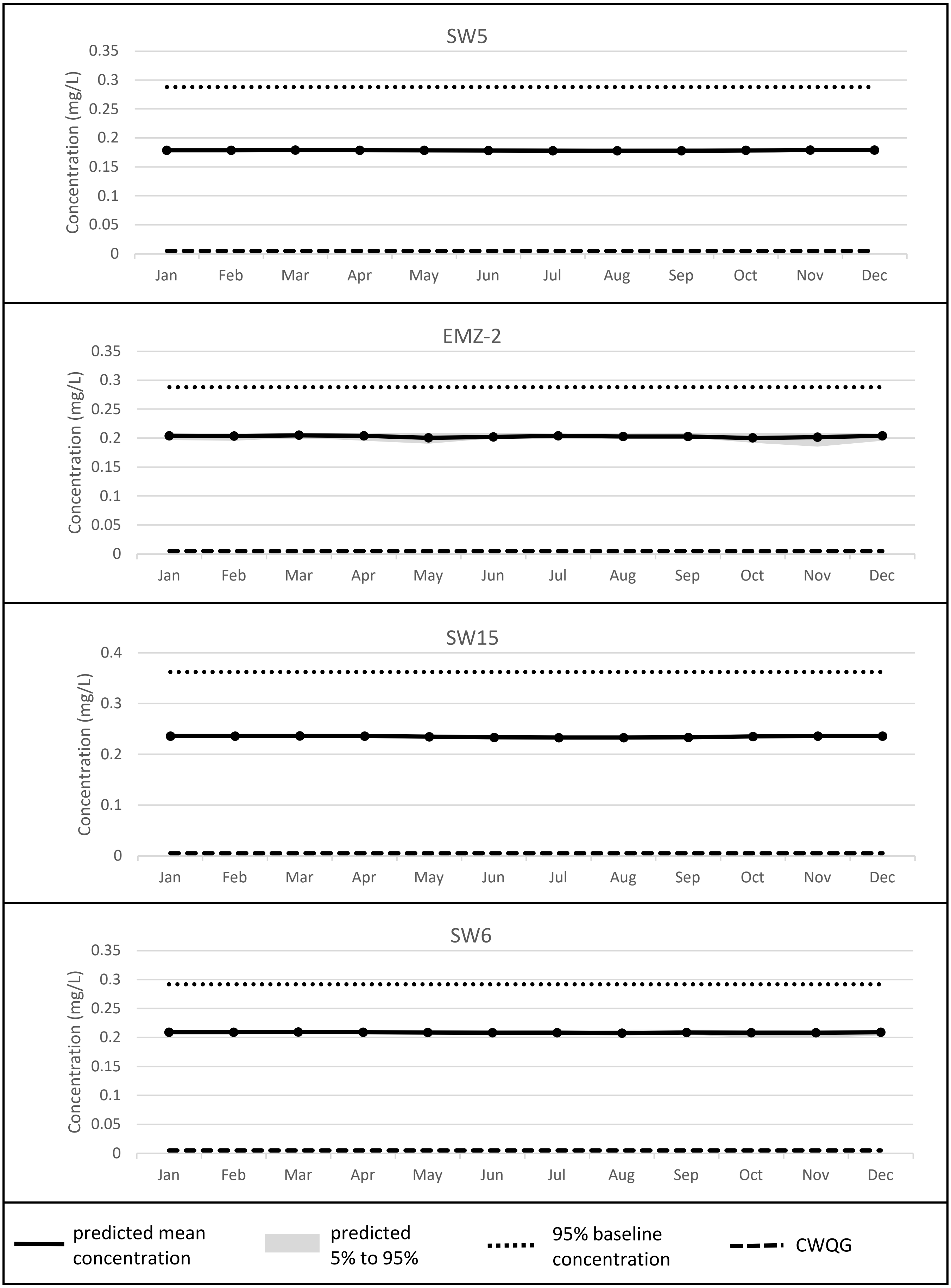


FIGURE C-46: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ANTIMONY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

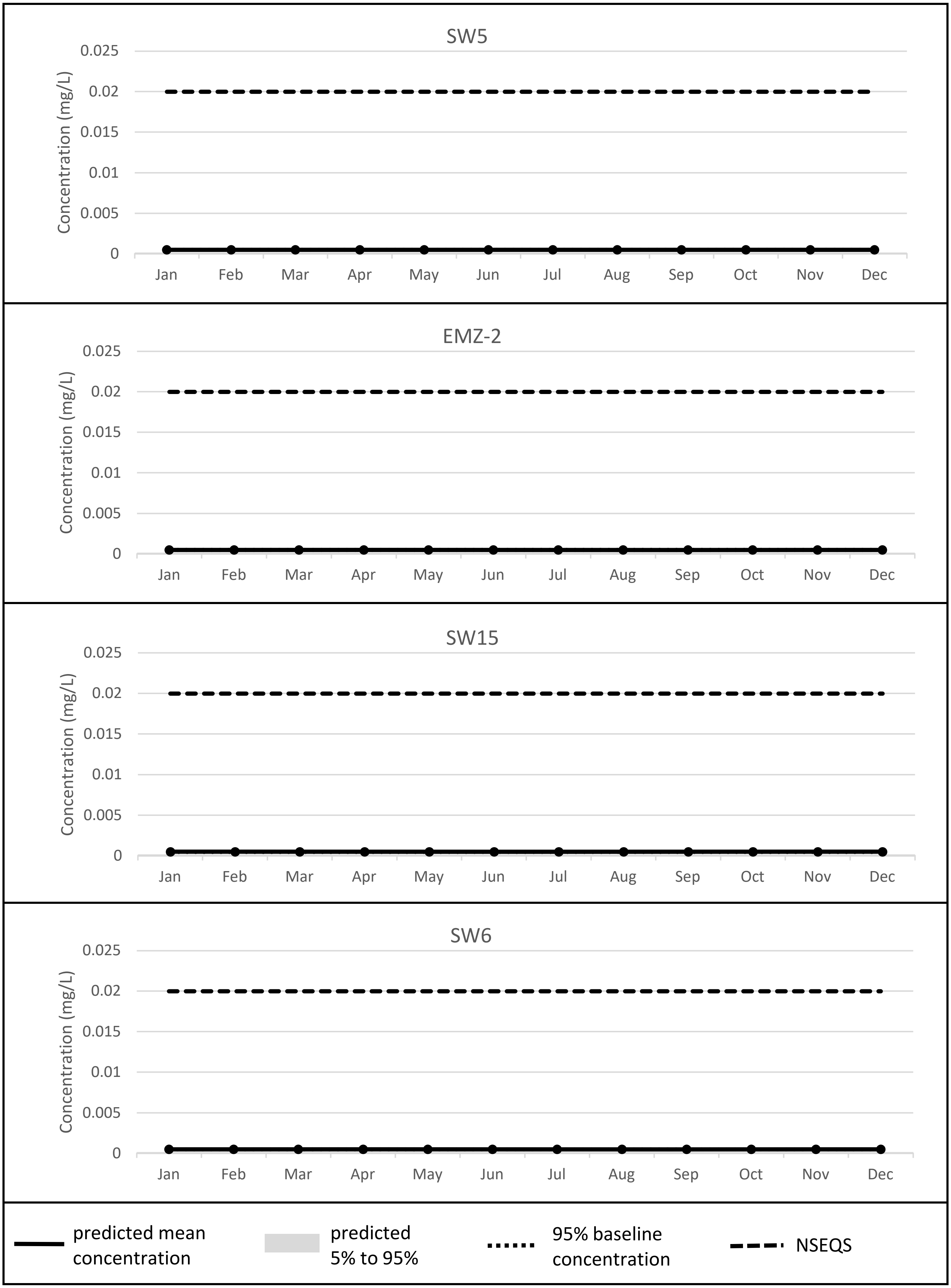


FIGURE C-47: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ARSENIC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

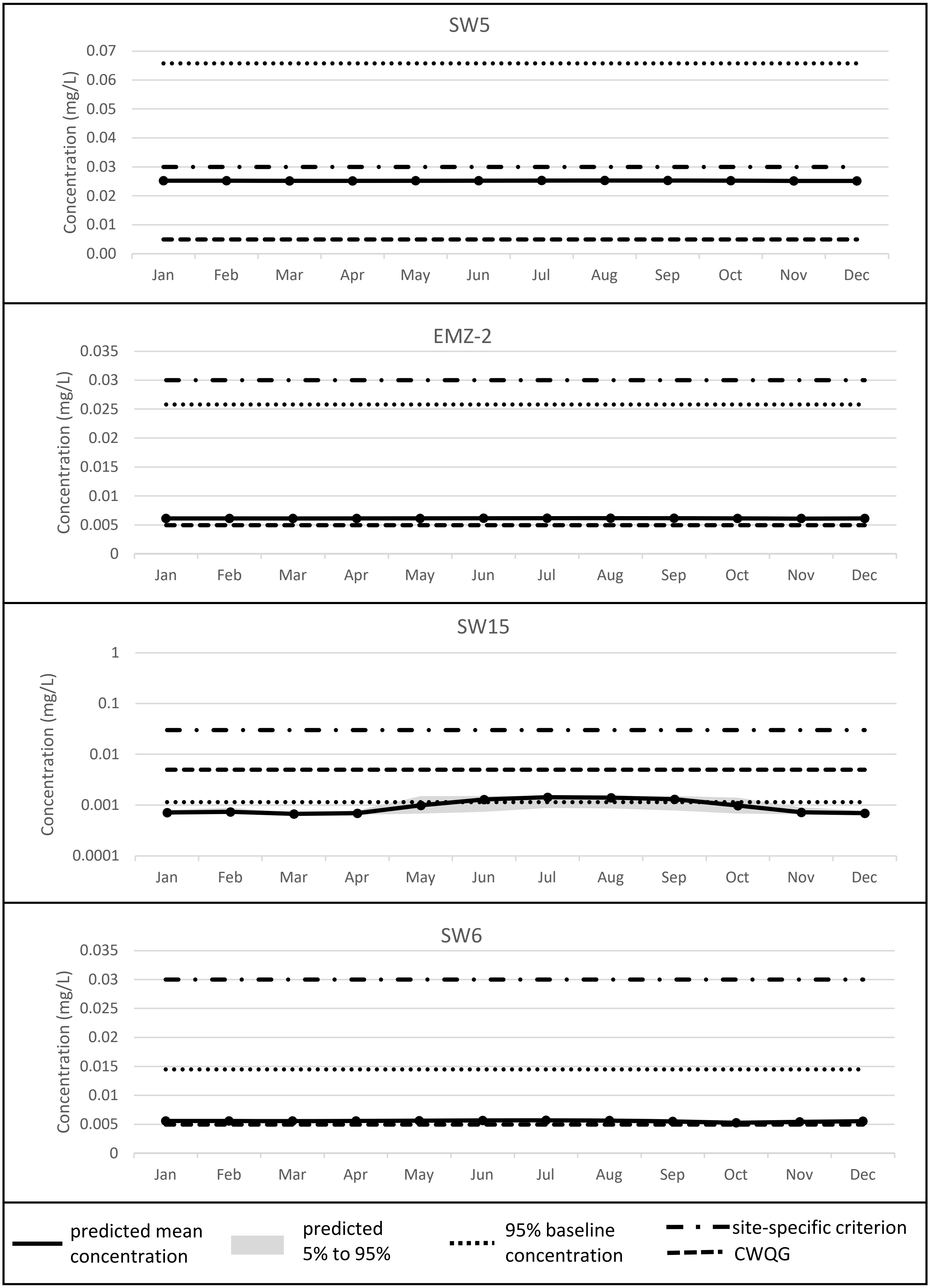


FIGURE C-48: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED BORON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

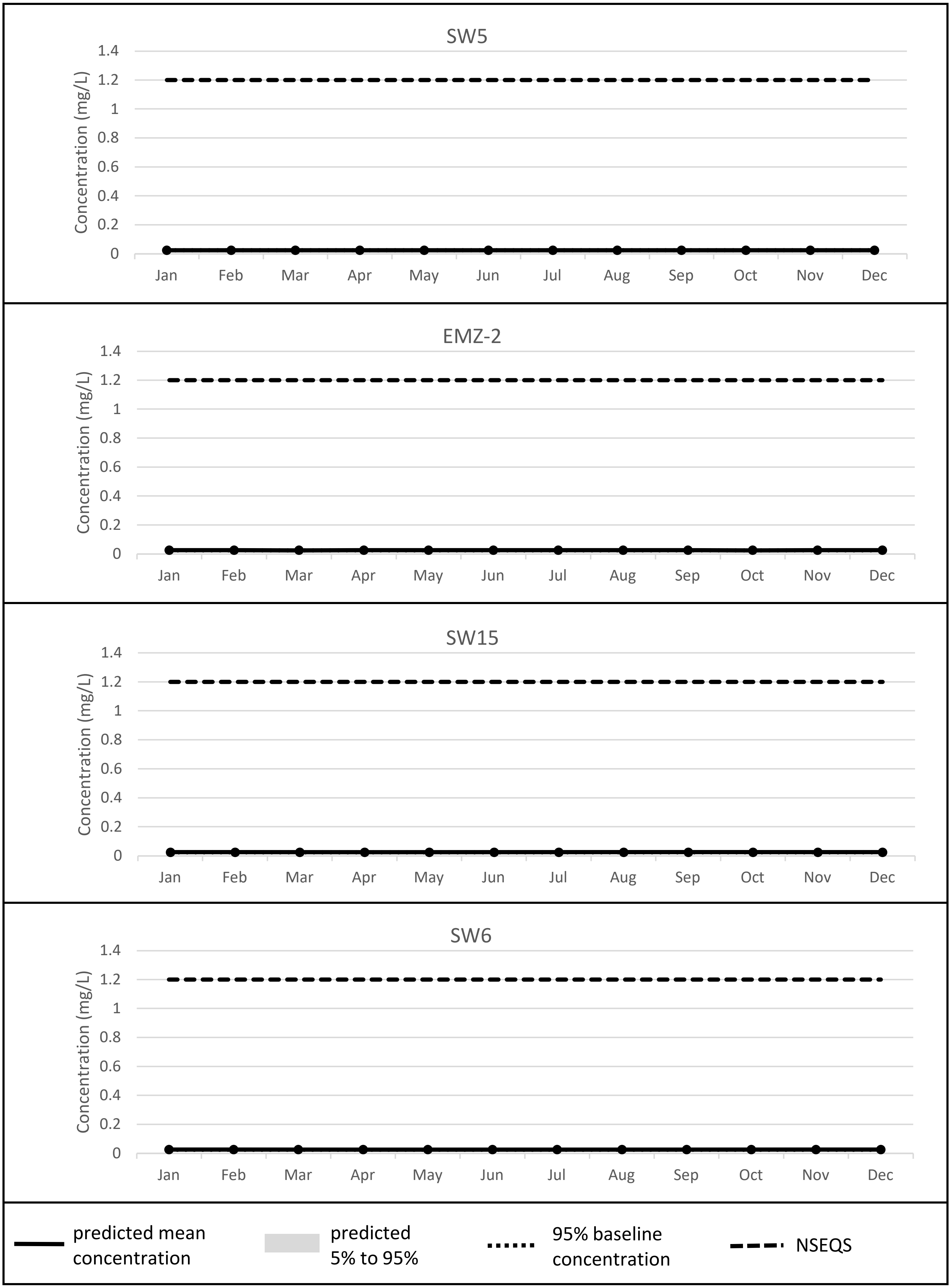


FIGURE C-49: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED CADMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

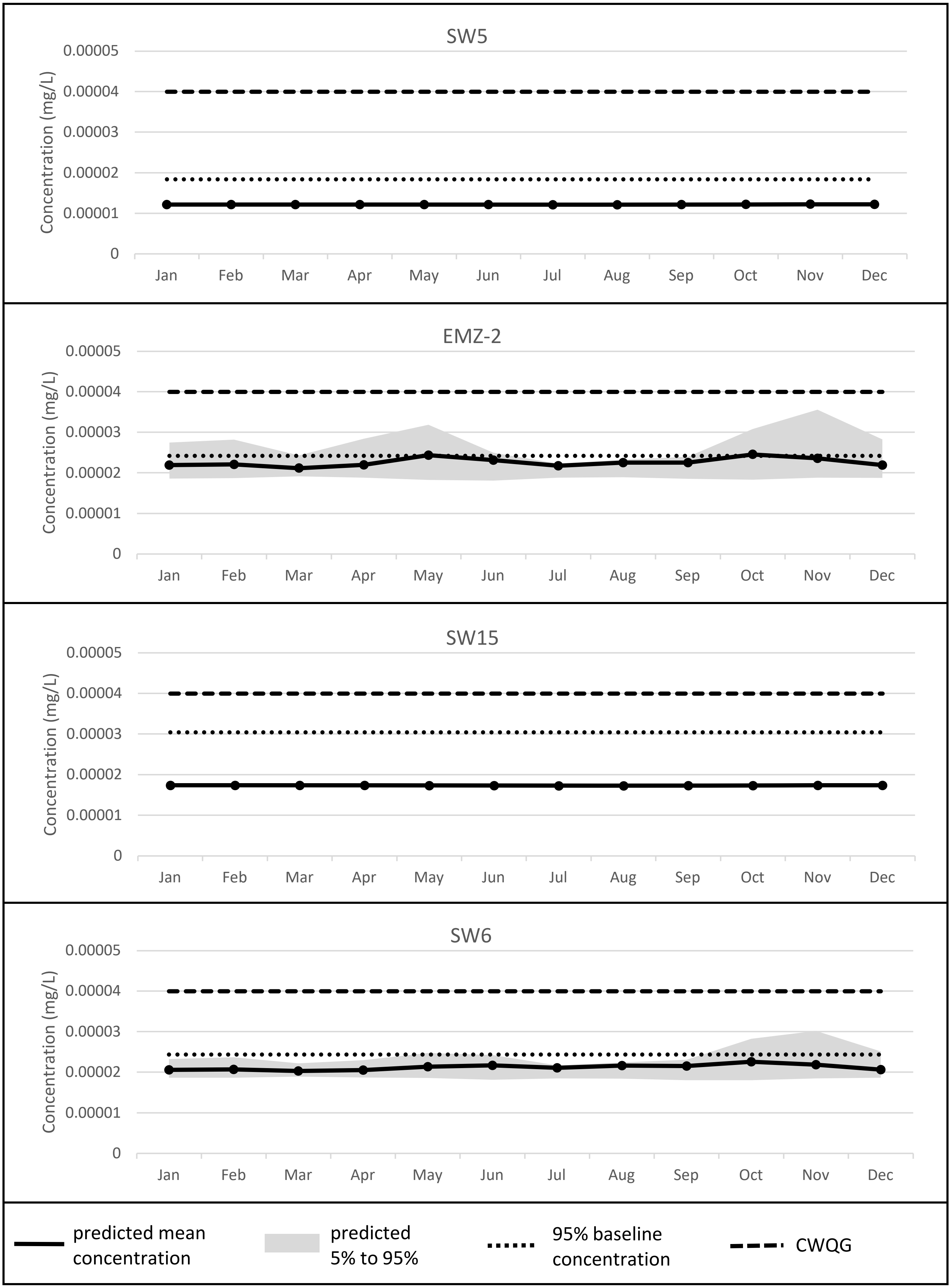


FIGURE C-50: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS
PREDICTED CHROMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

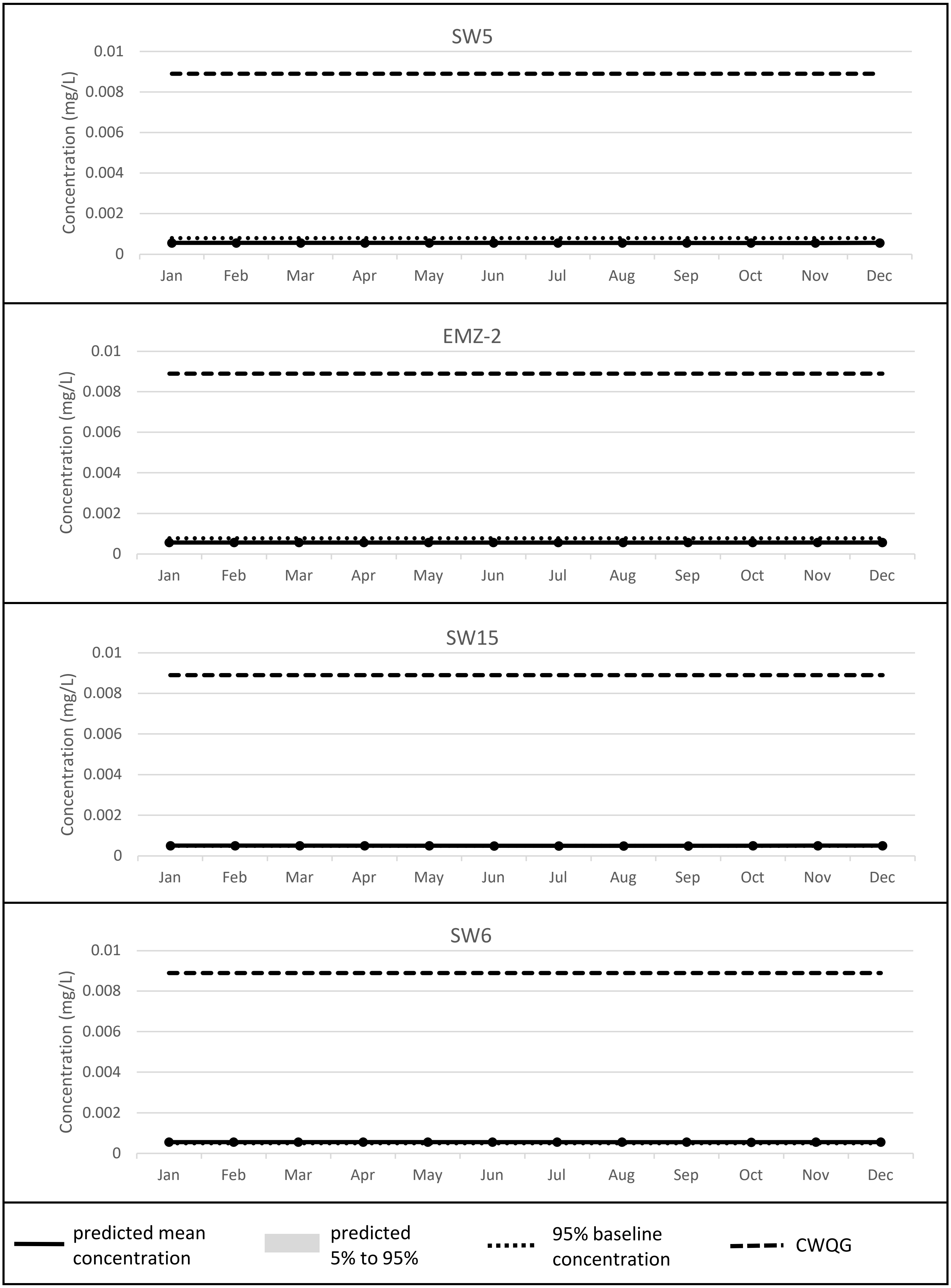


FIGURE C-51: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED COBALT CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

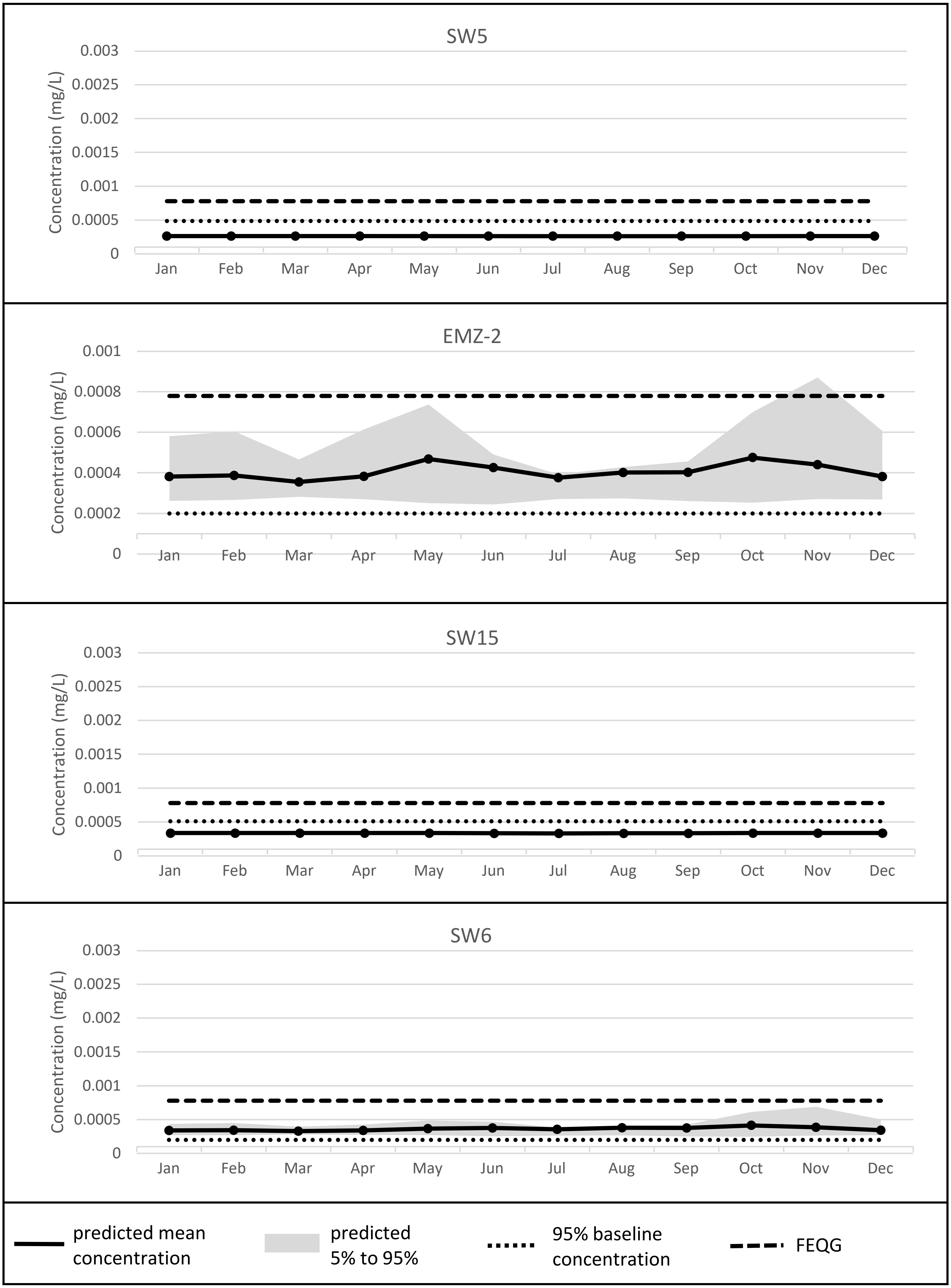


FIGURE C-52: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED COPPER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

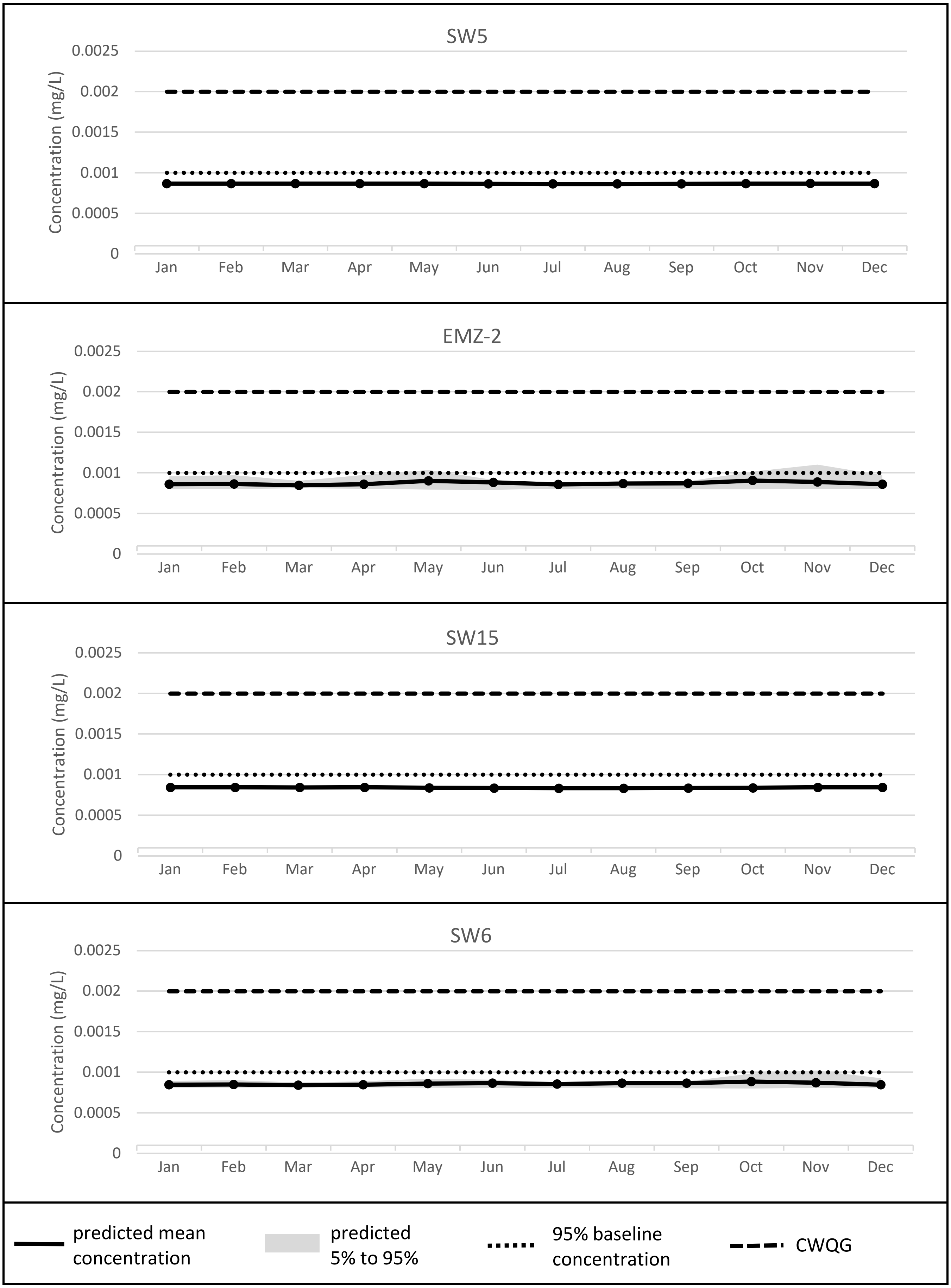


FIGURE C-53: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED IRON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

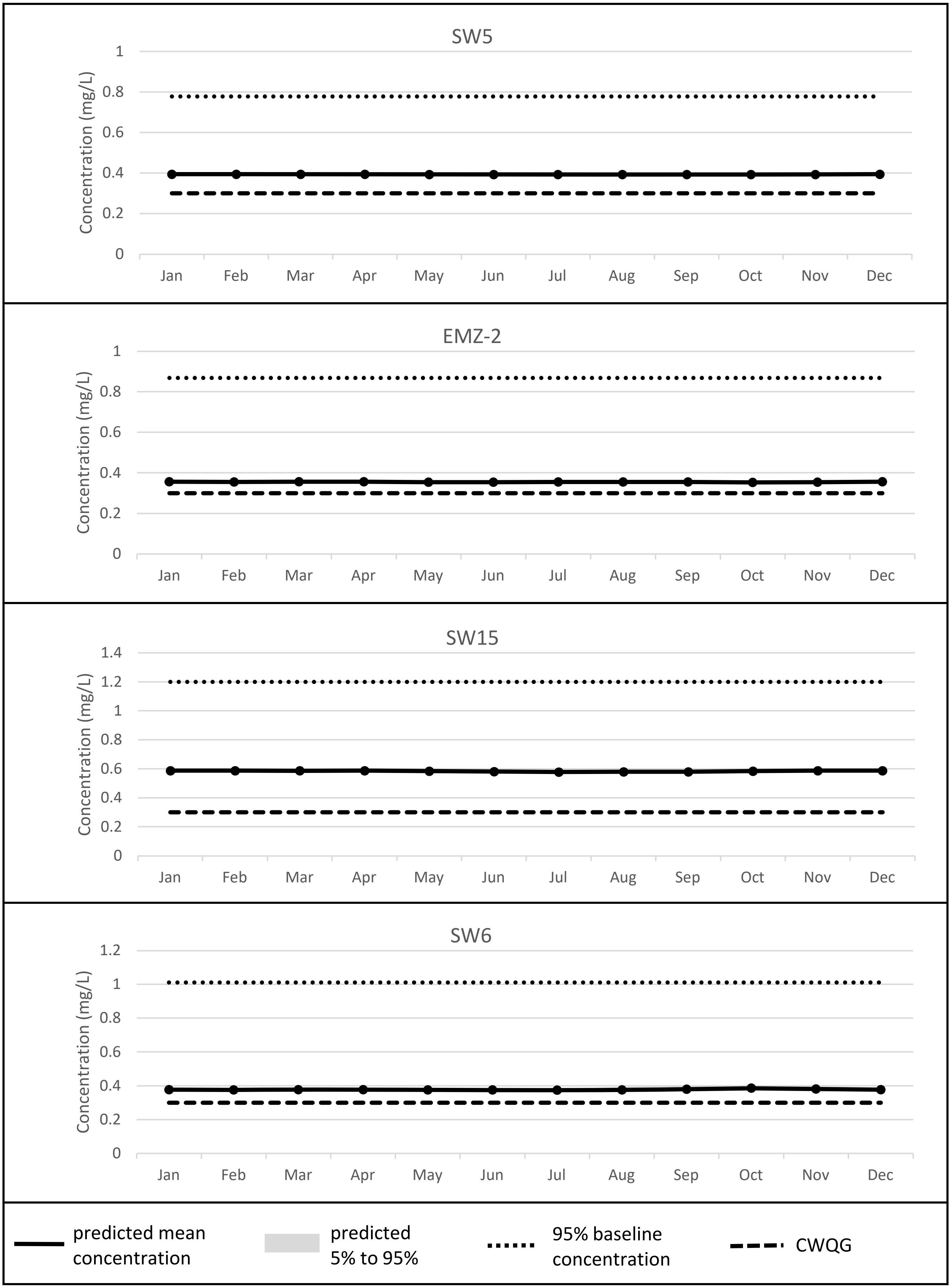


FIGURE C-54: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED LEAD CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

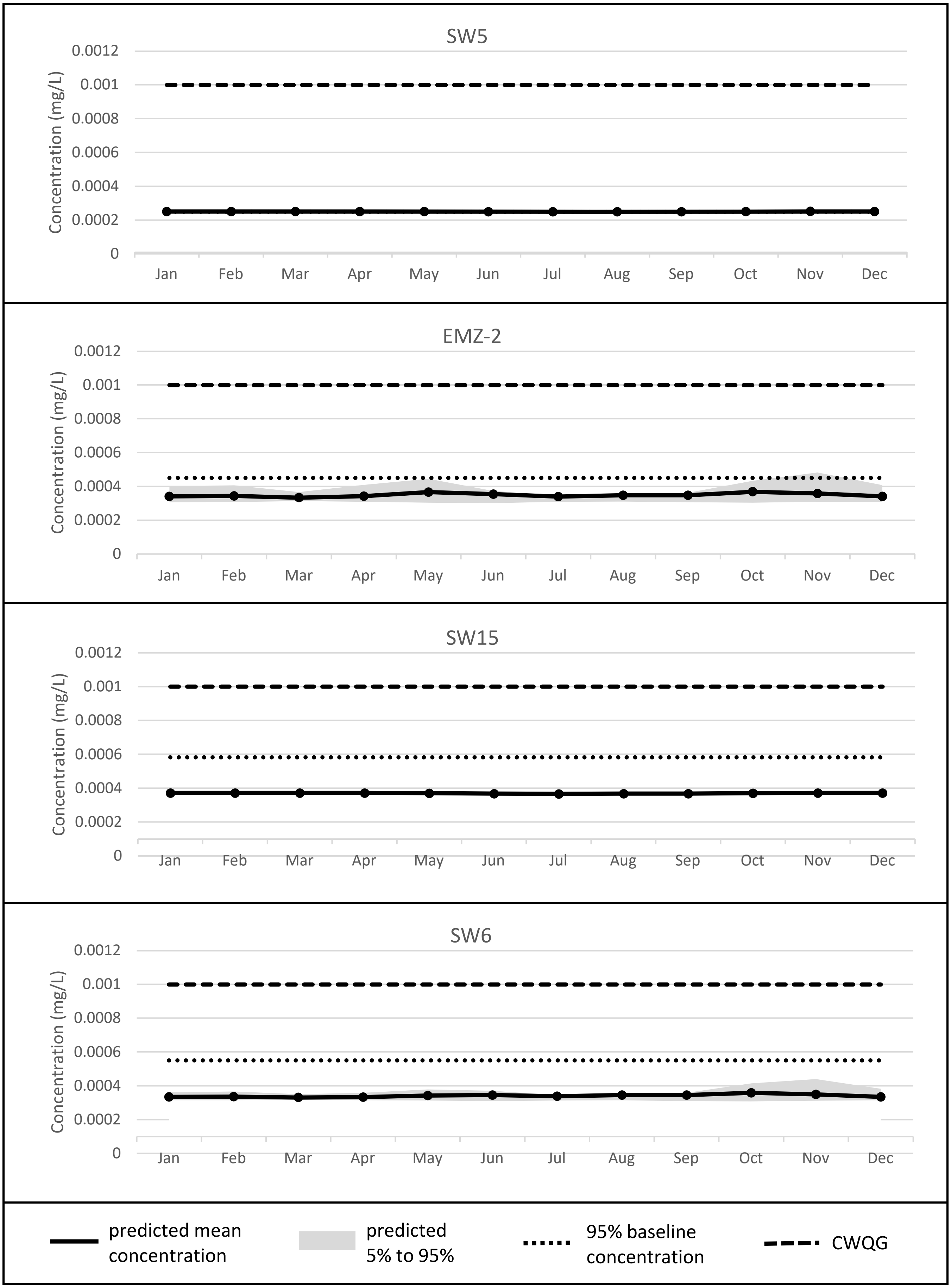


FIGURE C-55: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS
PREDICTED MANGANESE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

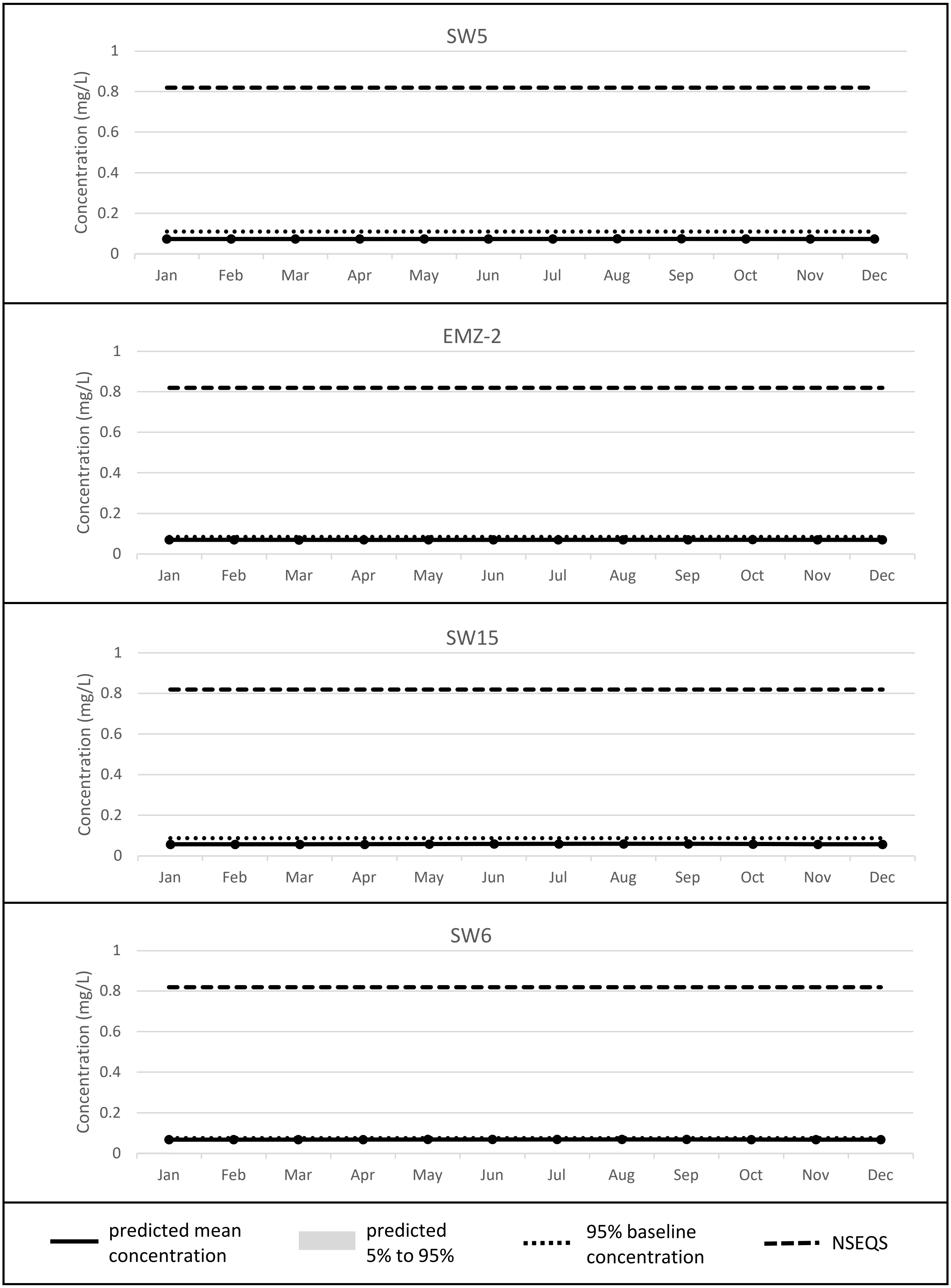


FIGURE C-56: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED MERCURY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

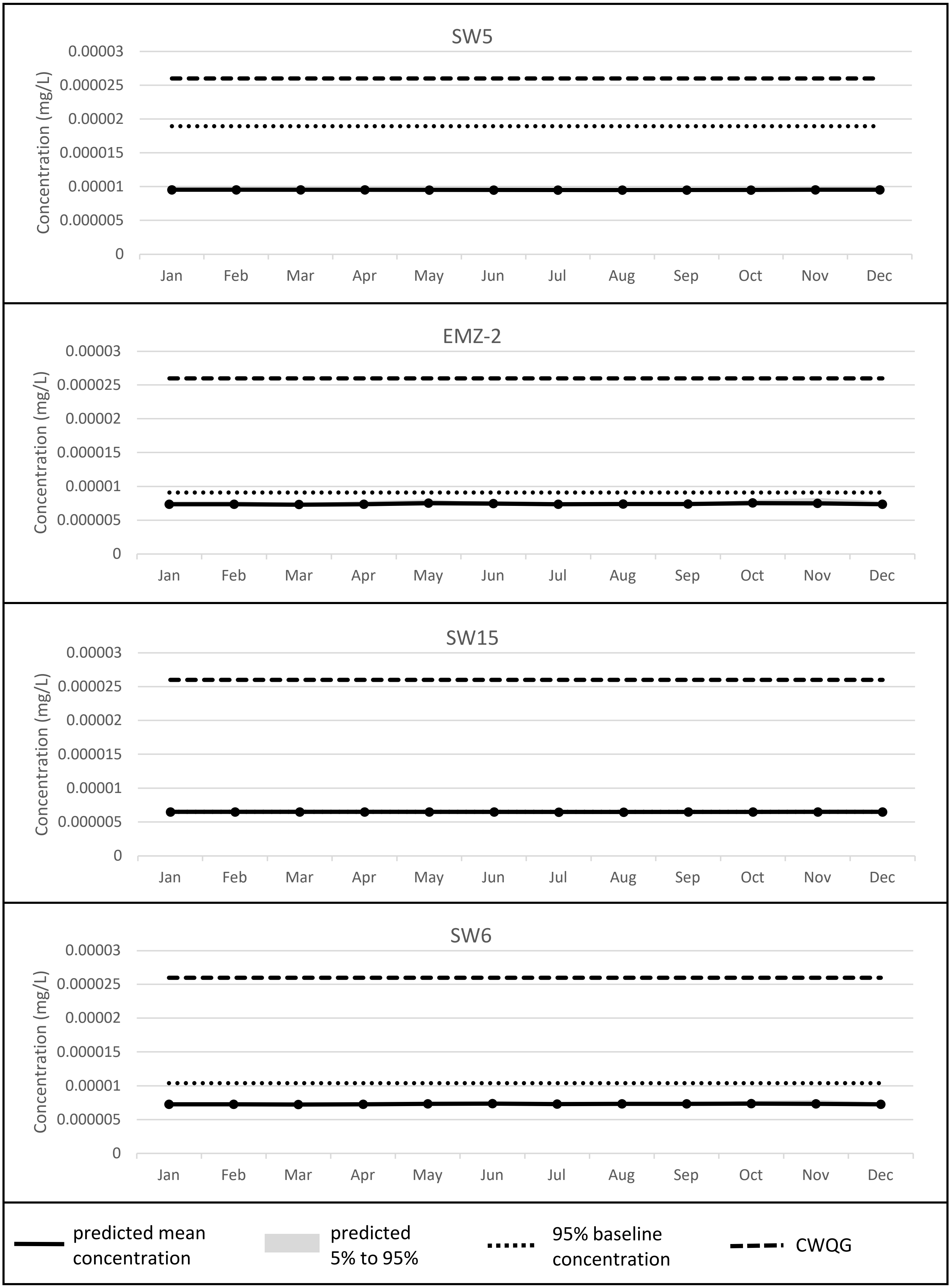


FIGURE C-57: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED MOLYBDENUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

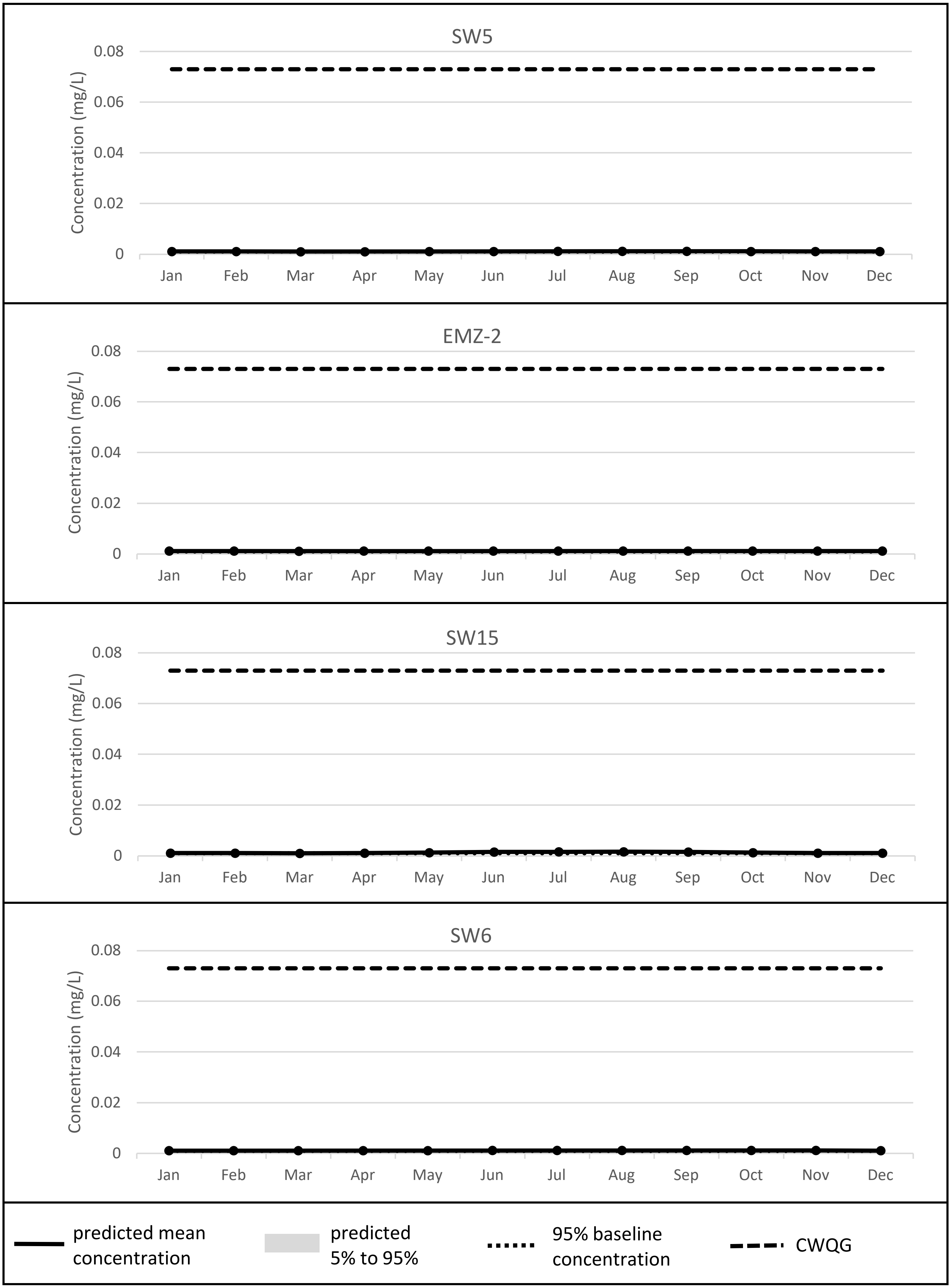


FIGURE C-58: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED NICKEL CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

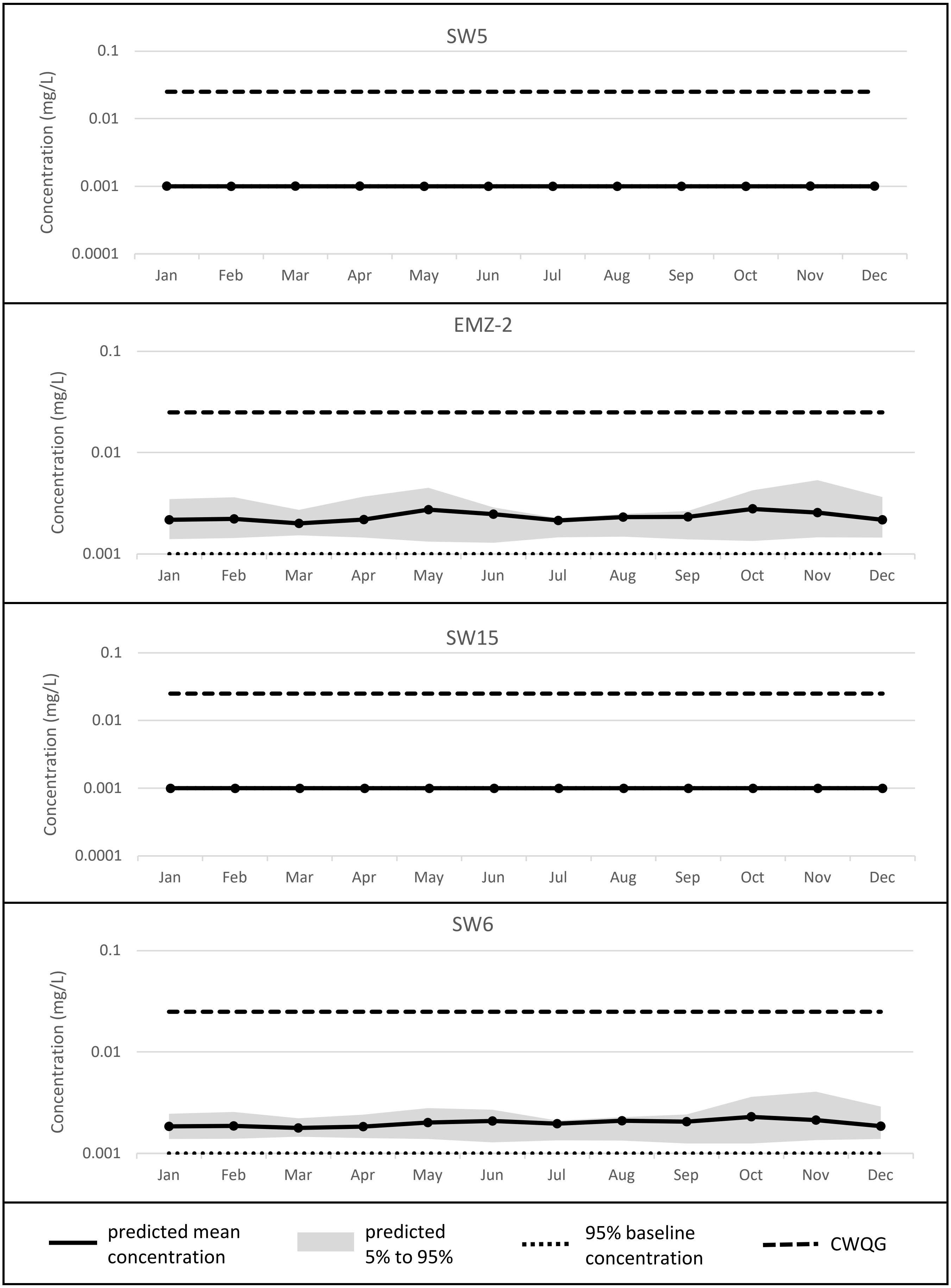


FIGURE C-59: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED NITRATE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

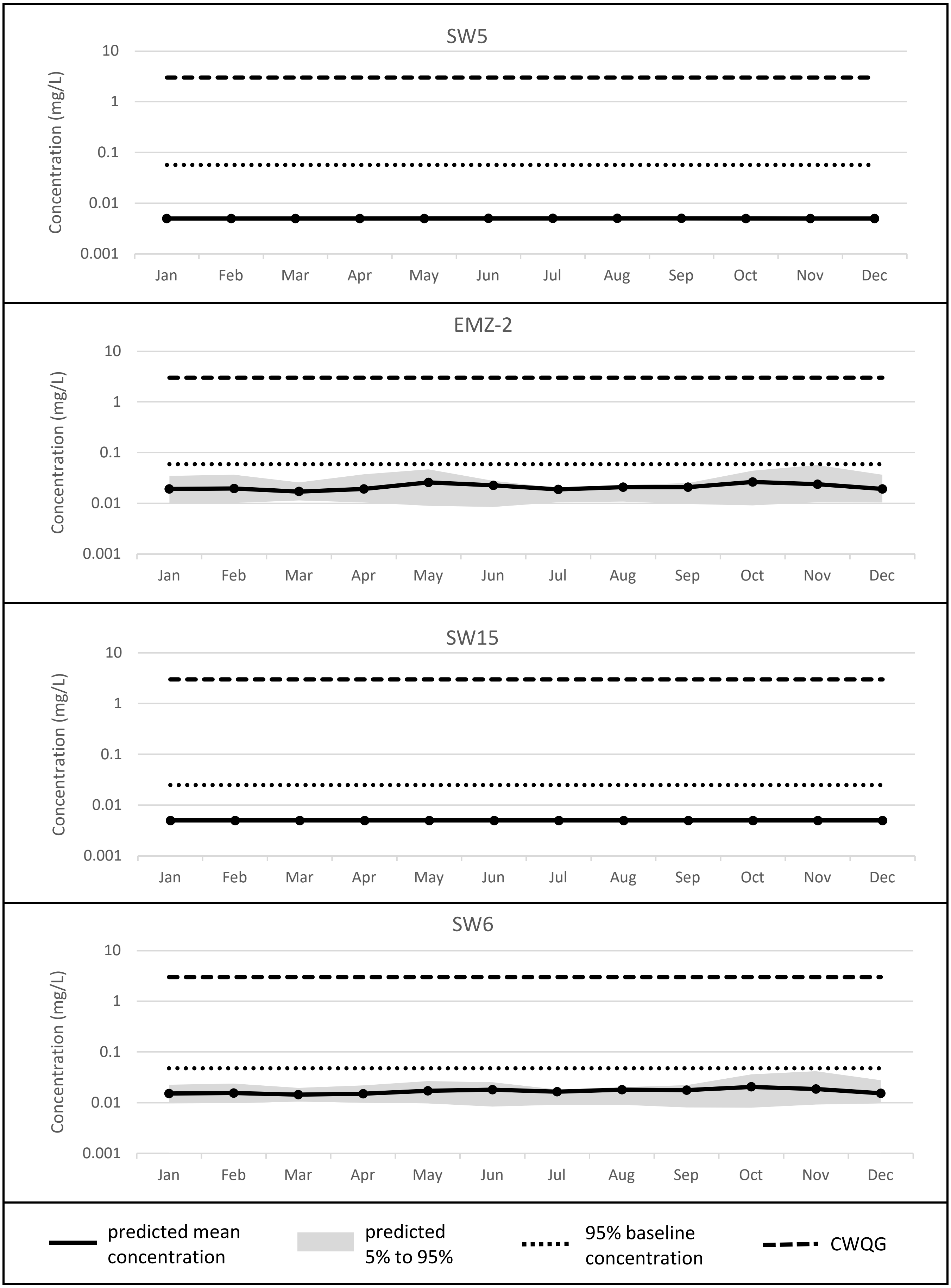


FIGURE C-60: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED NITRITE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

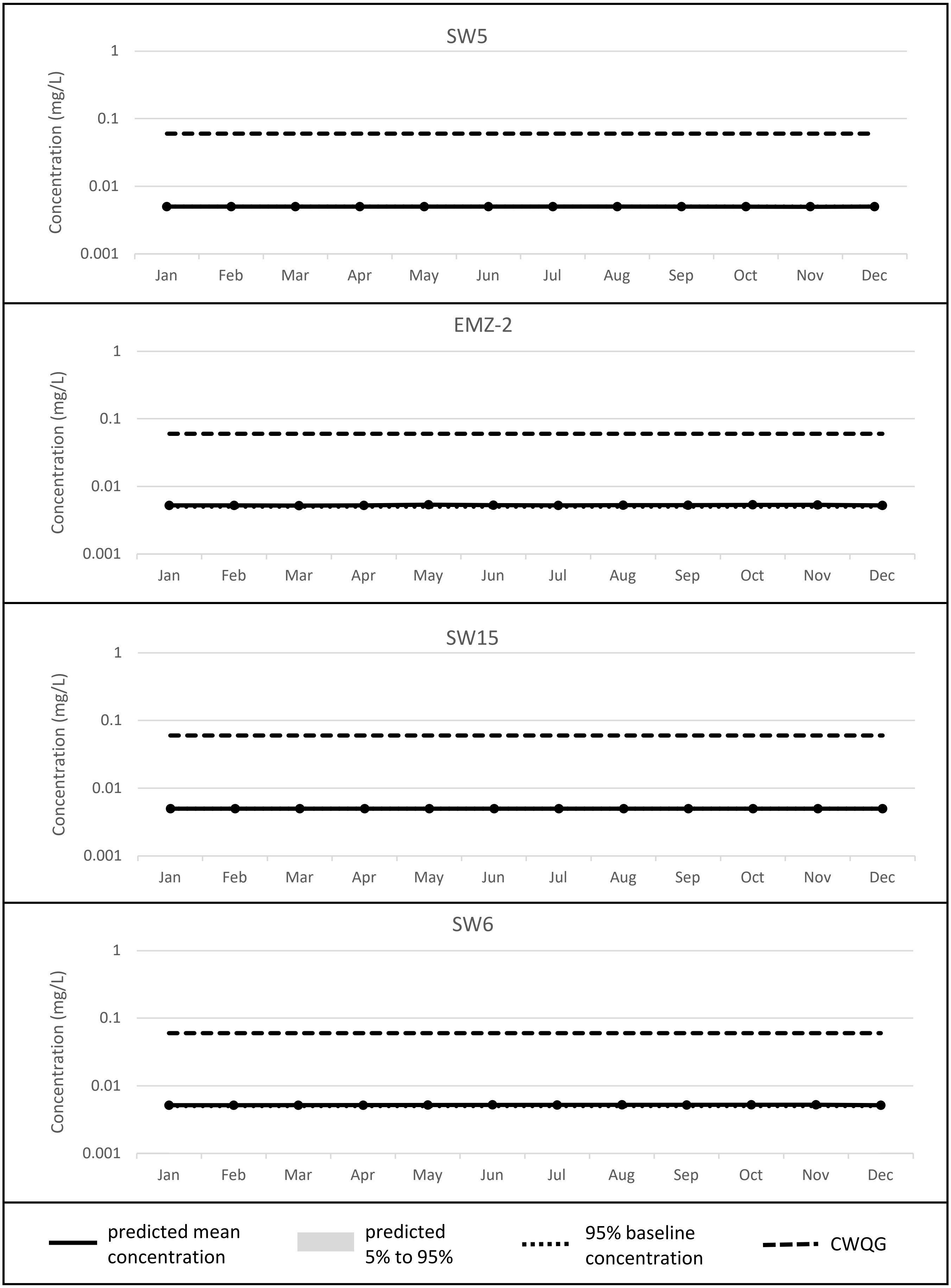


FIGURE C-61: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED SELENIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

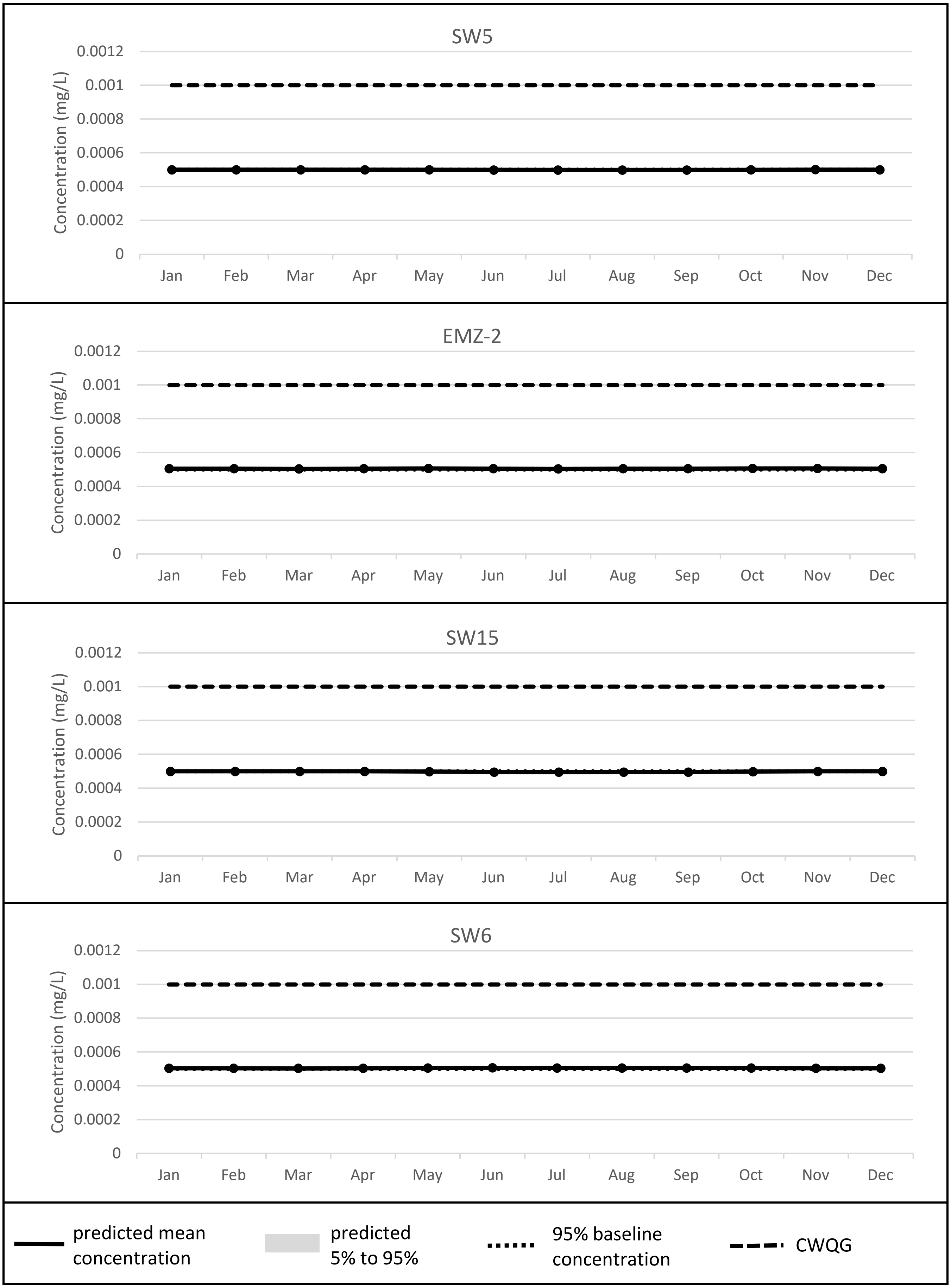


FIGURE C-62: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED SILVER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

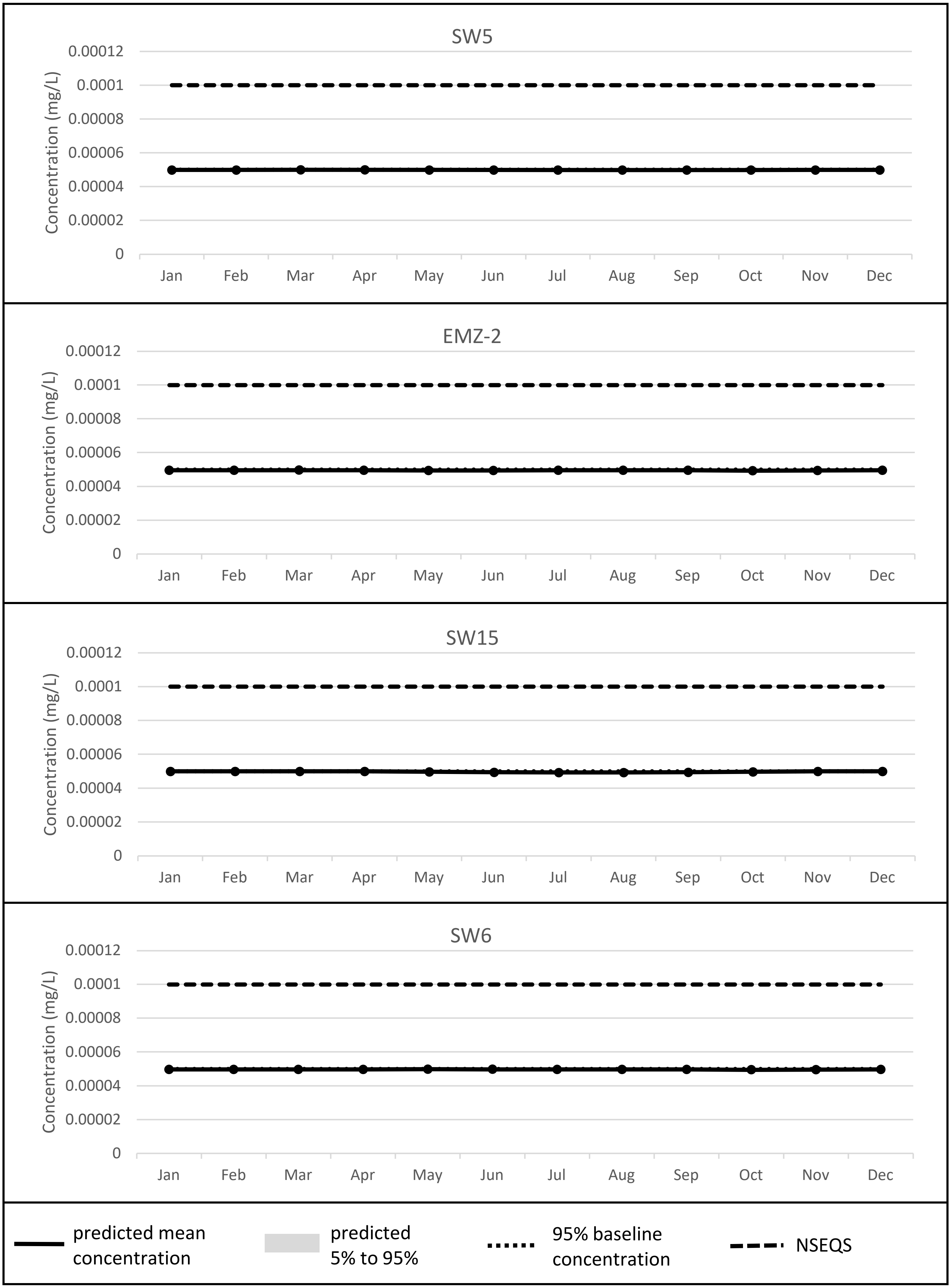


FIGURE C-63: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED THALLIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

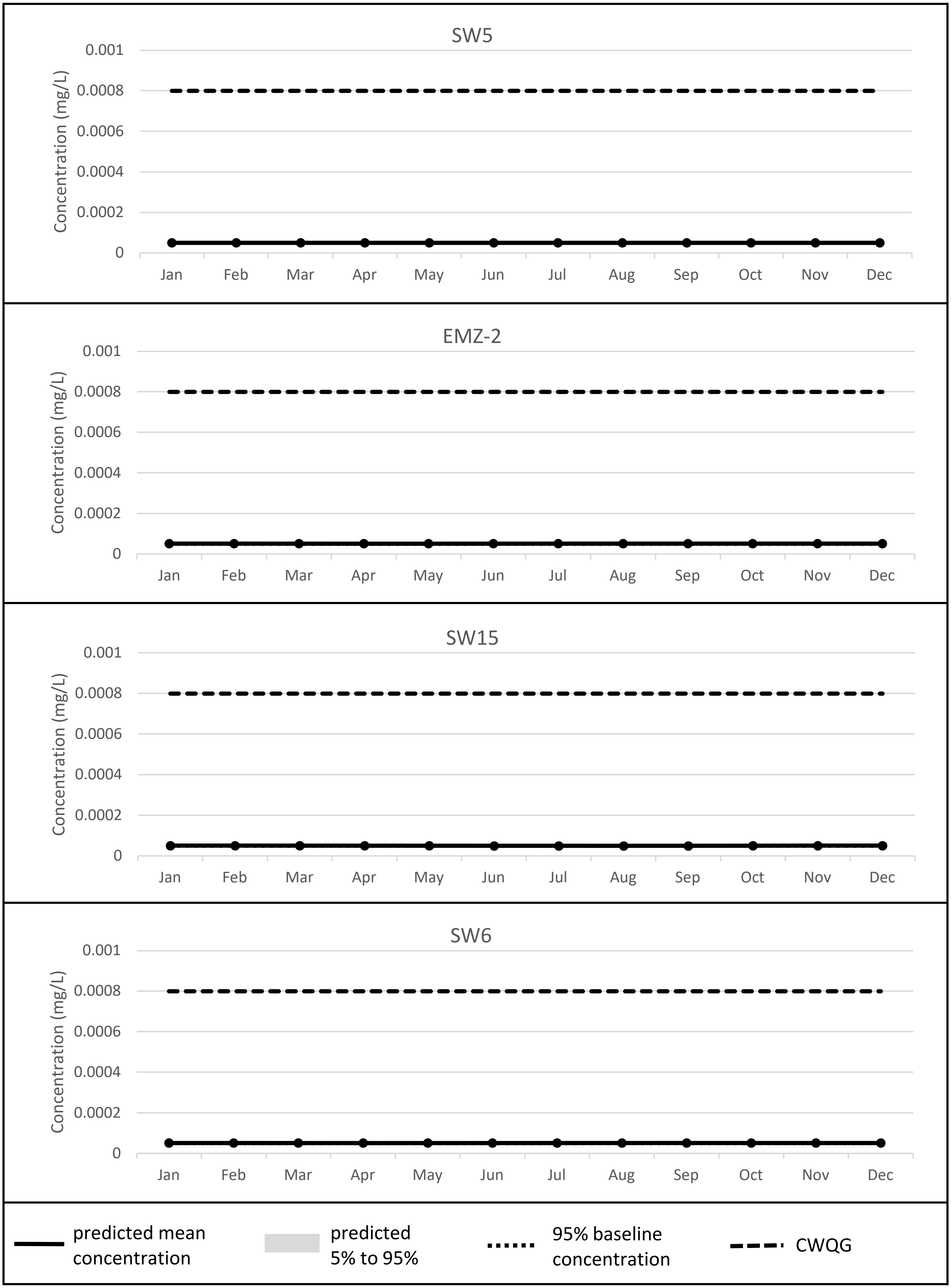


FIGURE C-64: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

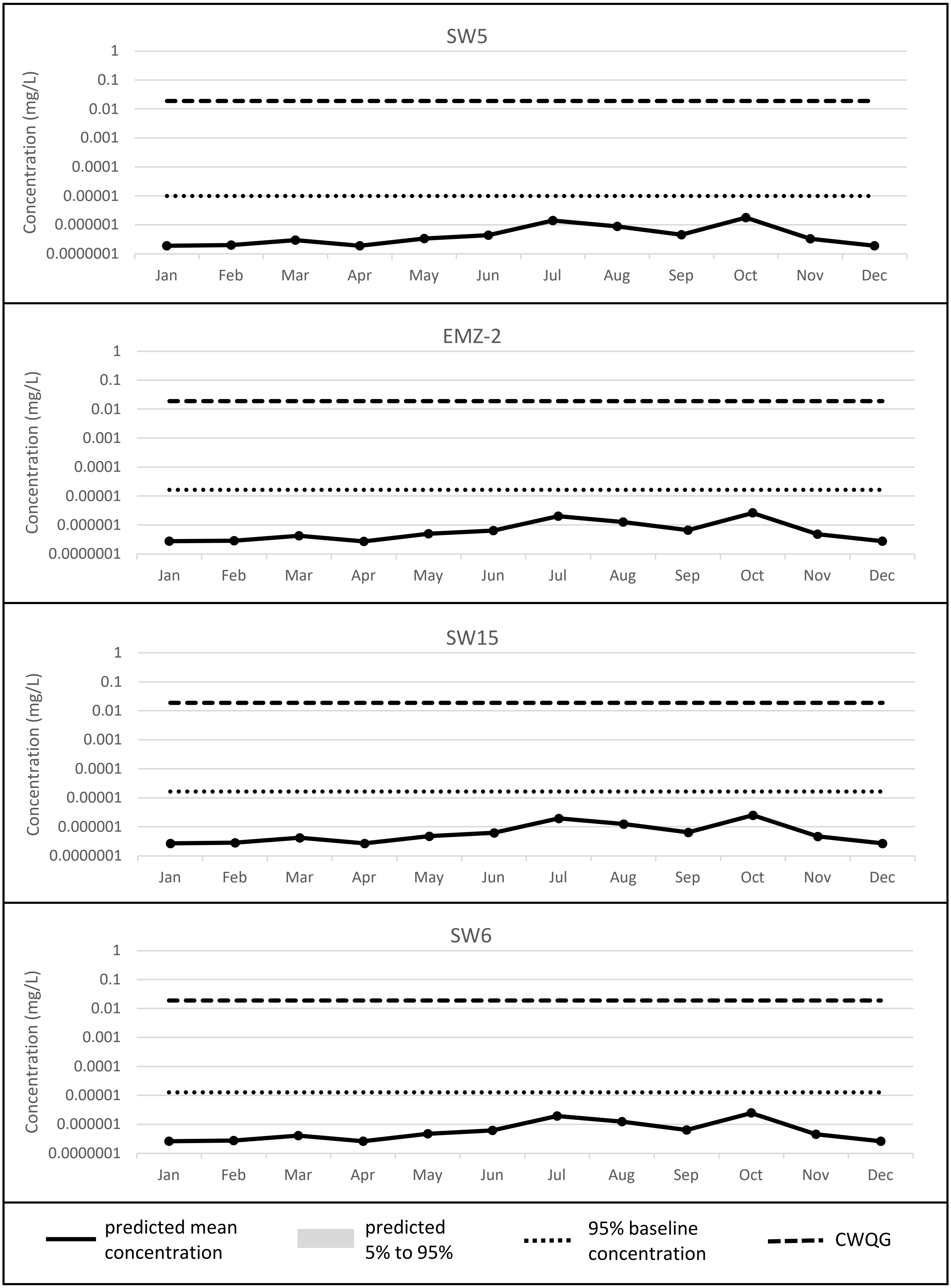


FIGURE C-65: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED URANIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

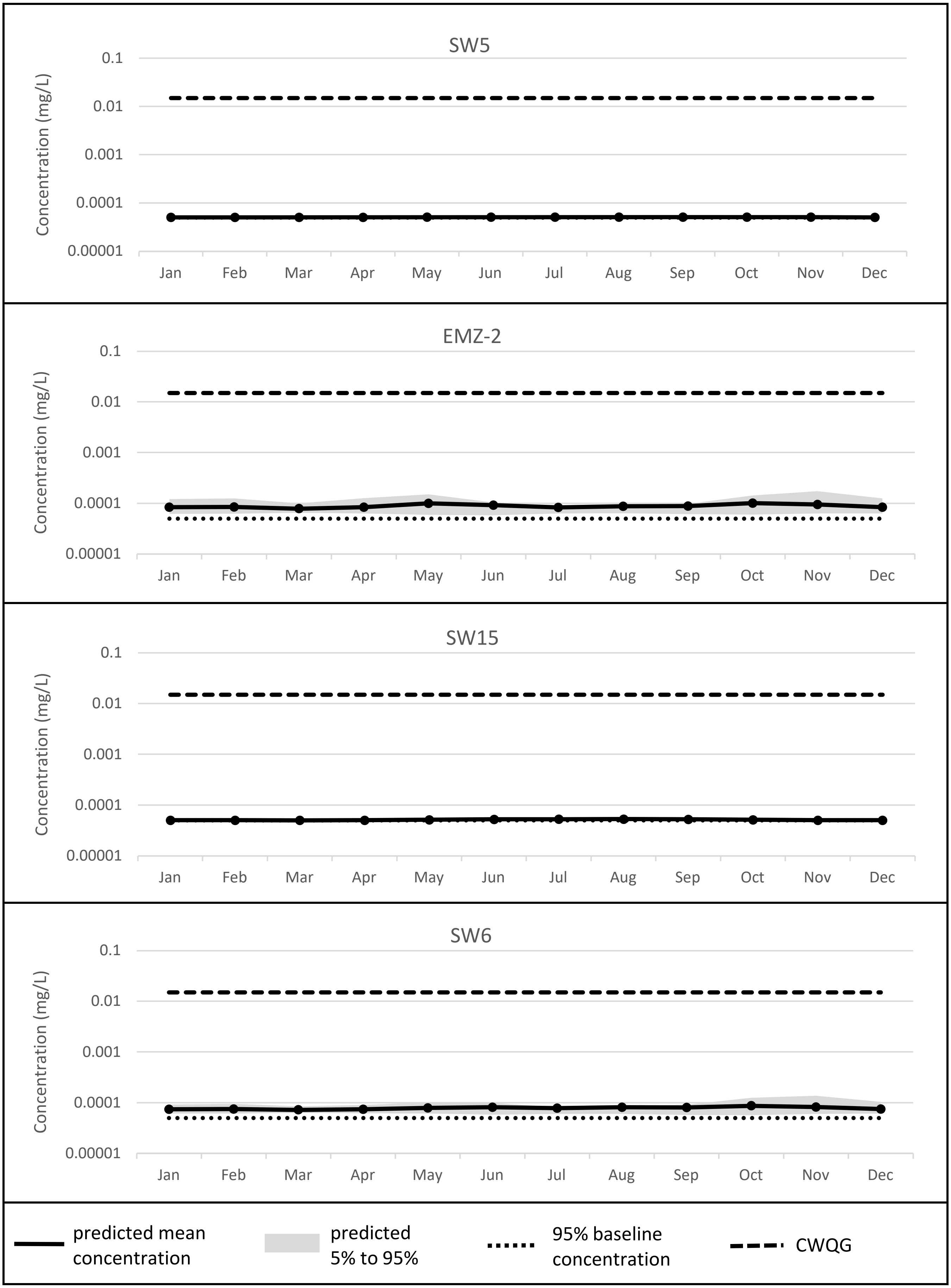


FIGURE C-66: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ZINC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

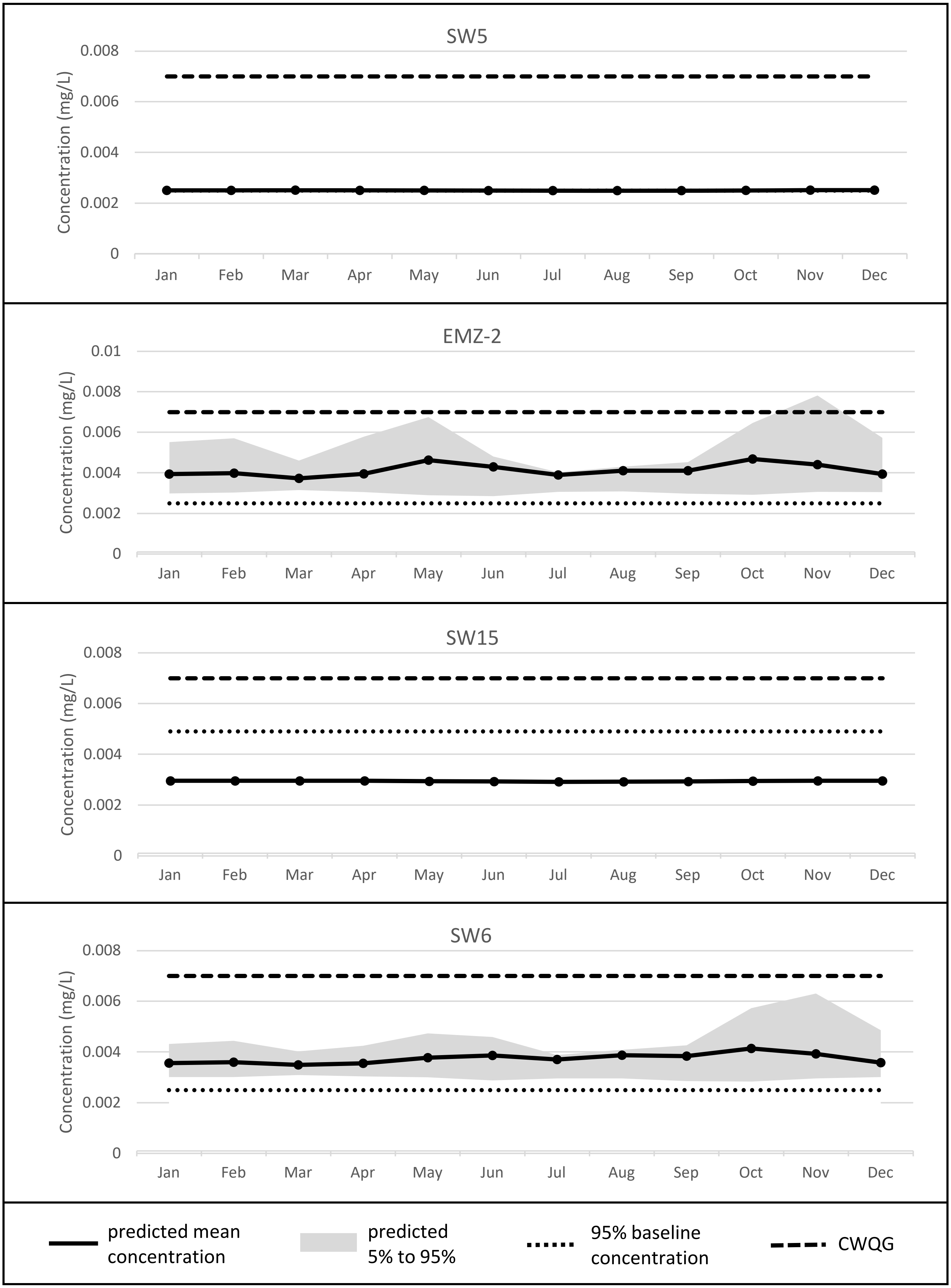


FIGURE C-67: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED ALUMINUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

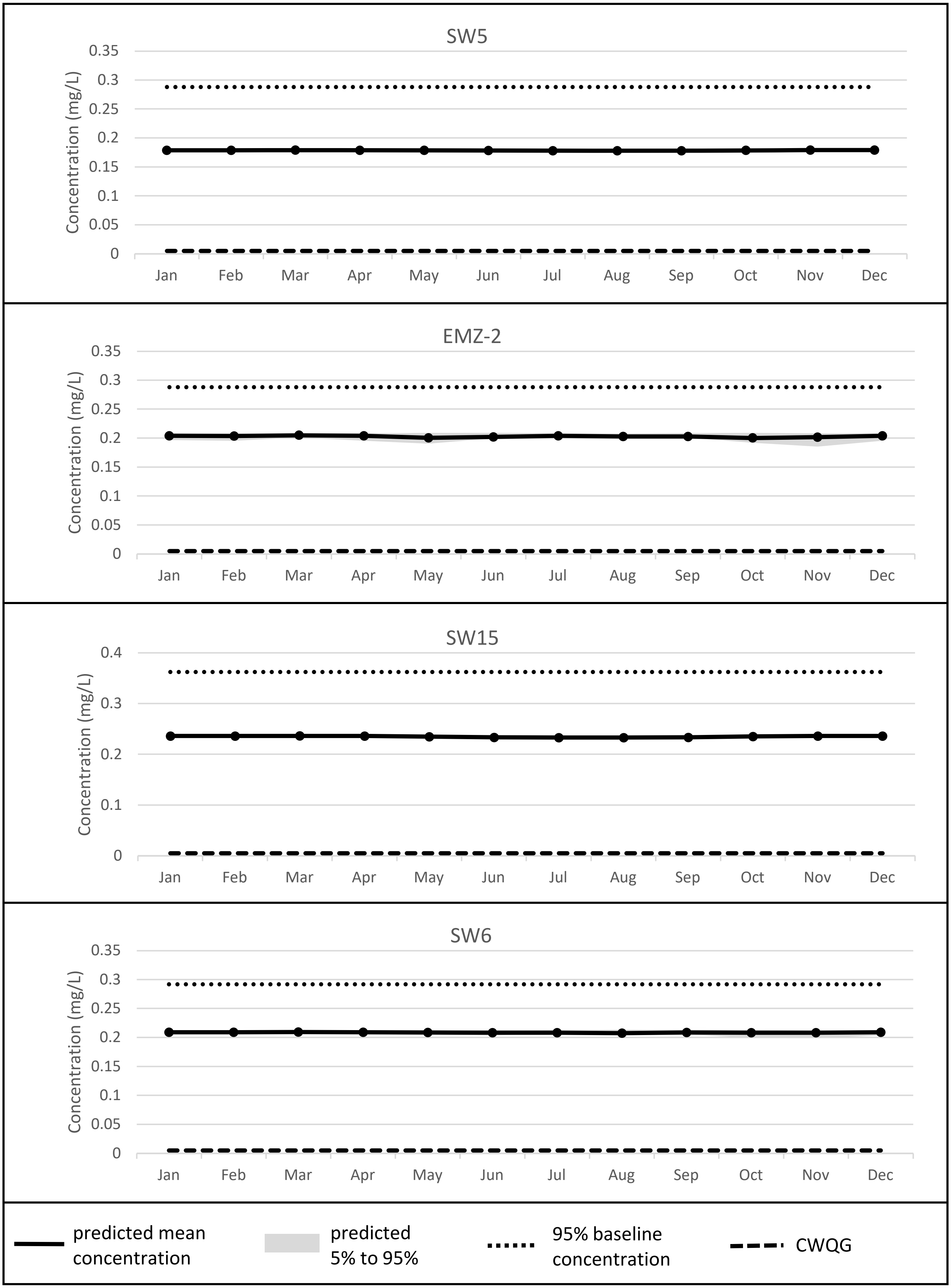


FIGURE C-68: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED ANTIMONY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

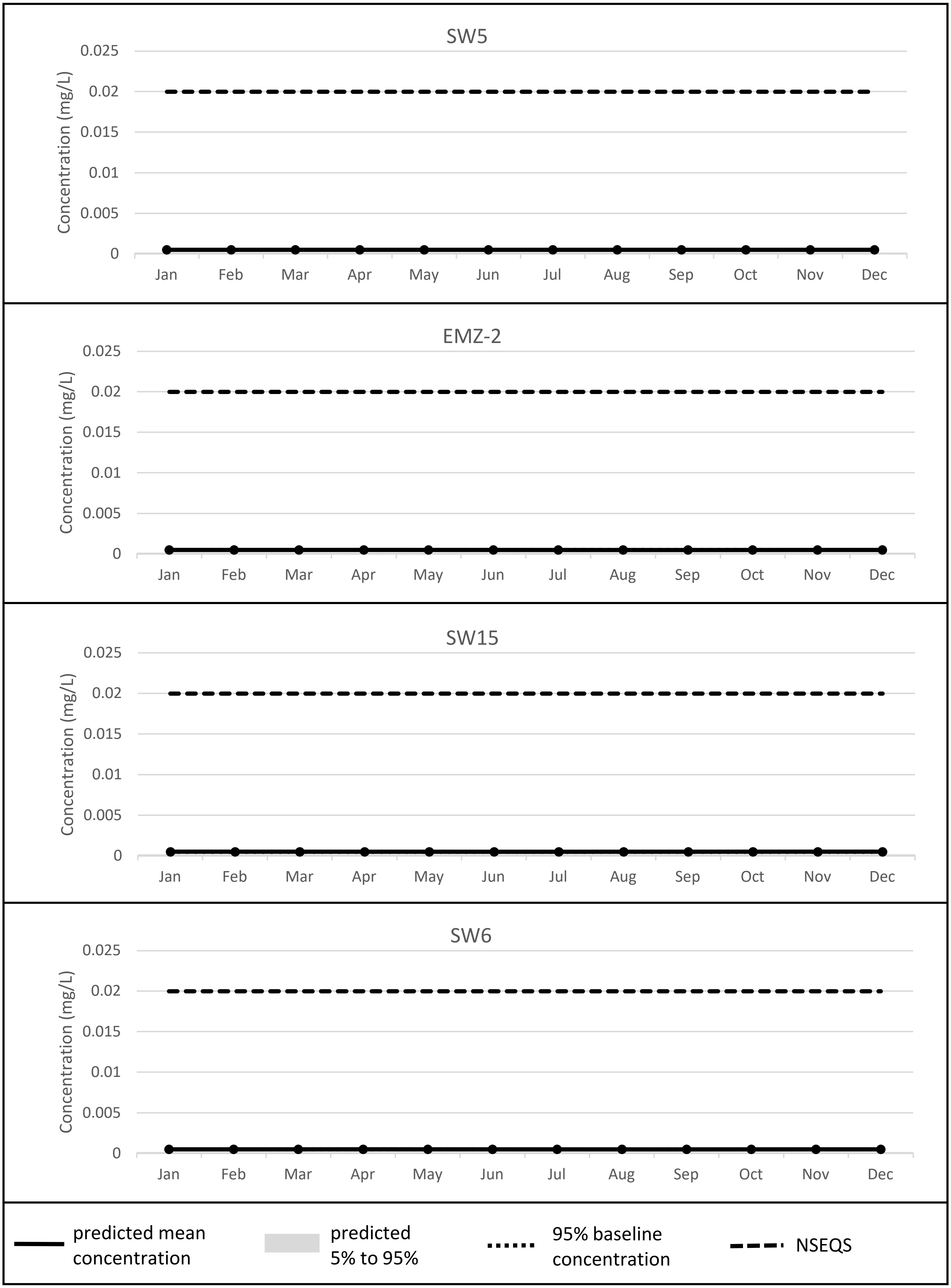


FIGURE C-69: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED ARSENIC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

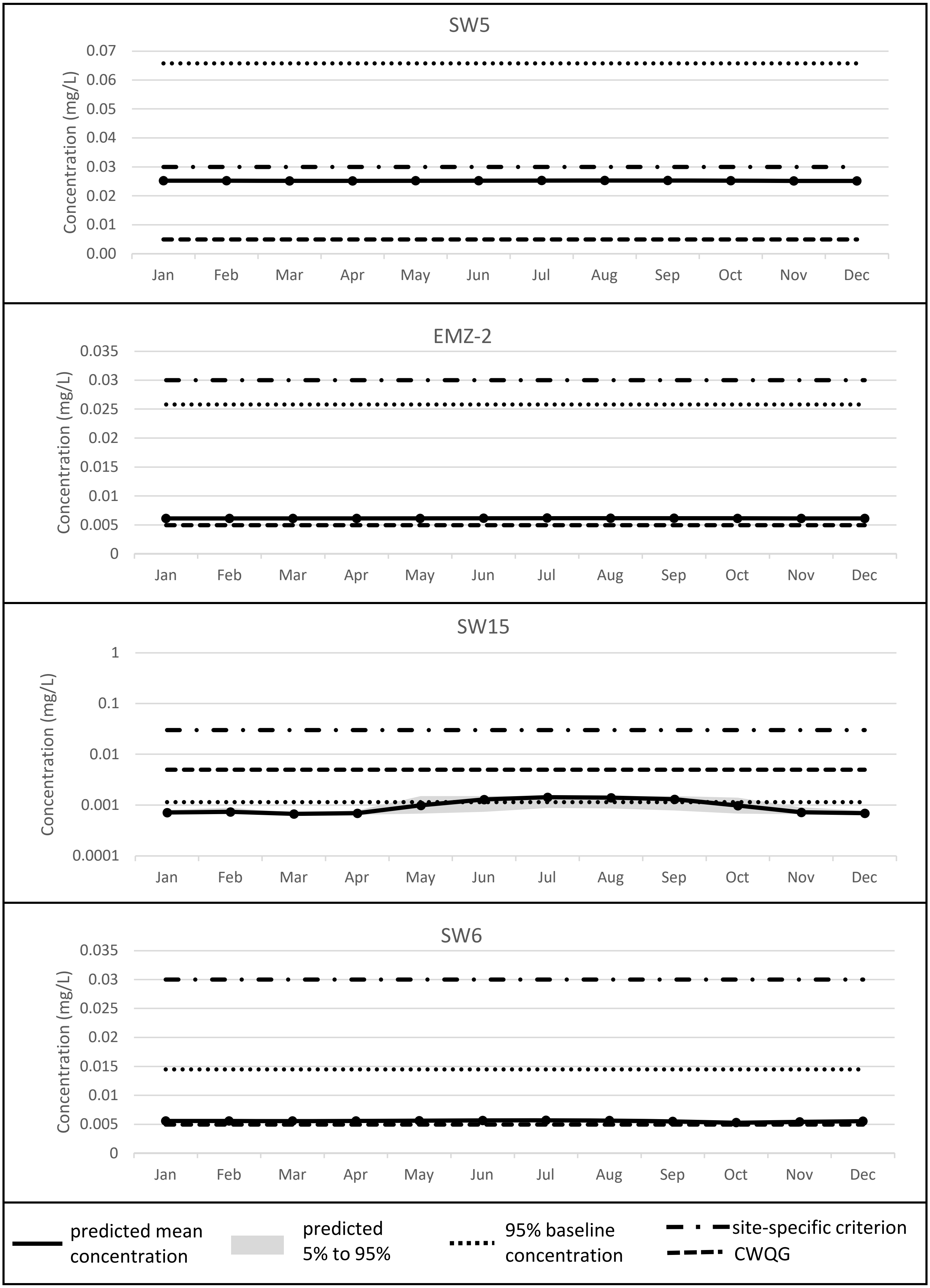


FIGURE C-70: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED BORON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

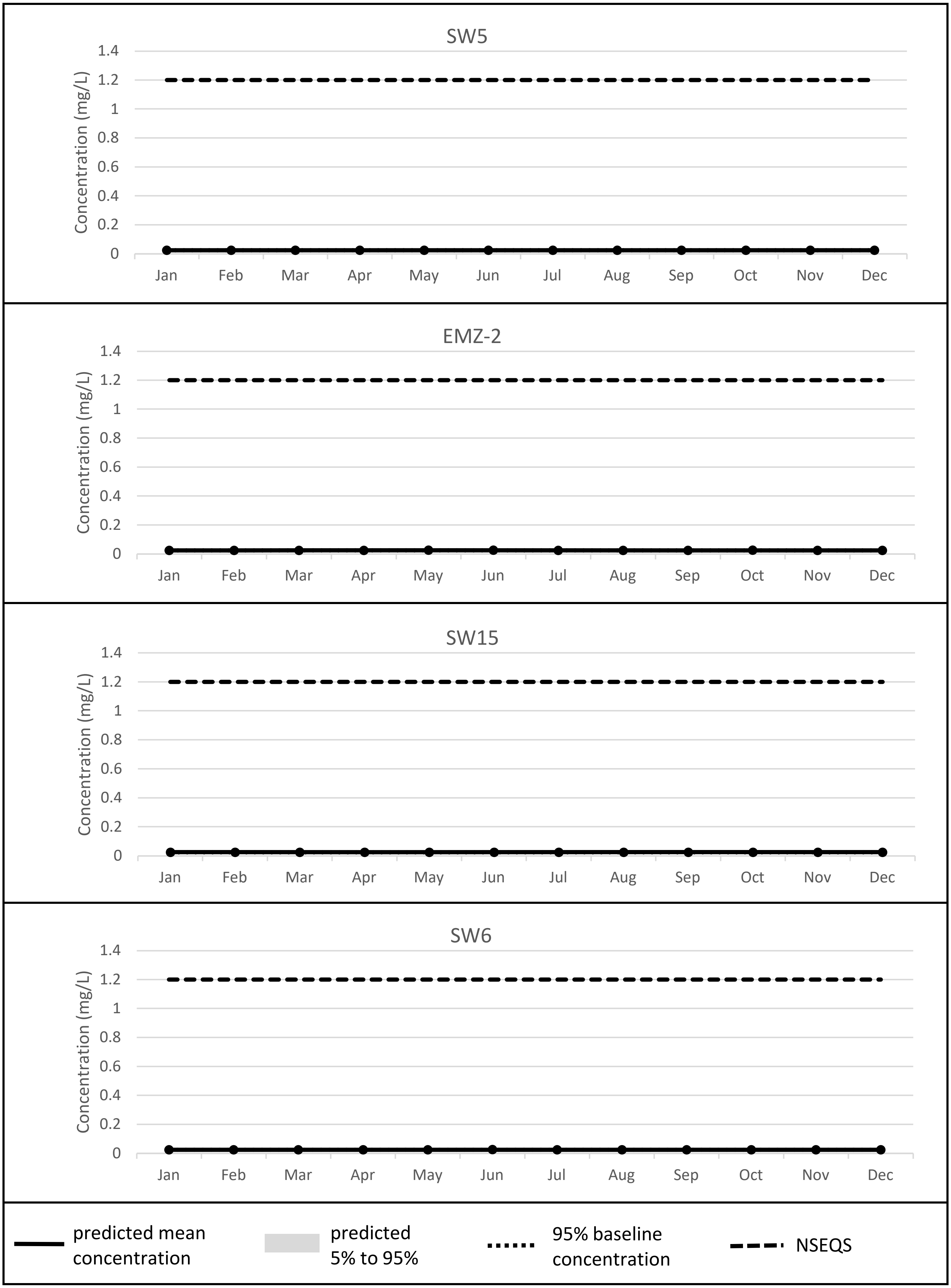


FIGURE C-71: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED CADMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

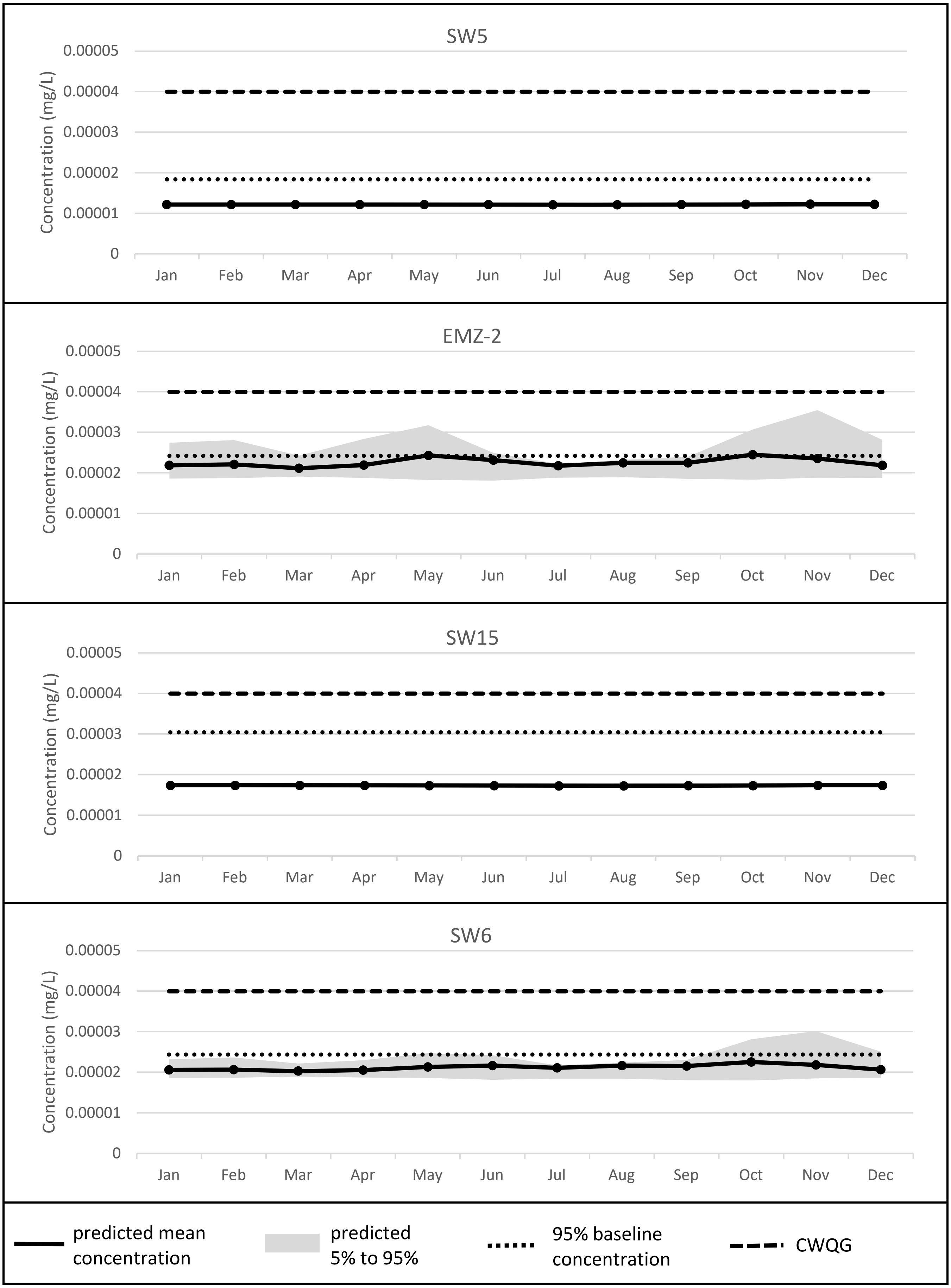


**FIGURE C-72: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED CHROMIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)**

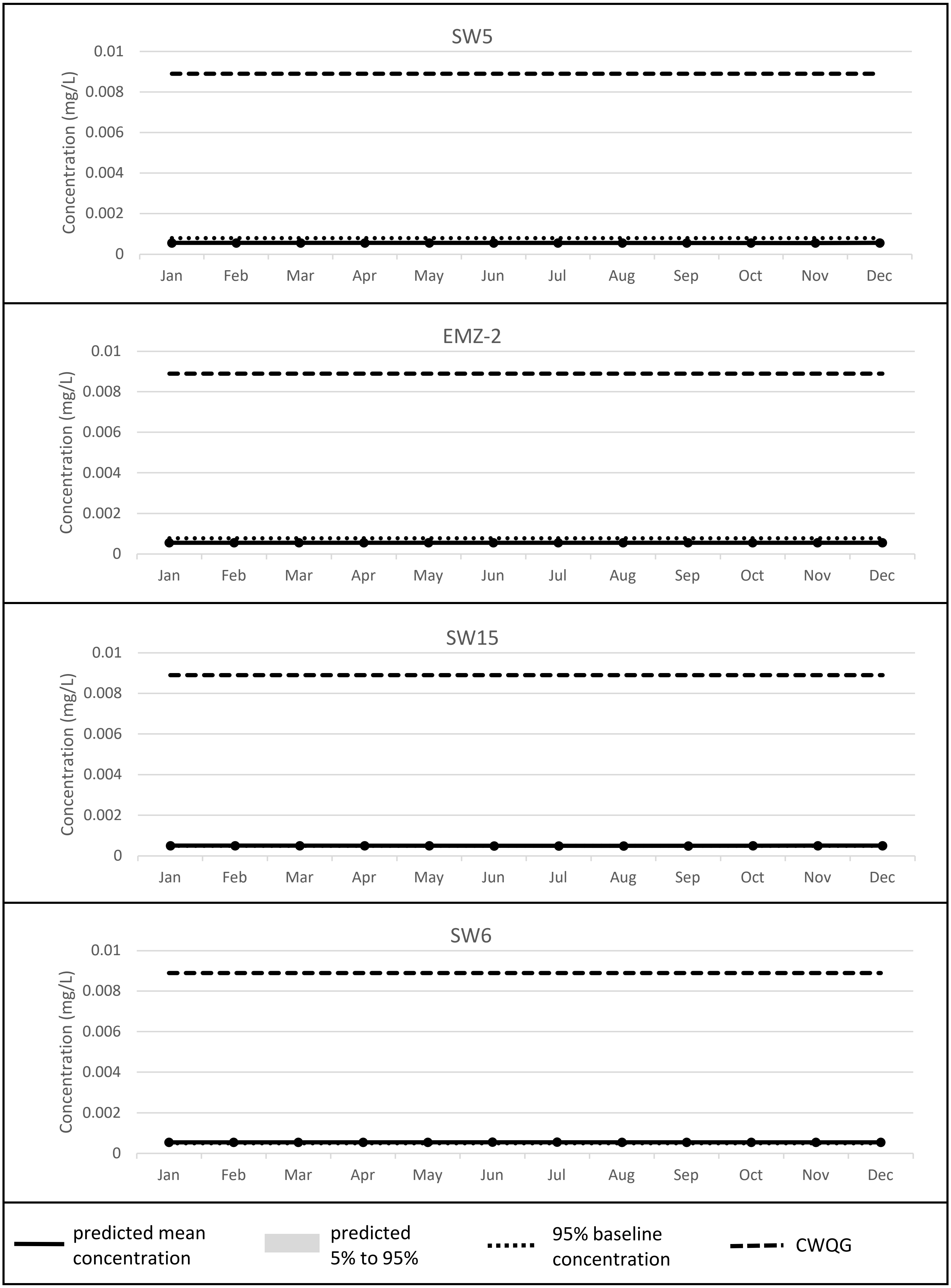


FIGURE C-73: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED COBALT CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

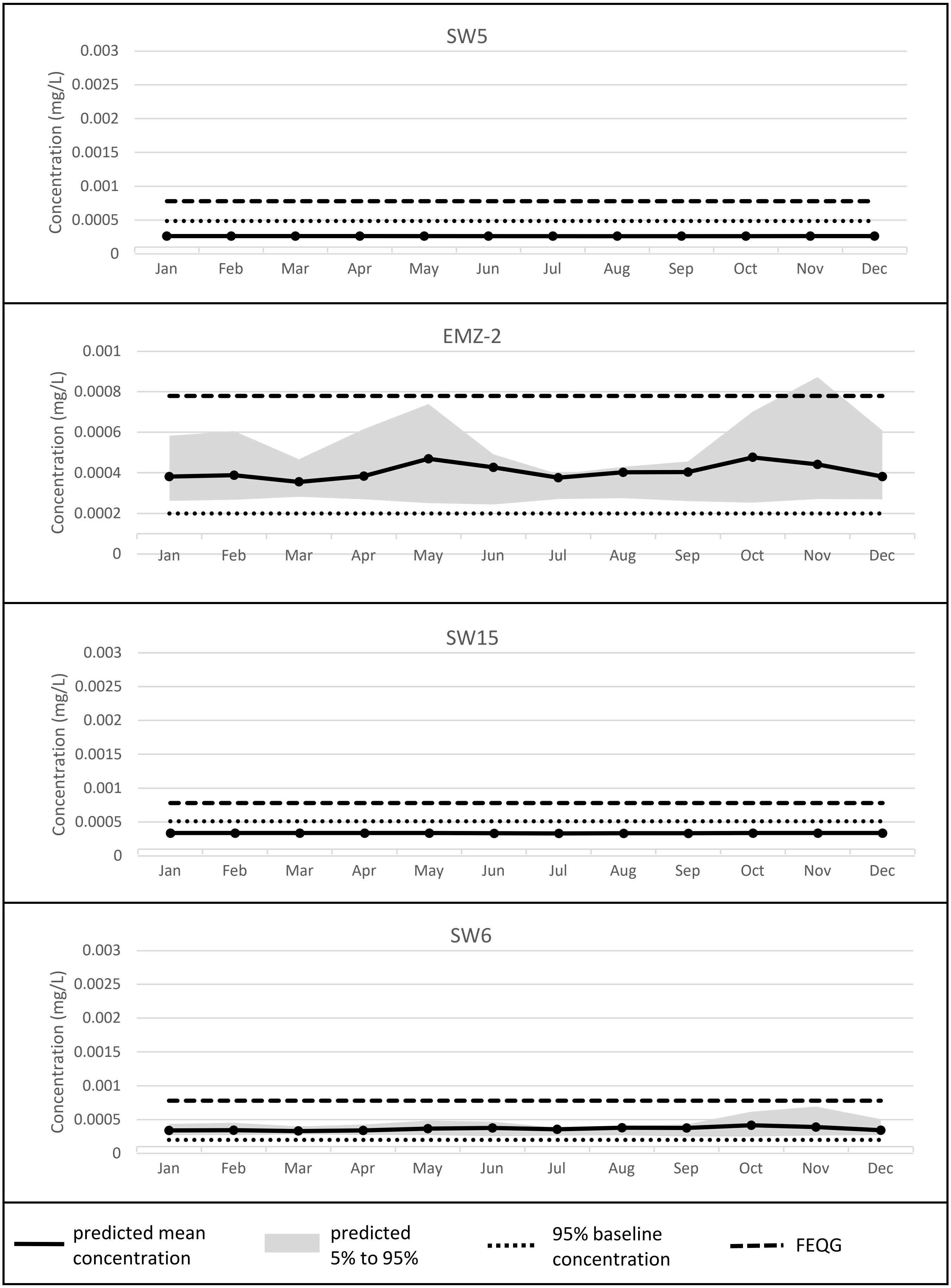


FIGURE C-74: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED COPPER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

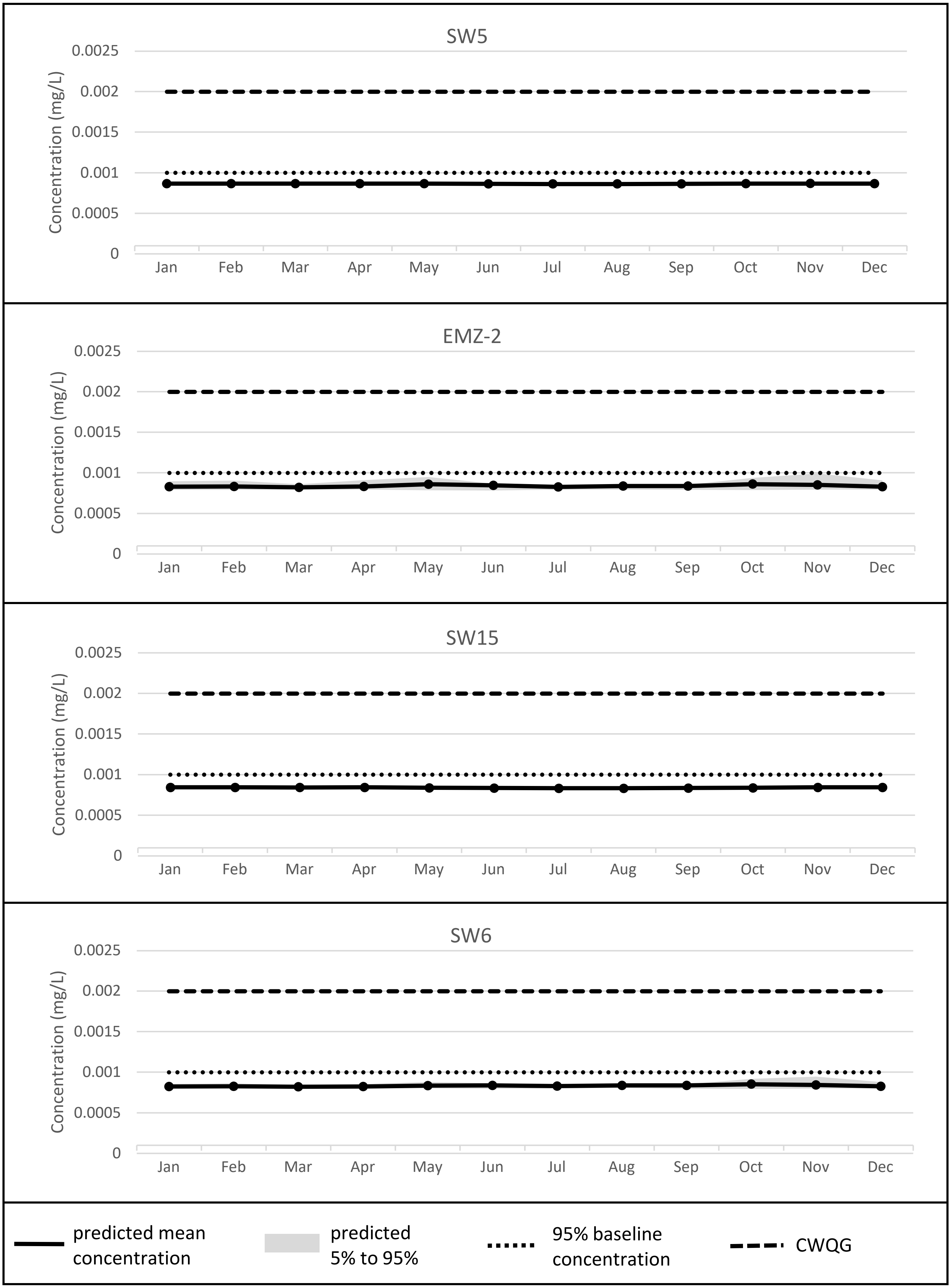


FIGURE C-75: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED IRON CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

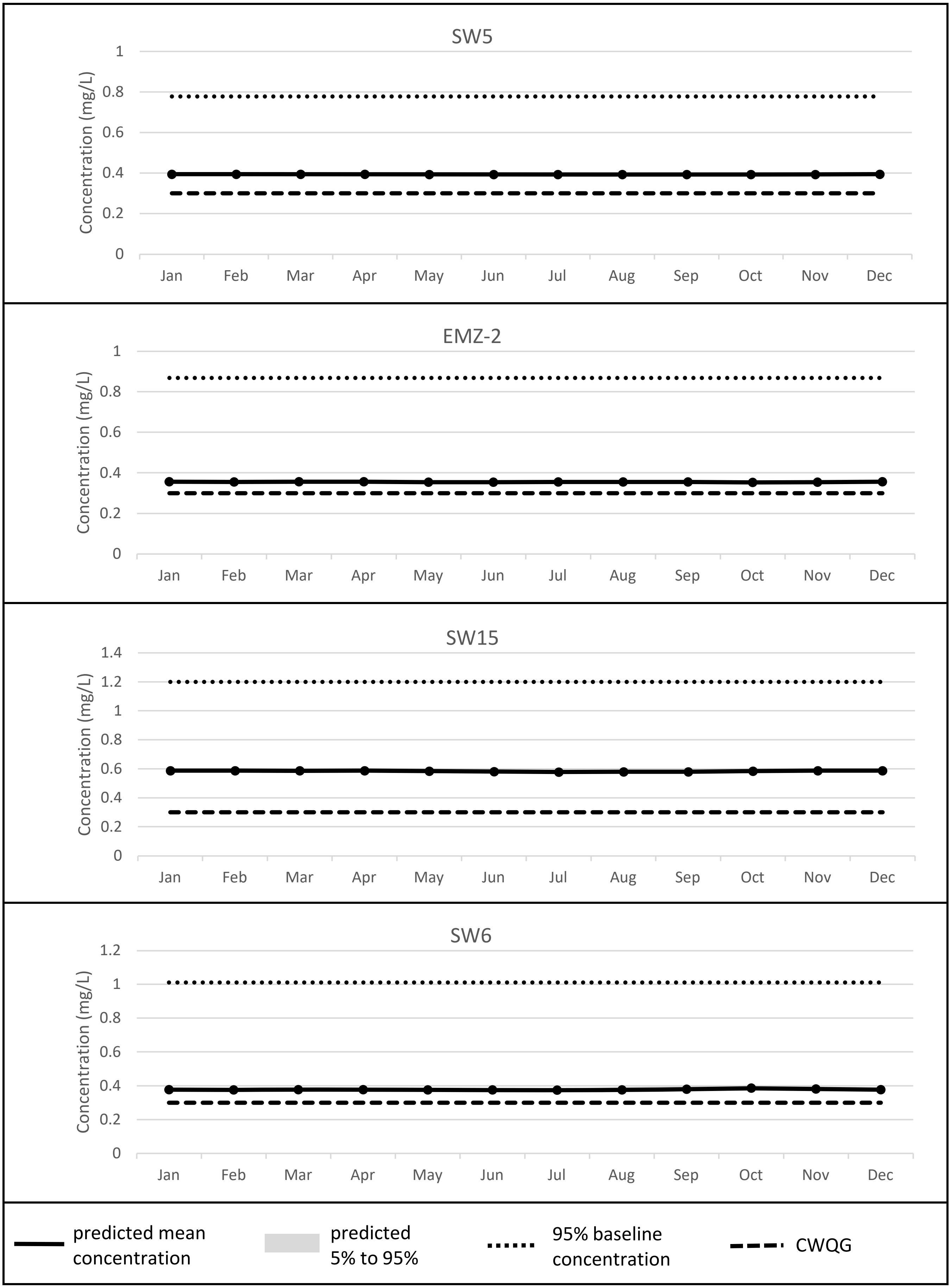


FIGURE C-76: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED LEAD CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

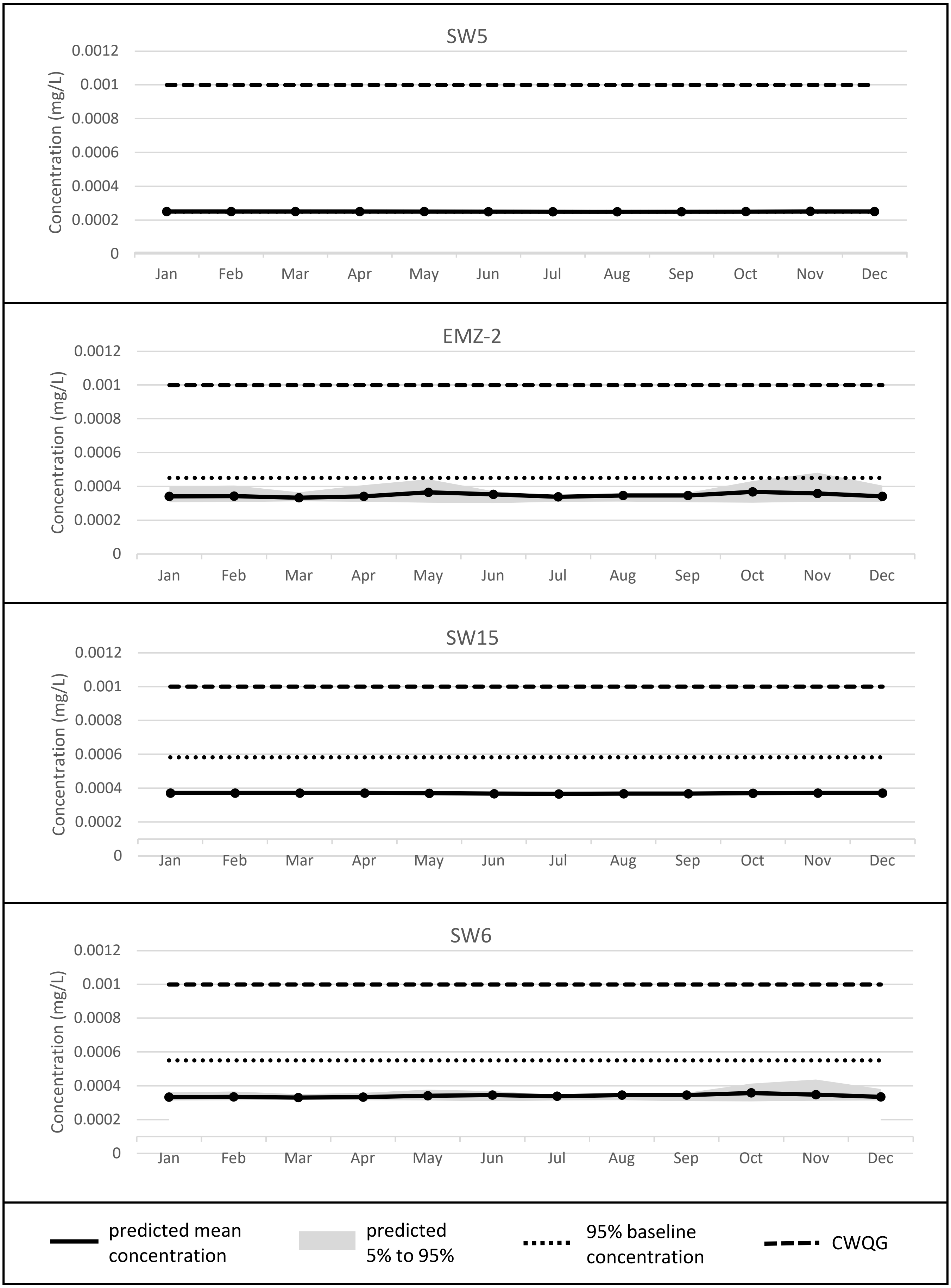


**FIGURE C-77: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED MANGANESE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)**

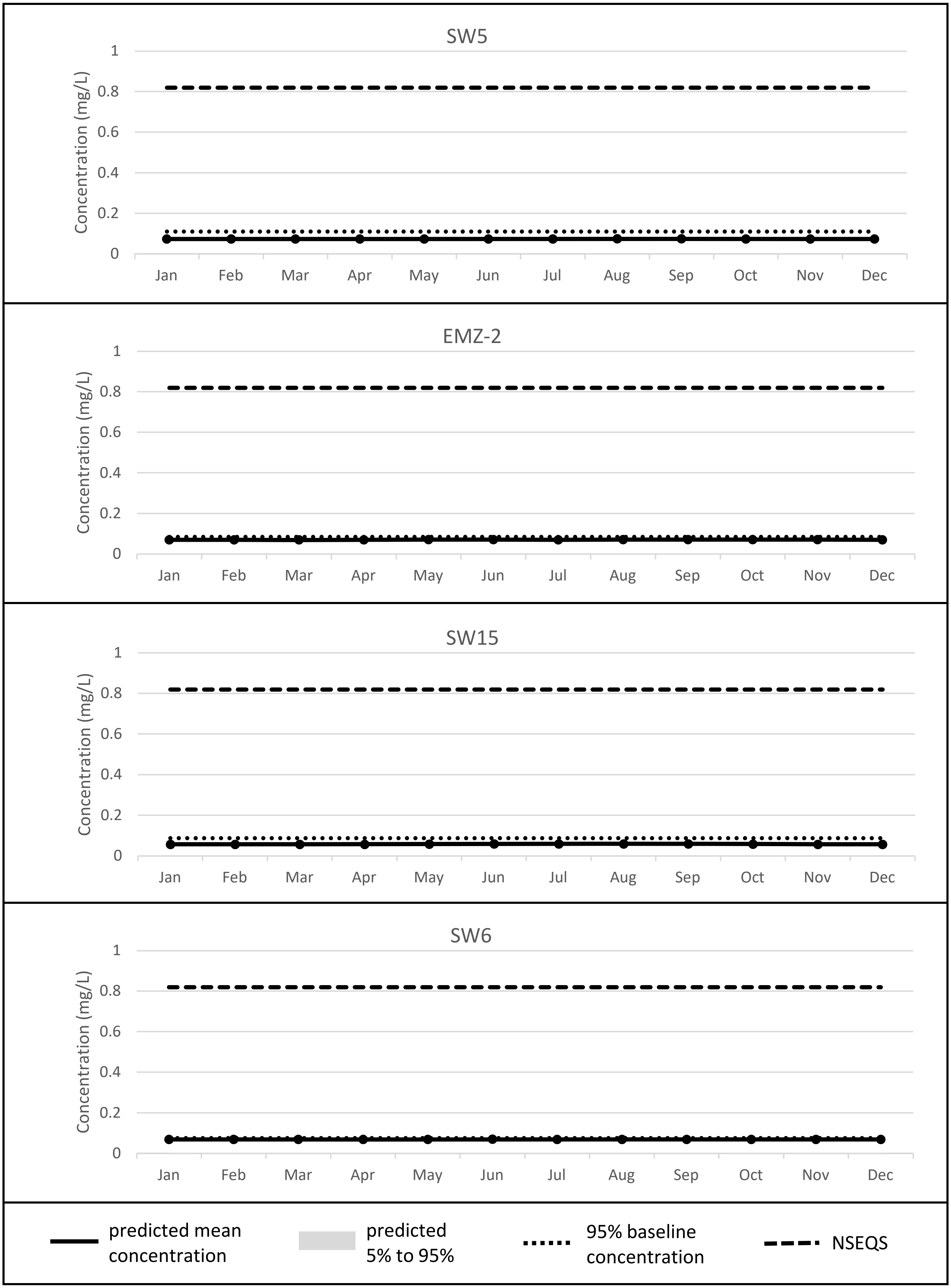


FIGURE C-78: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED MERCURY CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

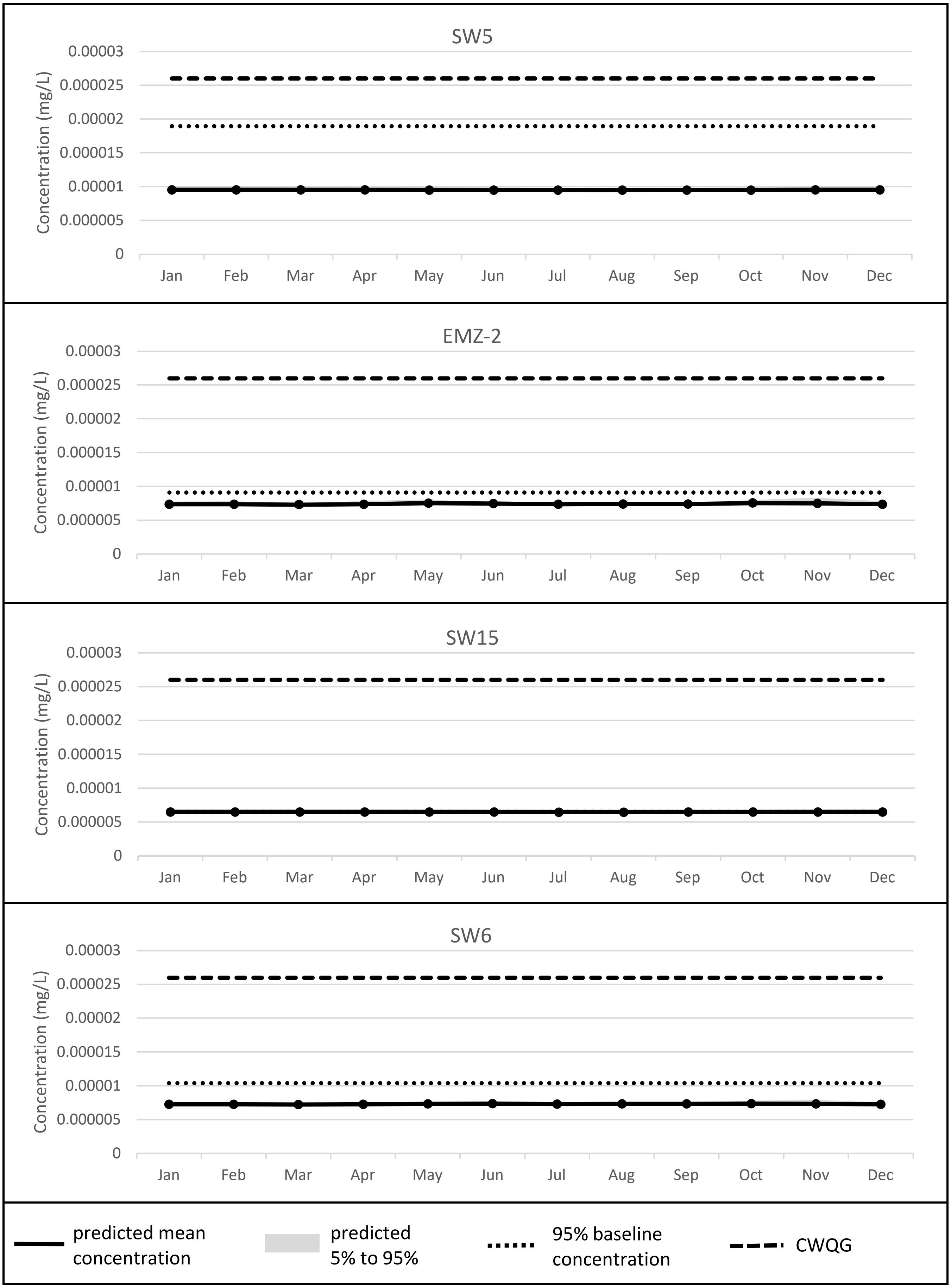


FIGURE C-79: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED MOLYBDENUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

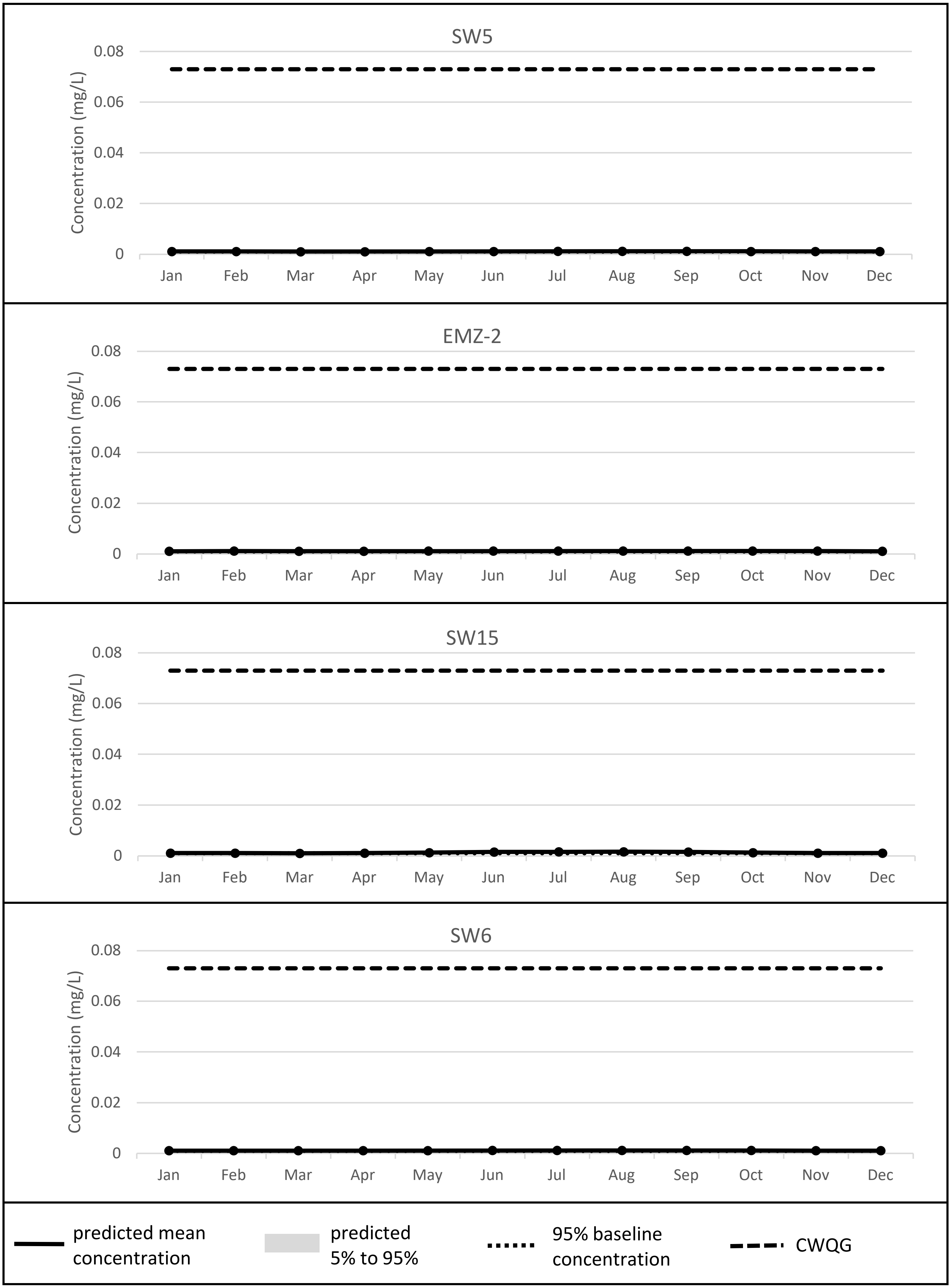


FIGURE C-80: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED NICKEL CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

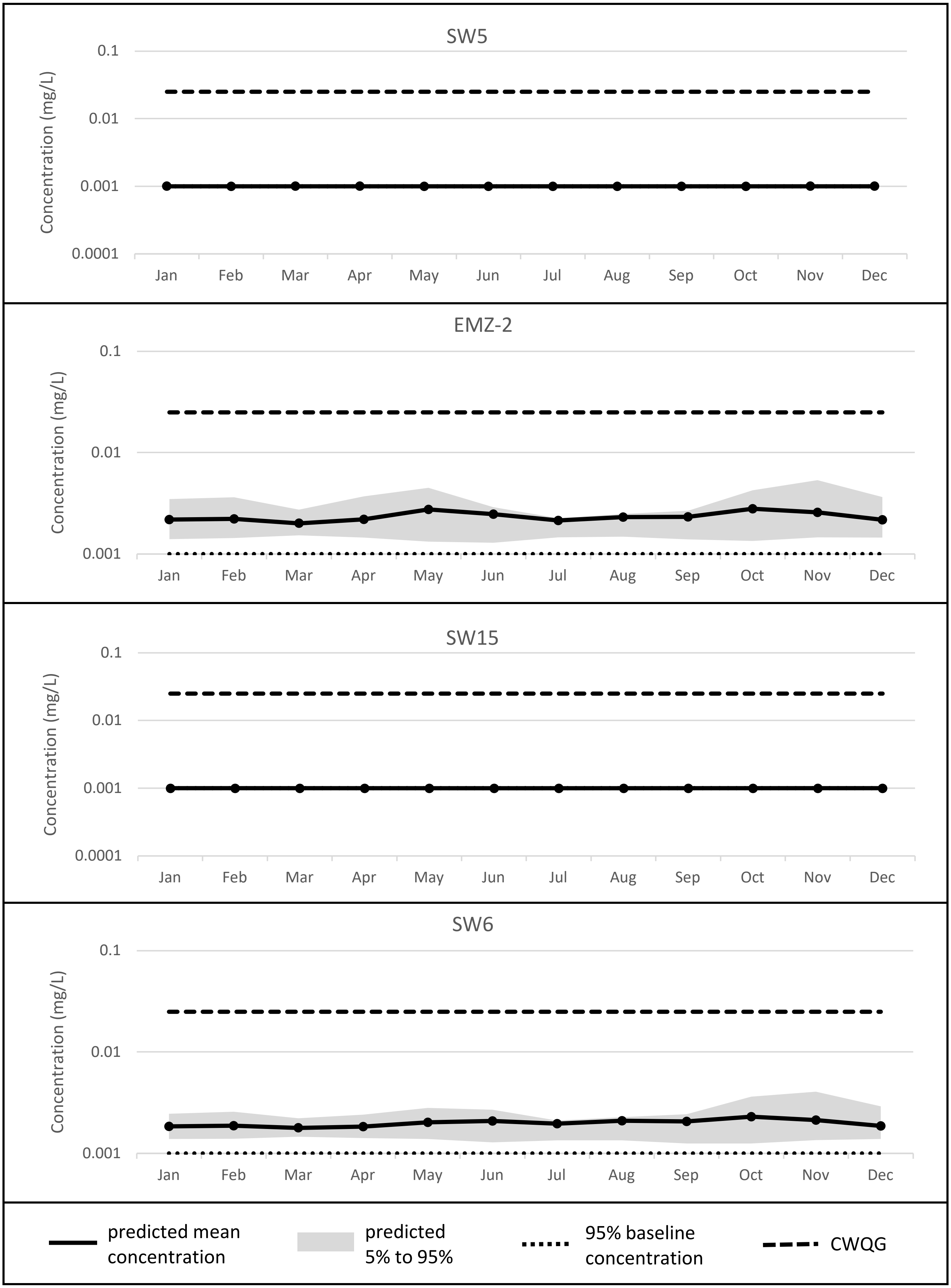


FIGURE C-81: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED NITRATE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

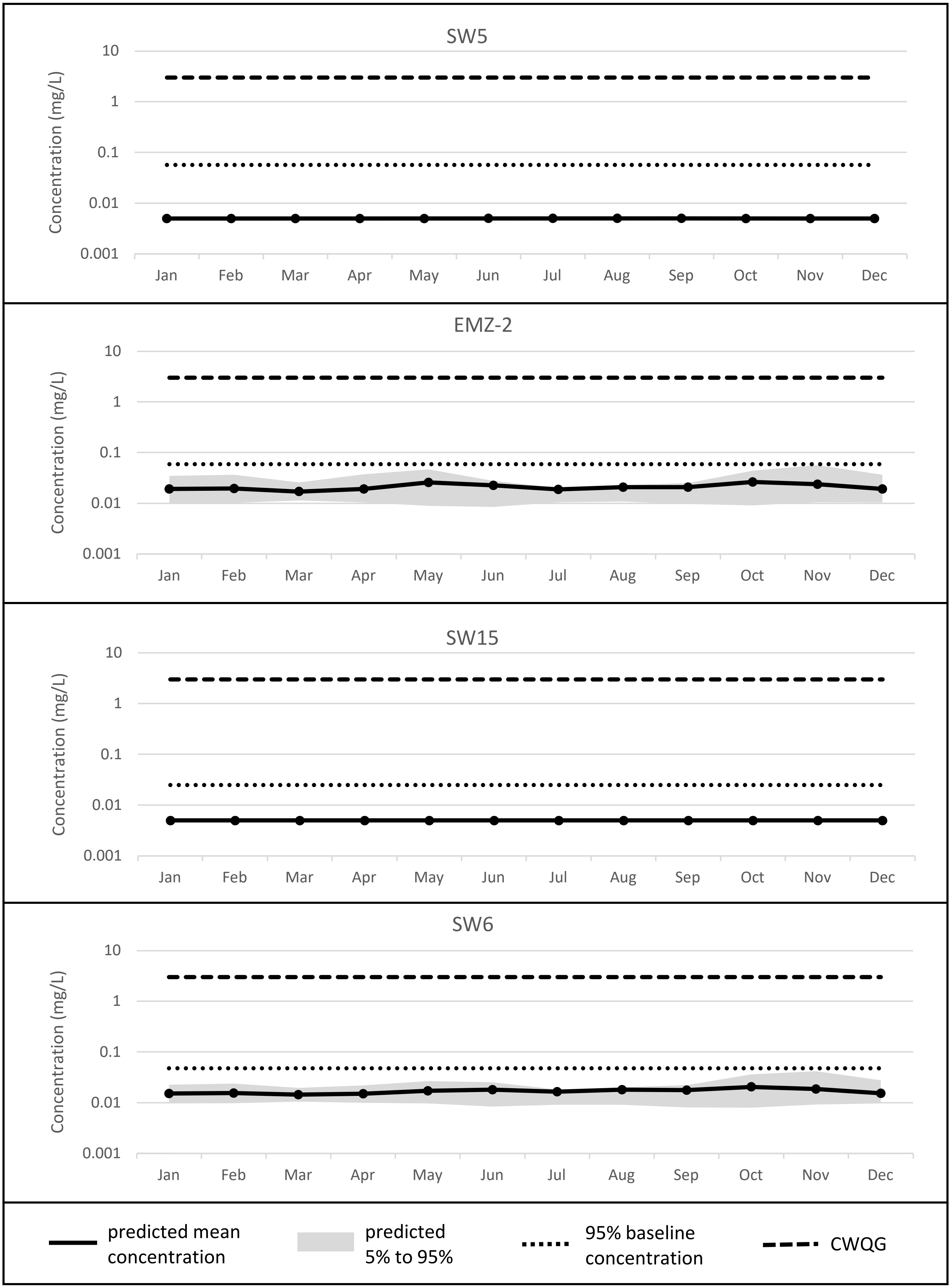


FIGURE C-82: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED NITRITE CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

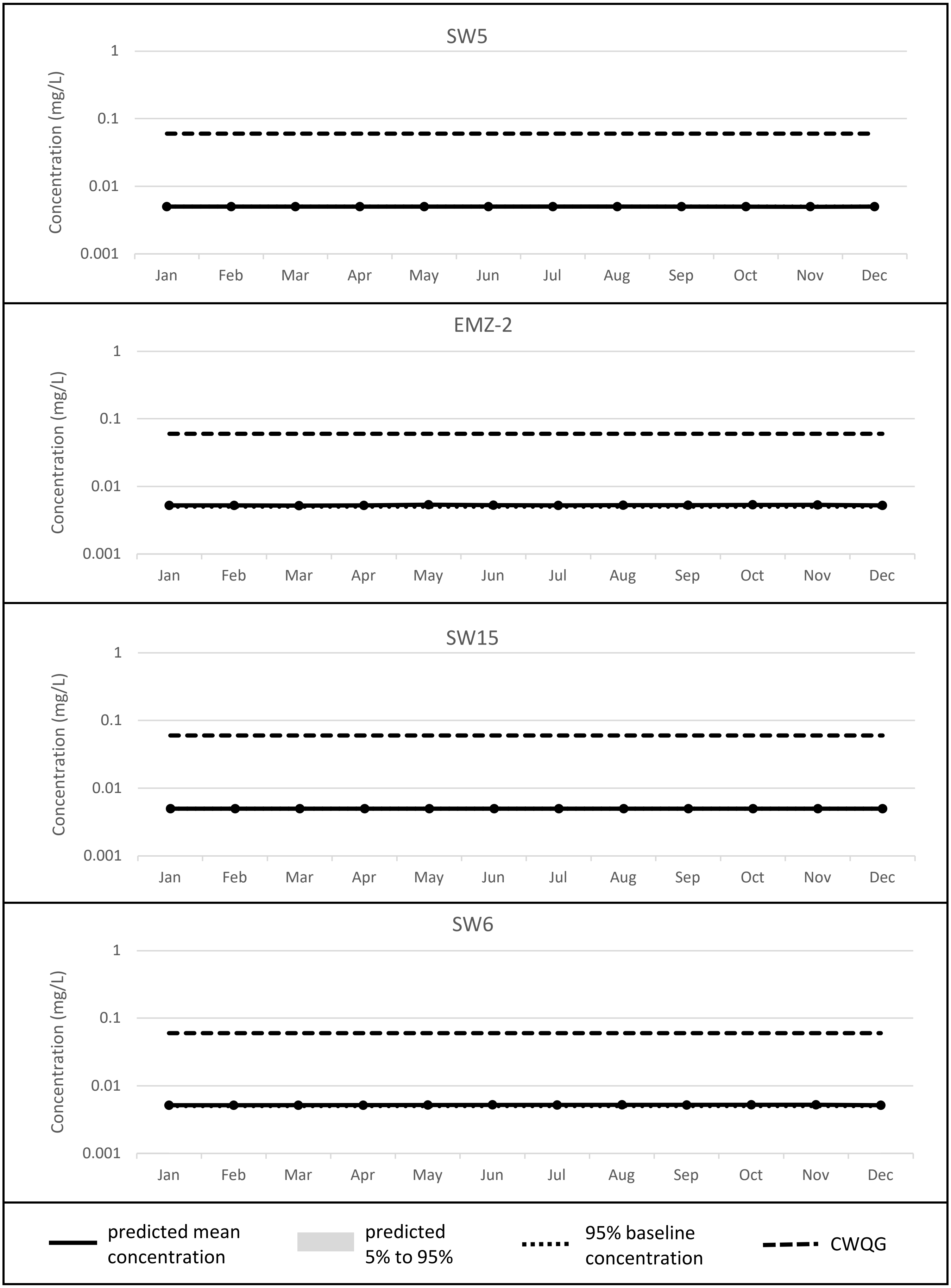


FIGURE C-83: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED SELENIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

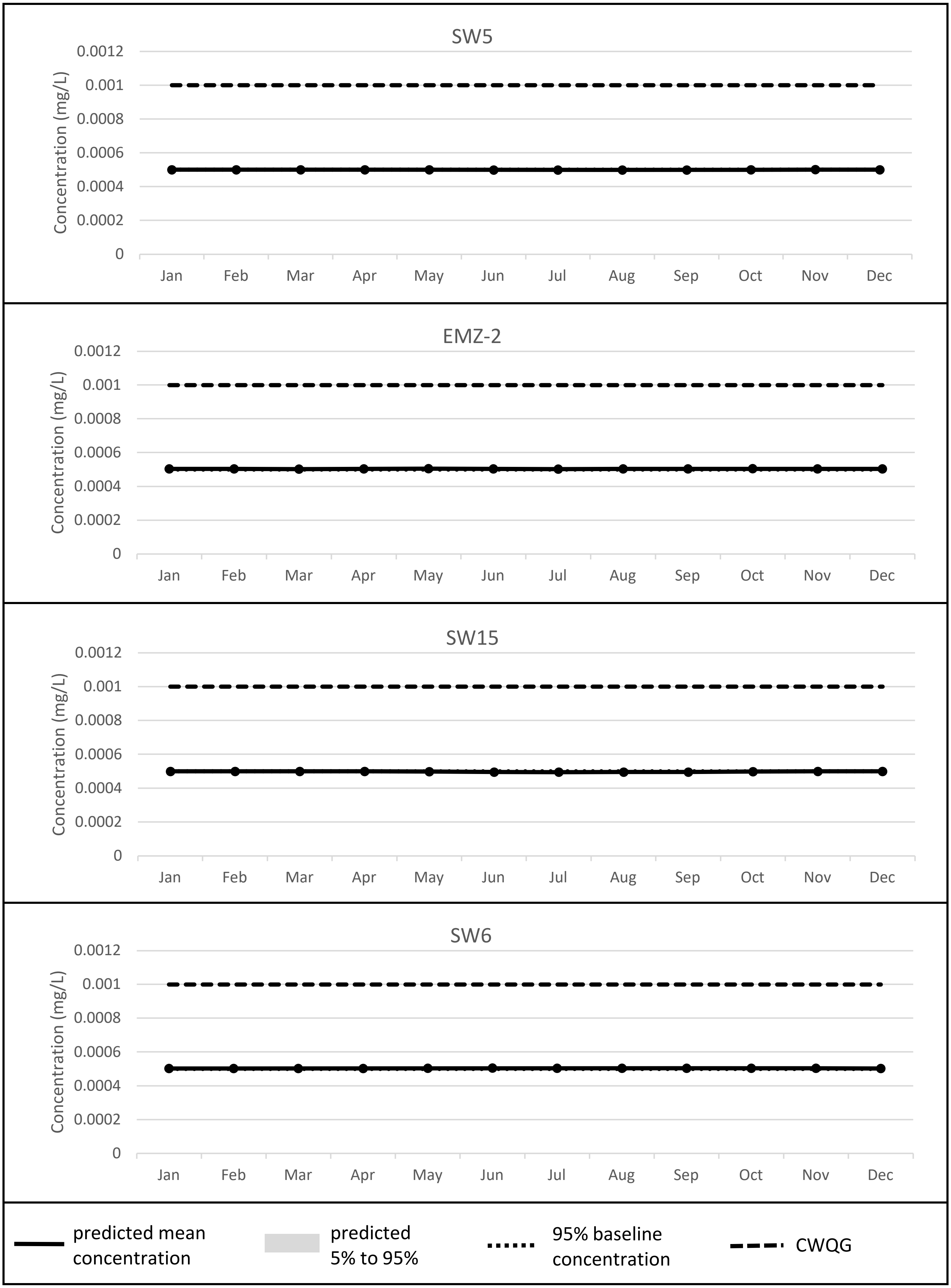


FIGURE C-84: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED SILVER CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

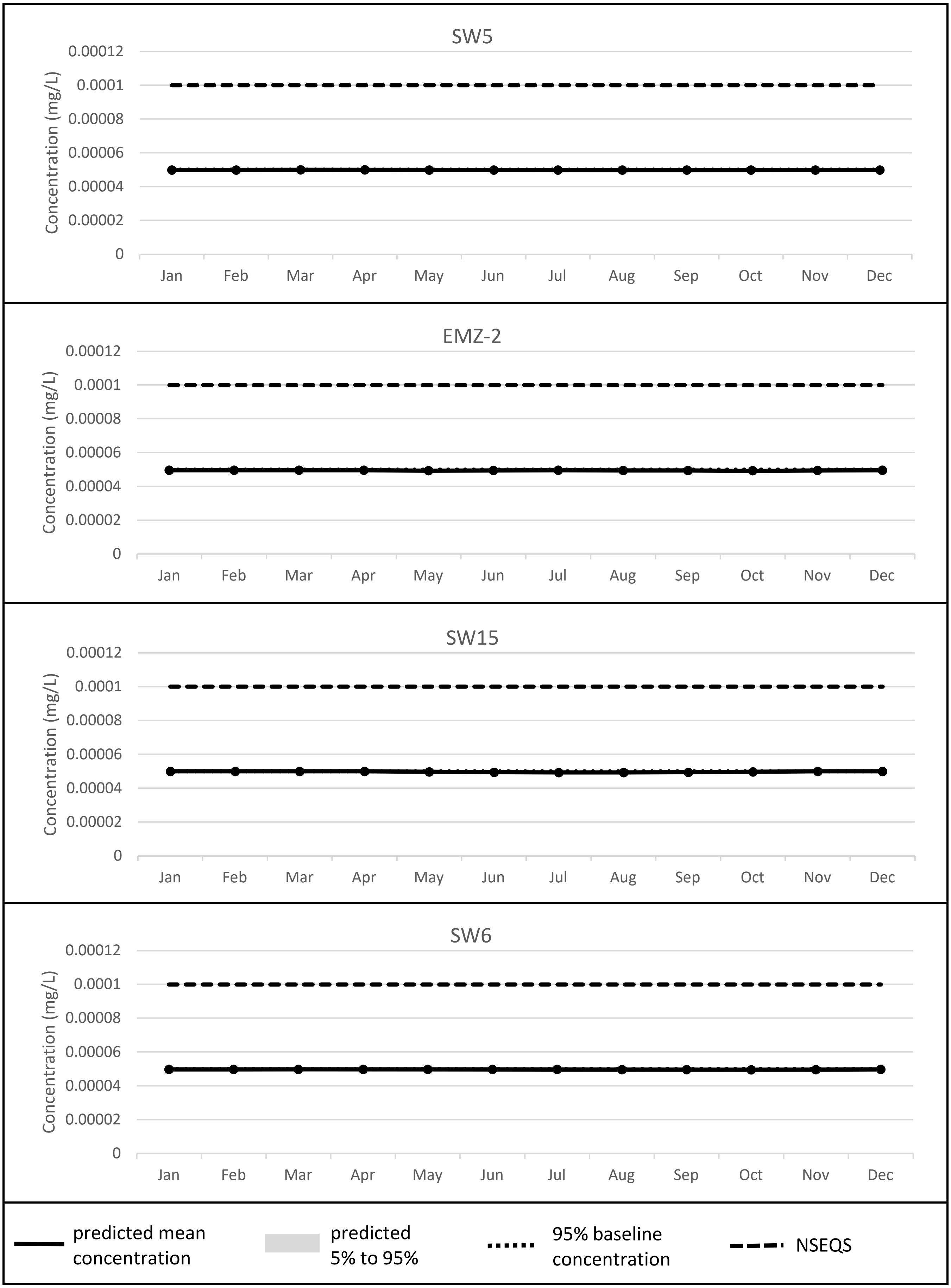


FIGURE C-85: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED THALLIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

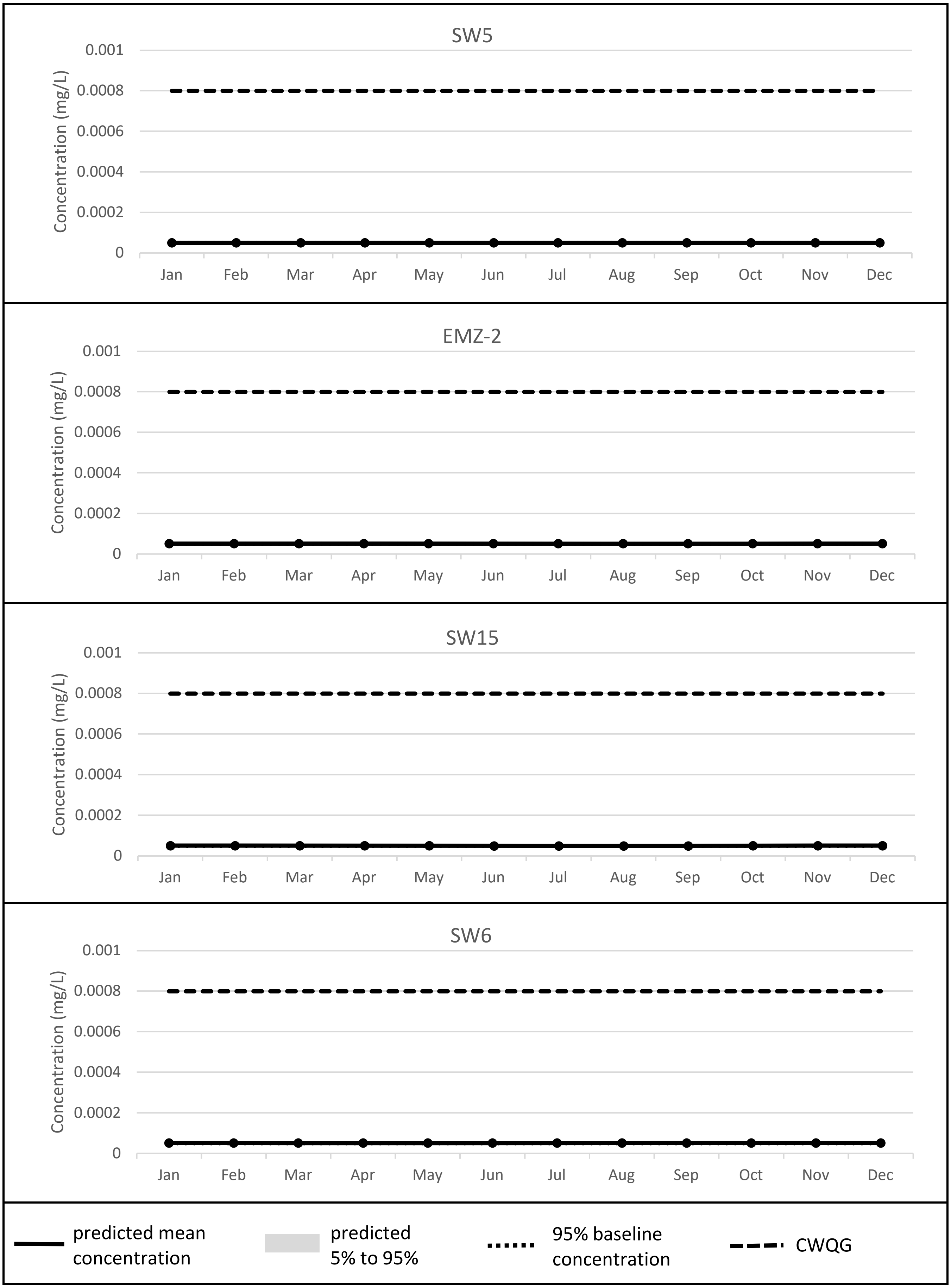


FIGURE C-86: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

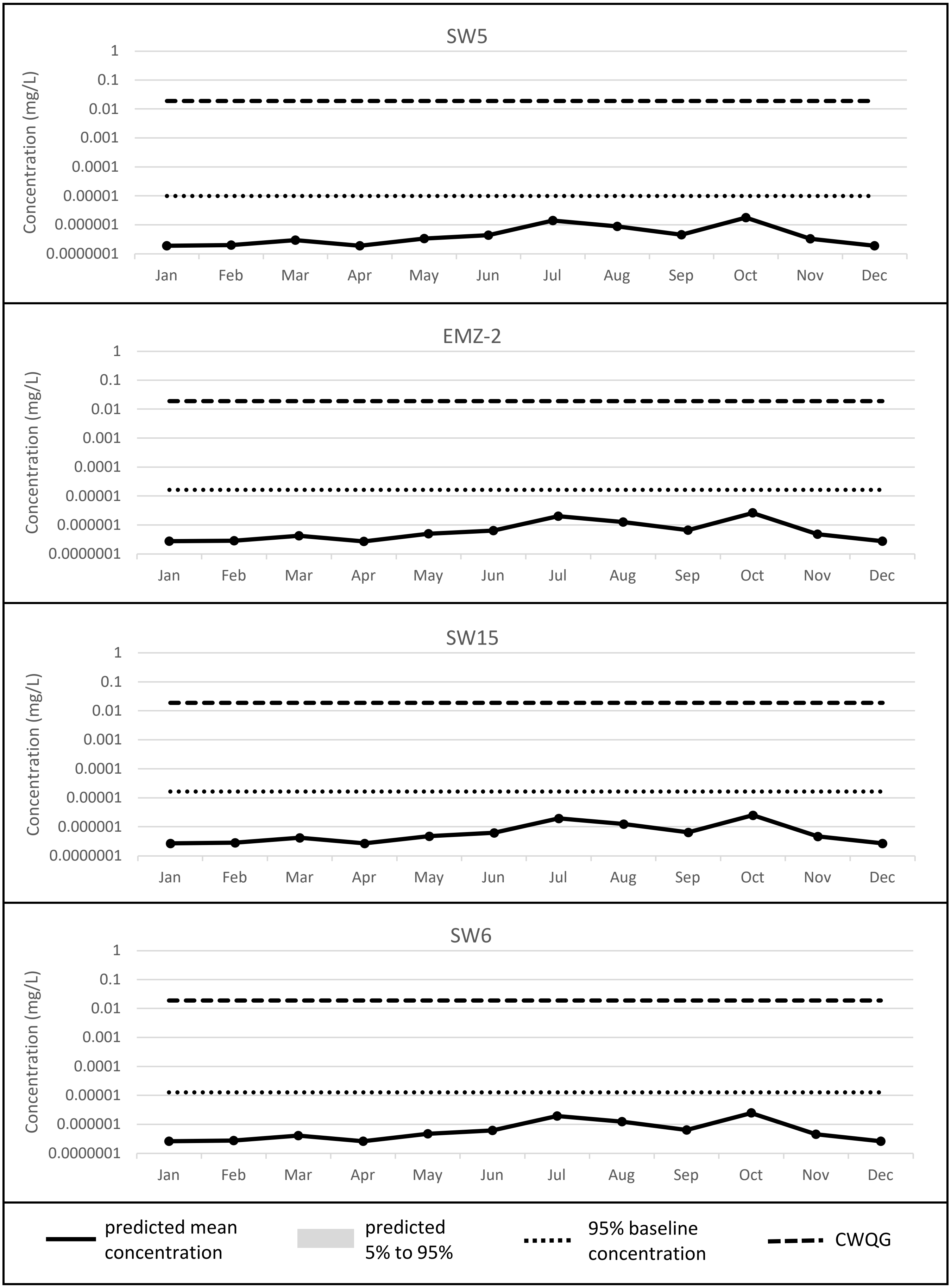


FIGURE C-87: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED URANIUM CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

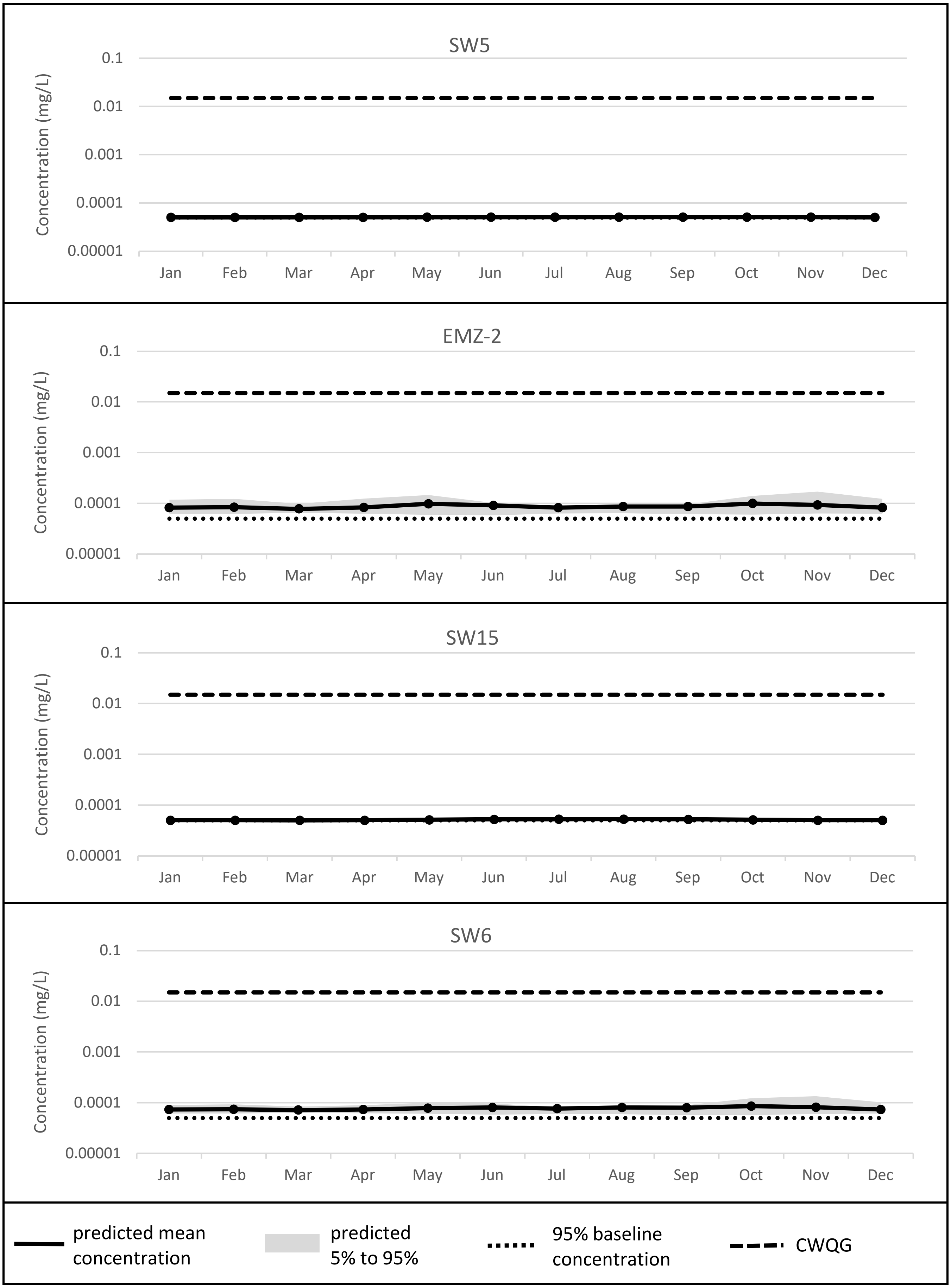


FIGURE C-88: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED ZINC CONCENTRATIONS (USING BASE CASE SOURCE TERMS)

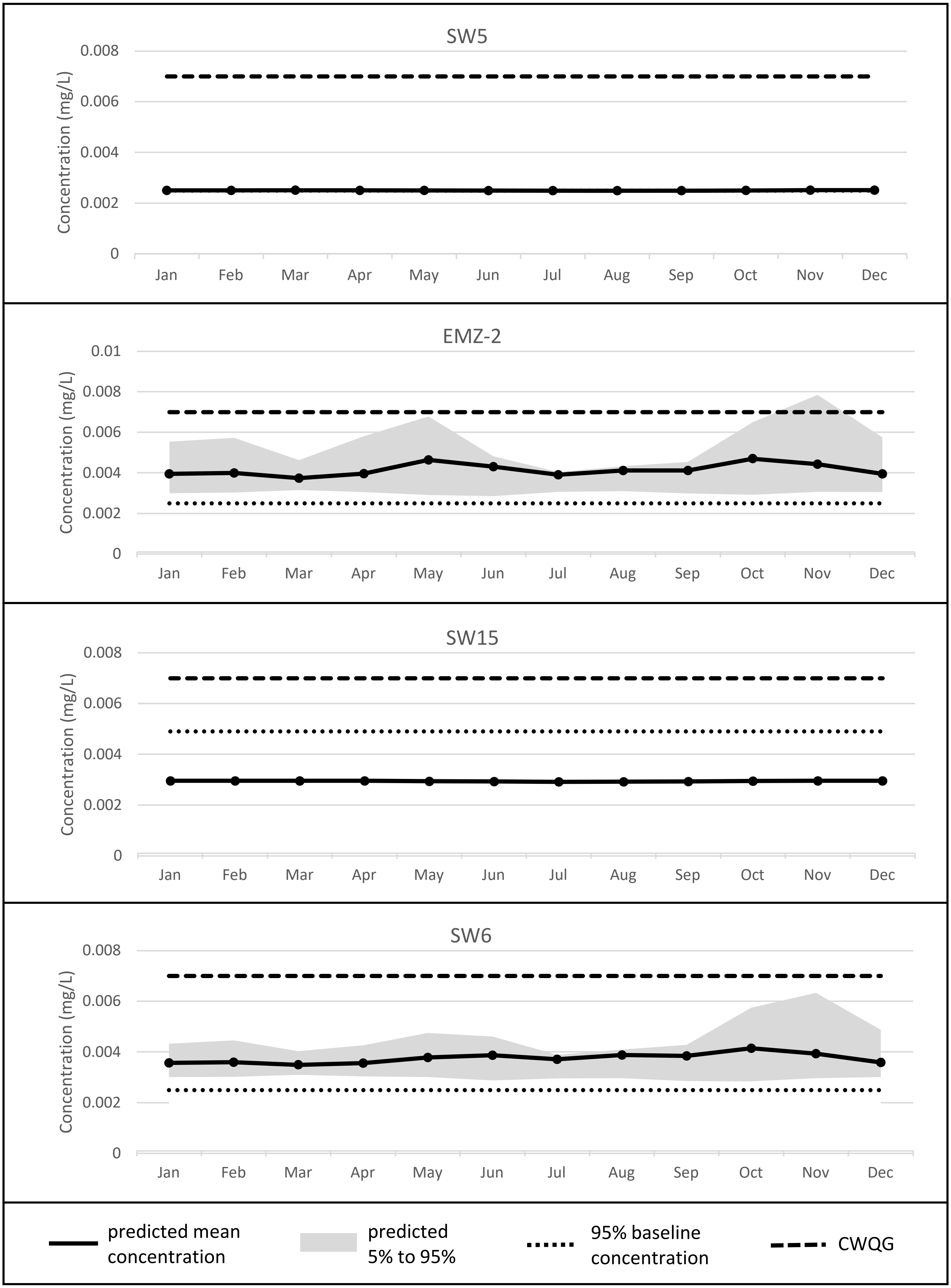


FIGURE C-89: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED ALUMINUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

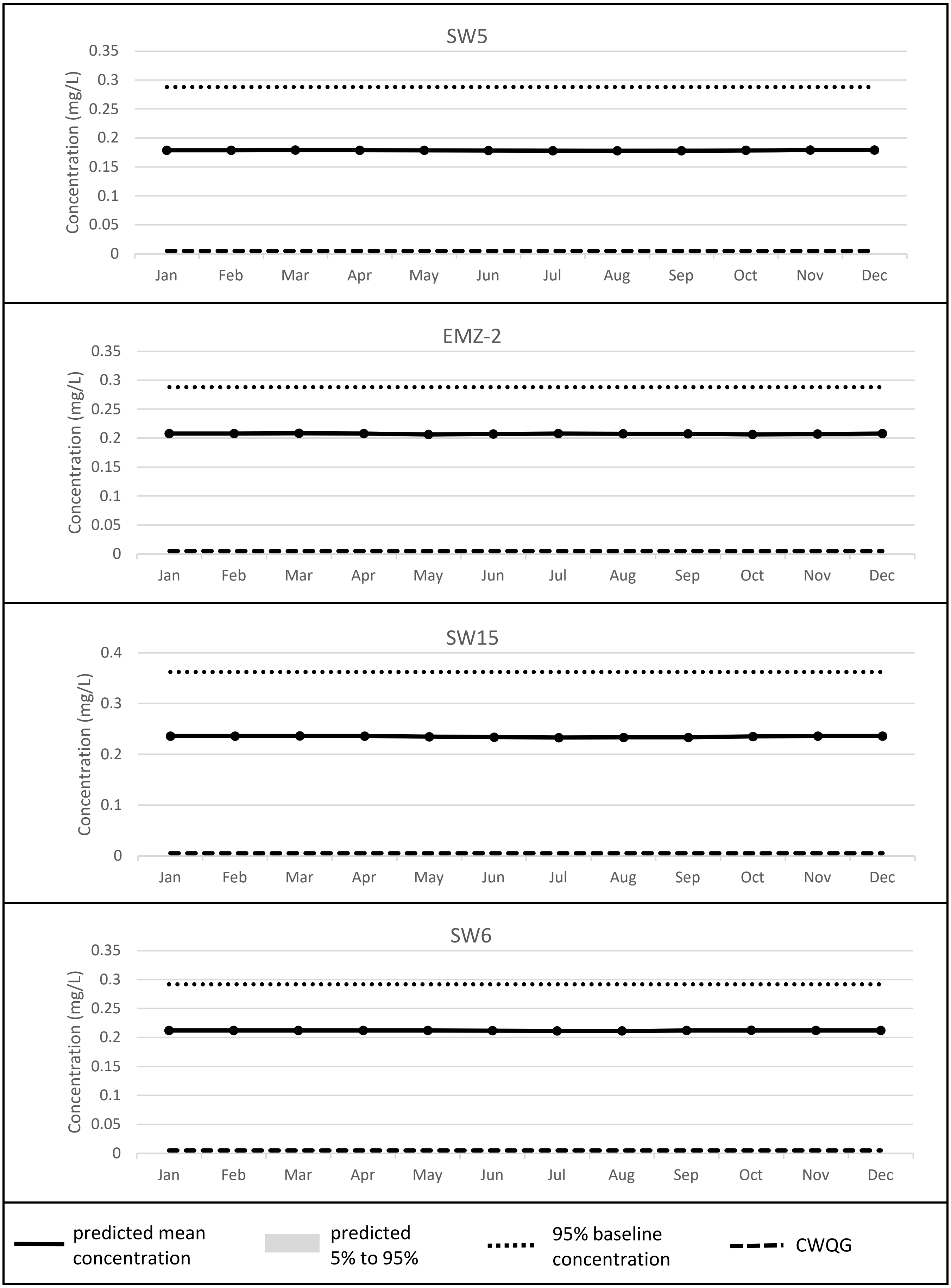


FIGURE C-90: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED ANTIMONY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

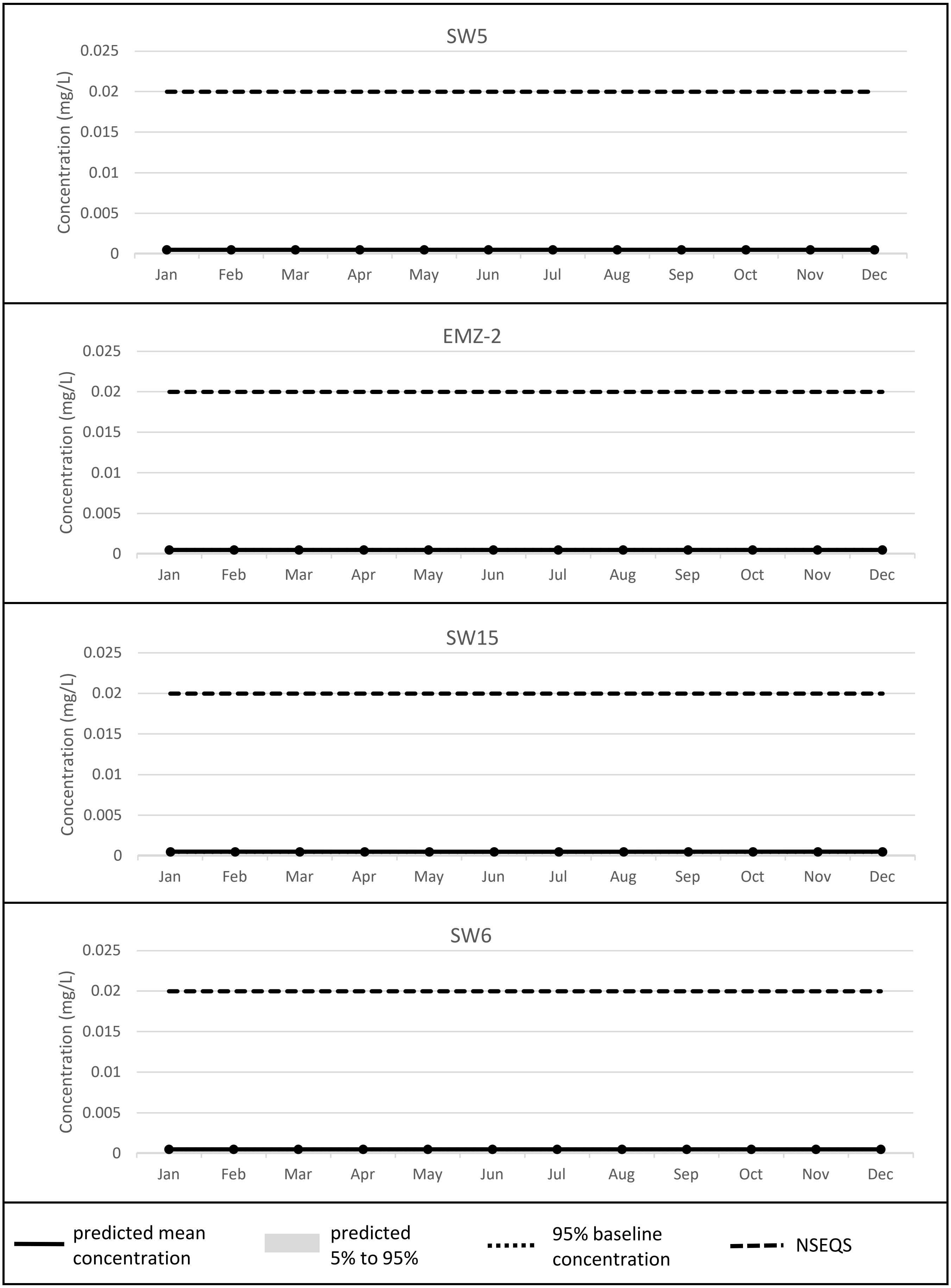
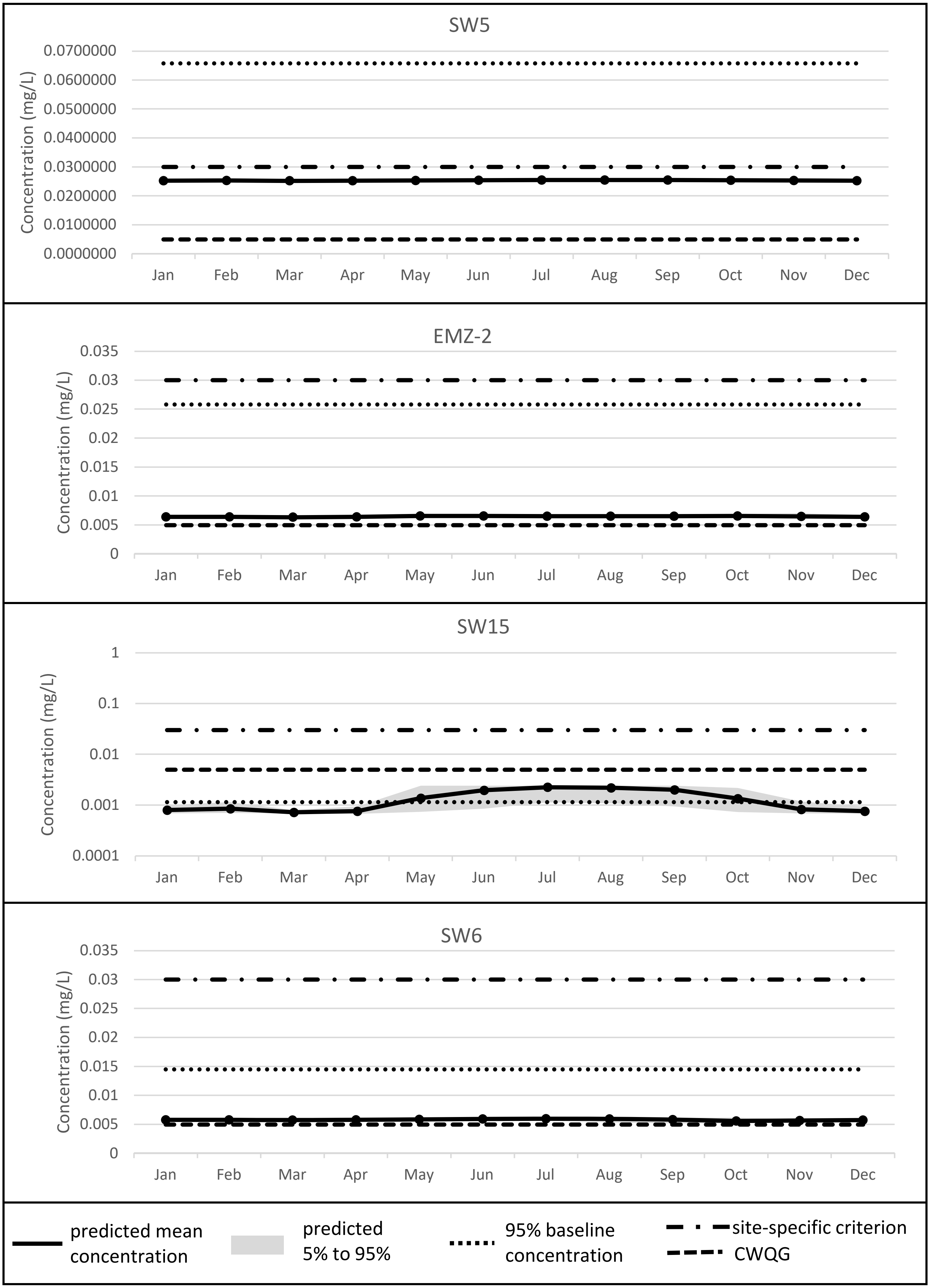


FIGURE C-91: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED ARSENIC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



PREDICTED BORON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

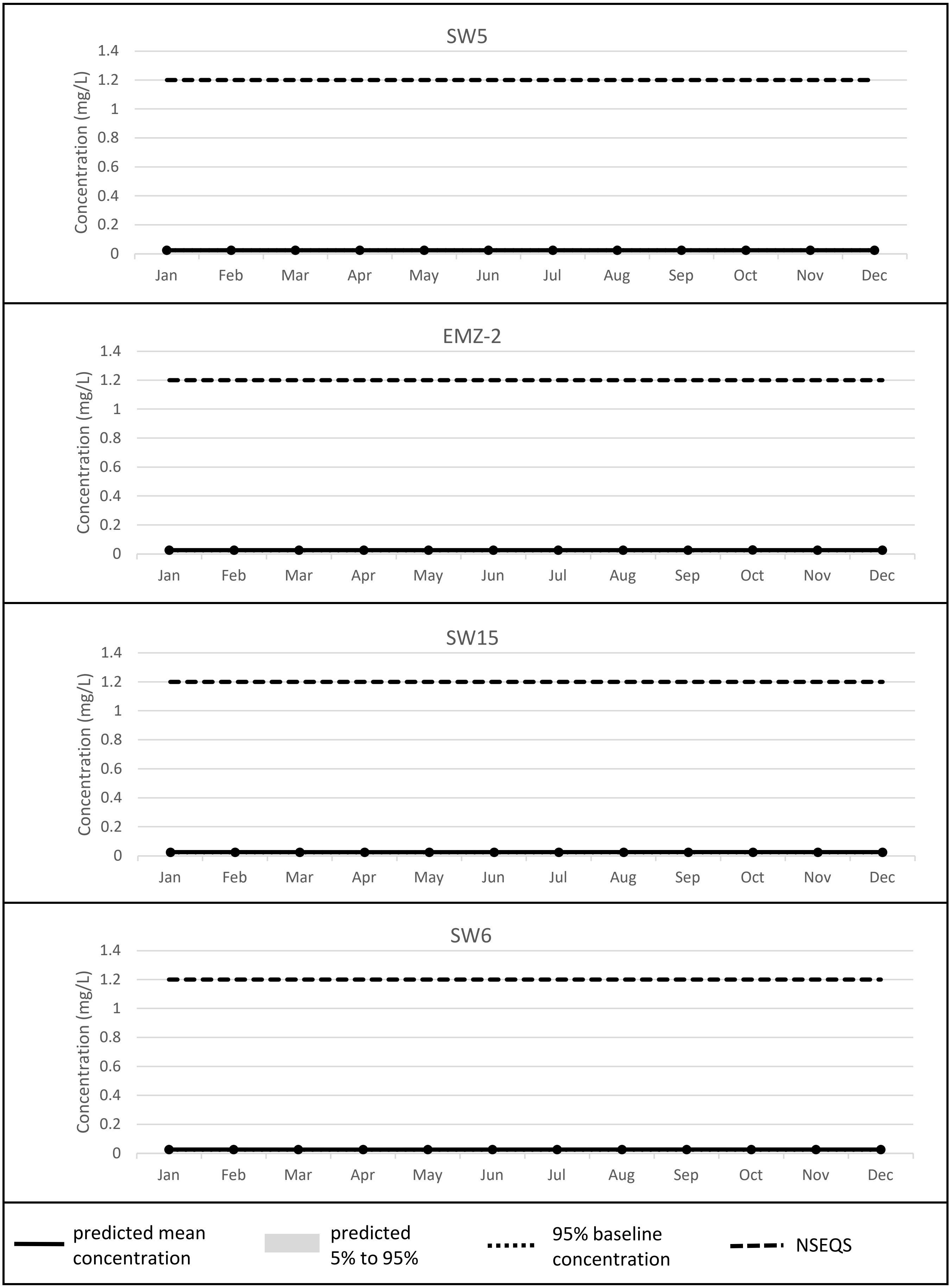


FIGURE C-93: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED CADMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

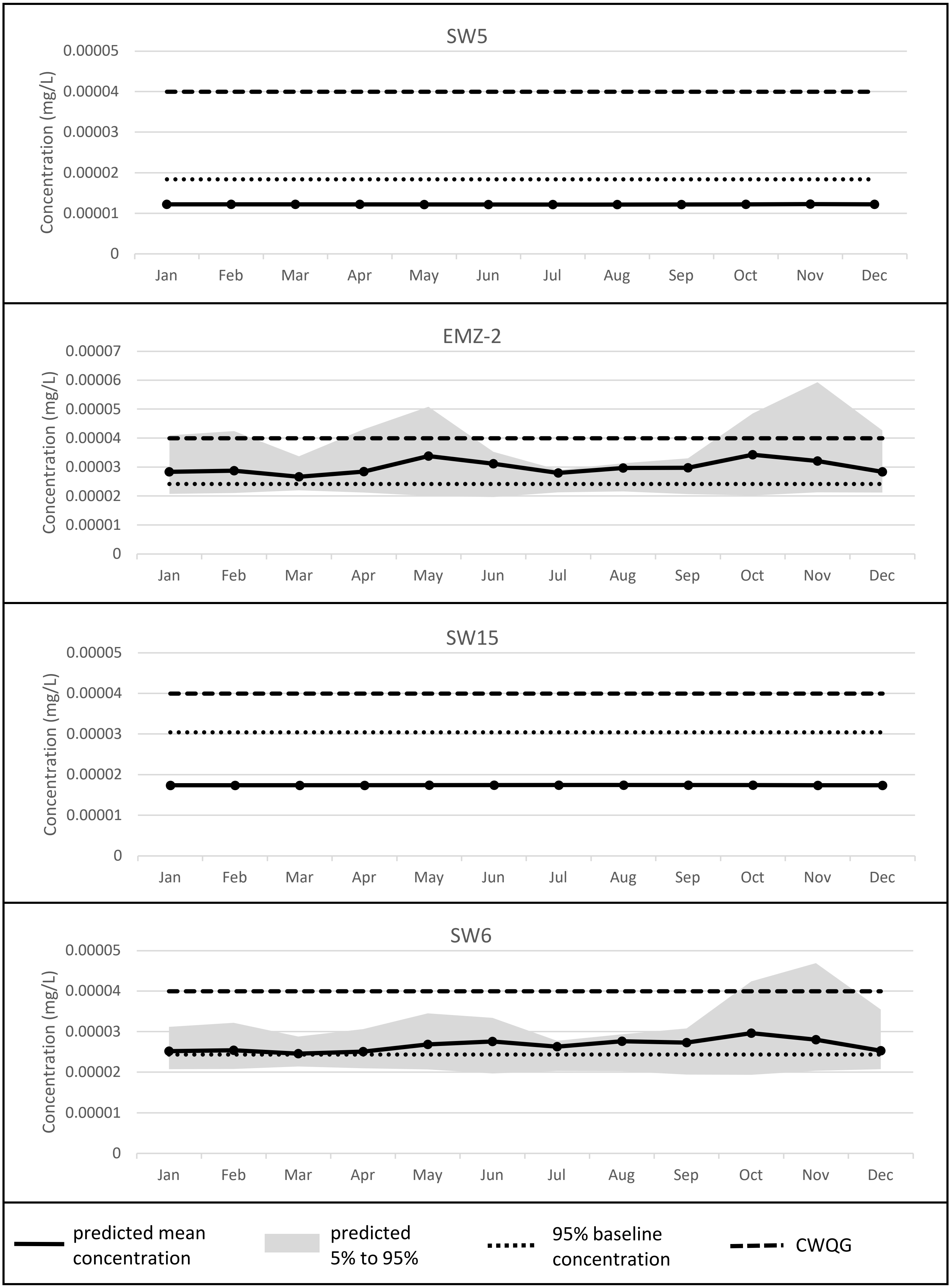


FIGURE C-94: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED CHROMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

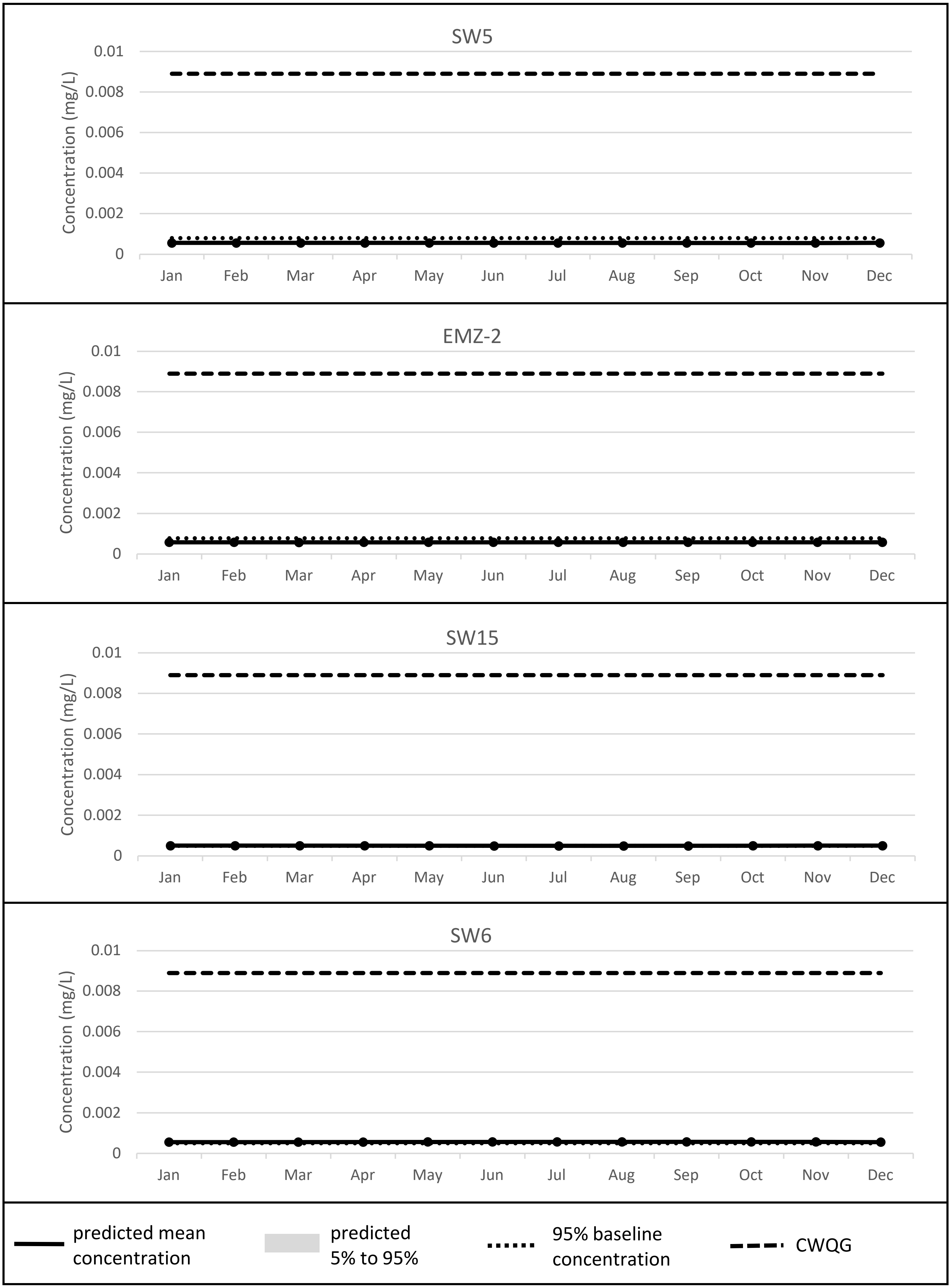


FIGURE C-95: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED COBALT CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

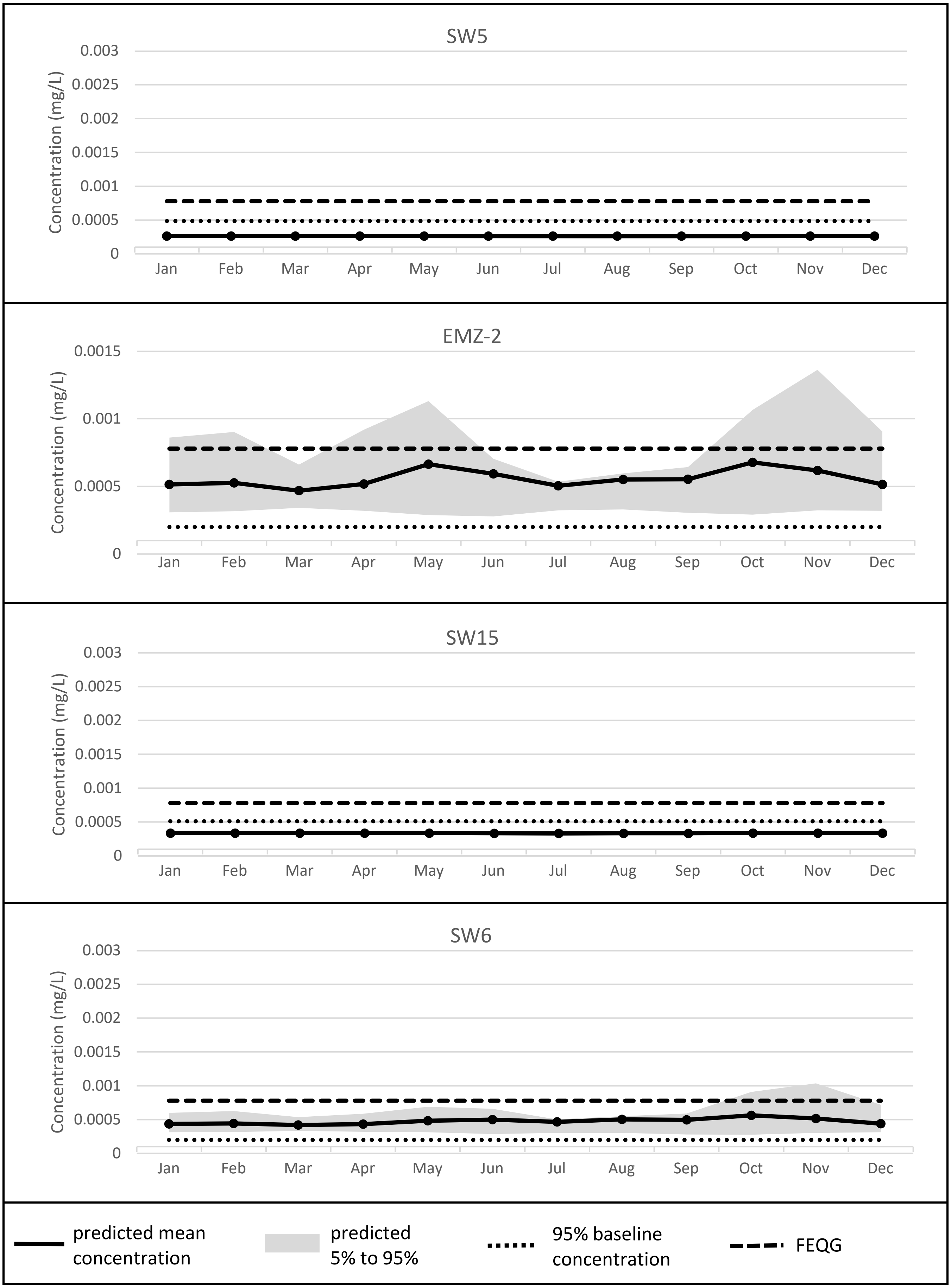
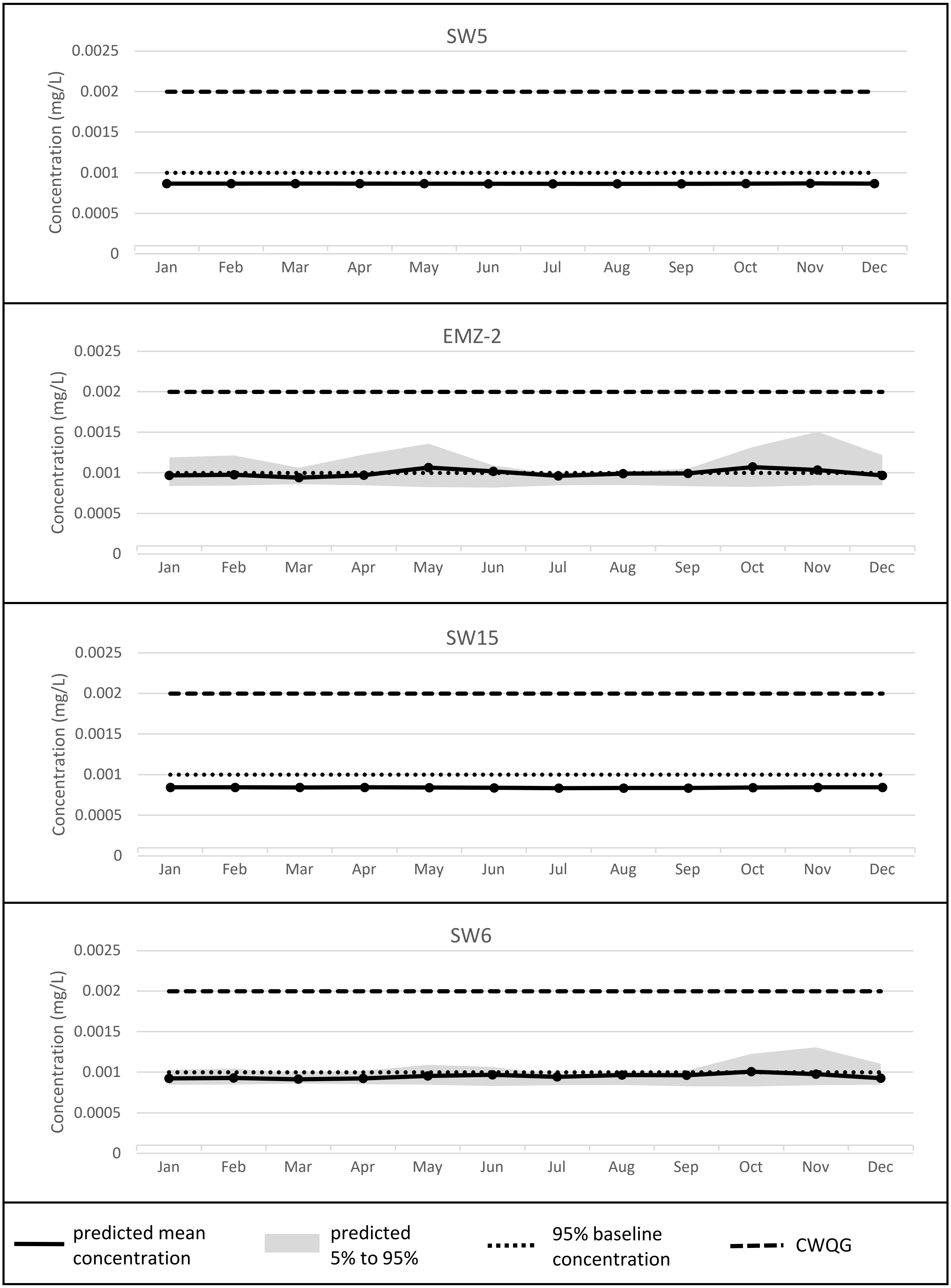


FIGURE C-96: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED COPPER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



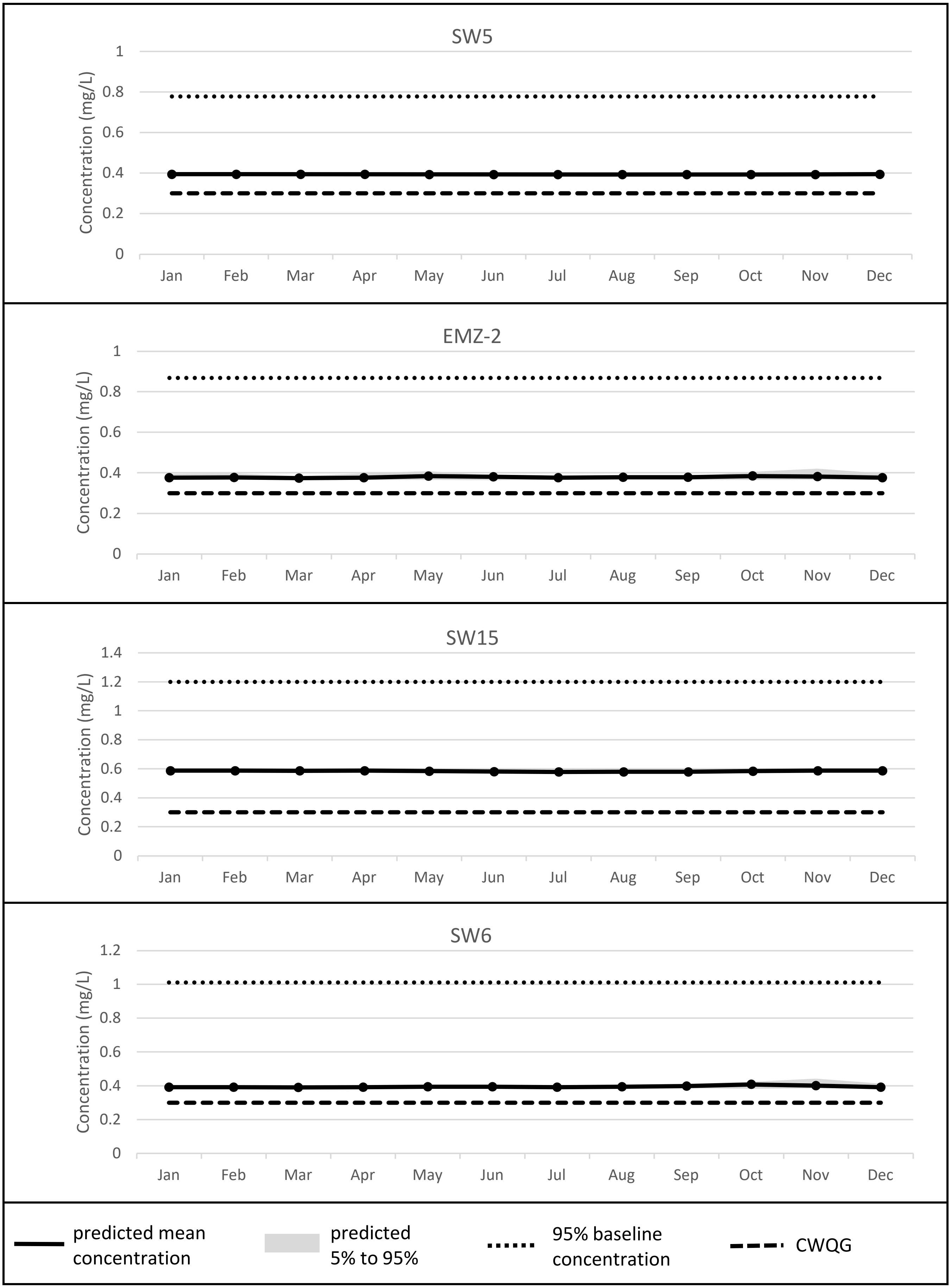

SW5
Concentration (mg/L)
1
0.8
0.6
0.4
0.2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
EMZ-2
Concentration (mg/L)
1
0.8
0.6
0.4
0.2
0
SW15
Concentration (mg/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SW6
Concentration (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
predicted mean concentration
predicted 5% to 95%
95% baseline concentration
CWQG

FIGURE C-98: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED LEAD CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

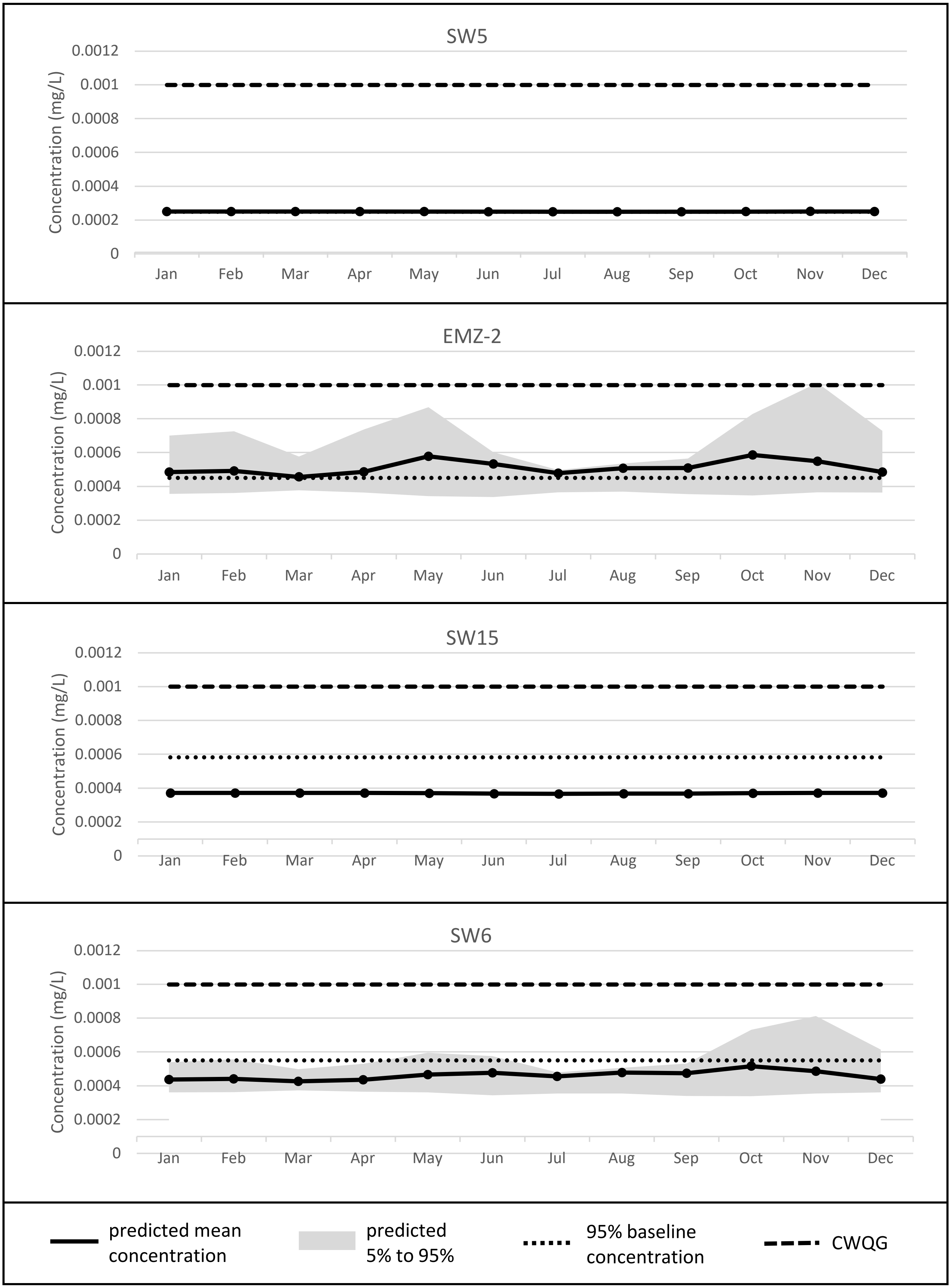


FIGURE C-99: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED MANGANESE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

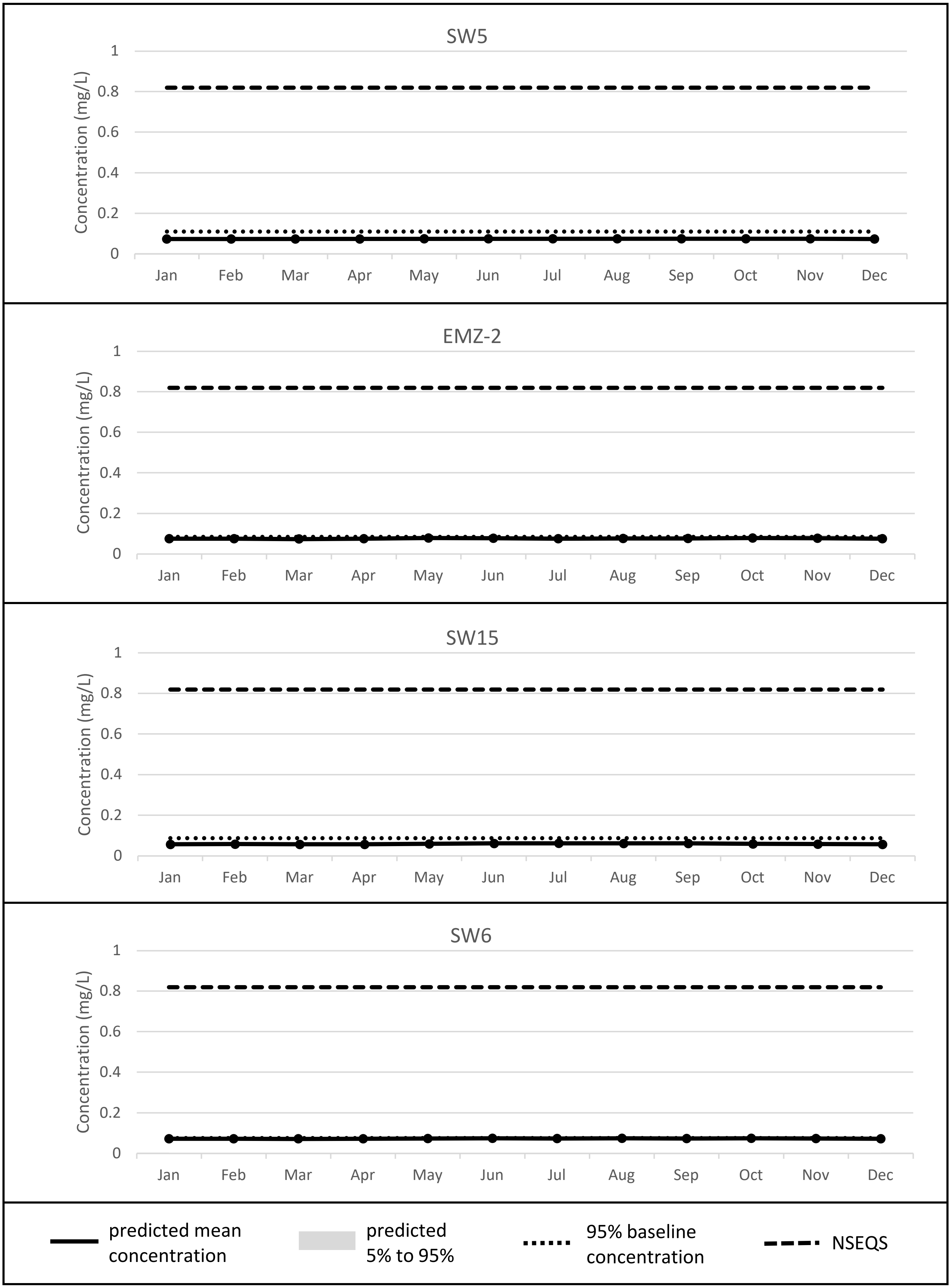


**FIGURE C-100: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED MERCURY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

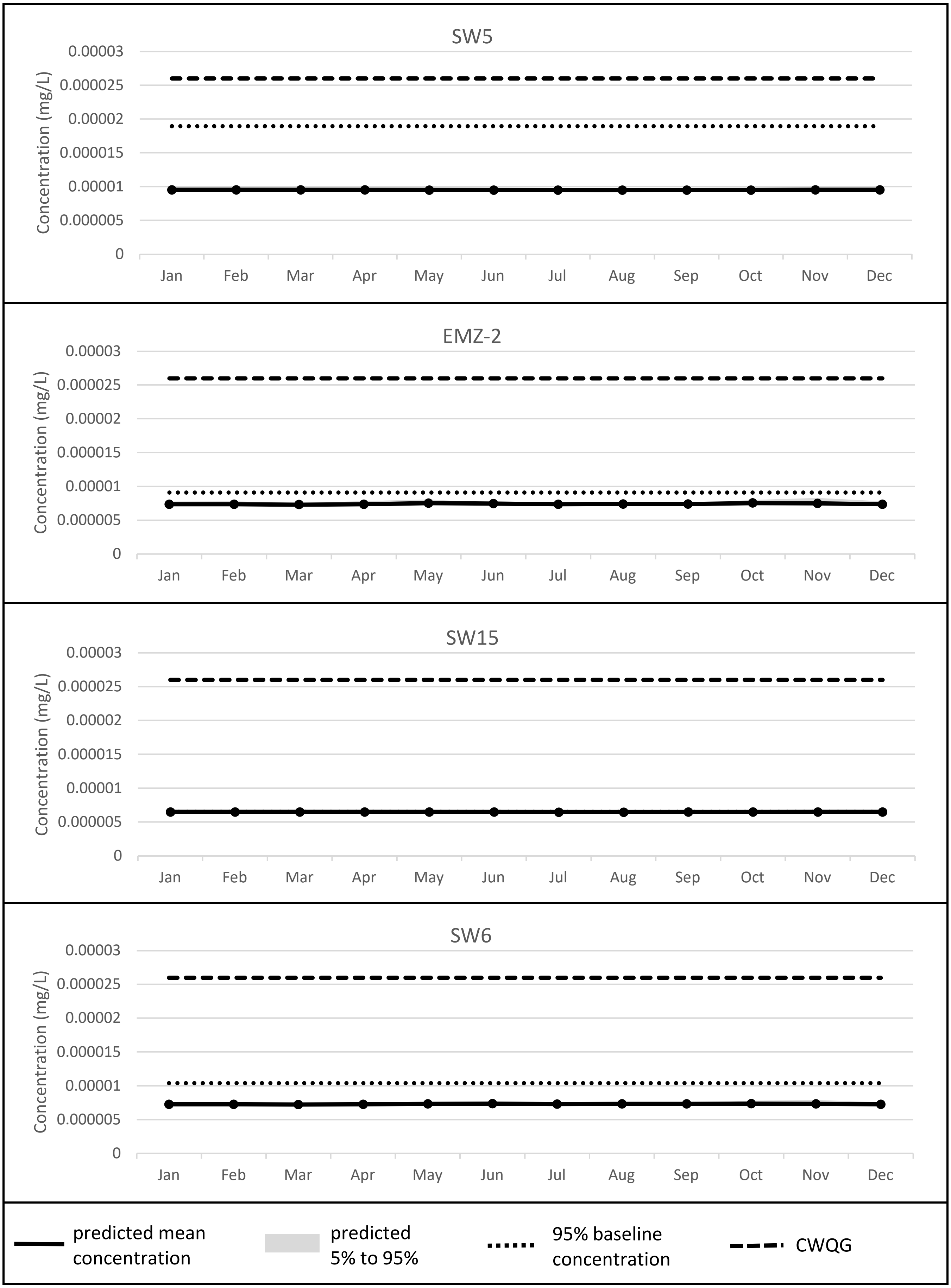


FIGURE C-101: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED MOLYBDENUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

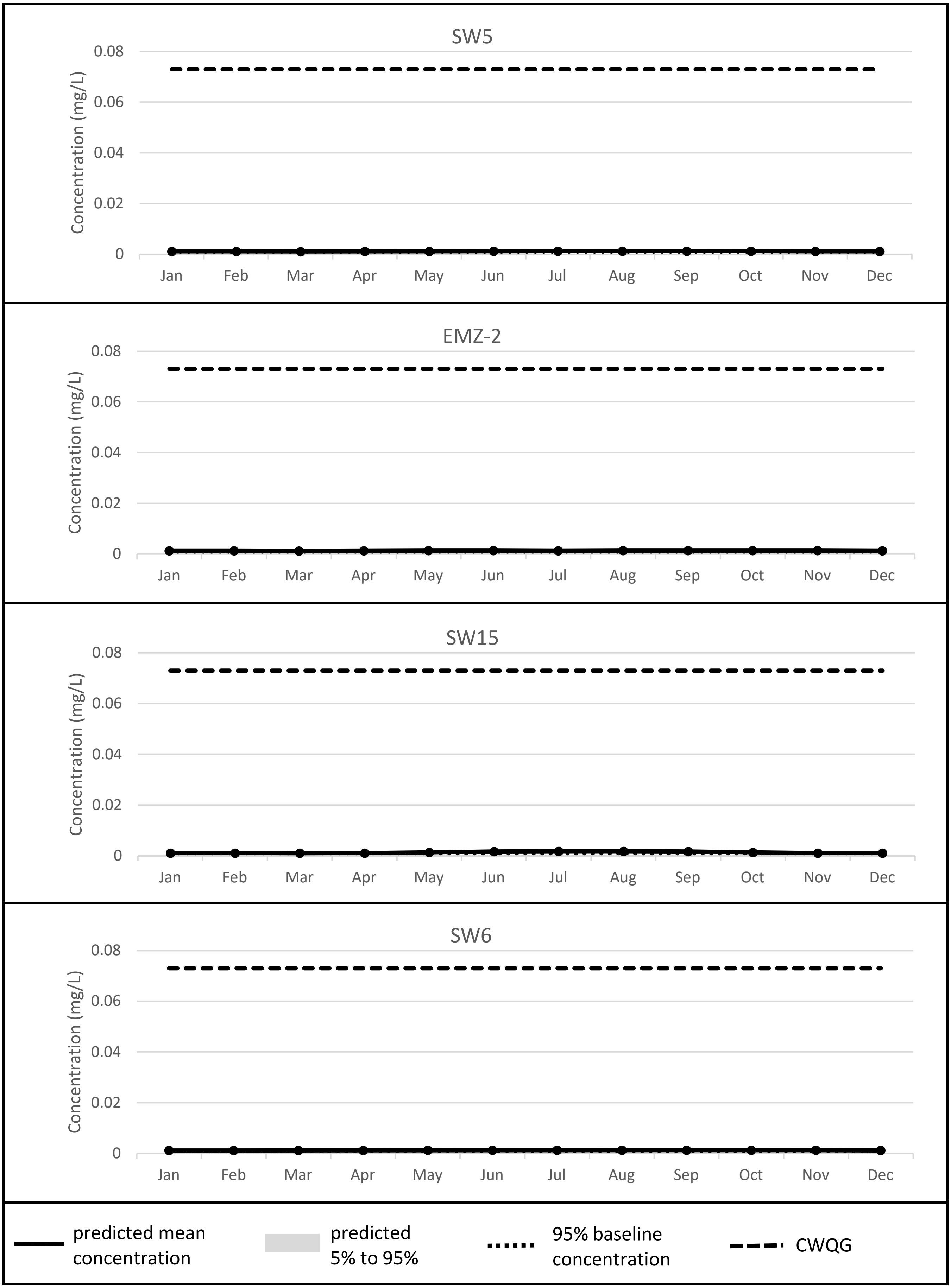


FIGURE C-102: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED NICKEL CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

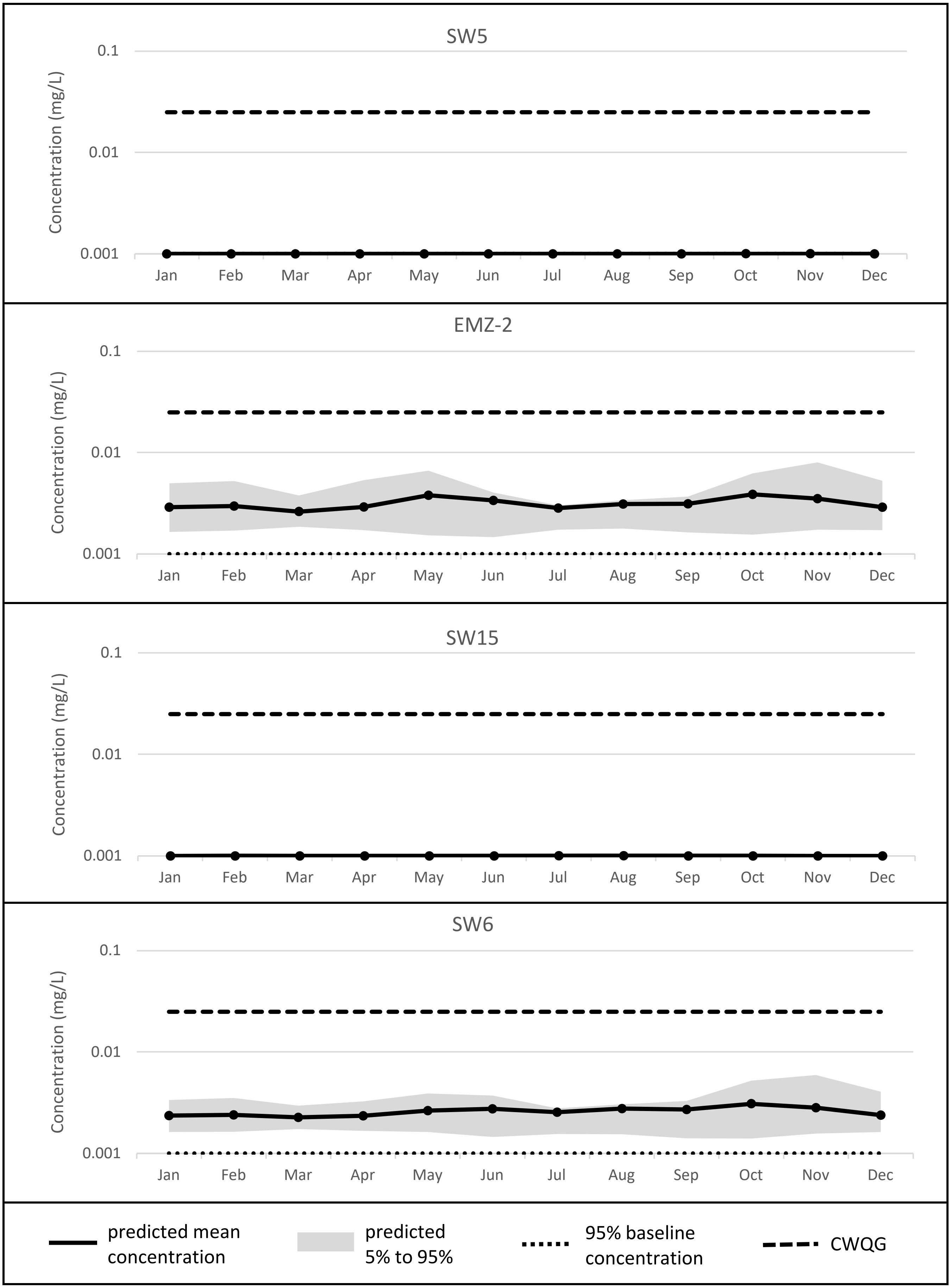


FIGURE C-103: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED NITRATE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

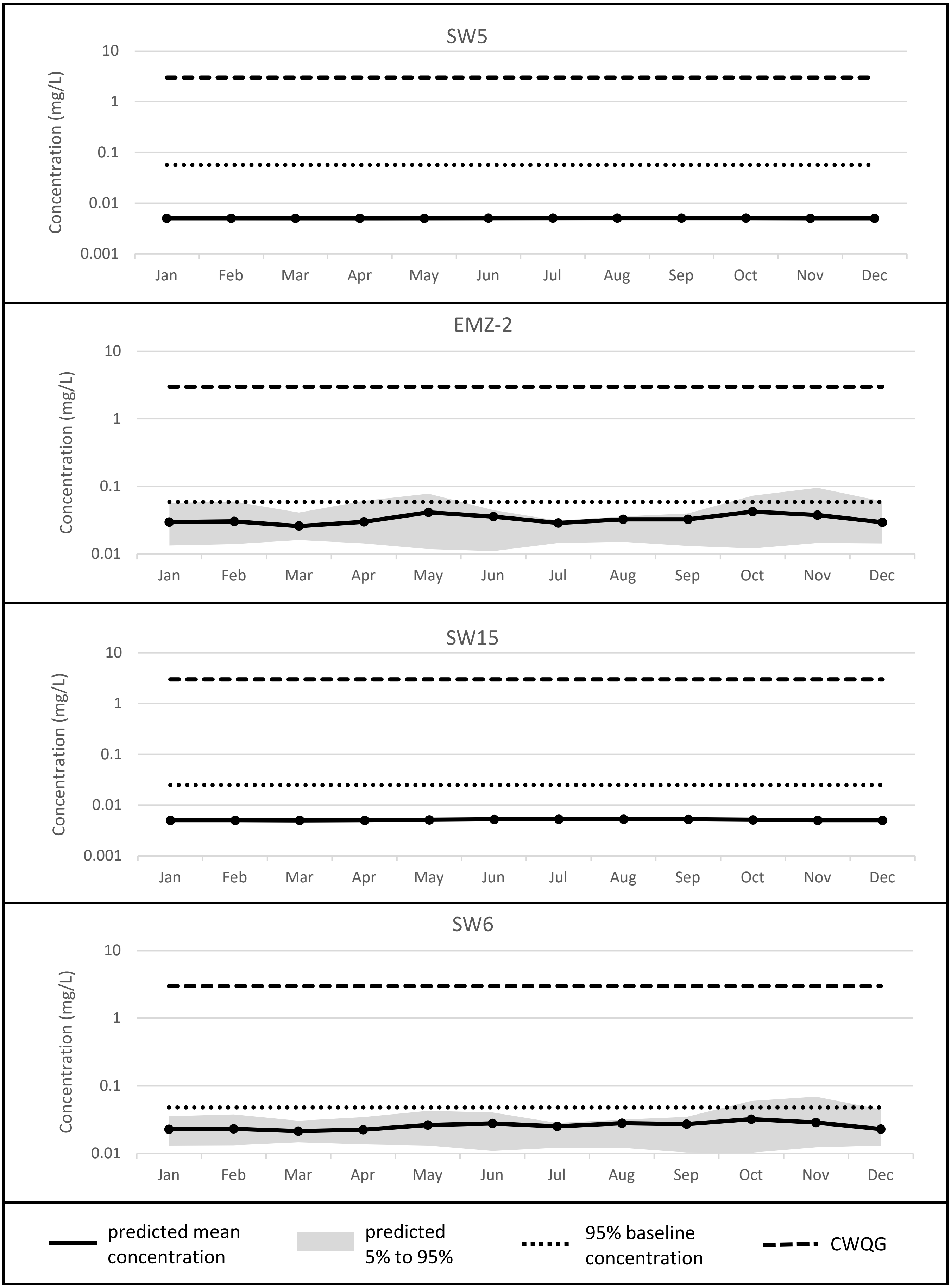


FIGURE C-104: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED NITRITE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

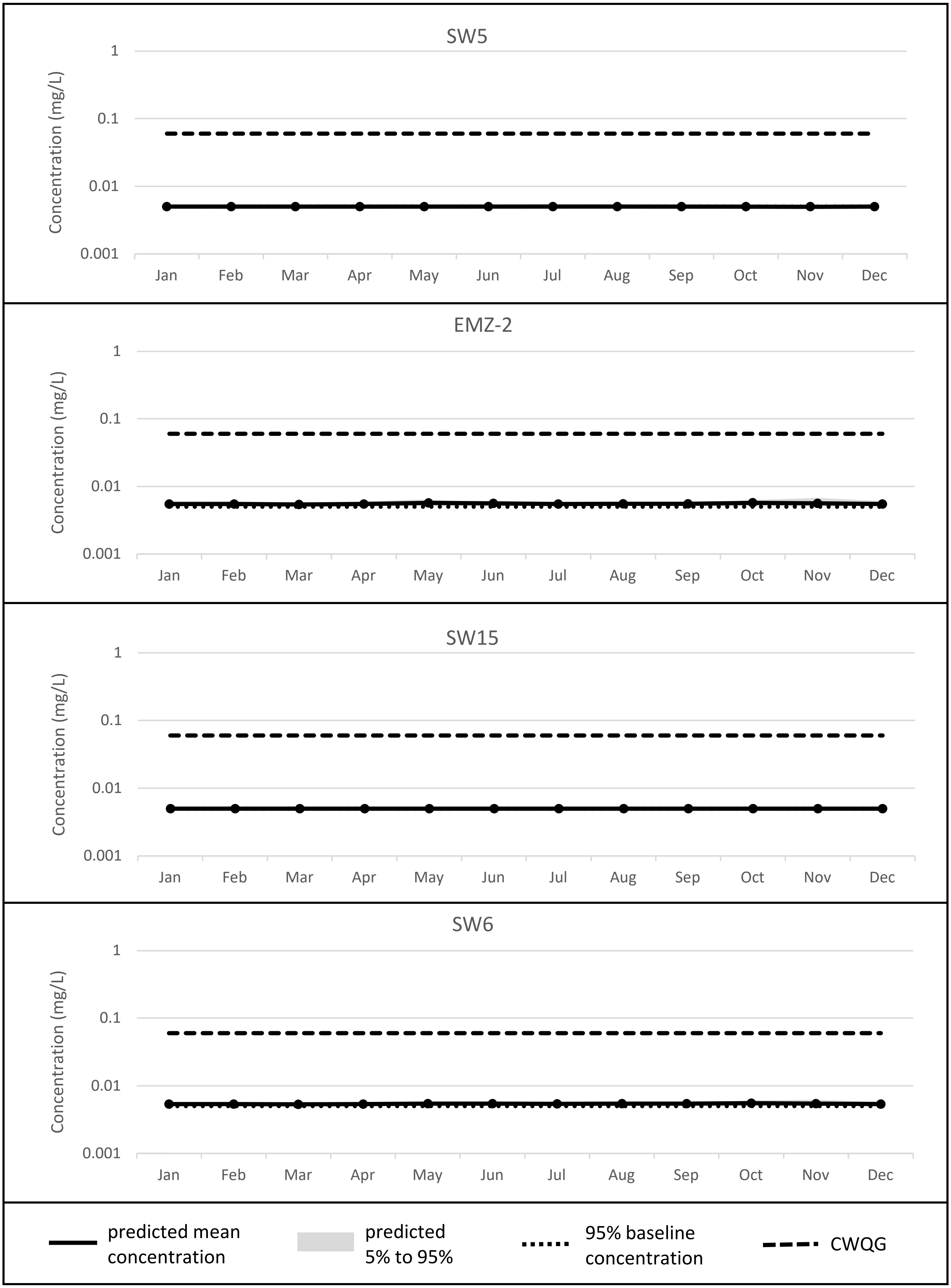
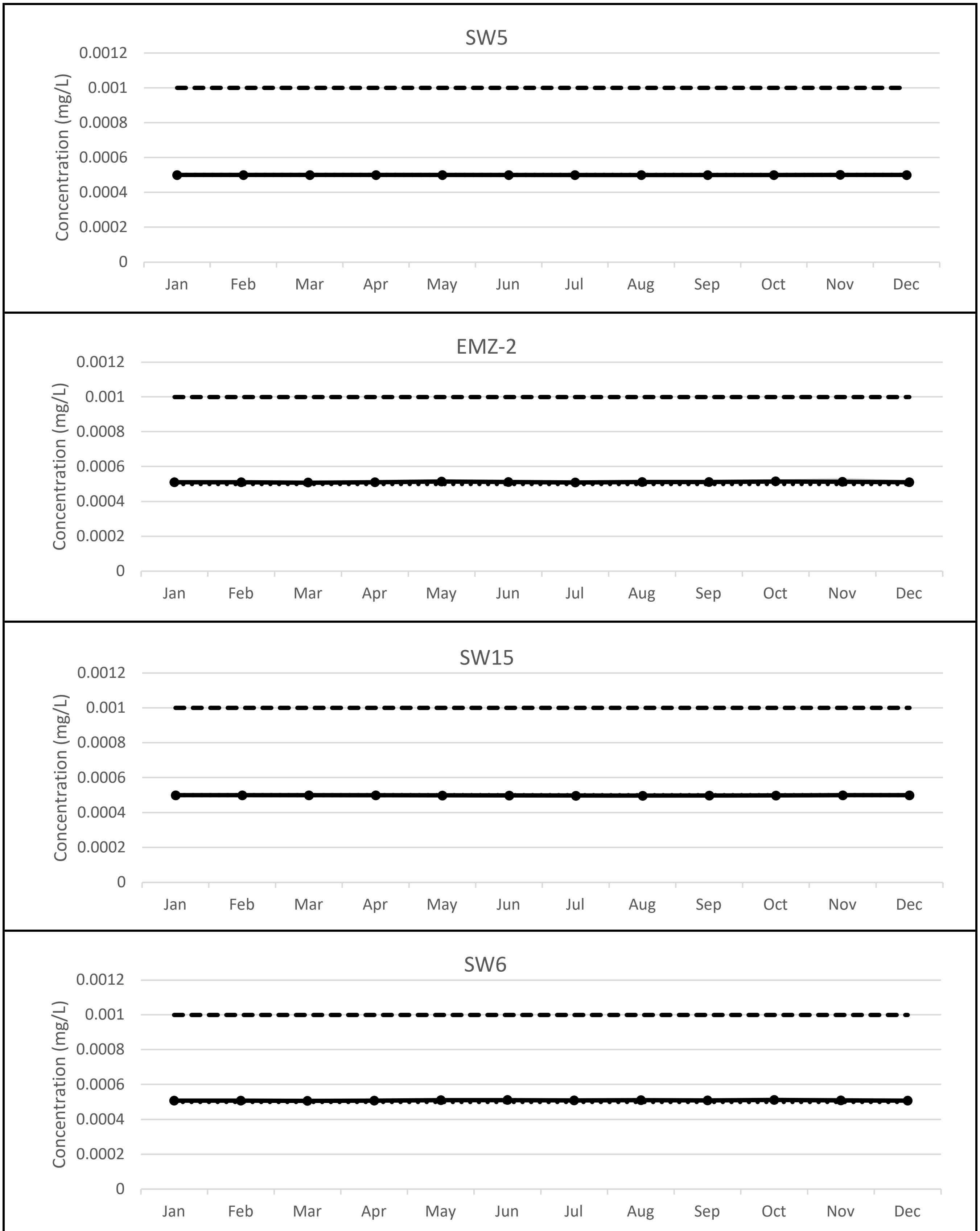


FIGURE C-105: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED SELENIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG

FIGURE C-106: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED SILVER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

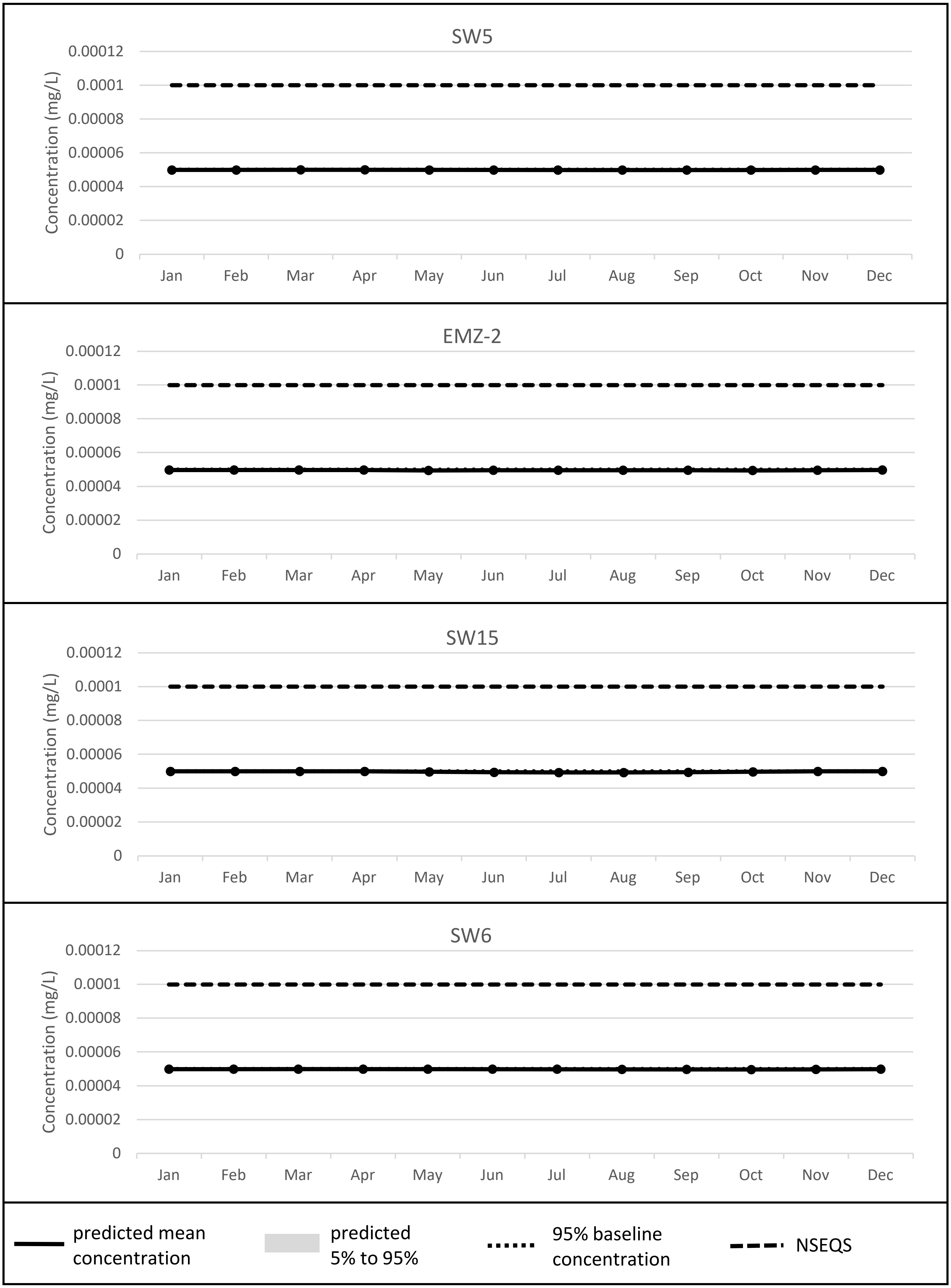


**FIGURE C-107: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED THALLIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

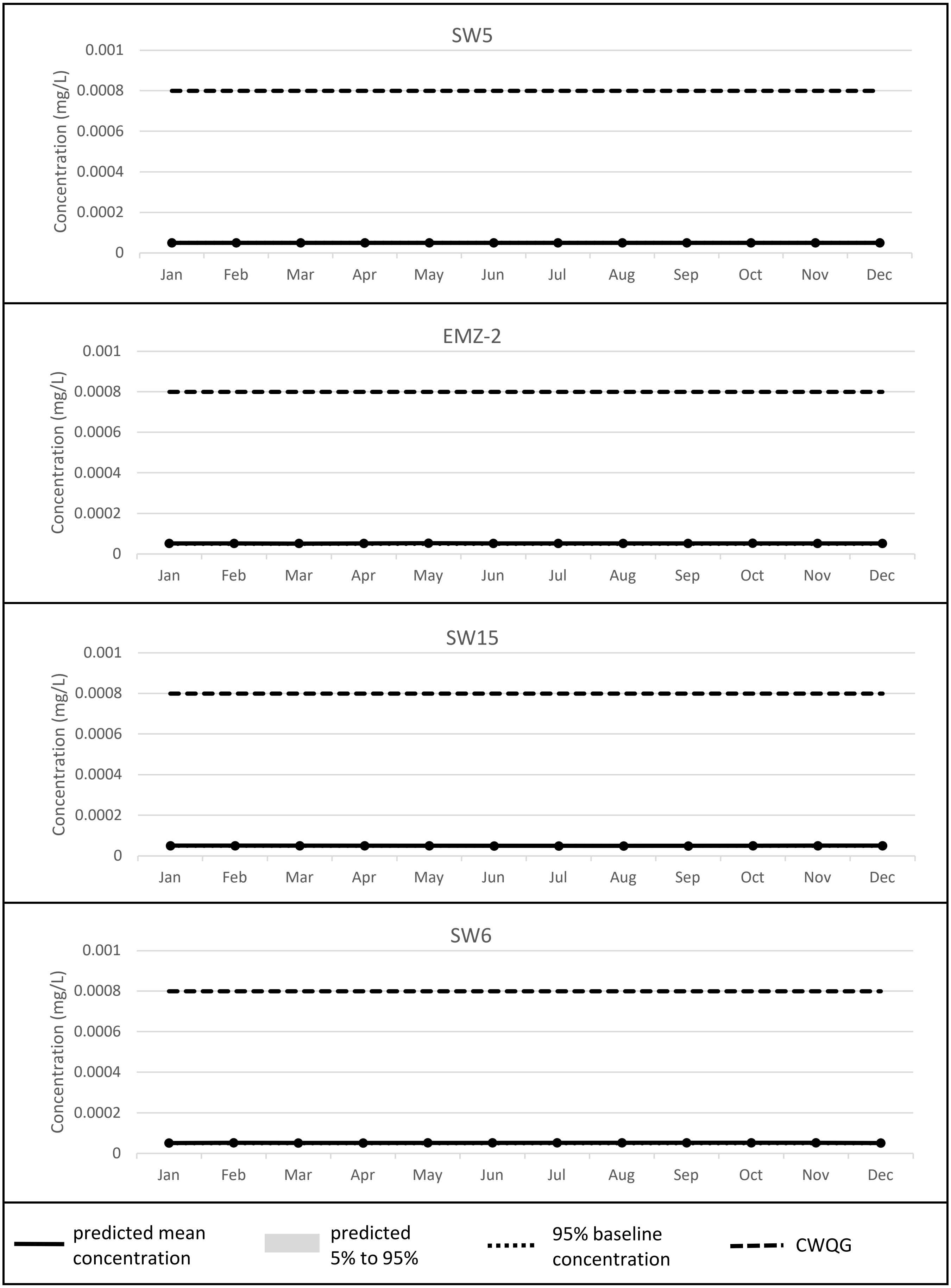


FIGURE C-108: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

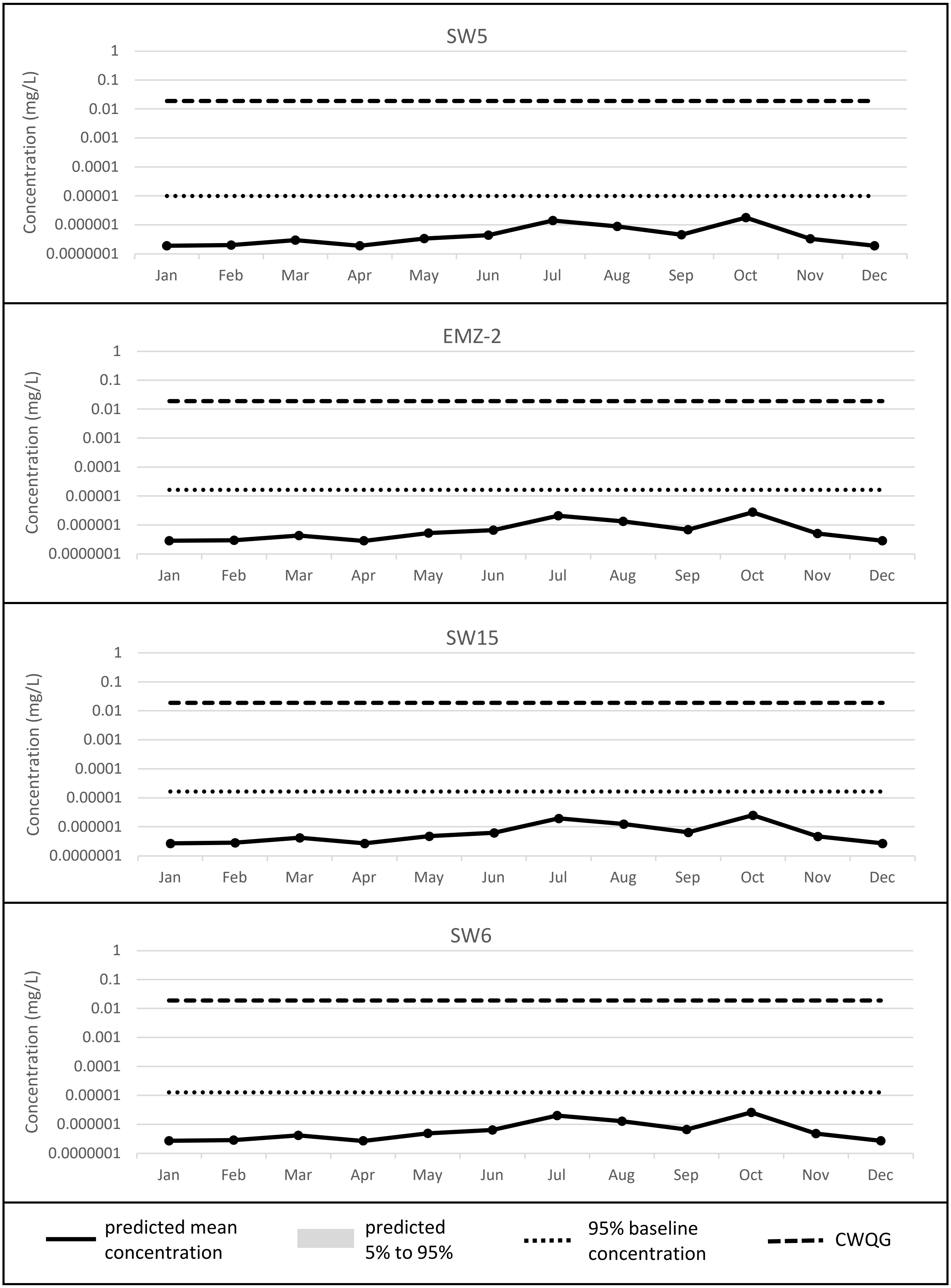


FIGURE C-109: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS PREDICTED URANIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

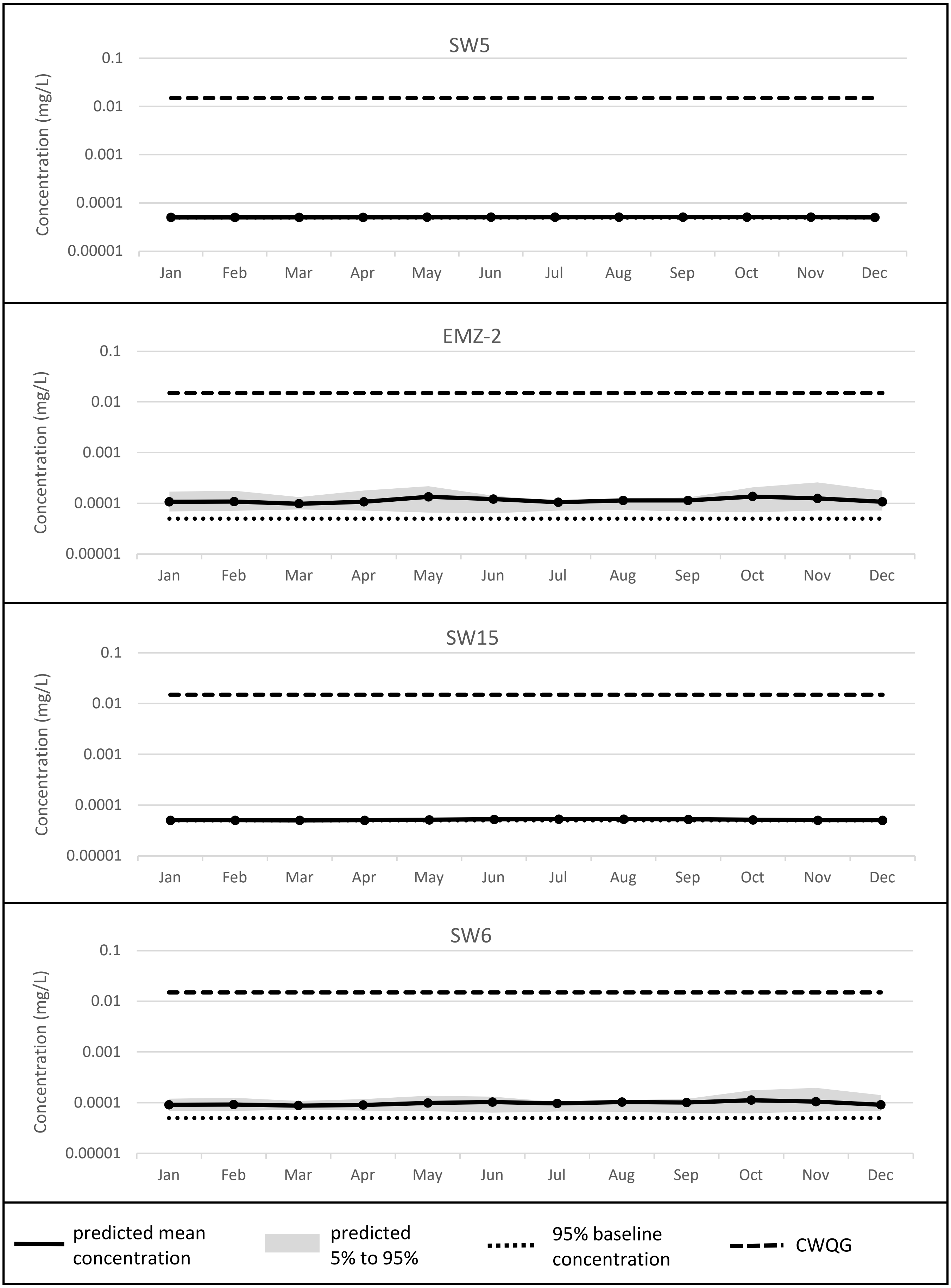


FIGURE C-110: SENSITIVITY ANALYSIS - 1% PAG IN TMF EMBANKMENTS
PREDICTED ZINC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

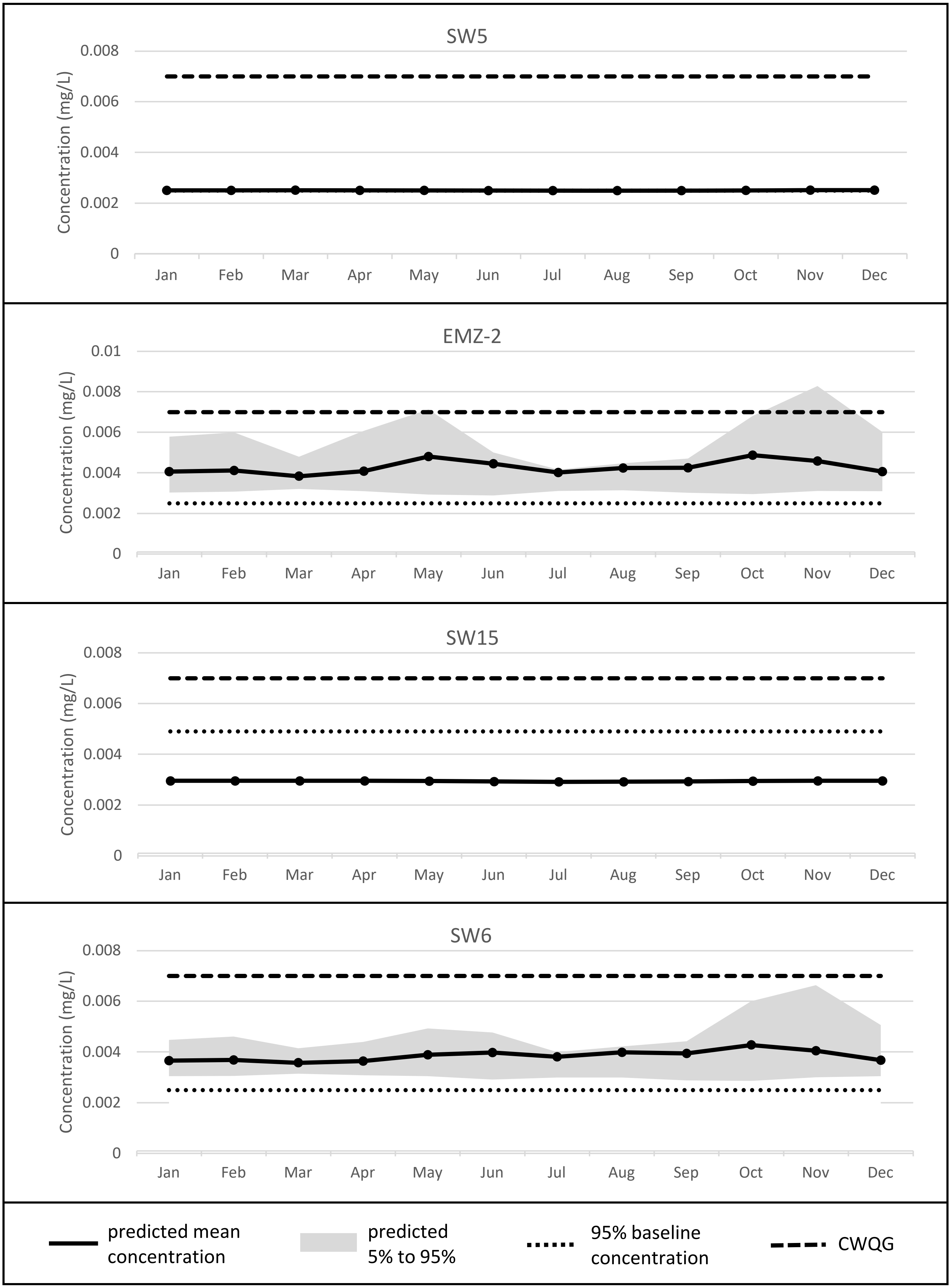


FIGURE C-111: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED ALUMINUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

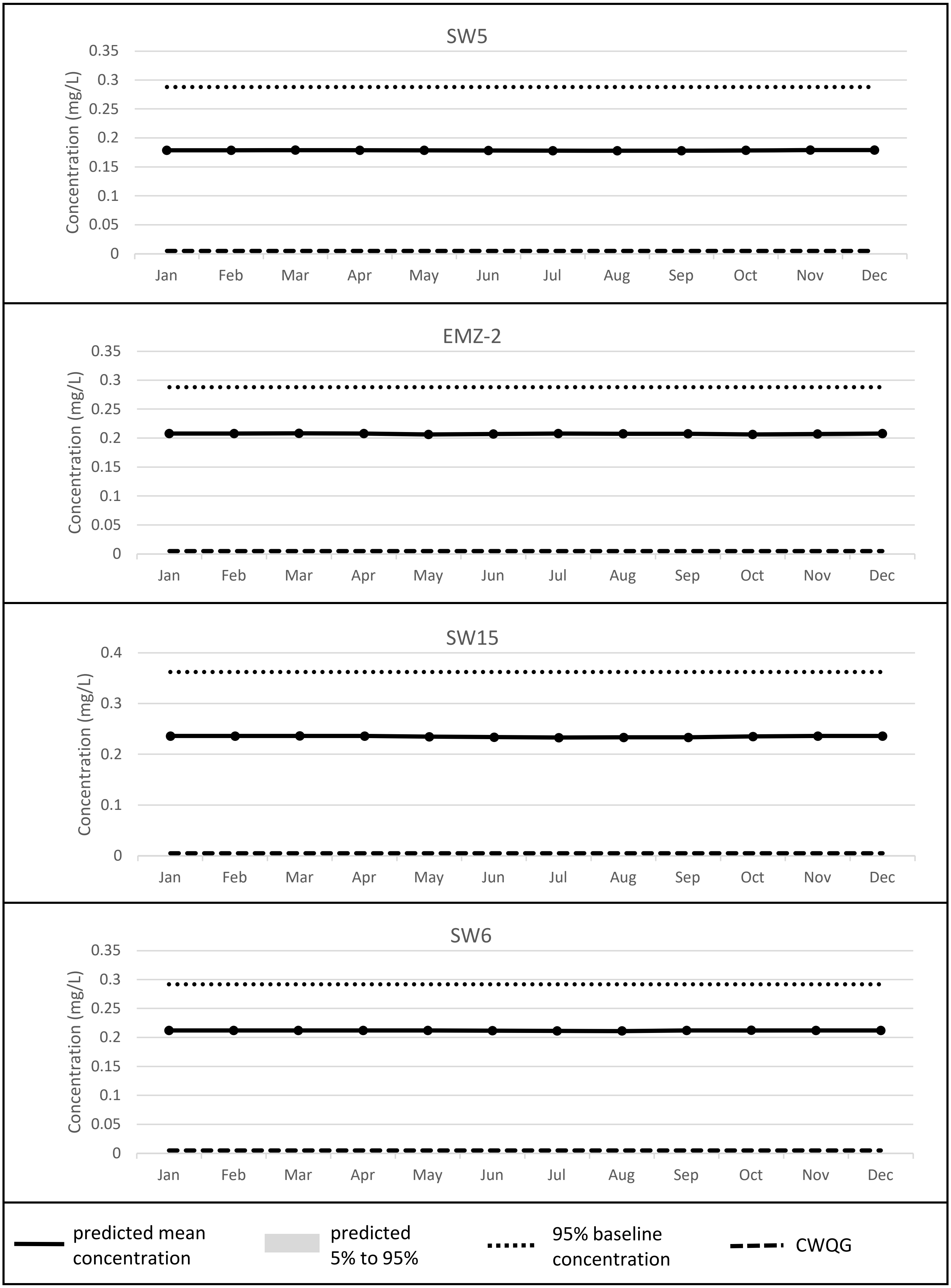
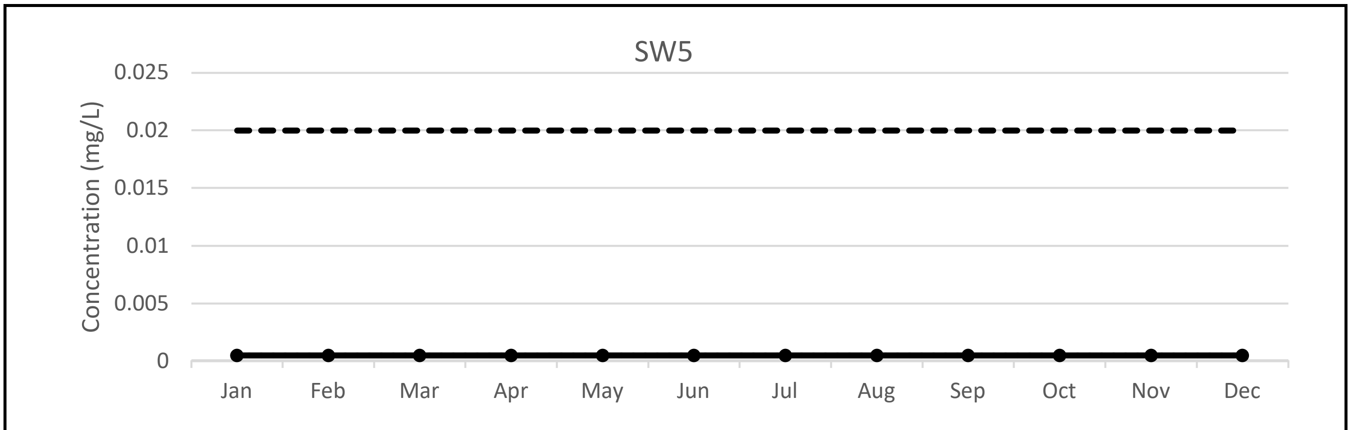
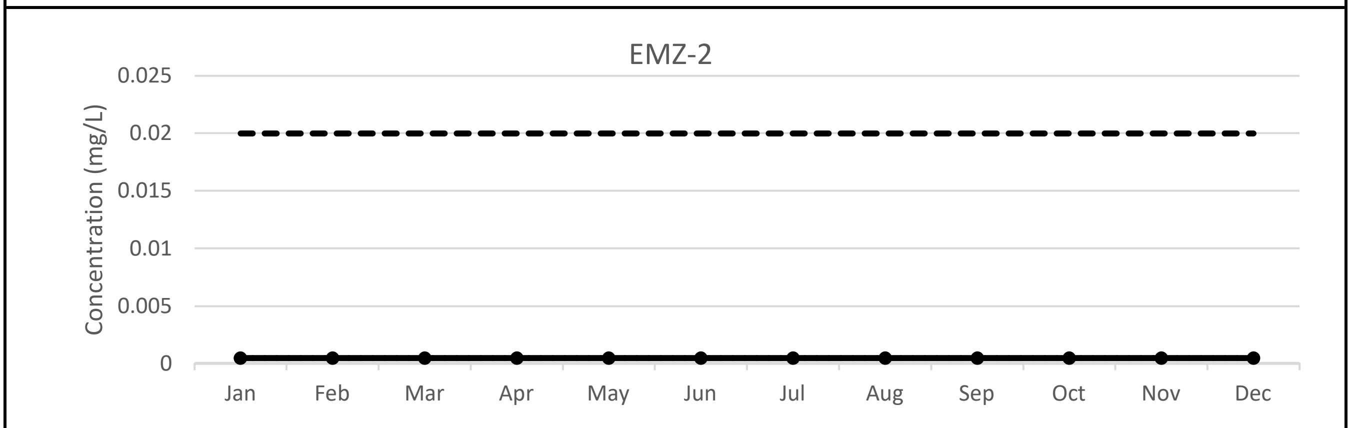
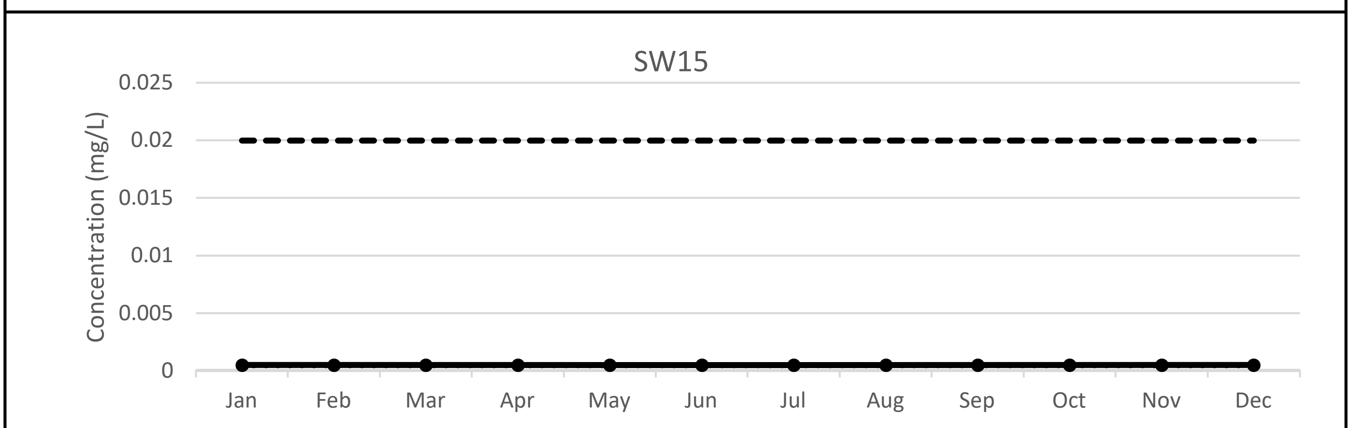
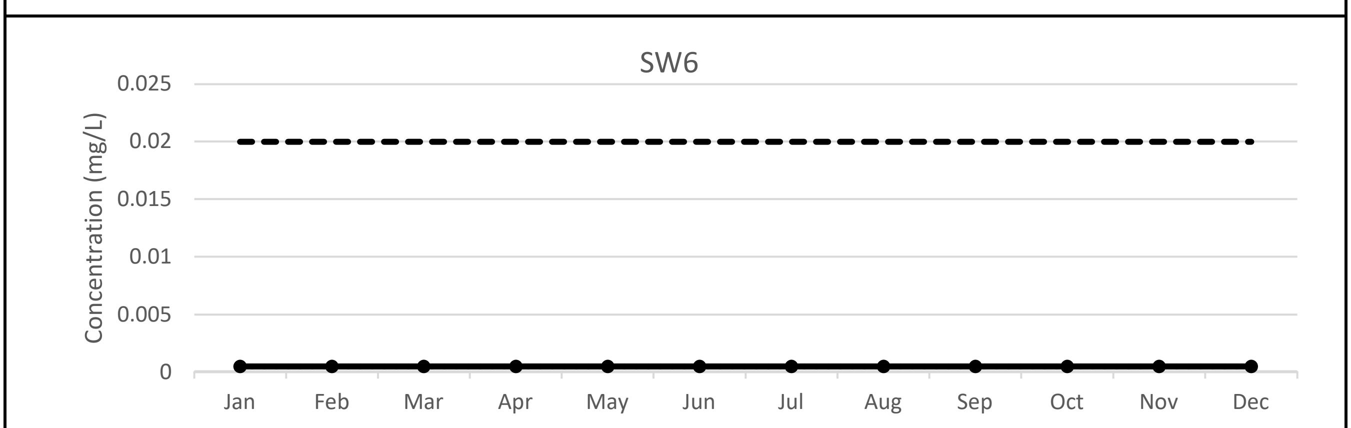


FIGURE C-112: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED ANTIMONY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)









predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | NSEQS

FIGURE C-113: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED ARSENIC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

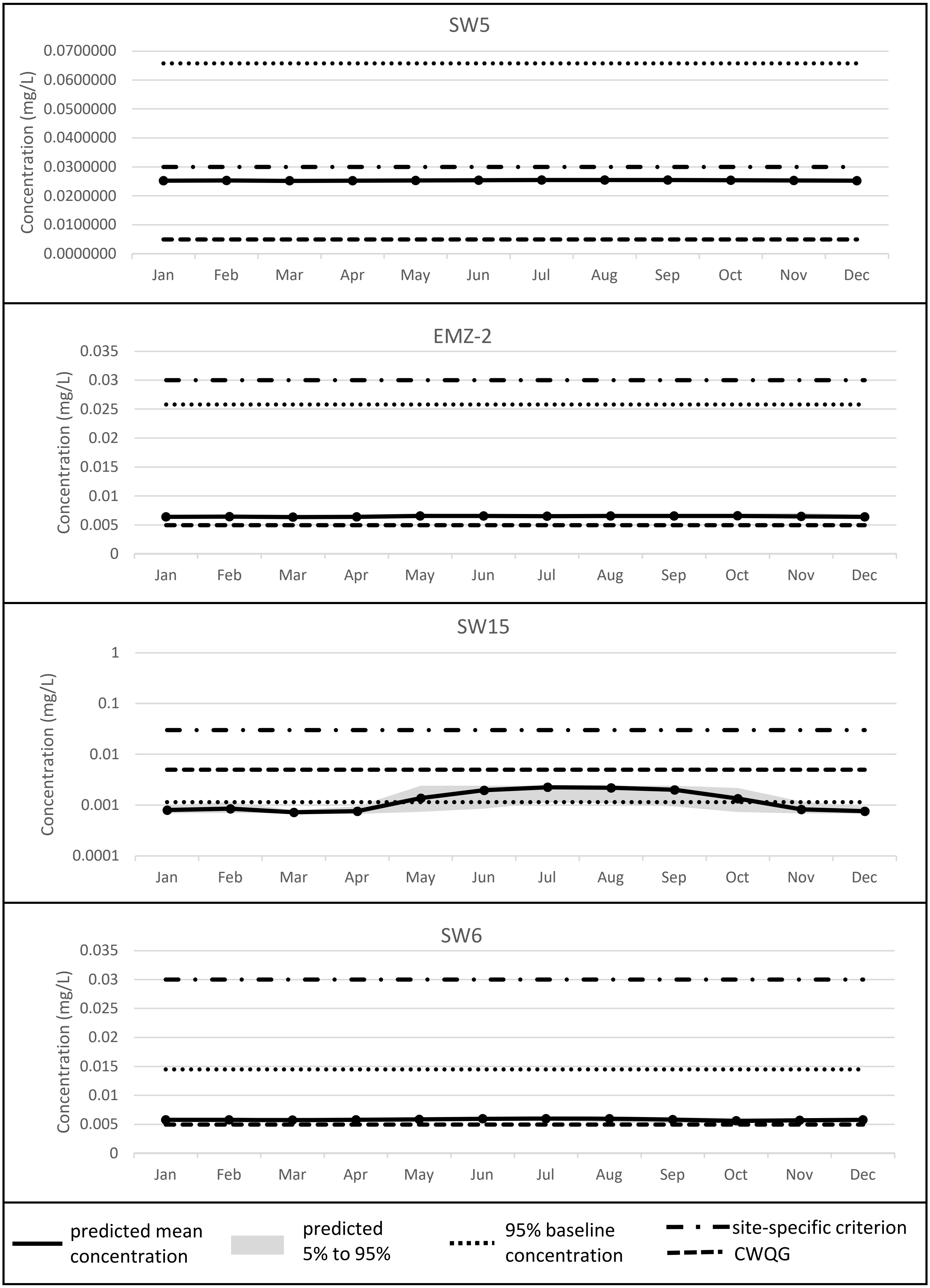


**FIGURE C-114: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED BORON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

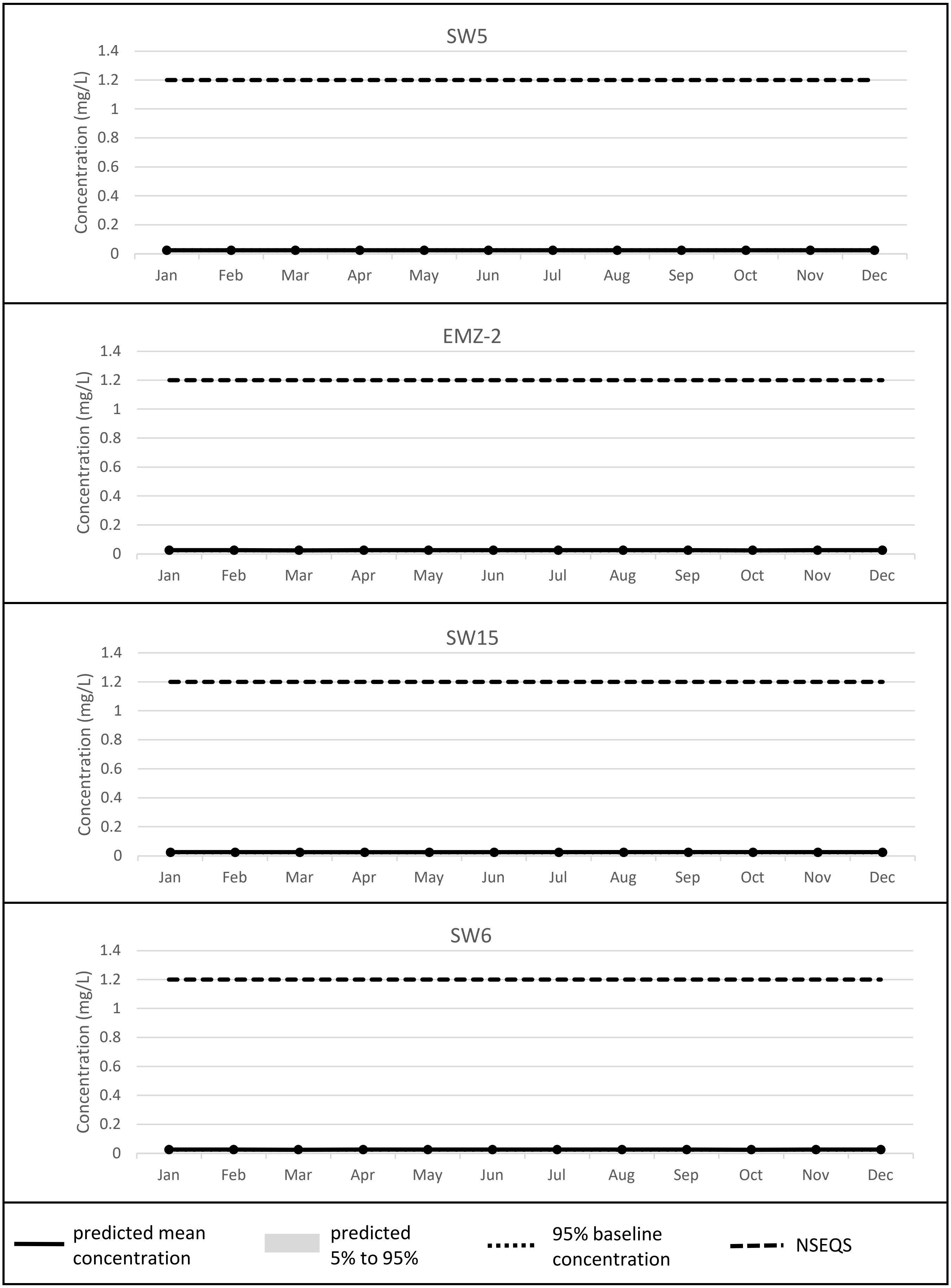


FIGURE C-115: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED CADMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

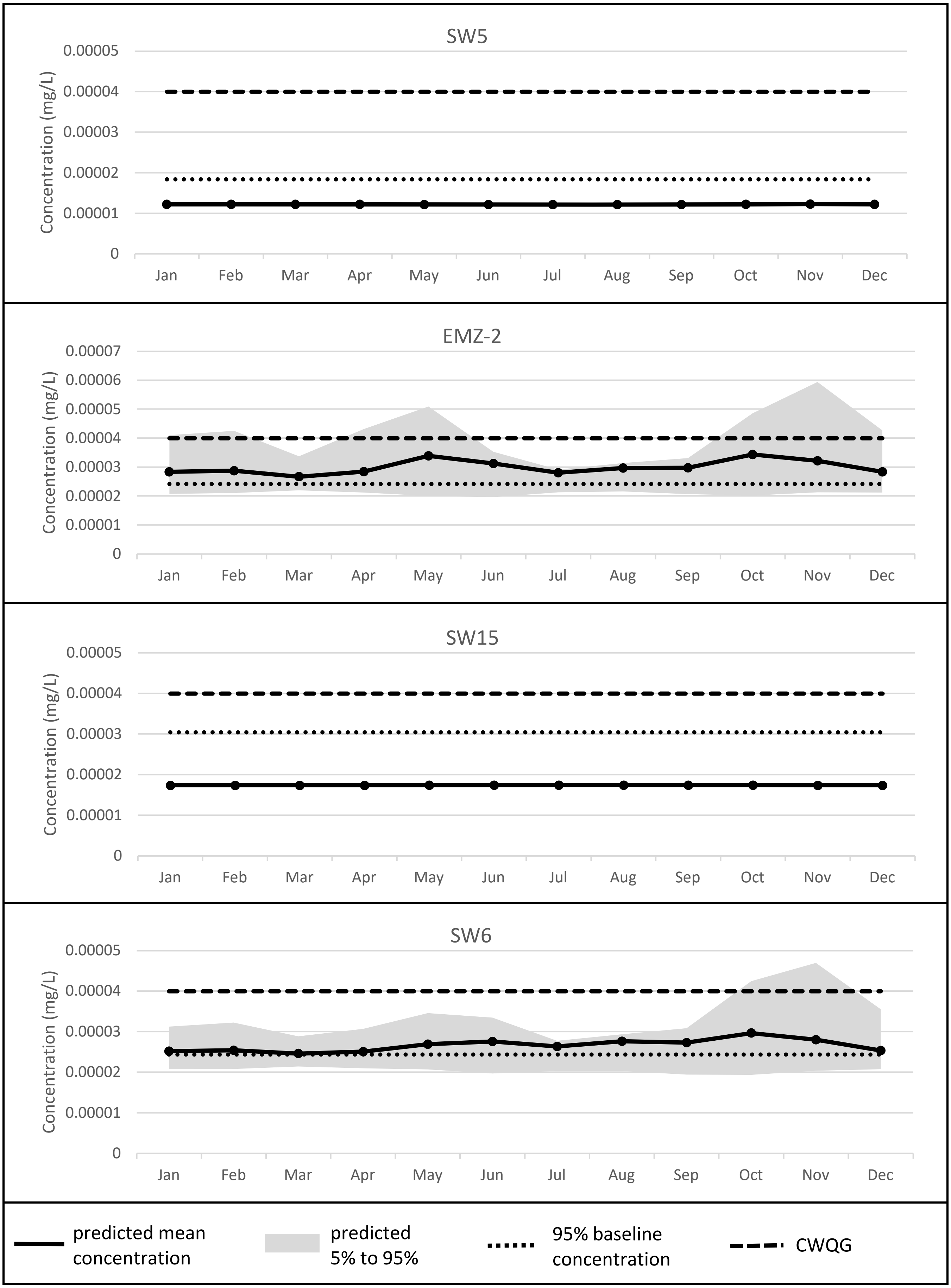


FIGURE C-116: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED CHROMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

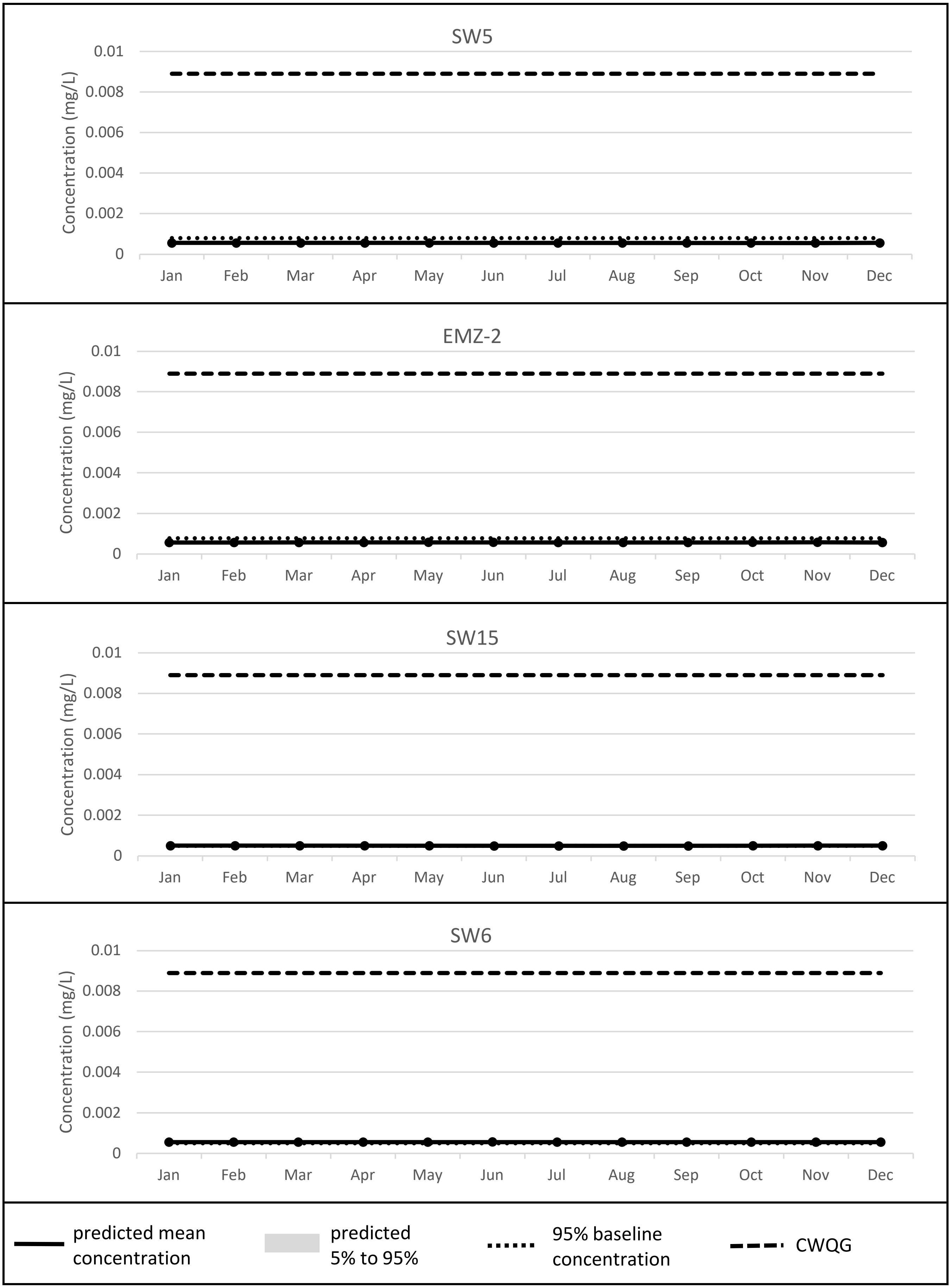


FIGURE C-117: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED COBALT CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

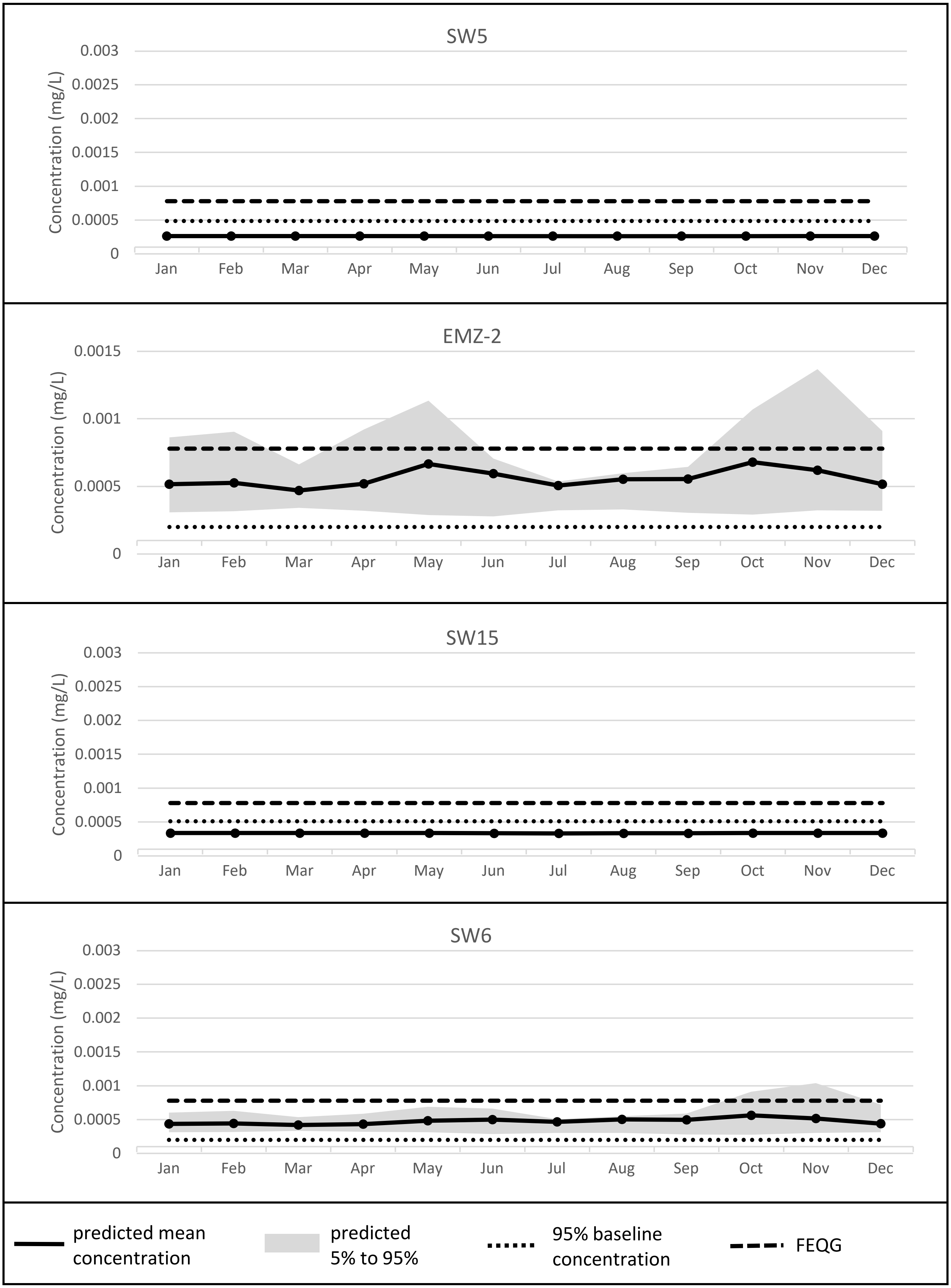


FIGURE C-118: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED COPPER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

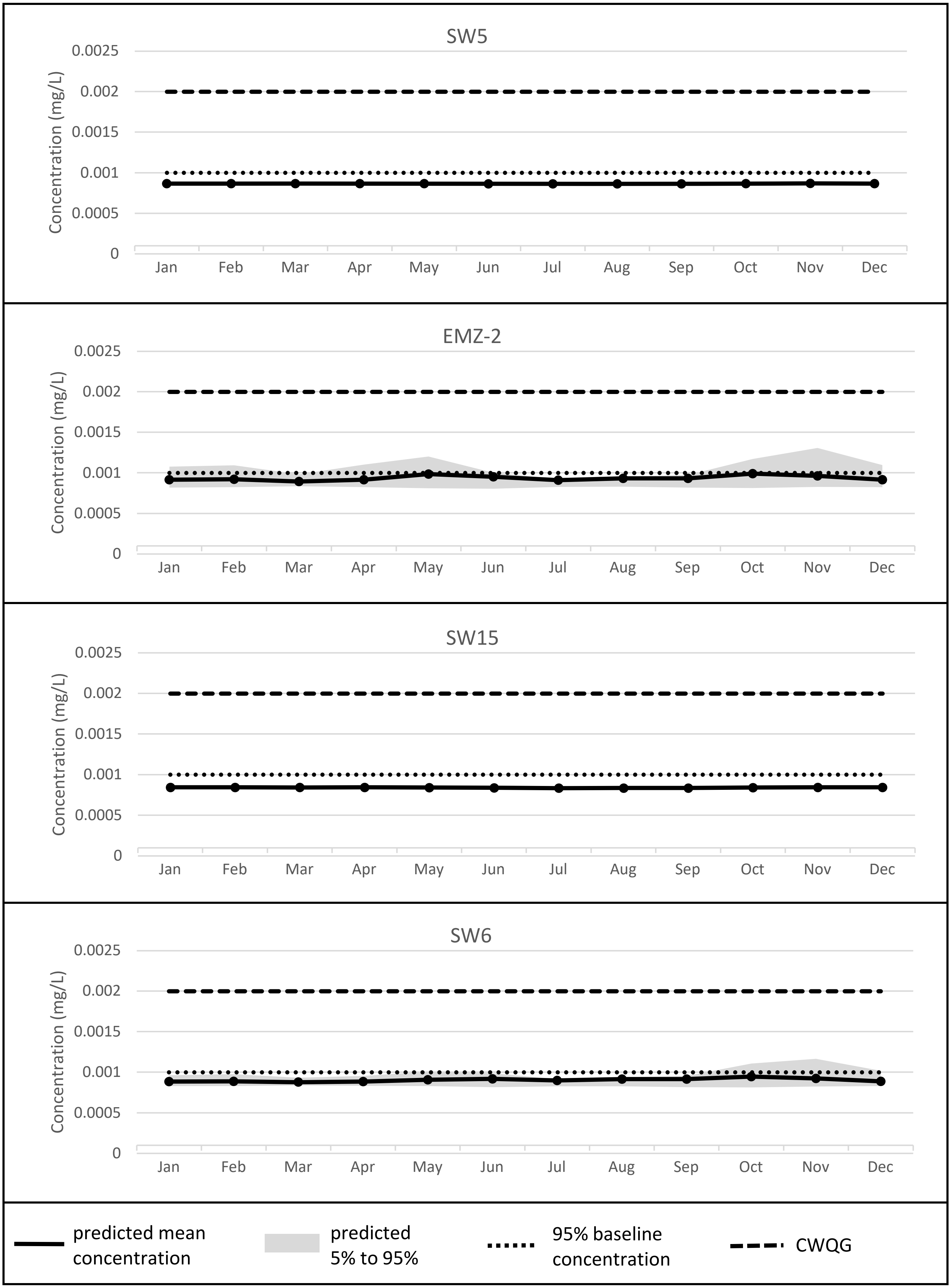


FIGURE C-119: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED IRON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

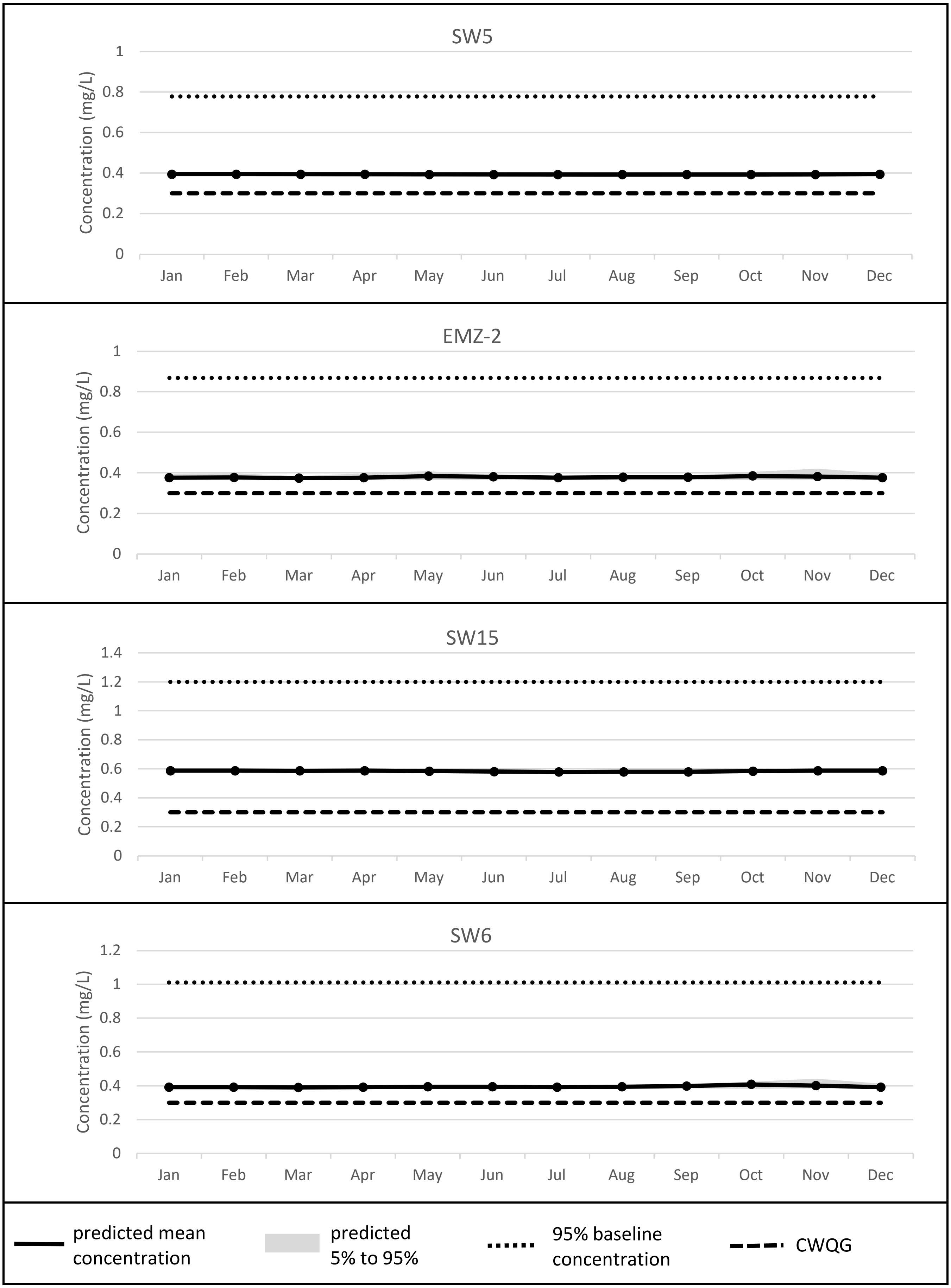


FIGURE C-120: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED LEAD CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

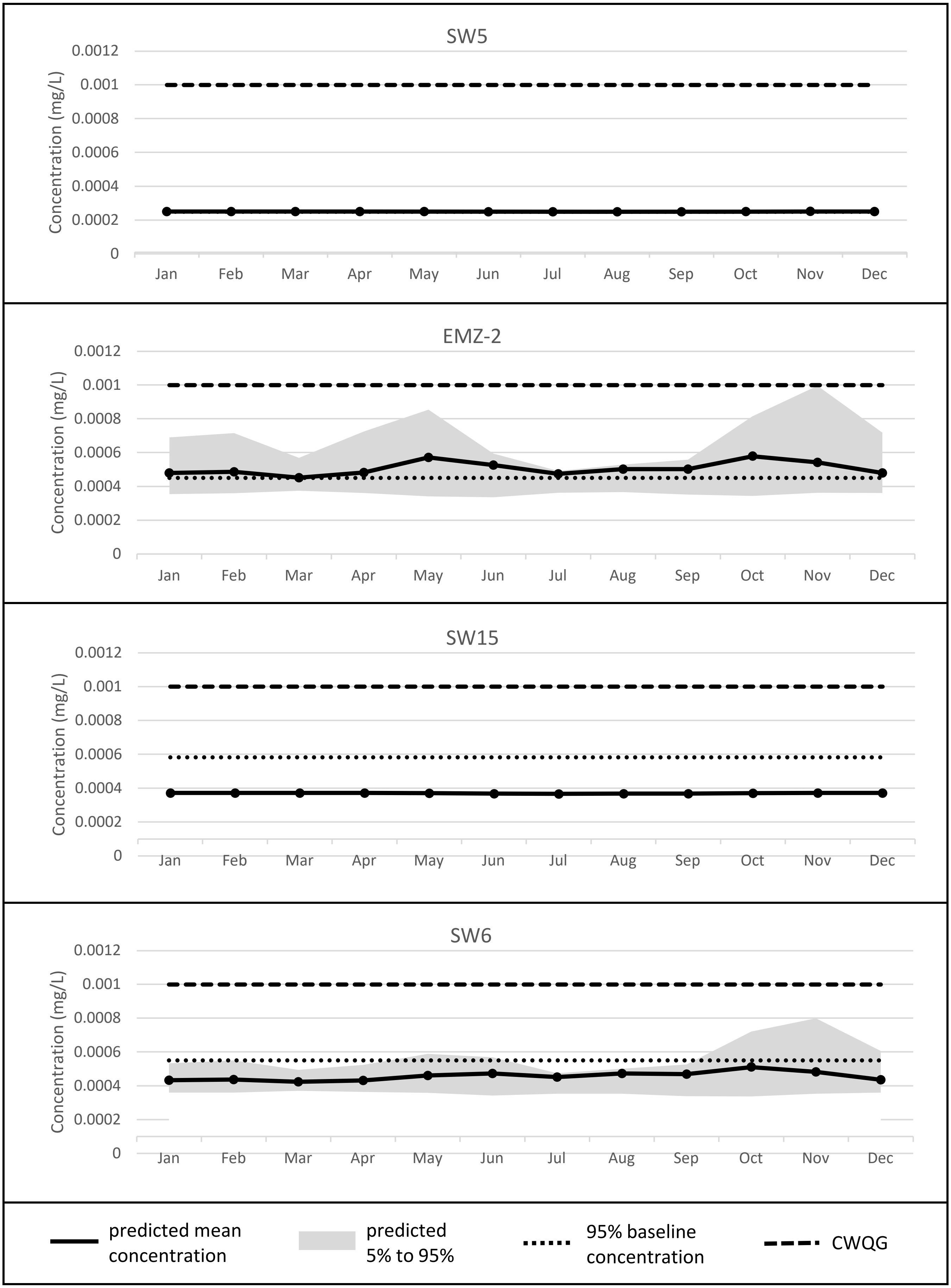


FIGURE C-121: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED MANGANESE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

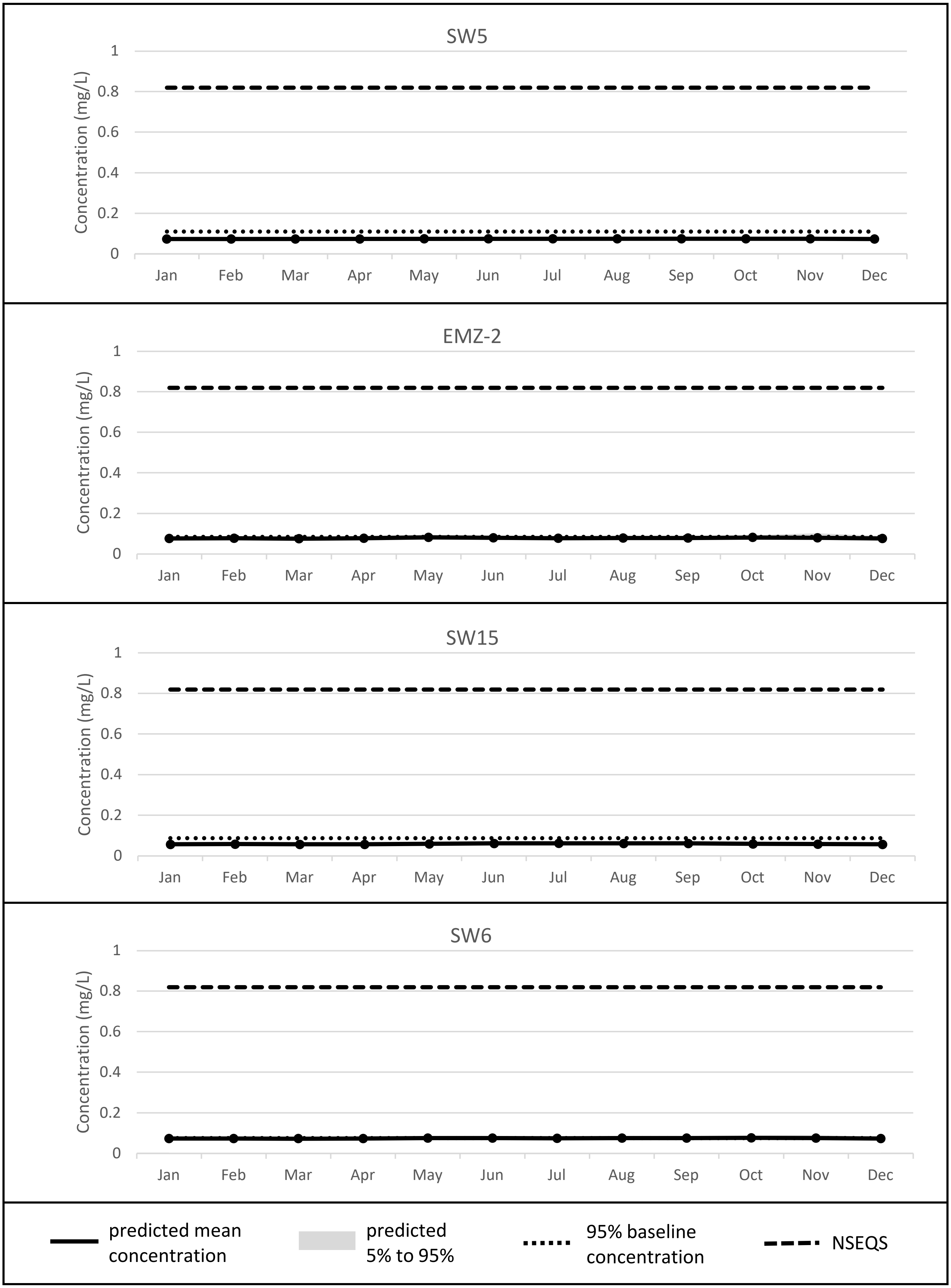


FIGURE C-122: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED MERCURY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

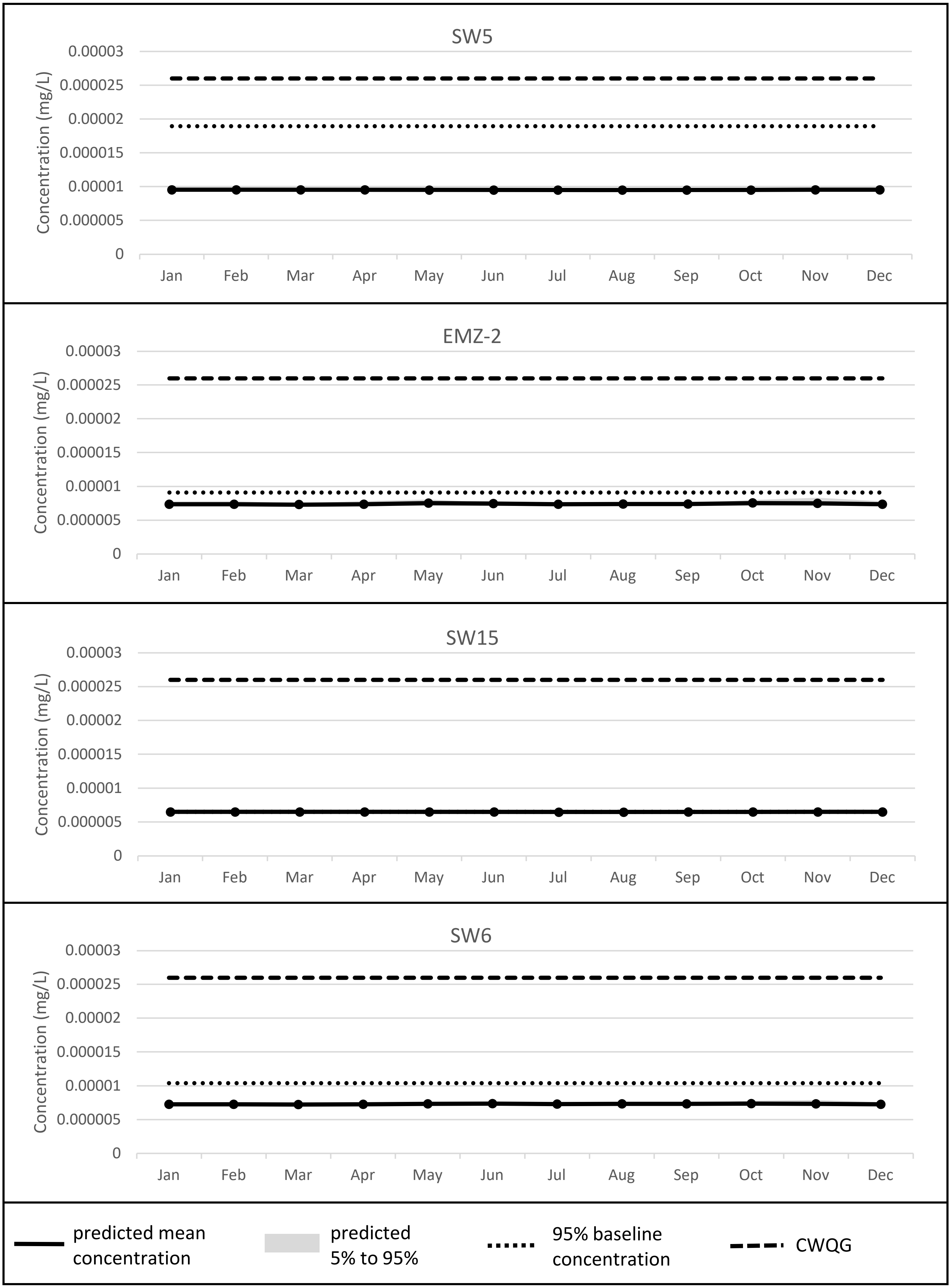


FIGURE C-123: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED MOLYBDENUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

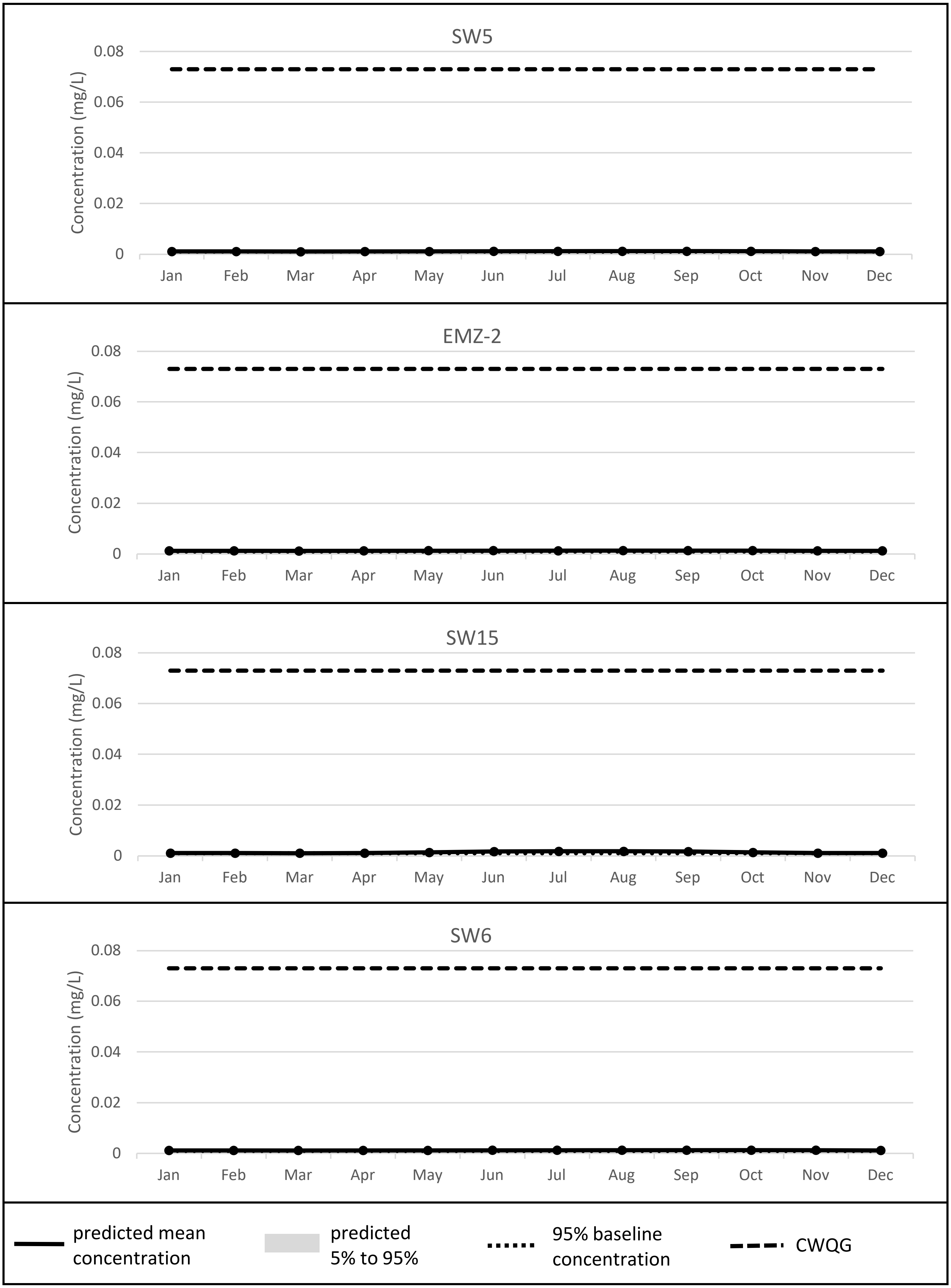


**FIGURE C-124: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED NICKEL CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

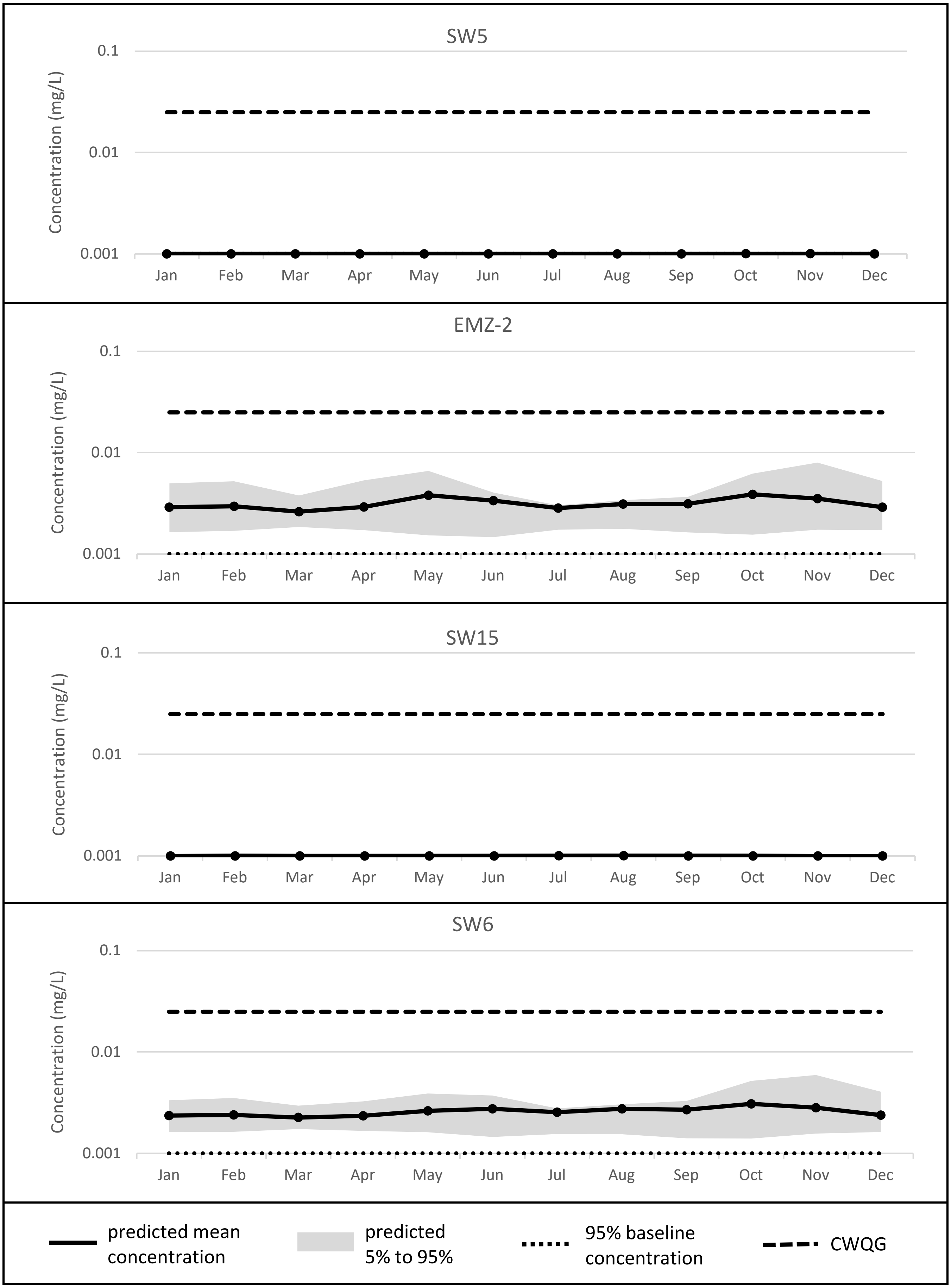


FIGURE C-125: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED NITRATE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

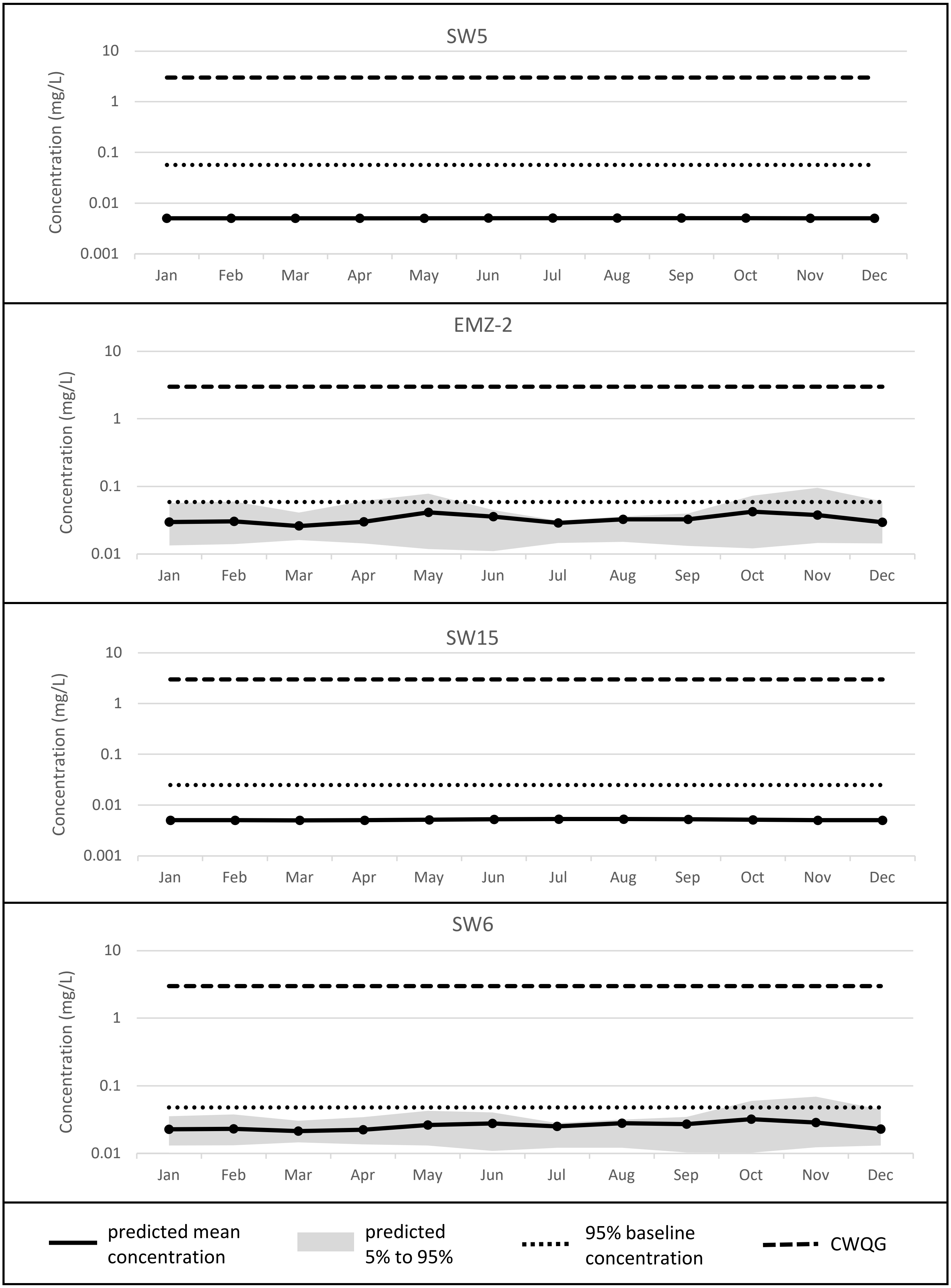


FIGURE C-126: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSAE PREDICTED NITRITE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

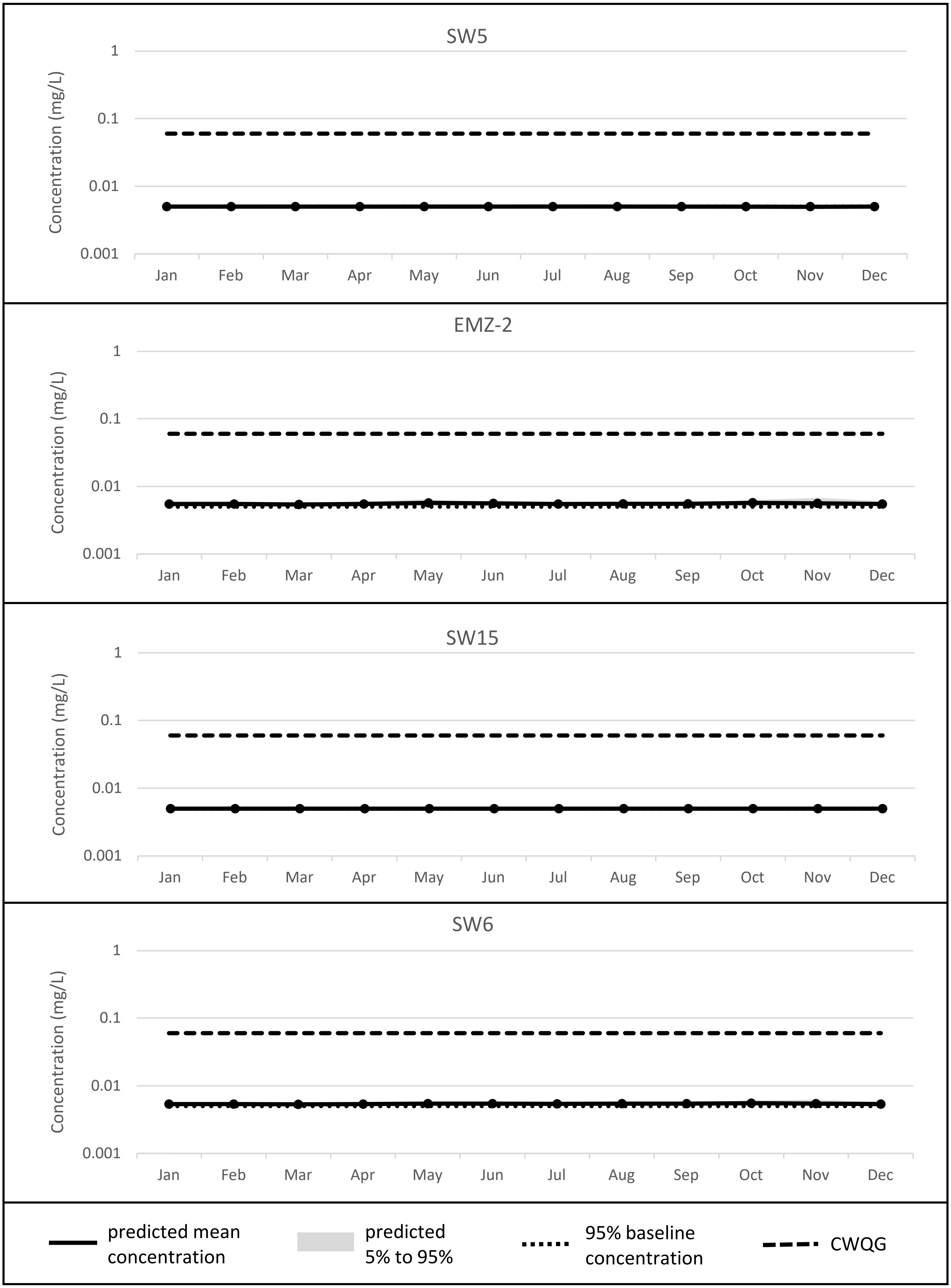
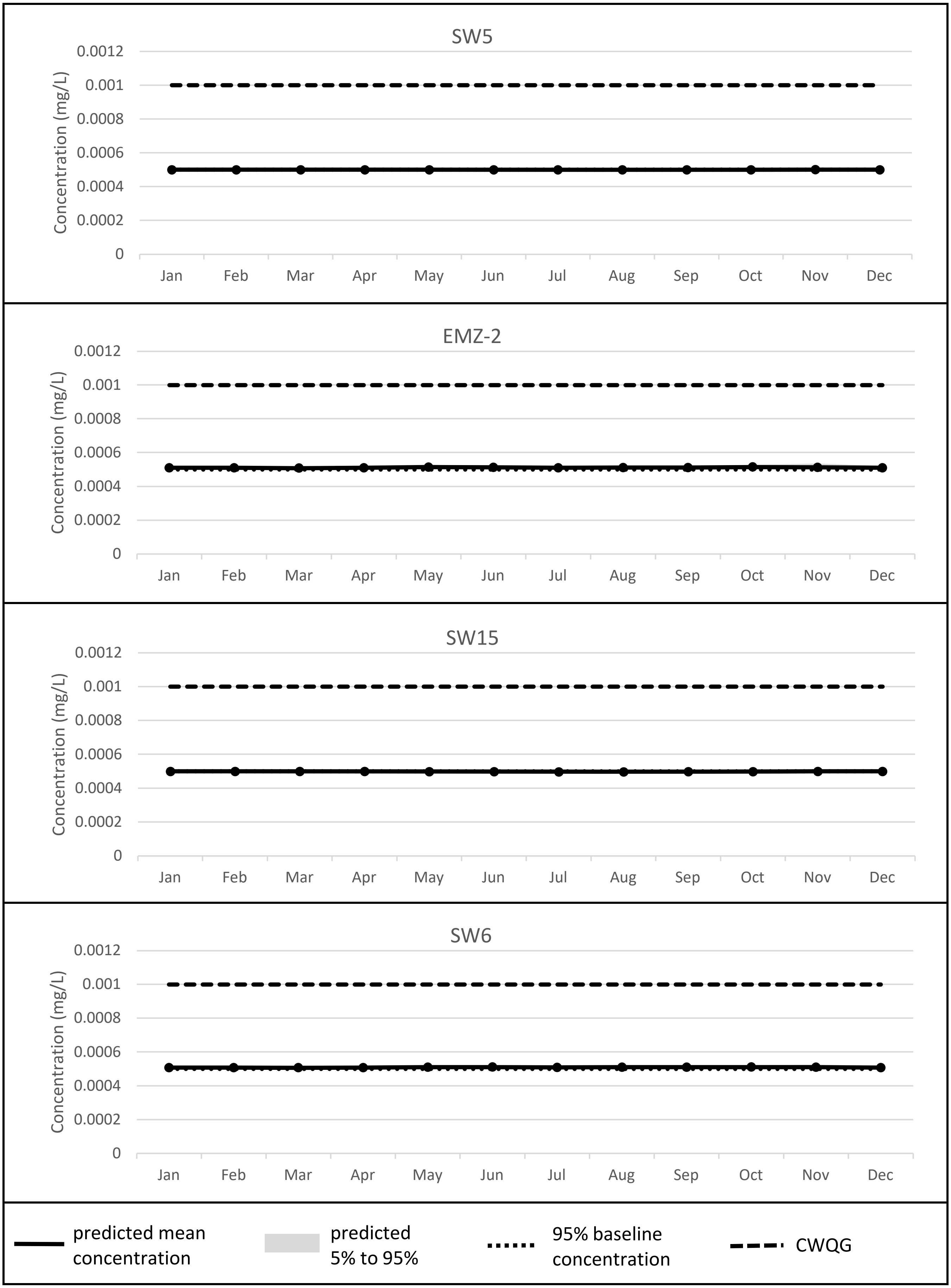


FIGURE C-127: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED SELENIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



PREDICTED SILVER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

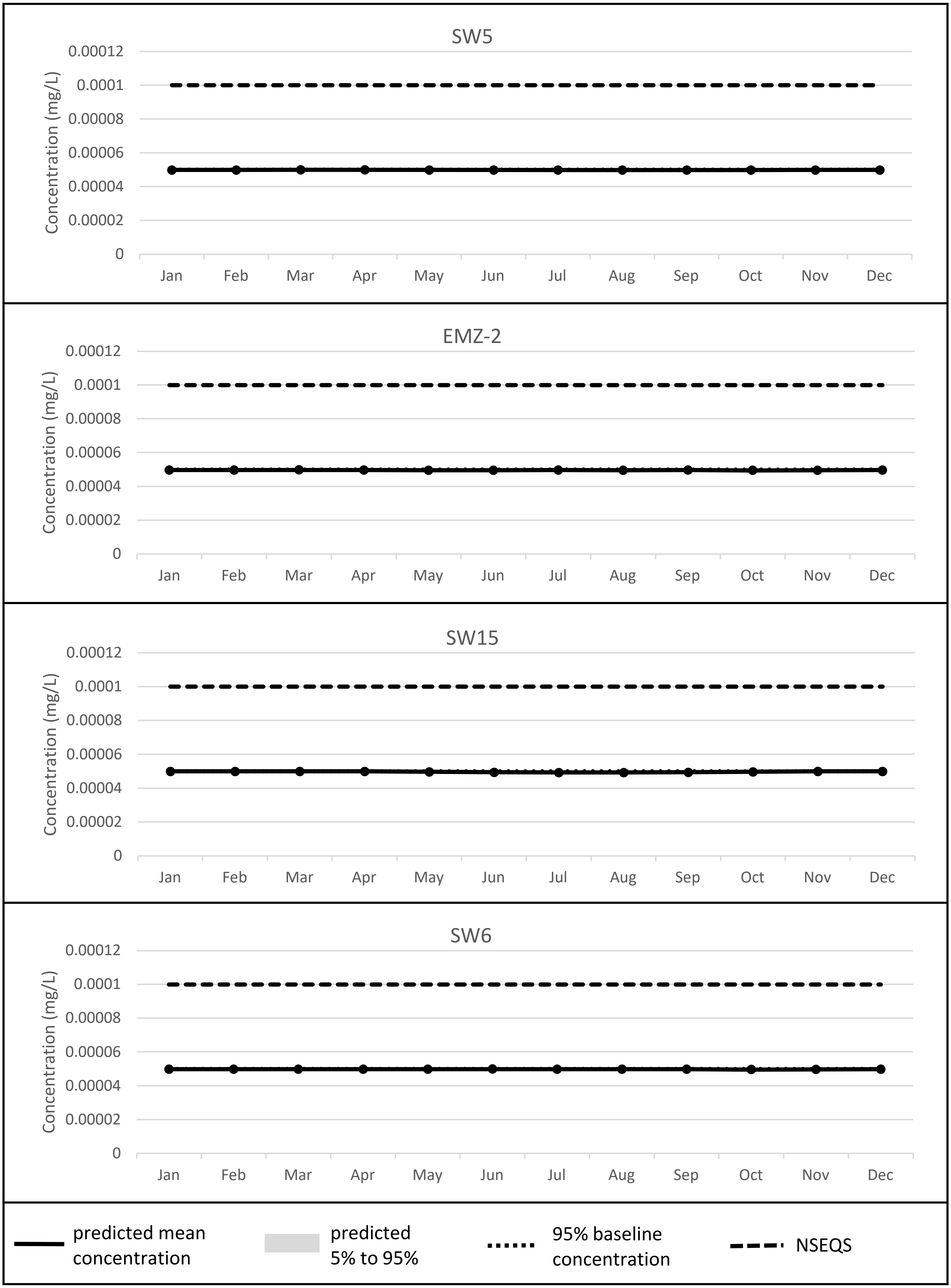


FIGURE C-129: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED THALLIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

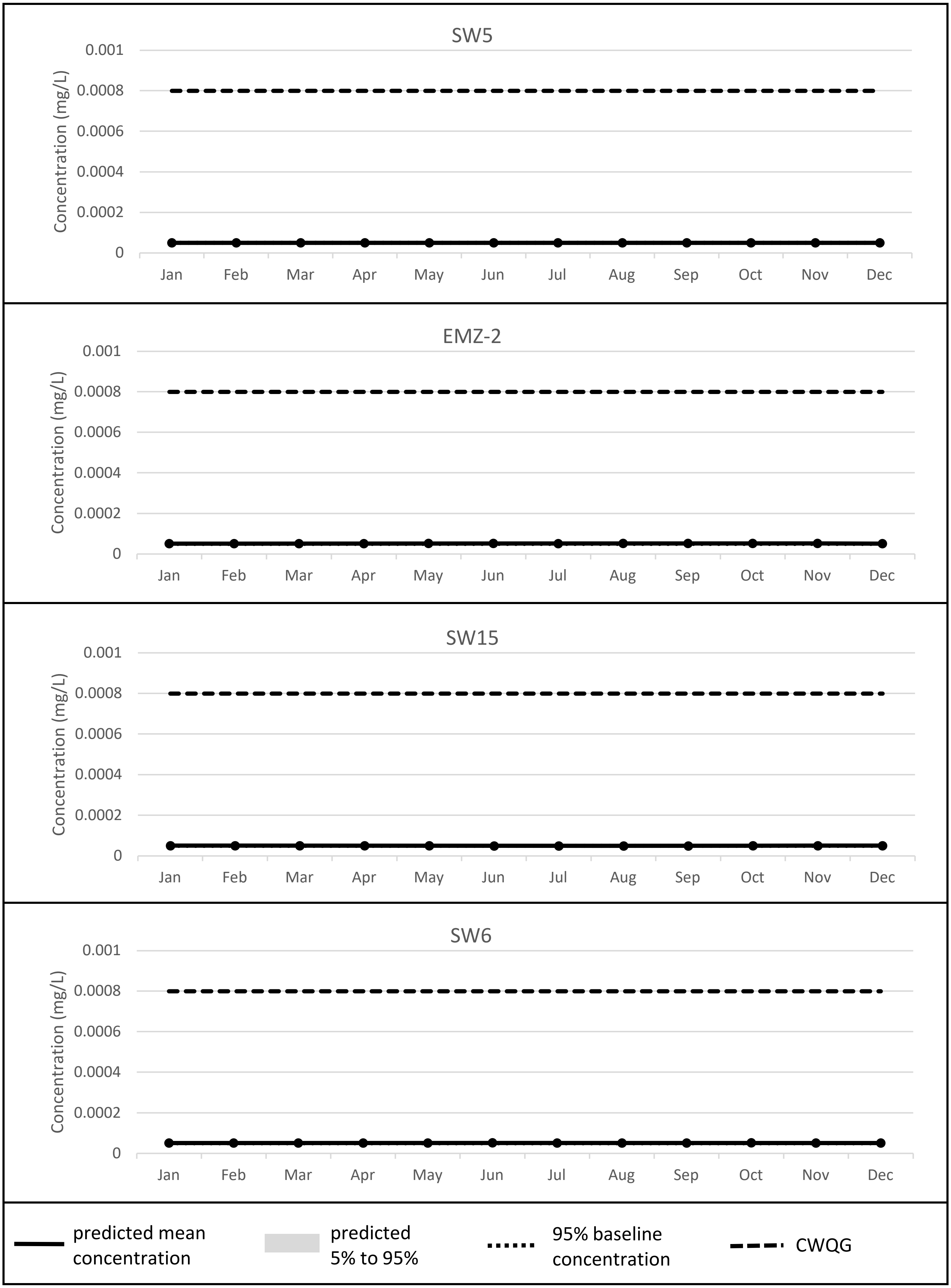


FIGURE C-130: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

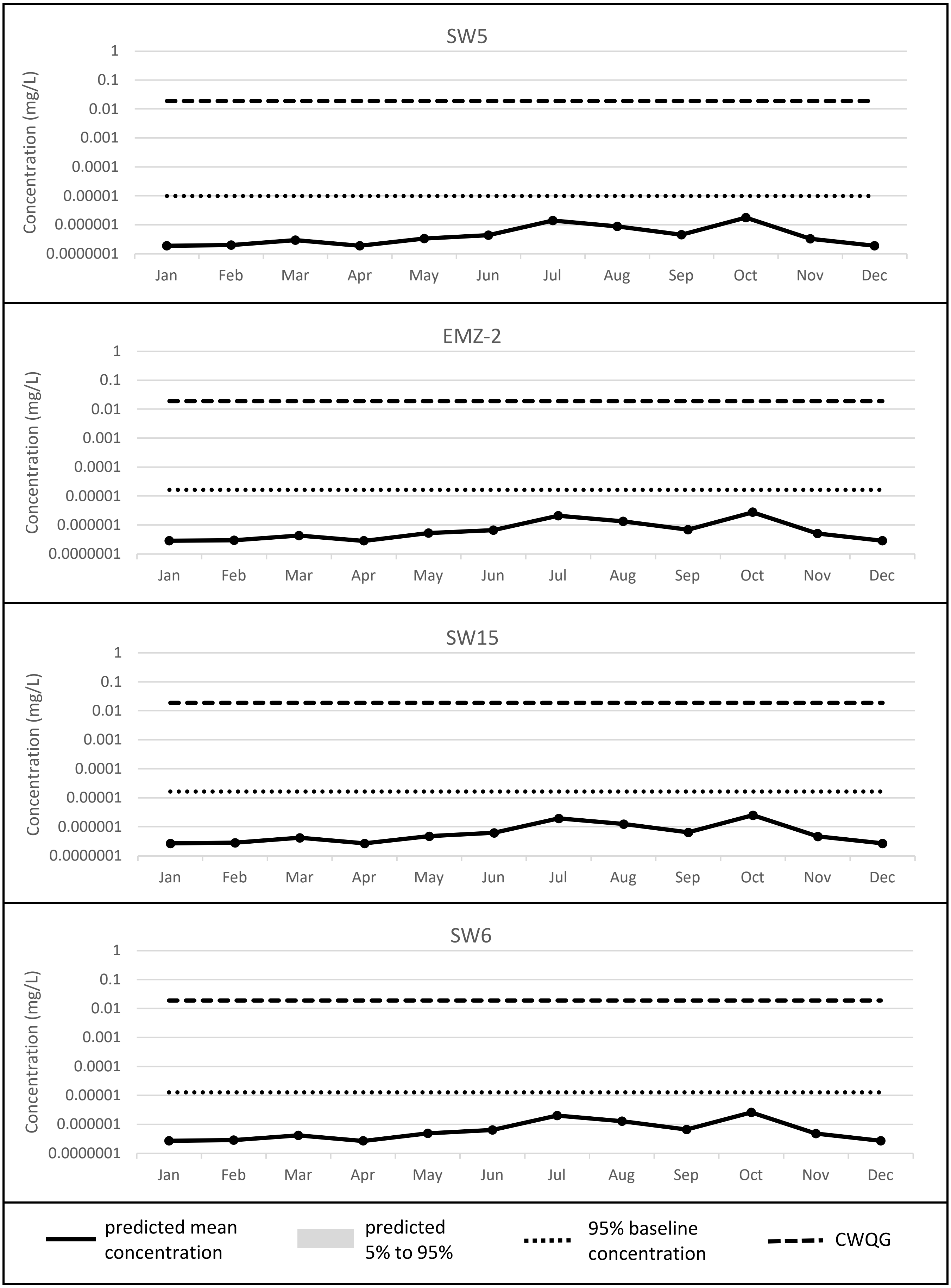


FIGURE C-131: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA PREDICTED URANIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

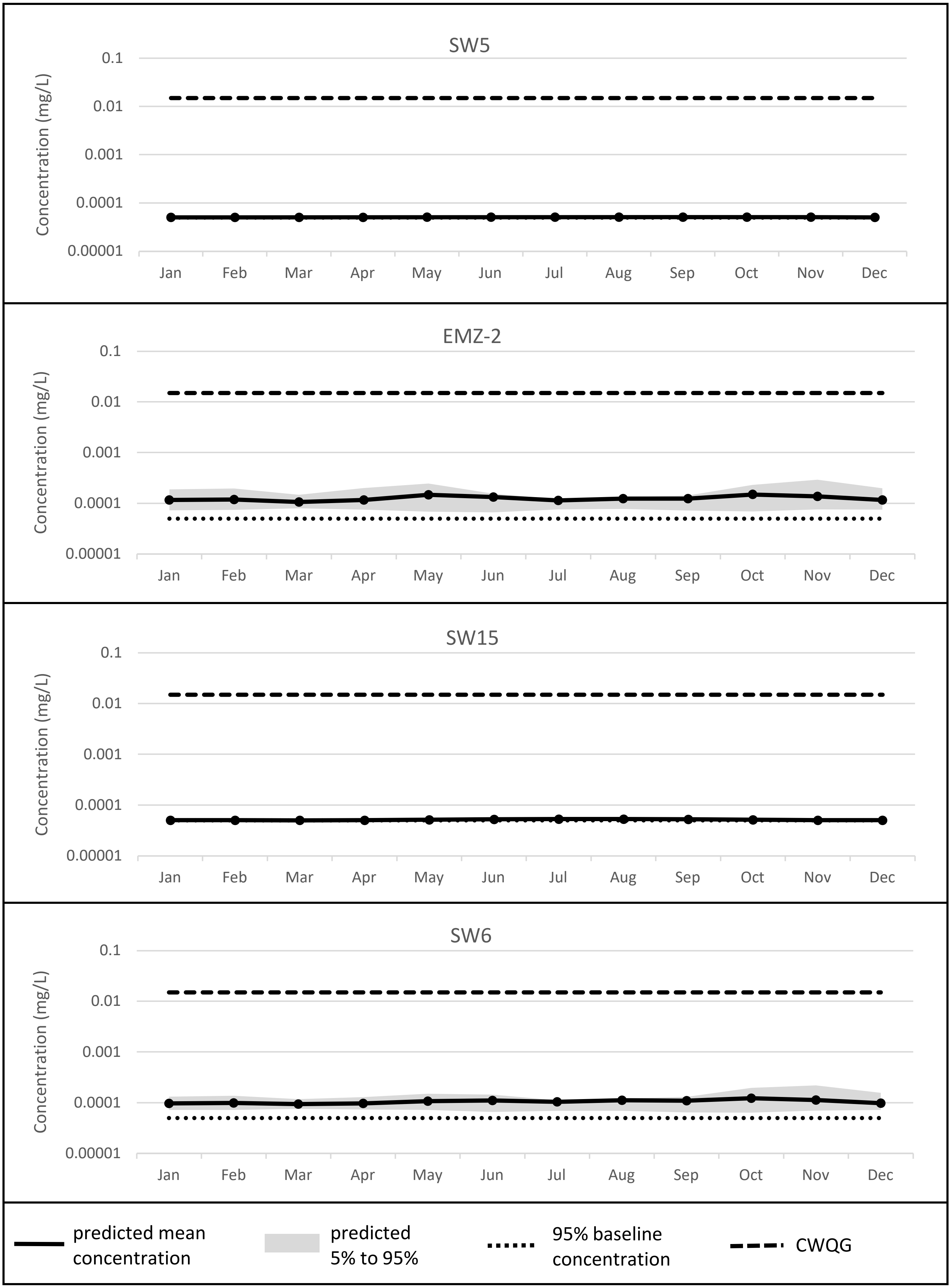


FIGURE C-132: SENSITIVITY ANALYSIS - 1% PAG IN NAG WRSA
PREDICTED ZINC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

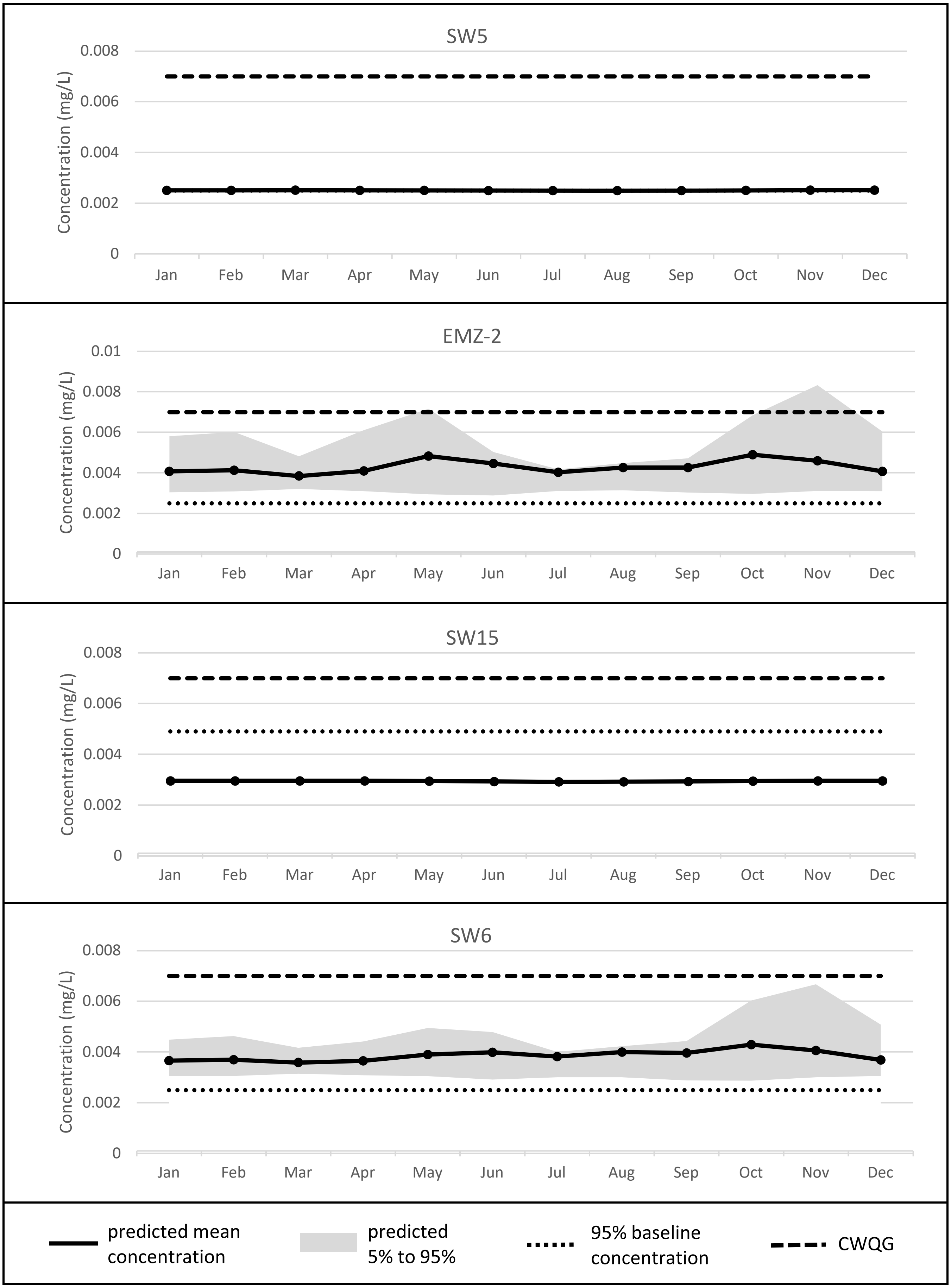


FIGURE C-133: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ALUMINUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

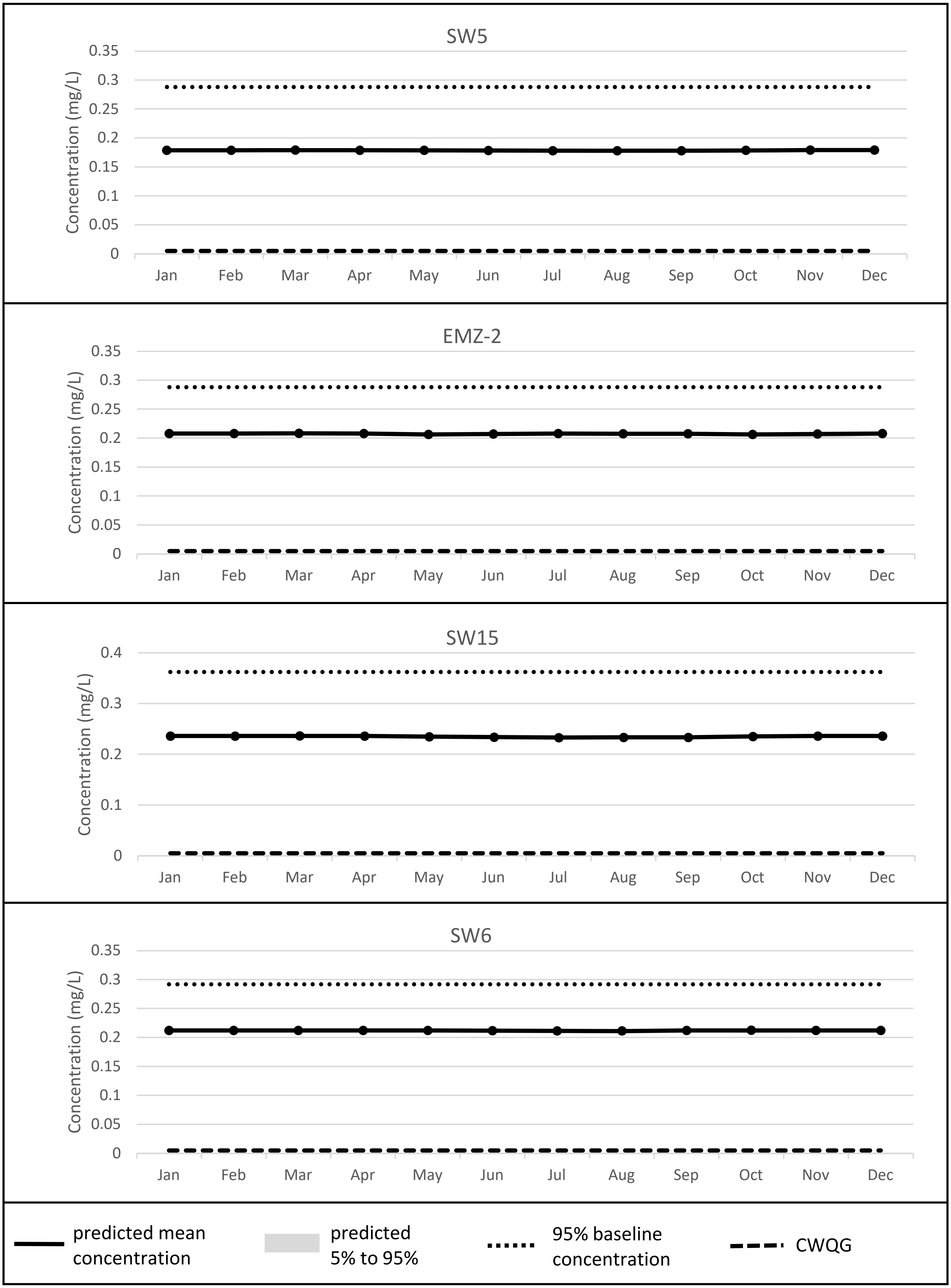


FIGURE C-134: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTSASE PREDICTED ANTIMONY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

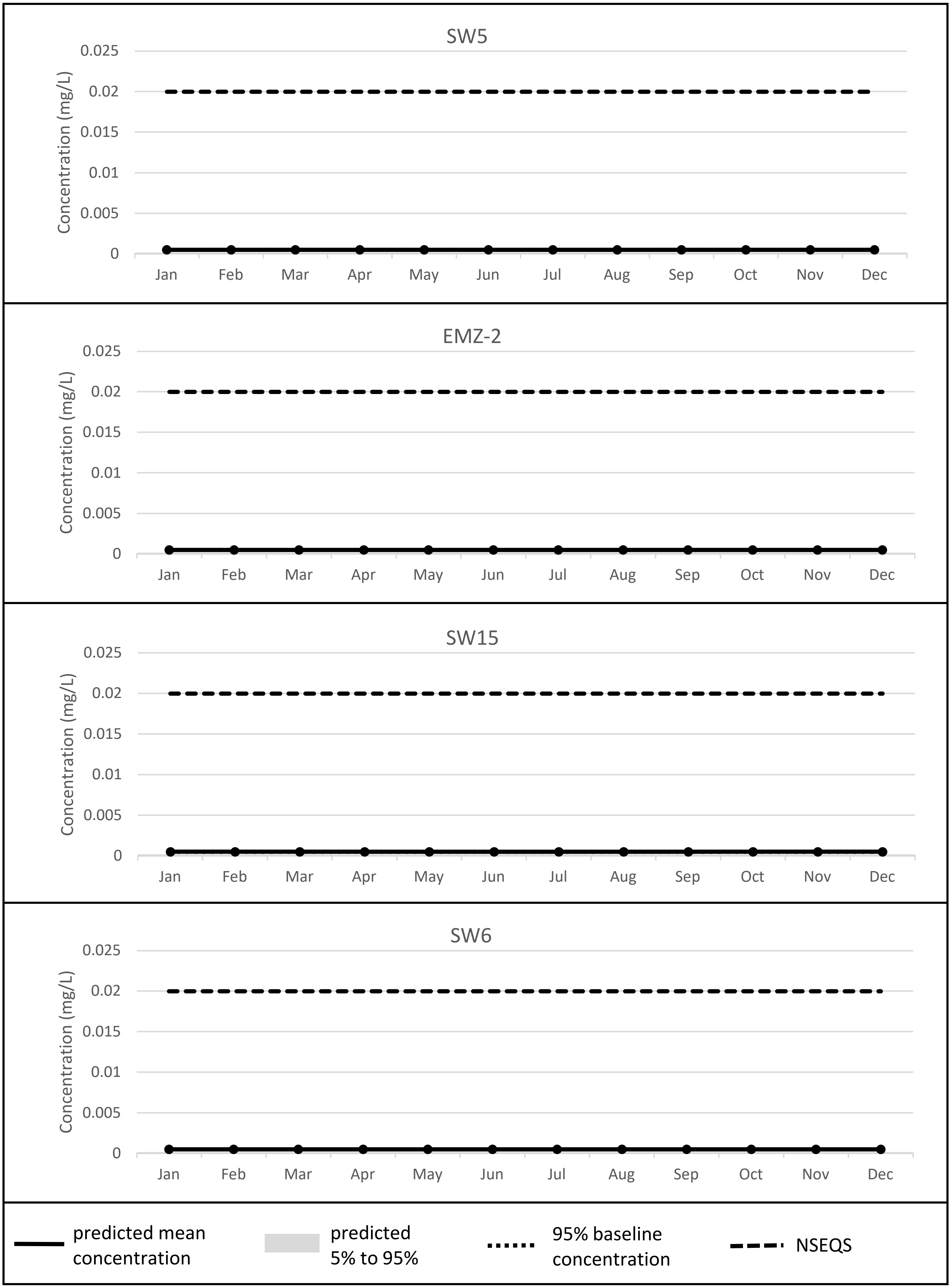


FIGURE C-135: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ARSENIC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

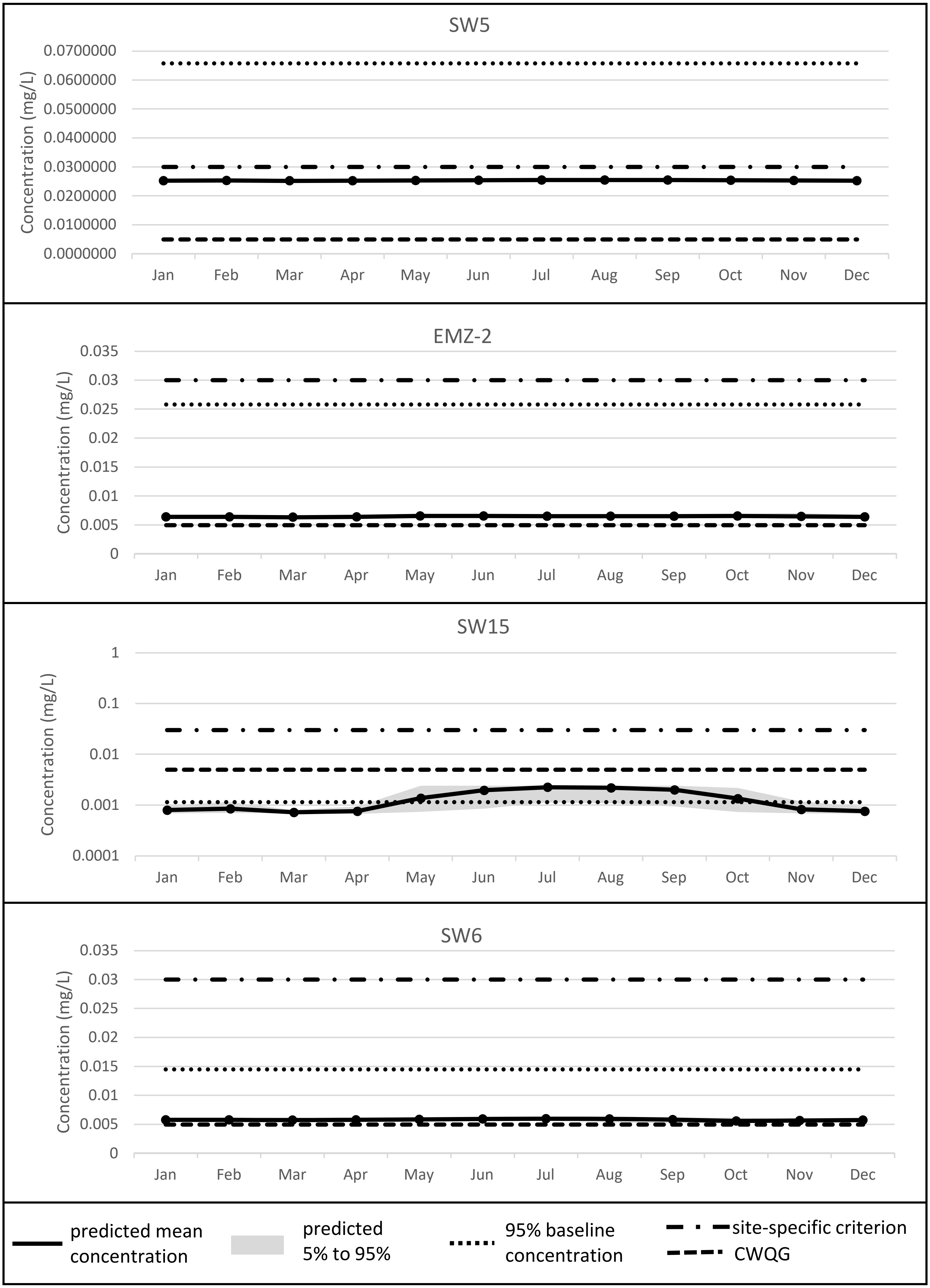


FIGURE C-136: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED BORON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

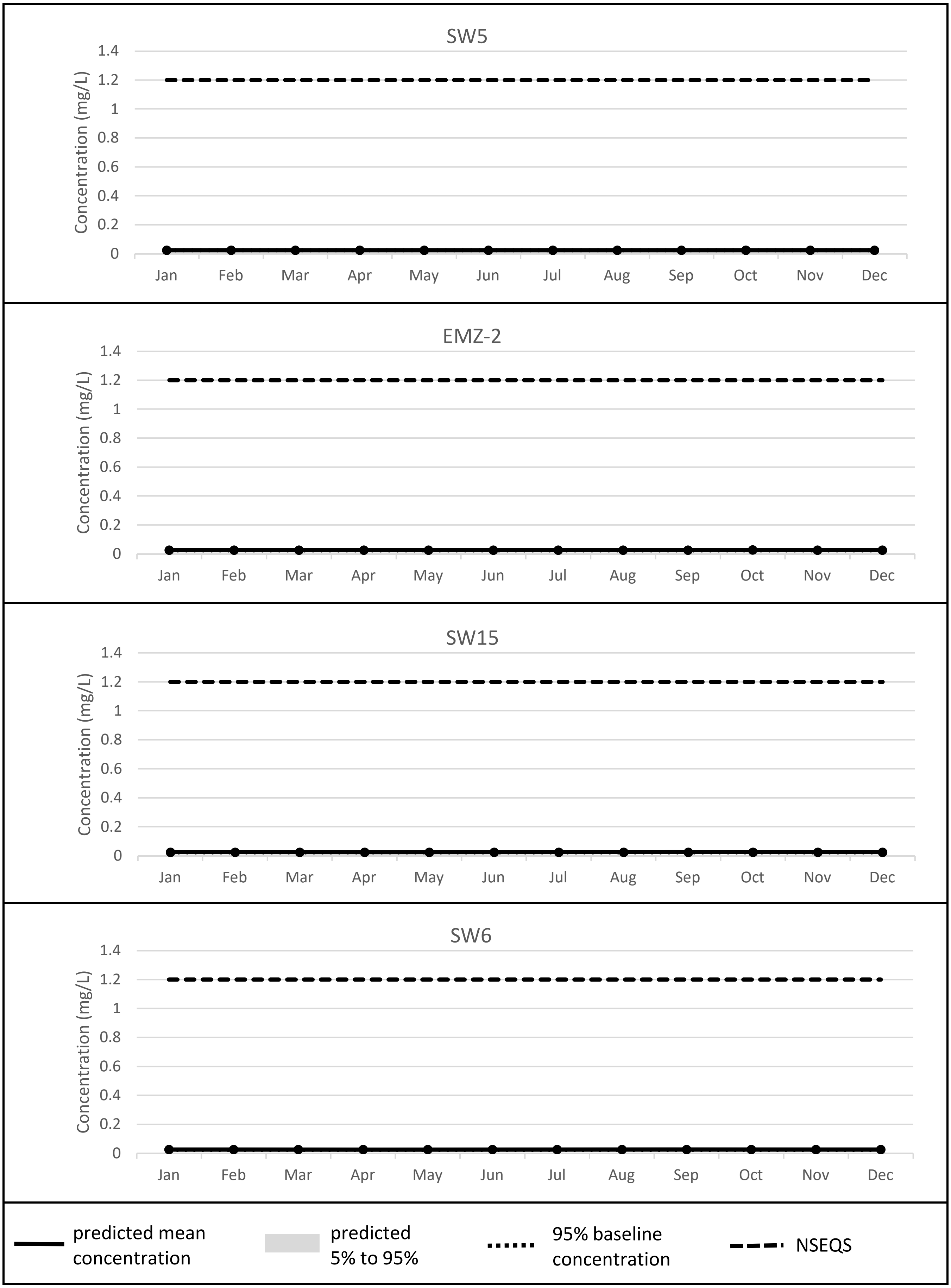


FIGURE C-137: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED CADMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

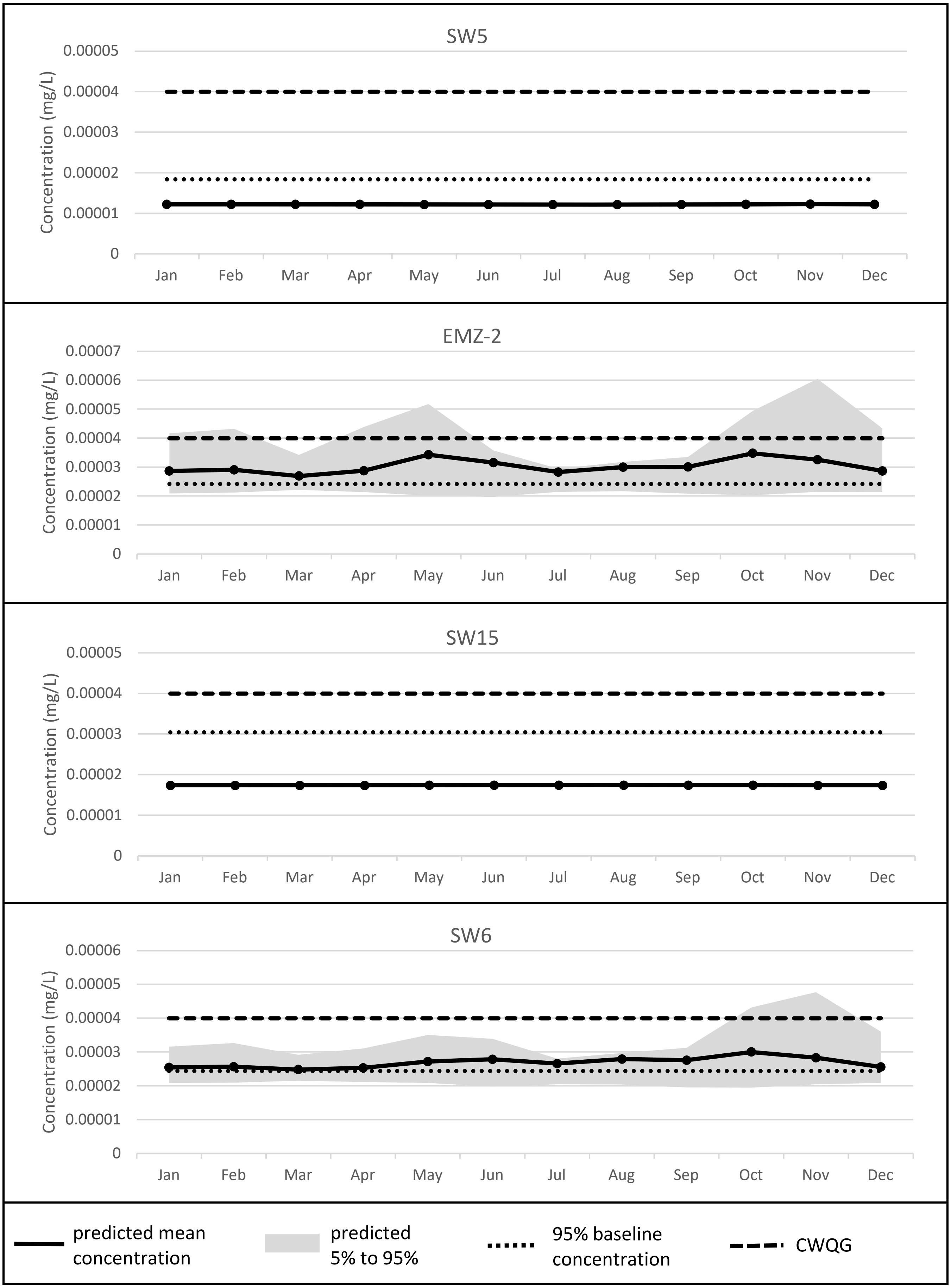


FIGURE C-138: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED CHROMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

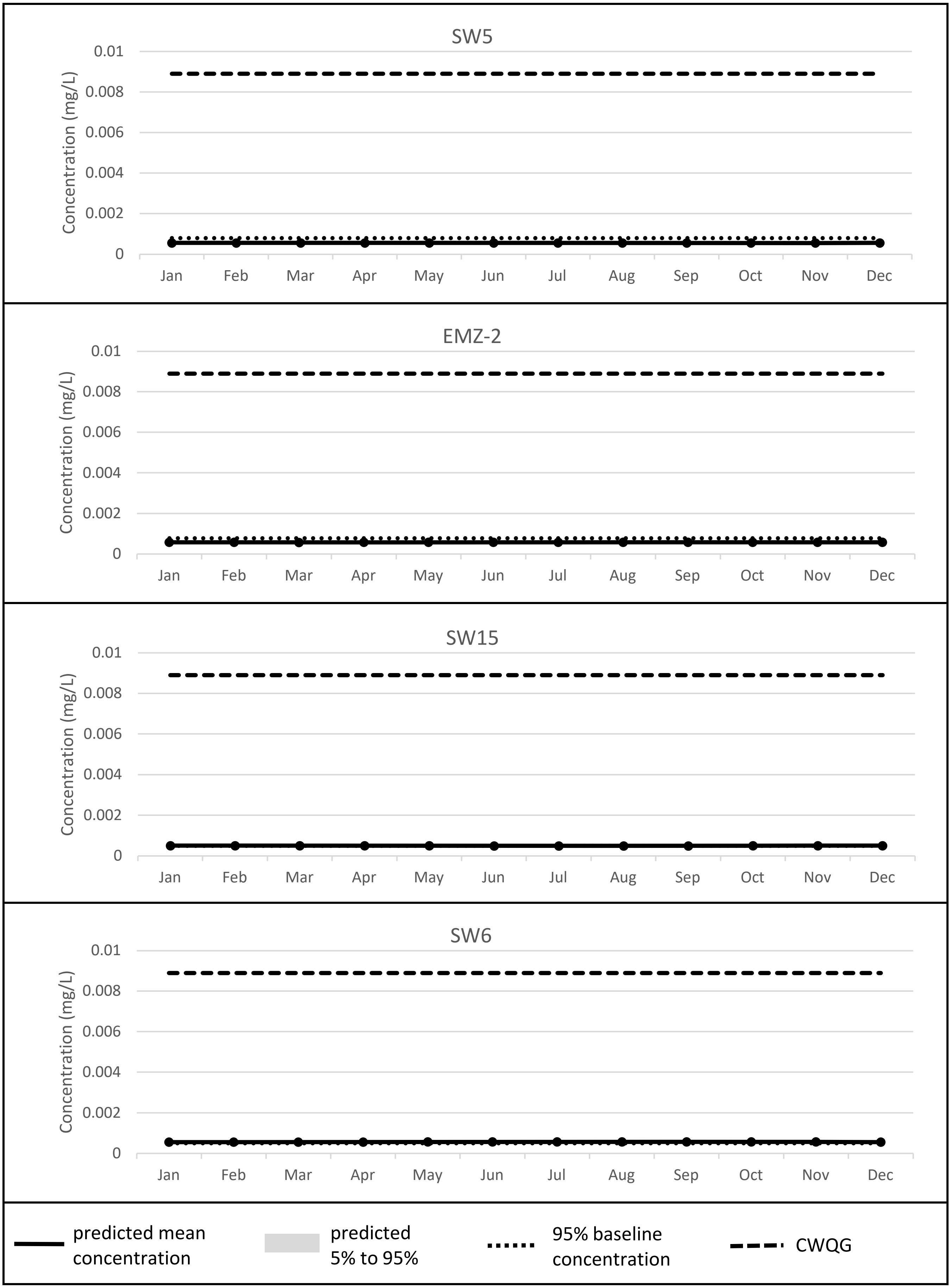


FIGURE C-139: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED COBALT CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

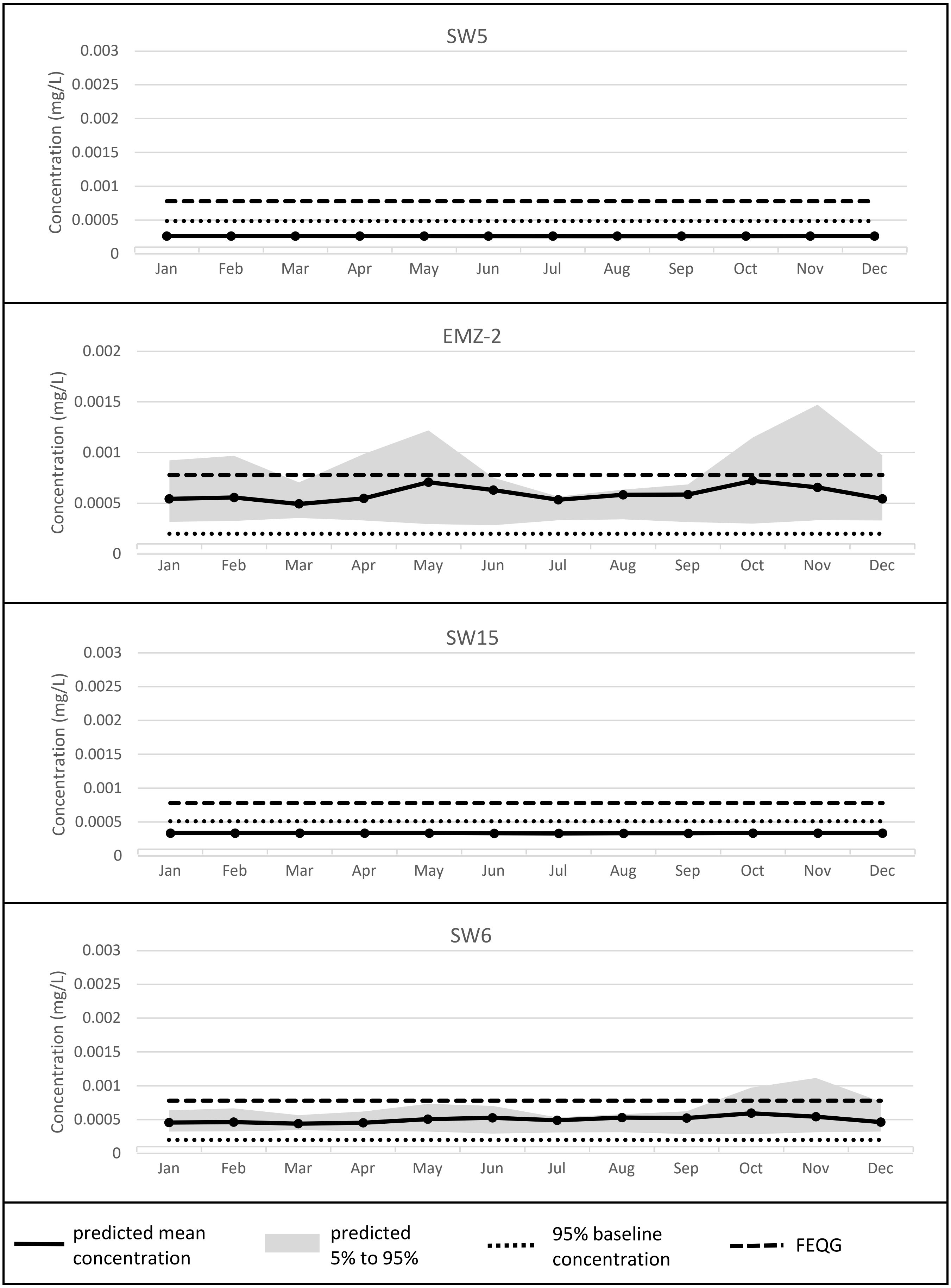


FIGURE C-140: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED COPPER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

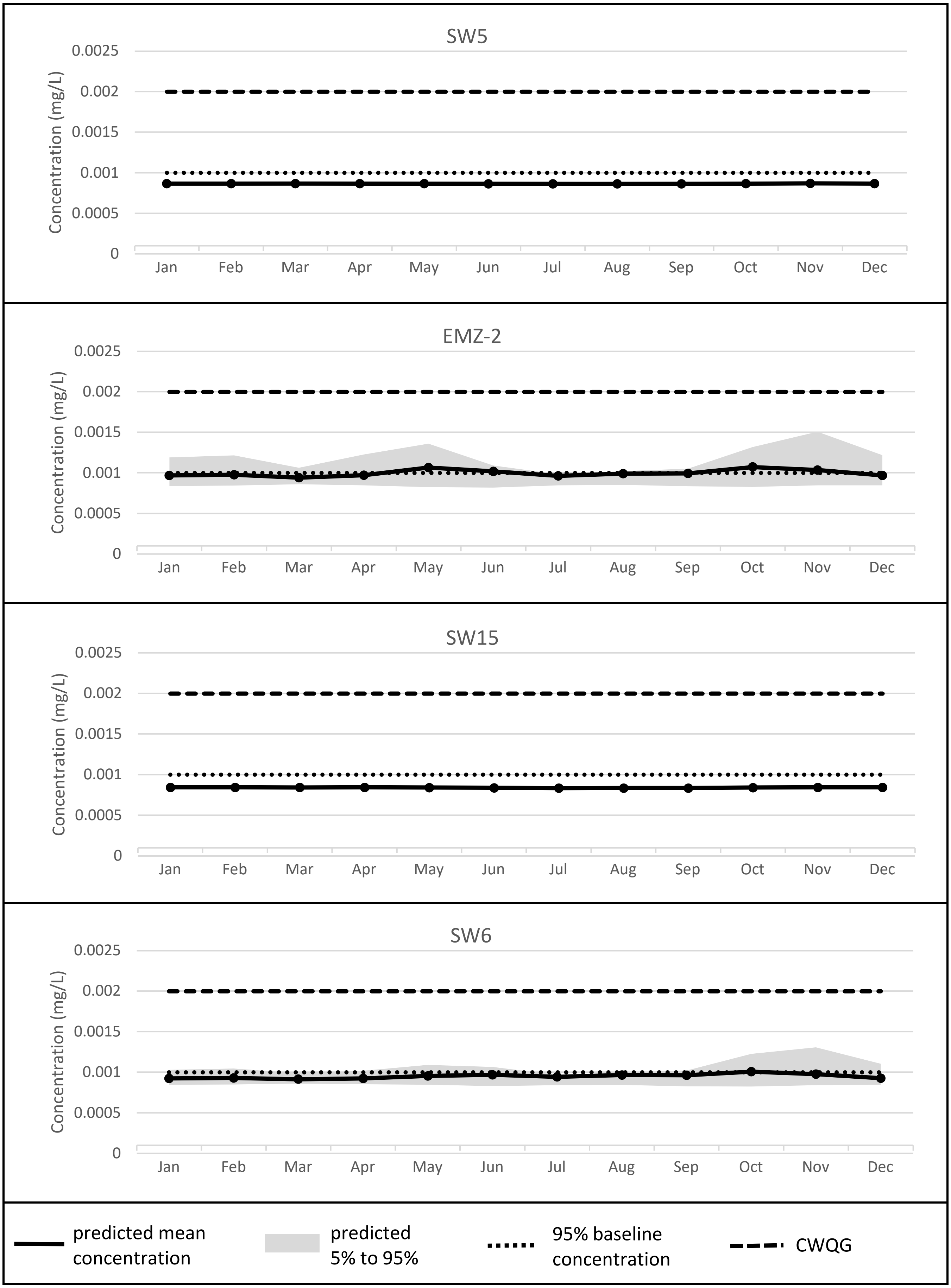


FIGURE C-141: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED IRON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

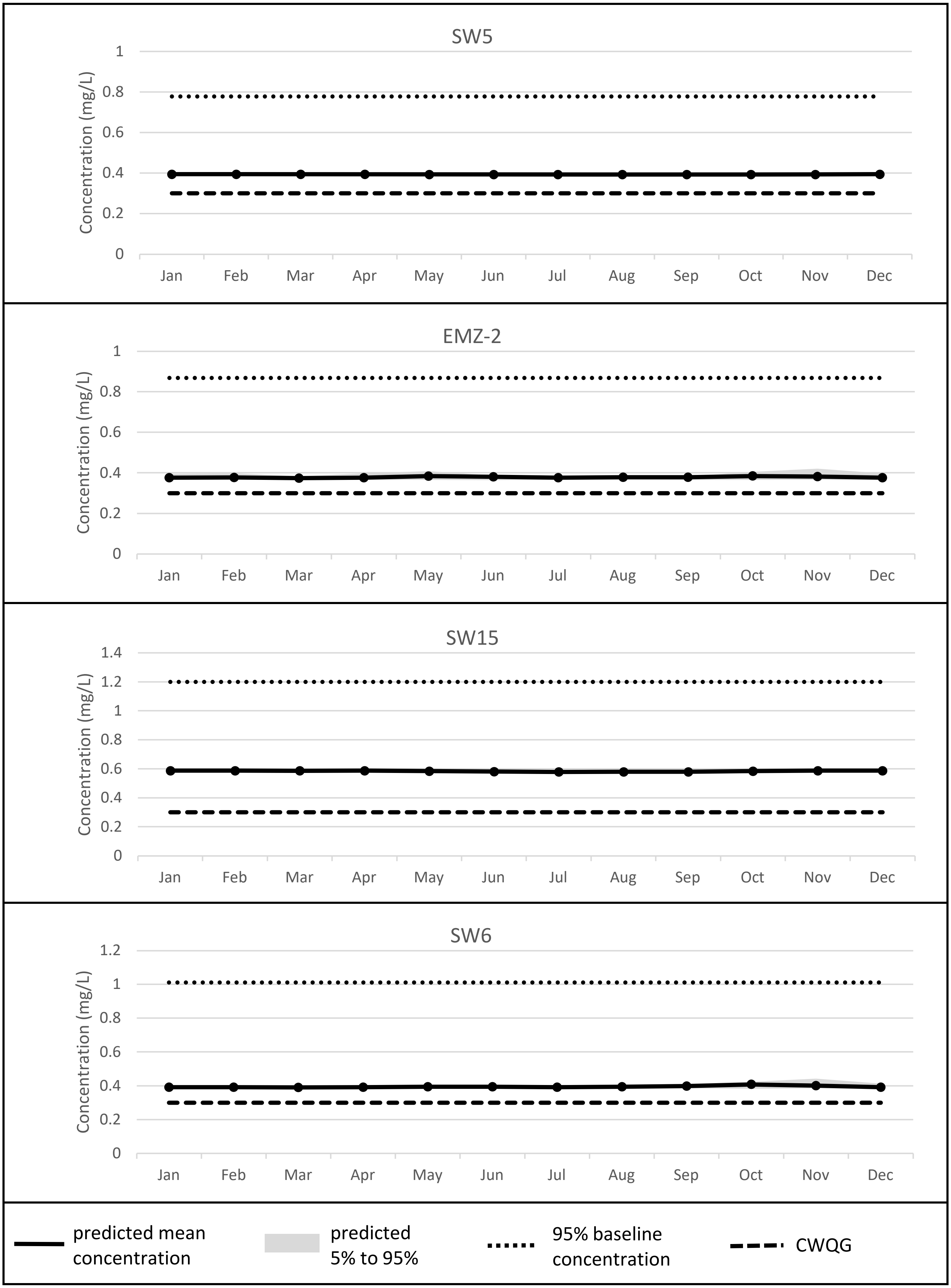
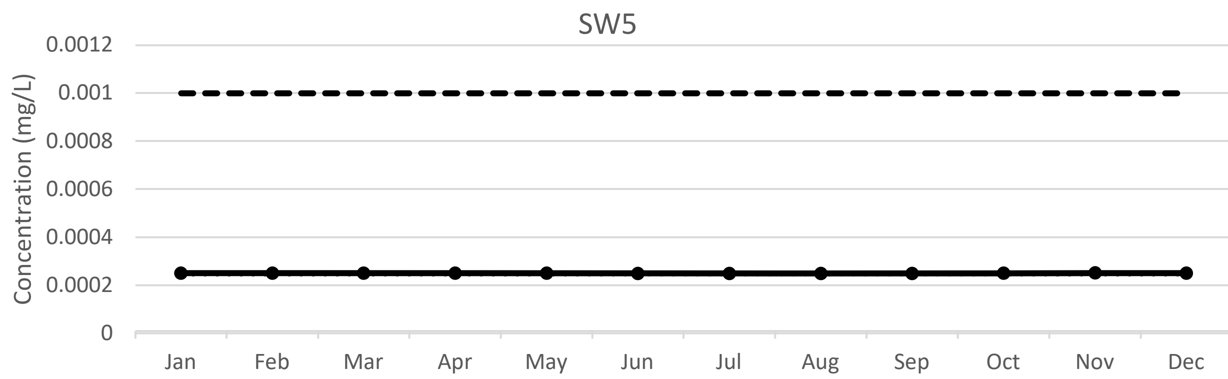
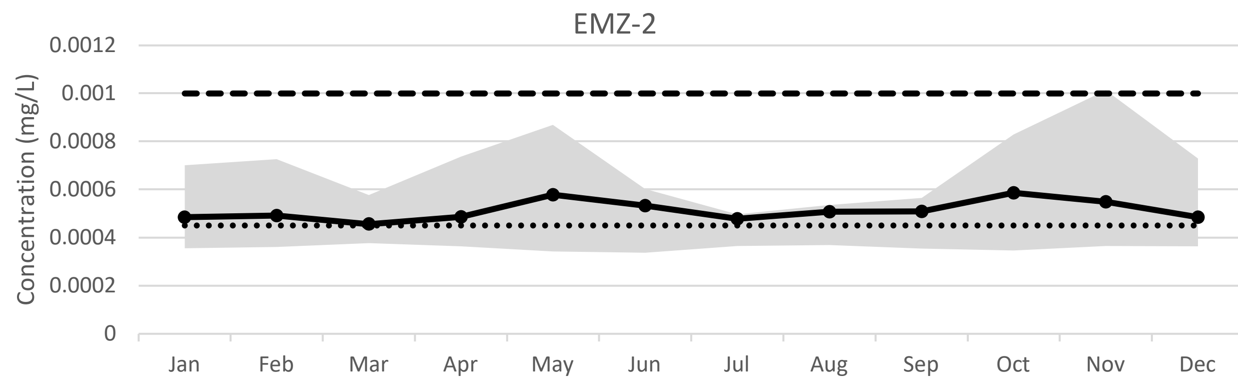
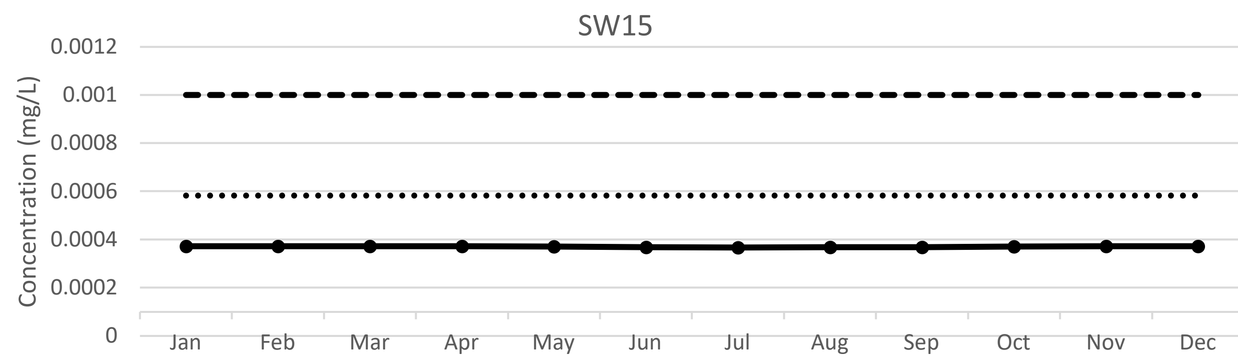
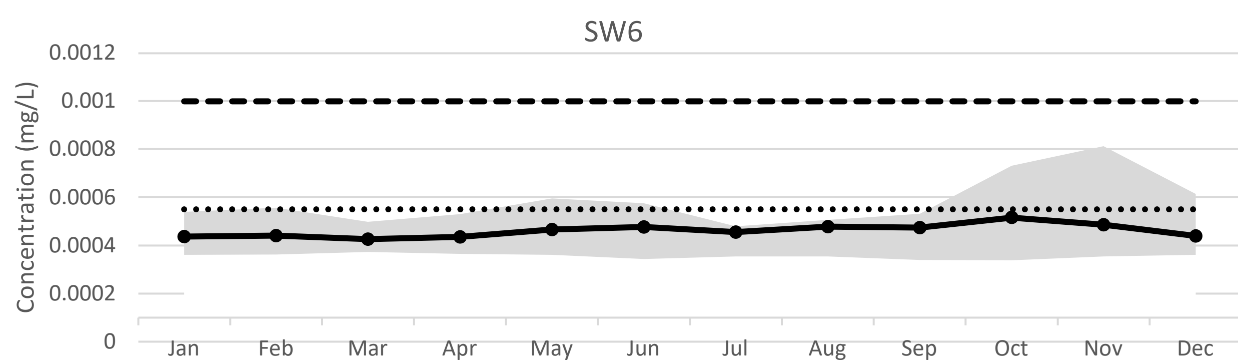


**FIGURE C-142: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS
PREDICTED LEAD CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**









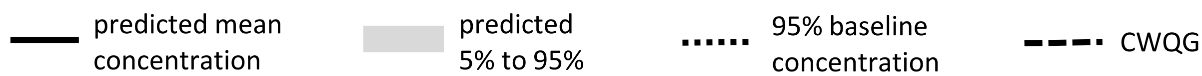


FIGURE C-143: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED MANGANESE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

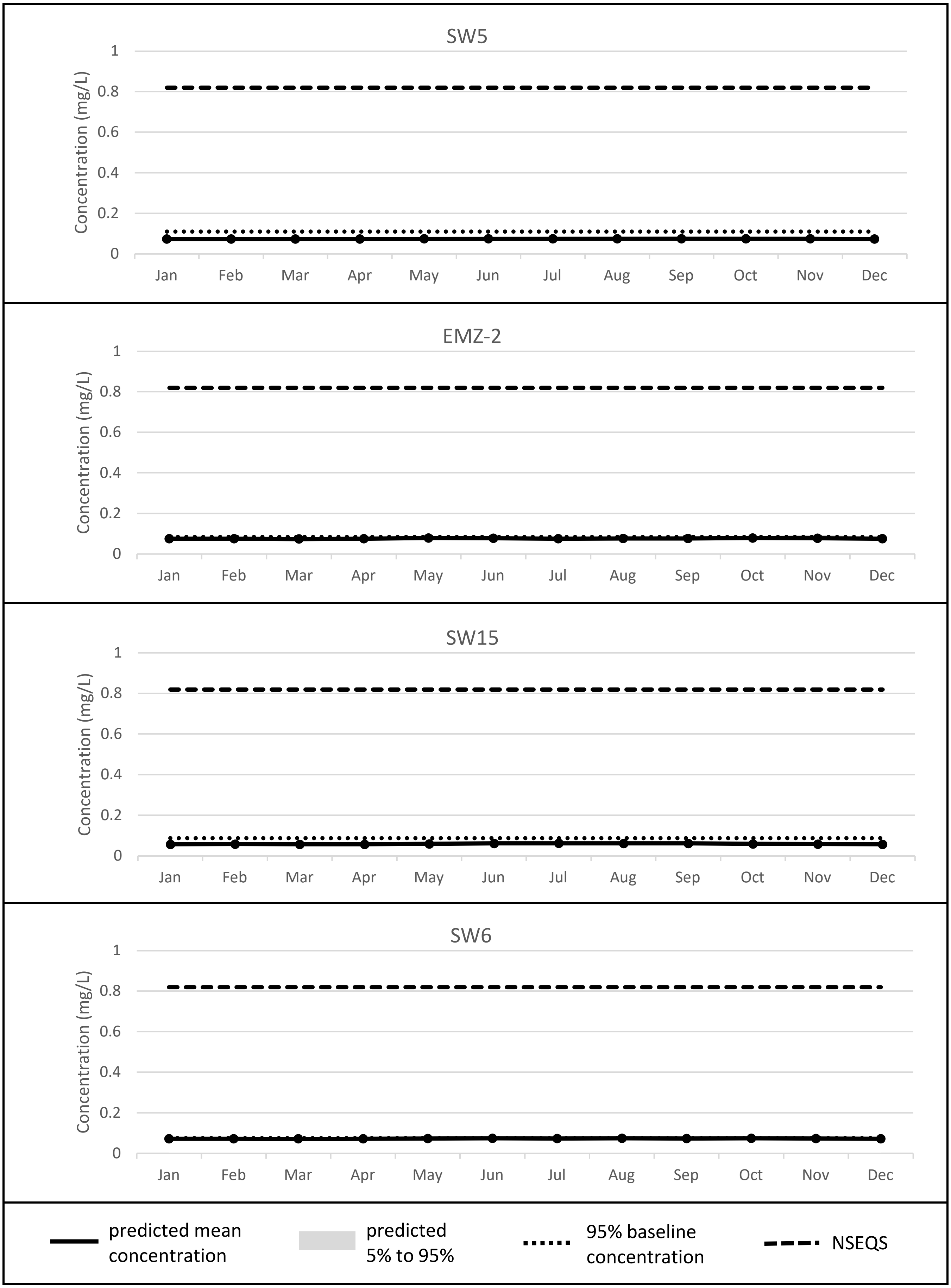


FIGURE C-144: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED MERCURY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

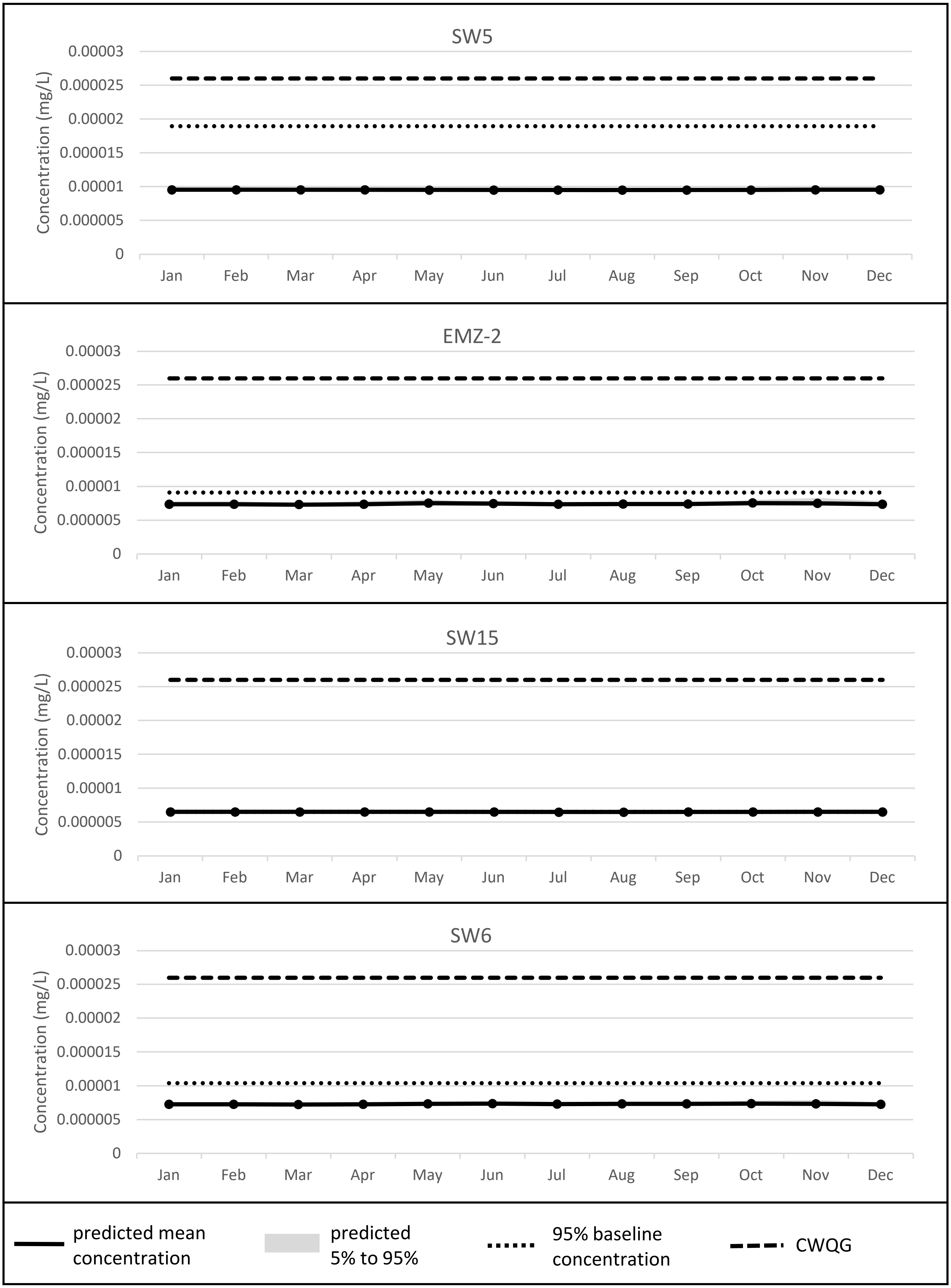


FIGURE C-145: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED MOLYBDENUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

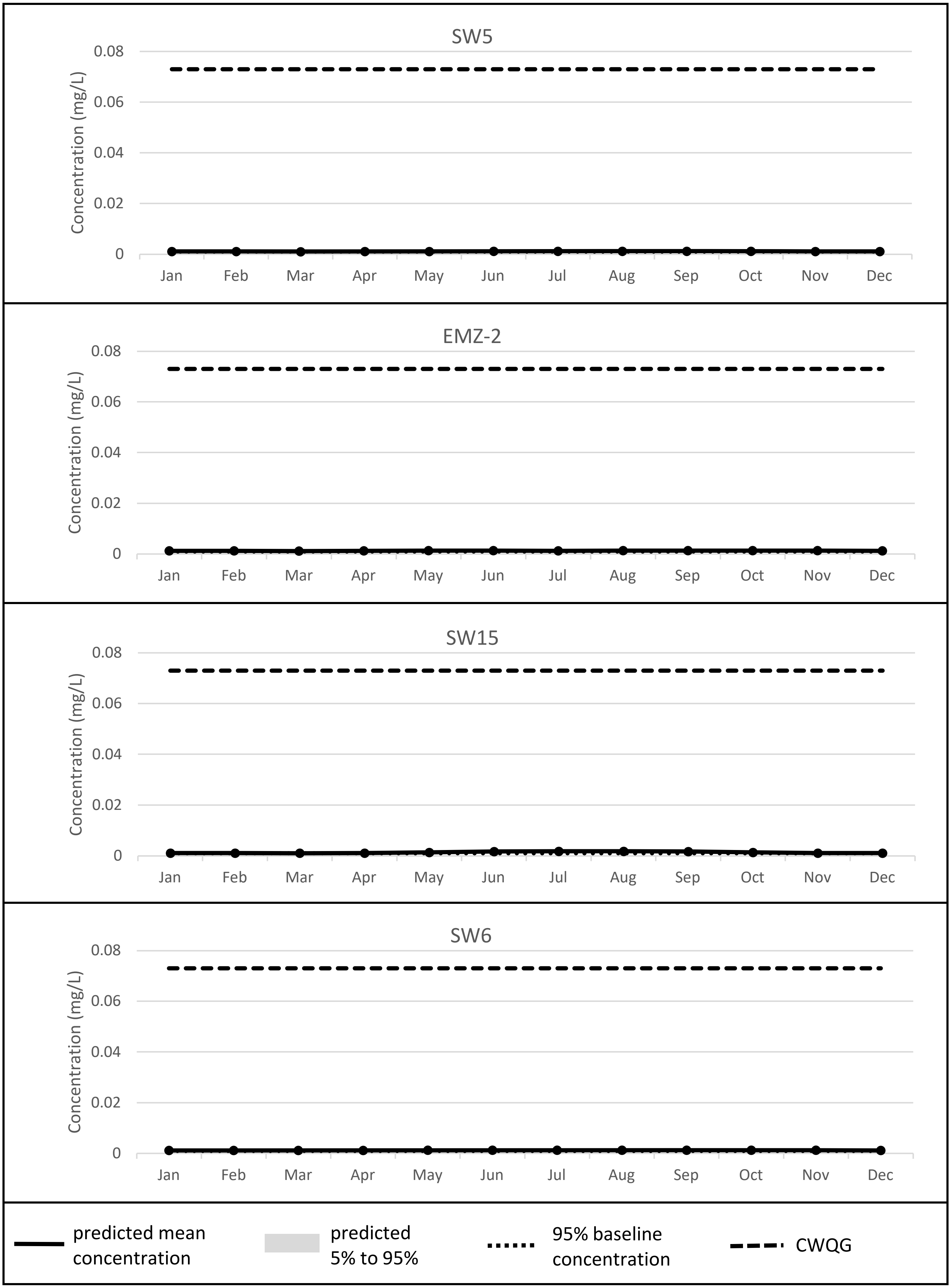


FIGURE C-146: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED NICKEL CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

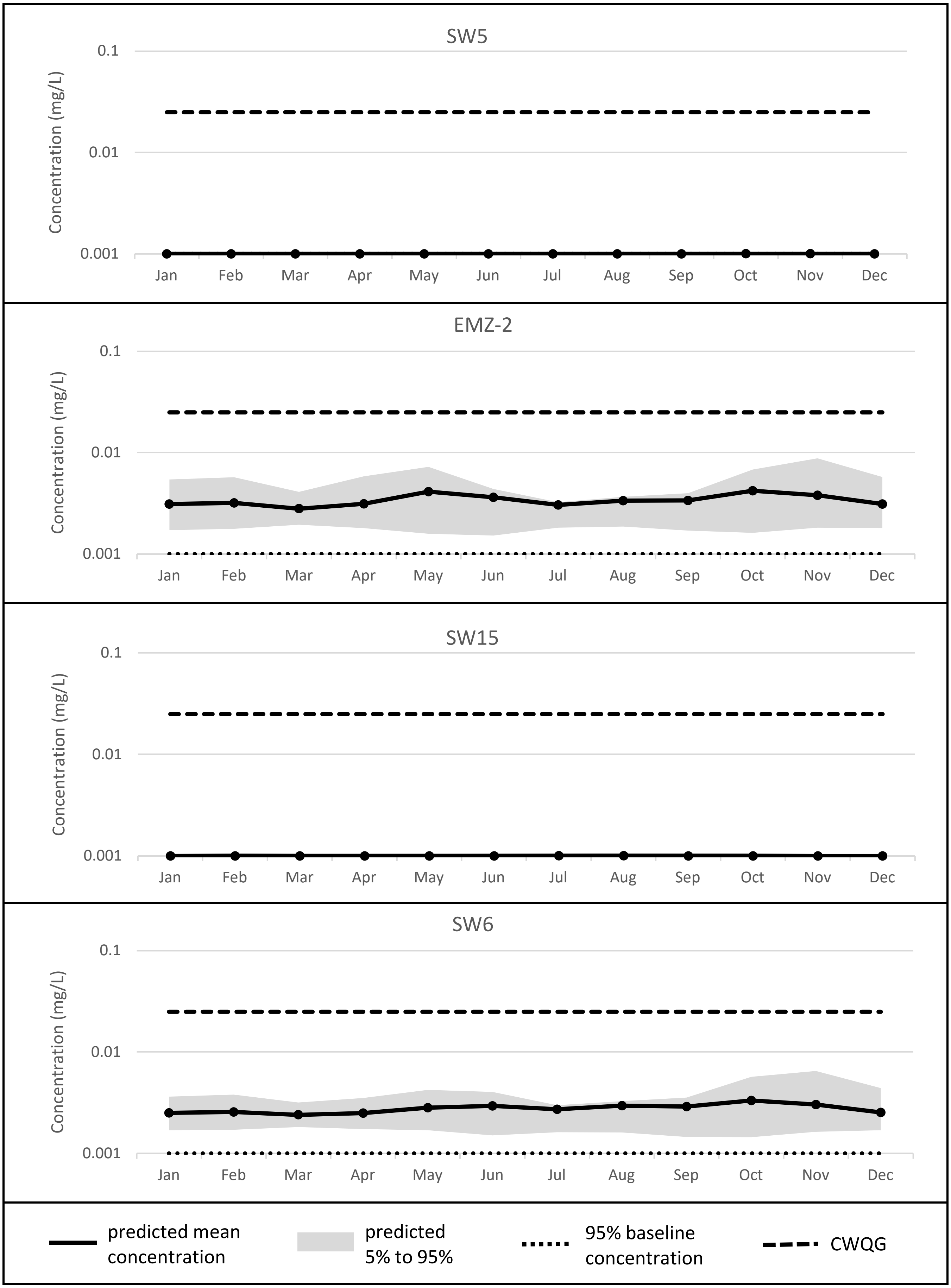


**FIGURE C-147: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS
PREDICTED NITRATE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

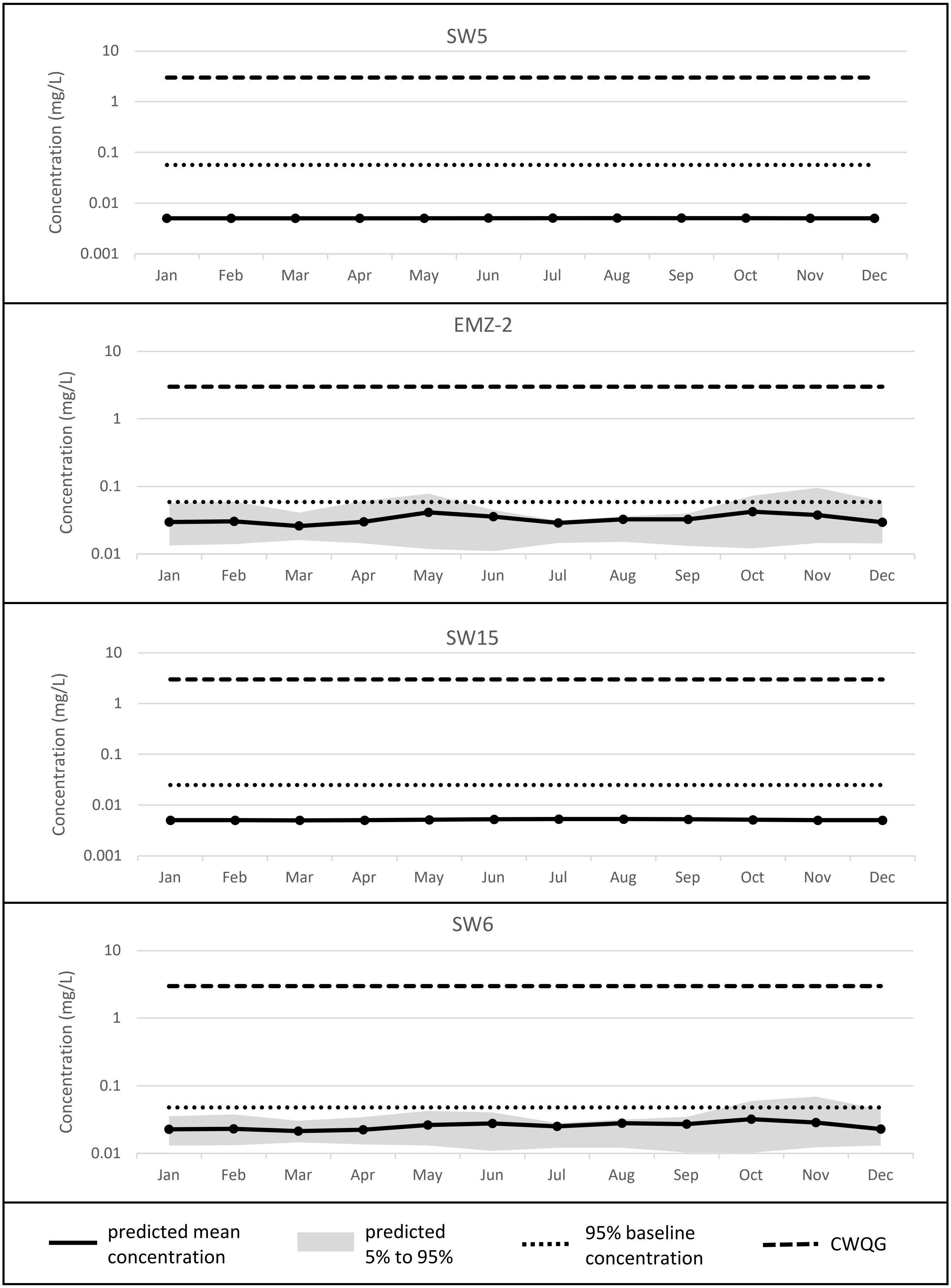


FIGURE C-148: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED NITRITE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

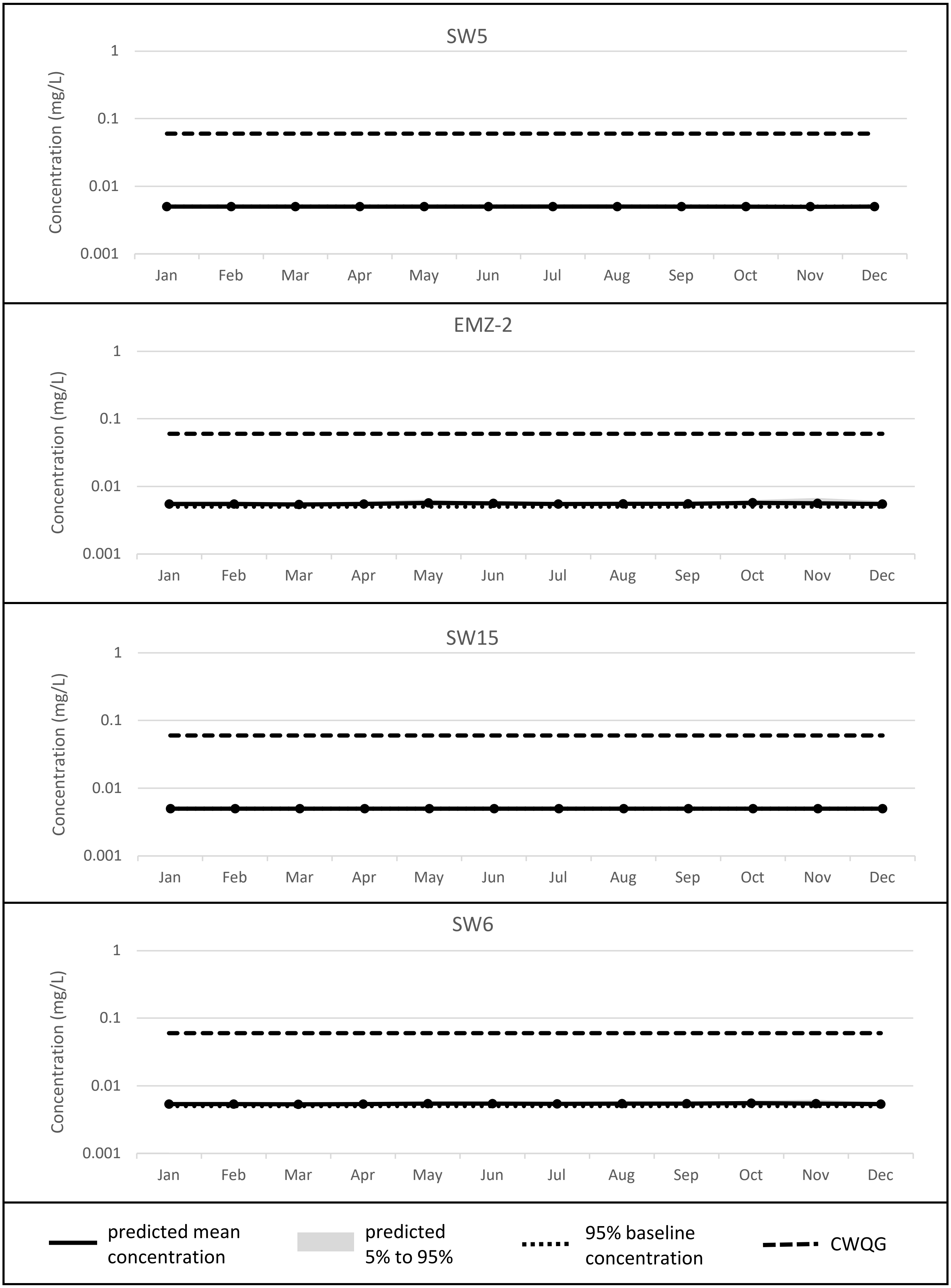


FIGURE C-149: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED SELENIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

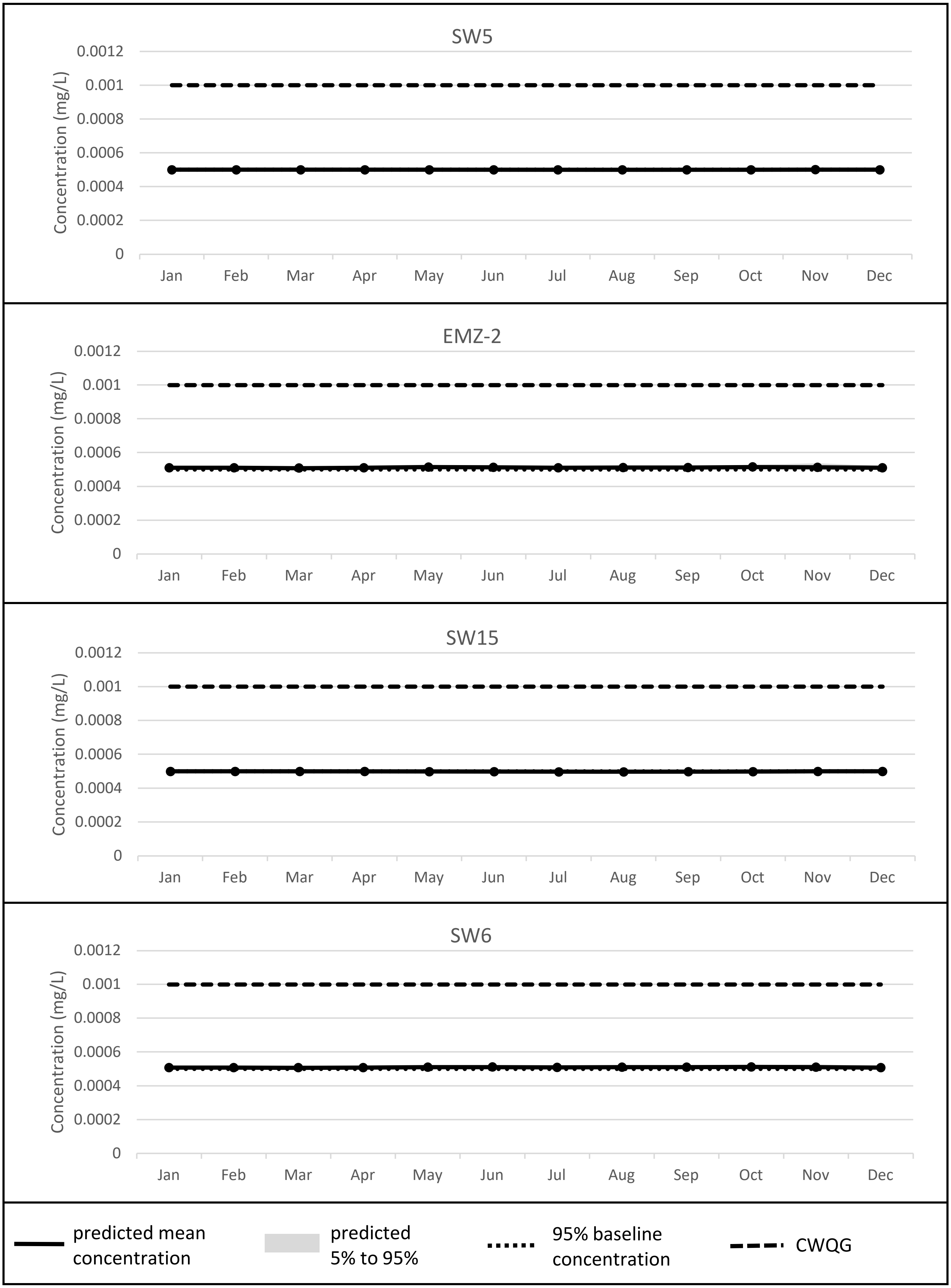


FIGURE C-150: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED SILVER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

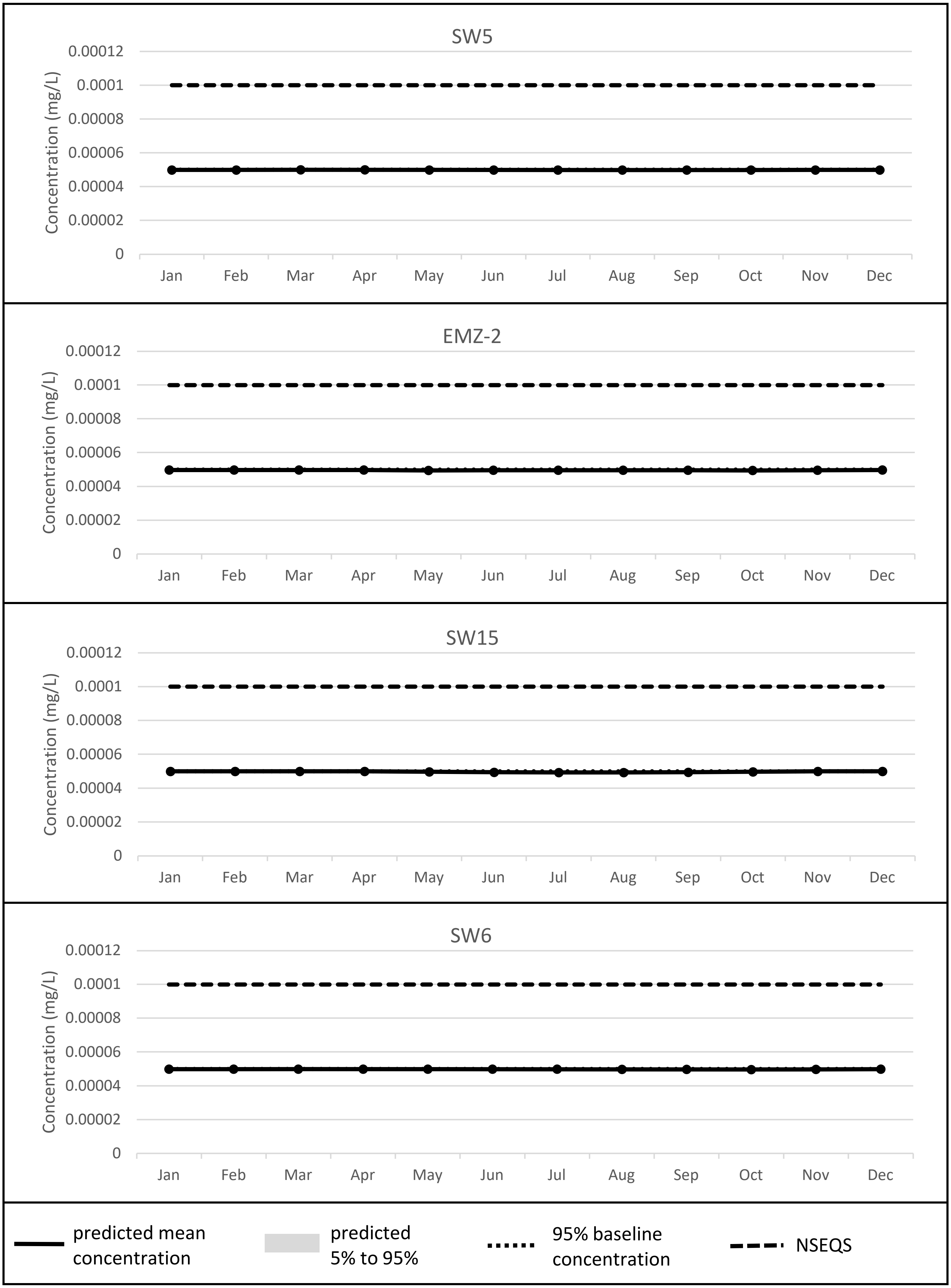


FIGURE C-151: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED THALLIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

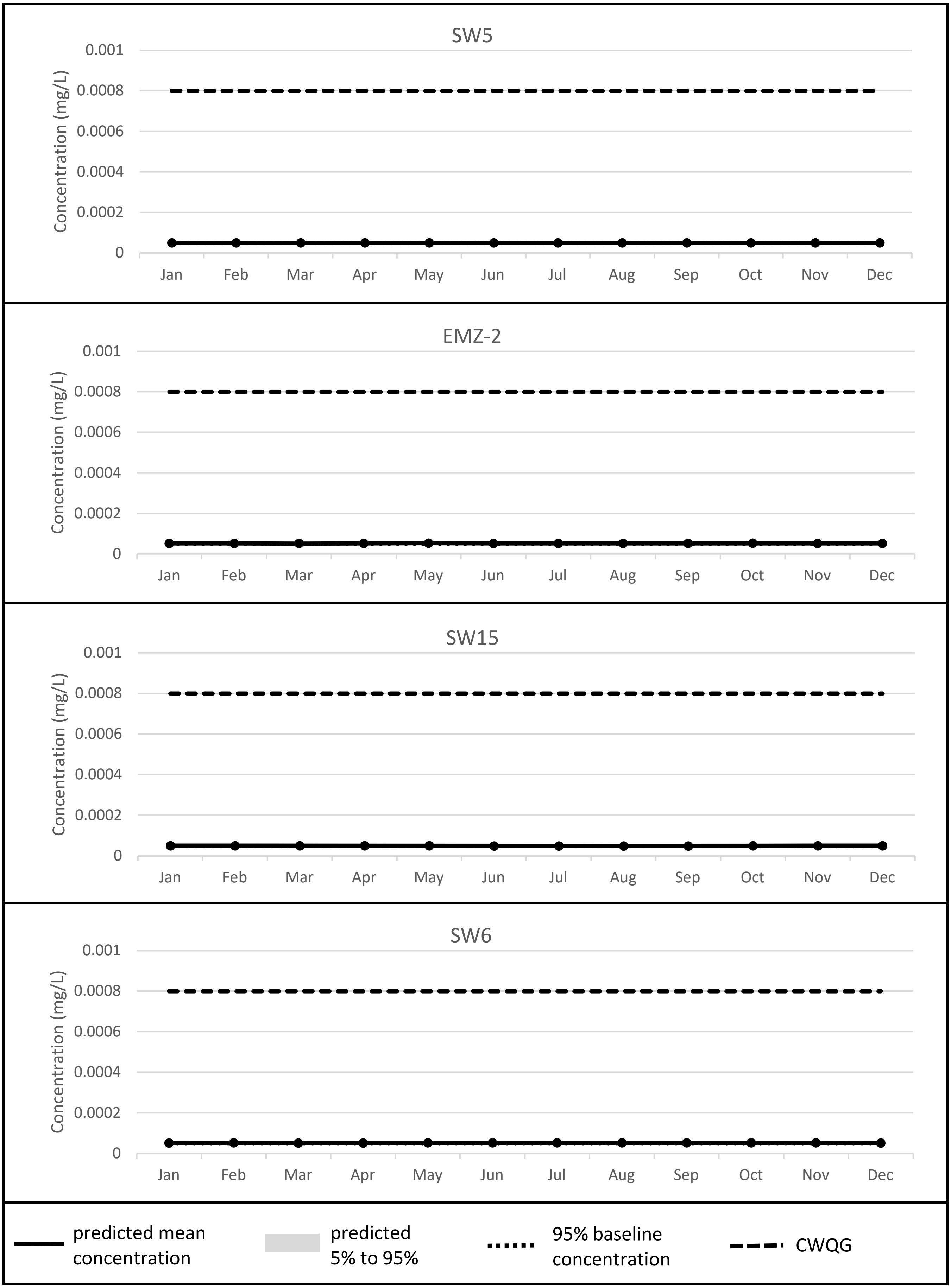
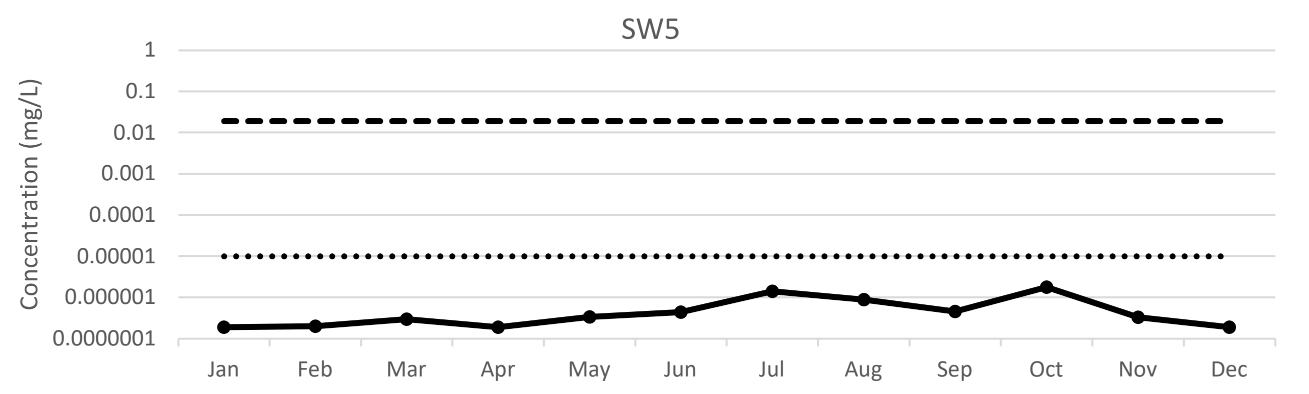
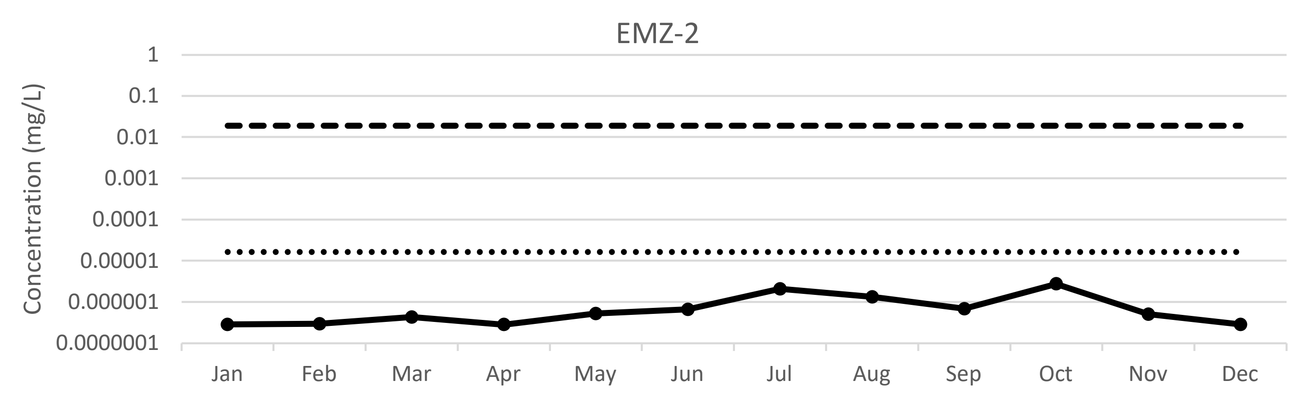
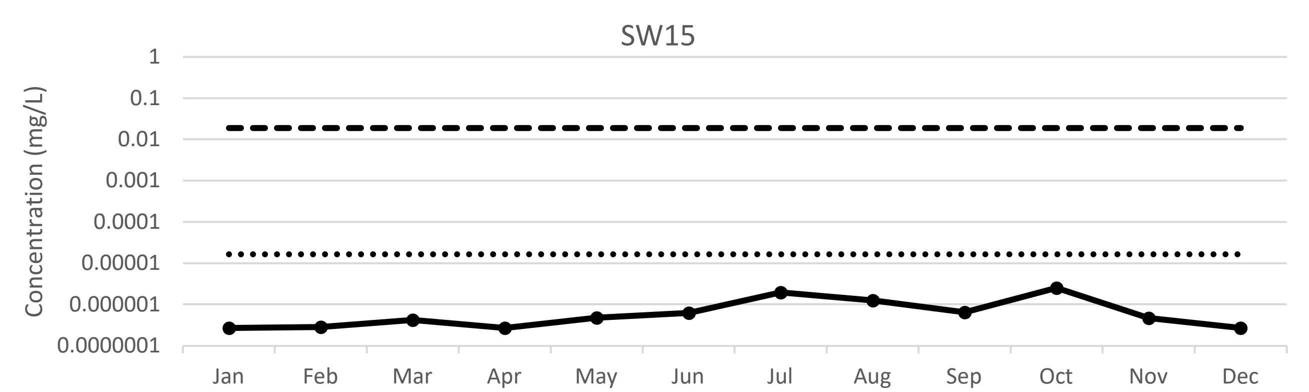
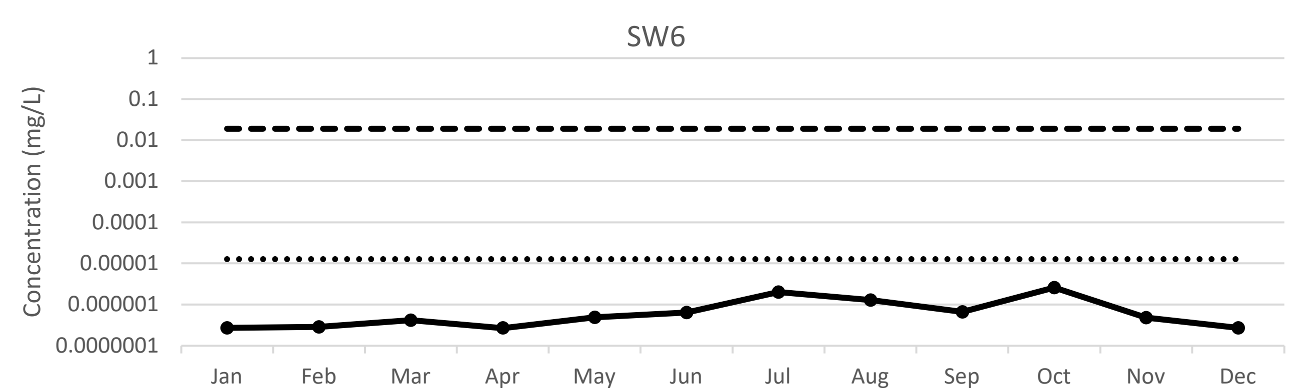


FIGURE C-152: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTSASE PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)









predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG

FIGURE C-153: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED URANIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

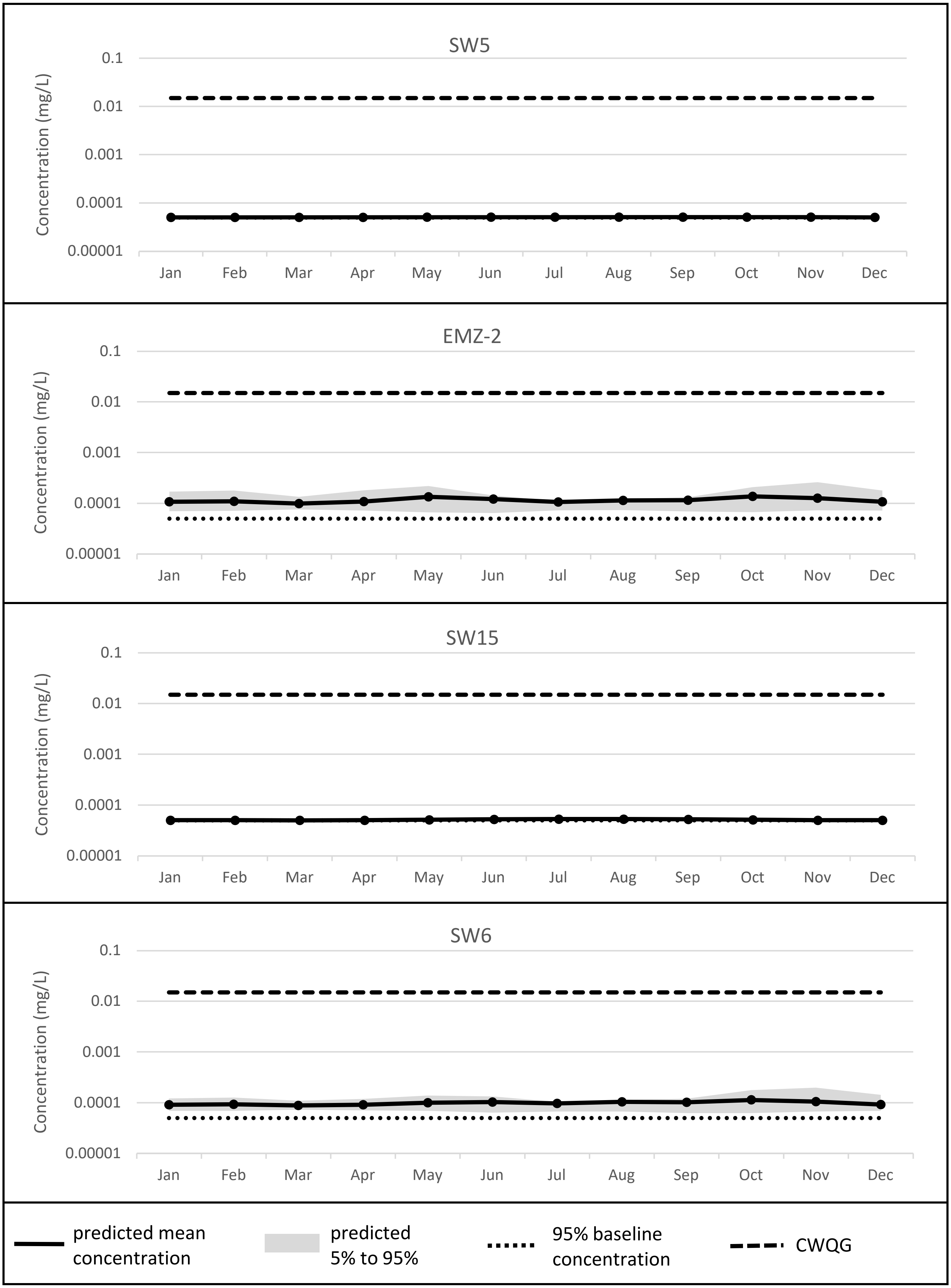


FIGURE C-154: SENSITIVITY ANALYSIS - 2% PAG IN TMF EMBANKMENTS PREDICTED ZINC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

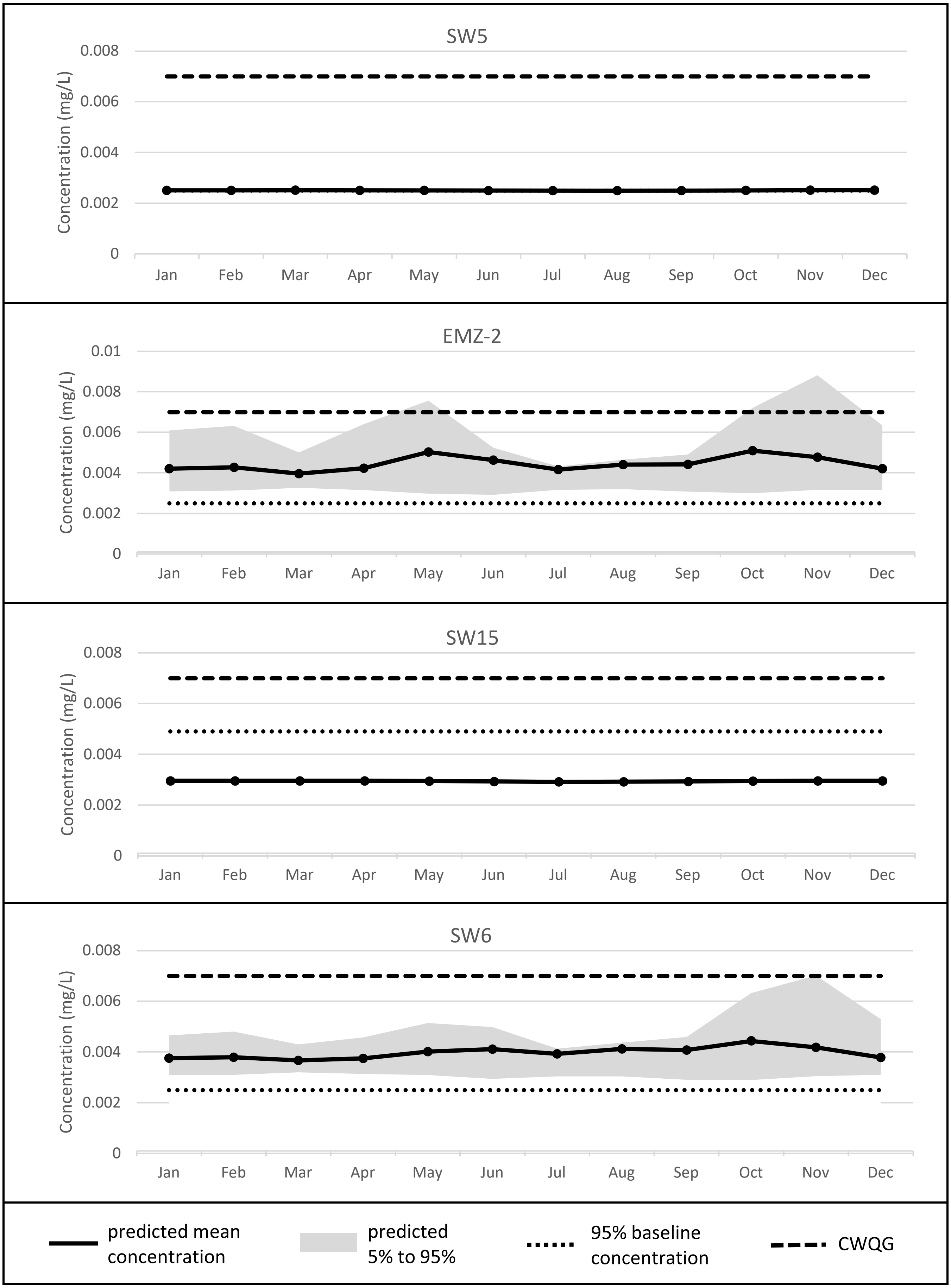


FIGURE C-155: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED ALUMINUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

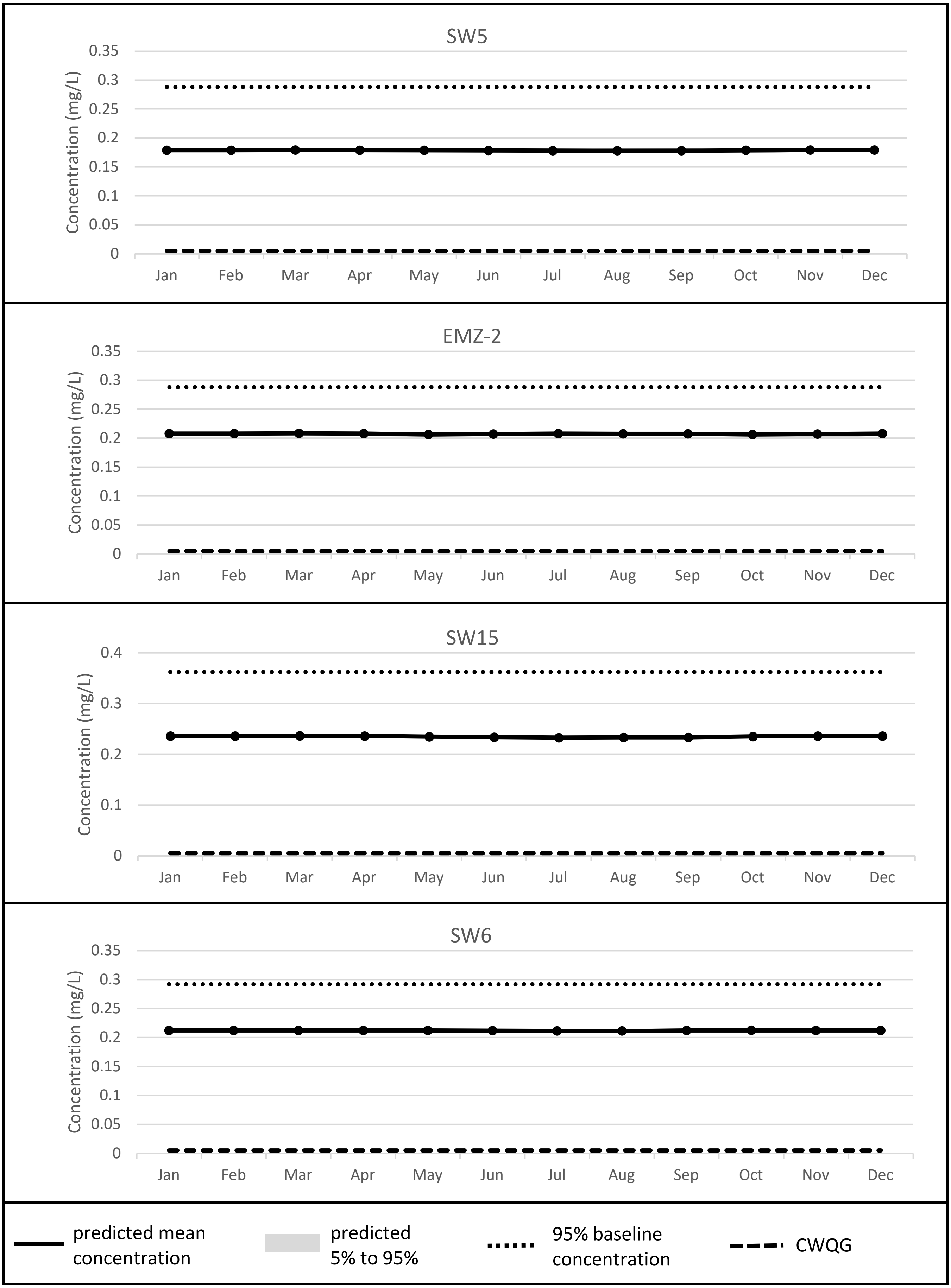


FIGURE C-156: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED ANTIMONY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

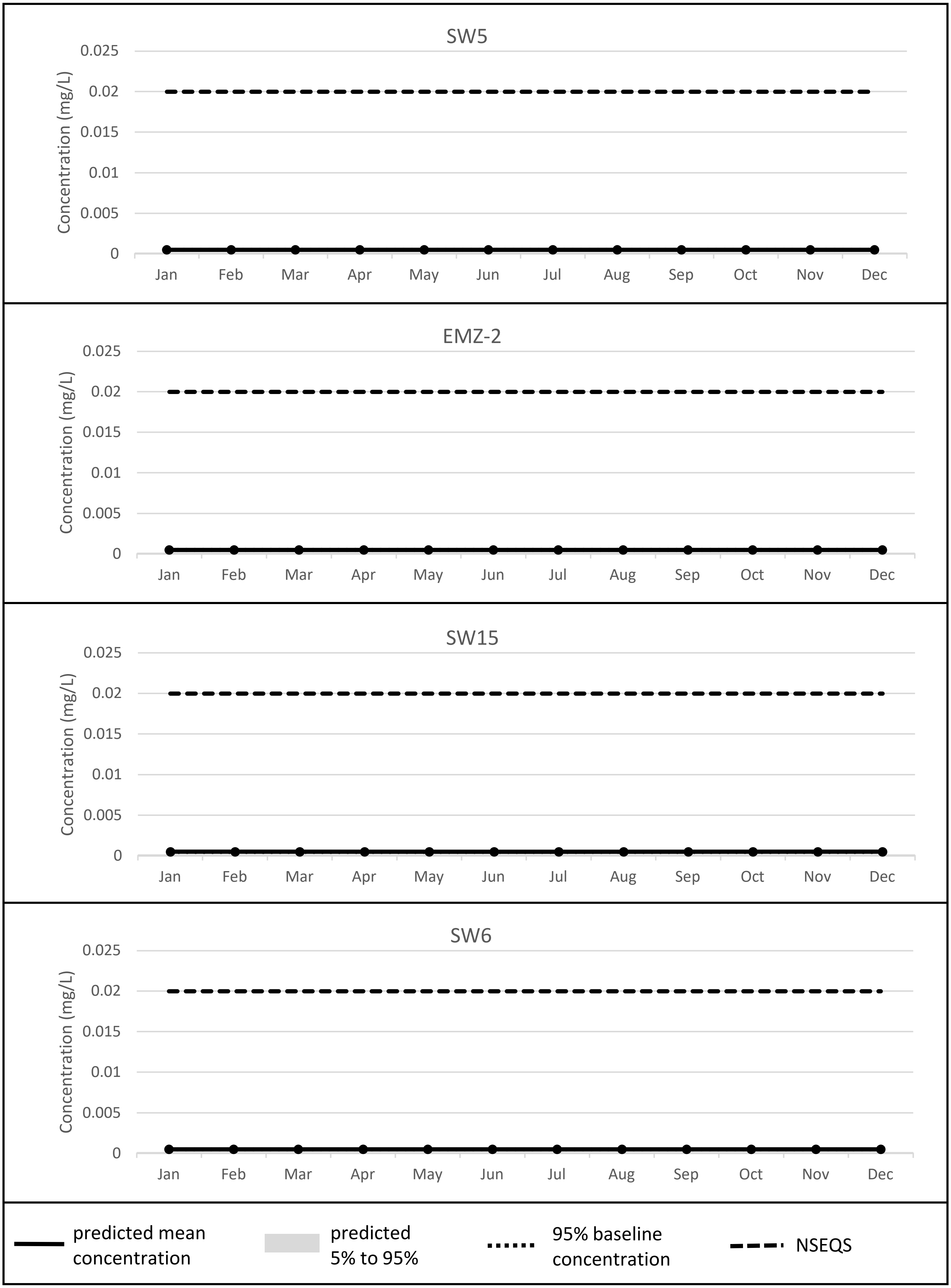


**FIGURE C-157: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED ARSENIC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

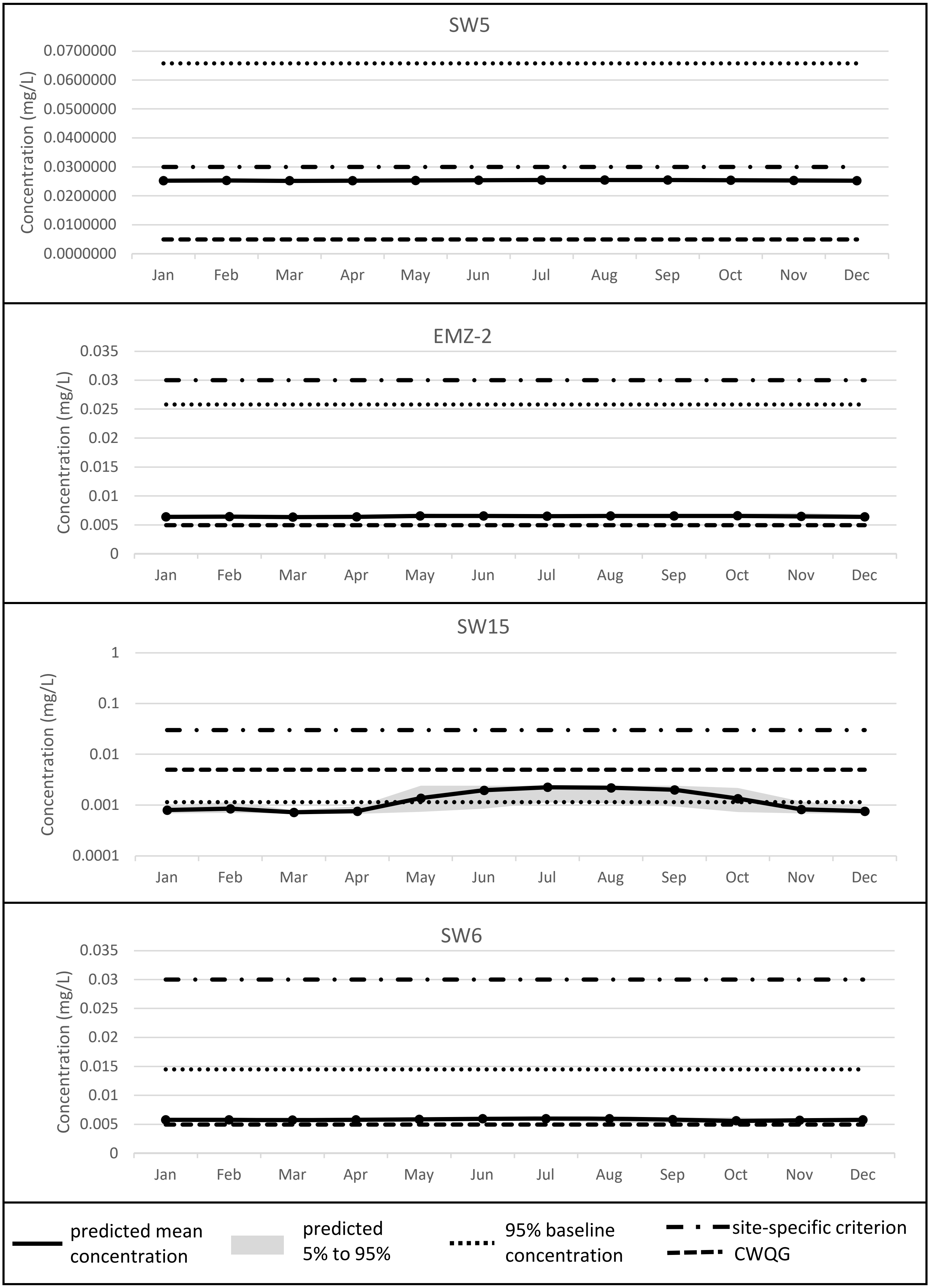
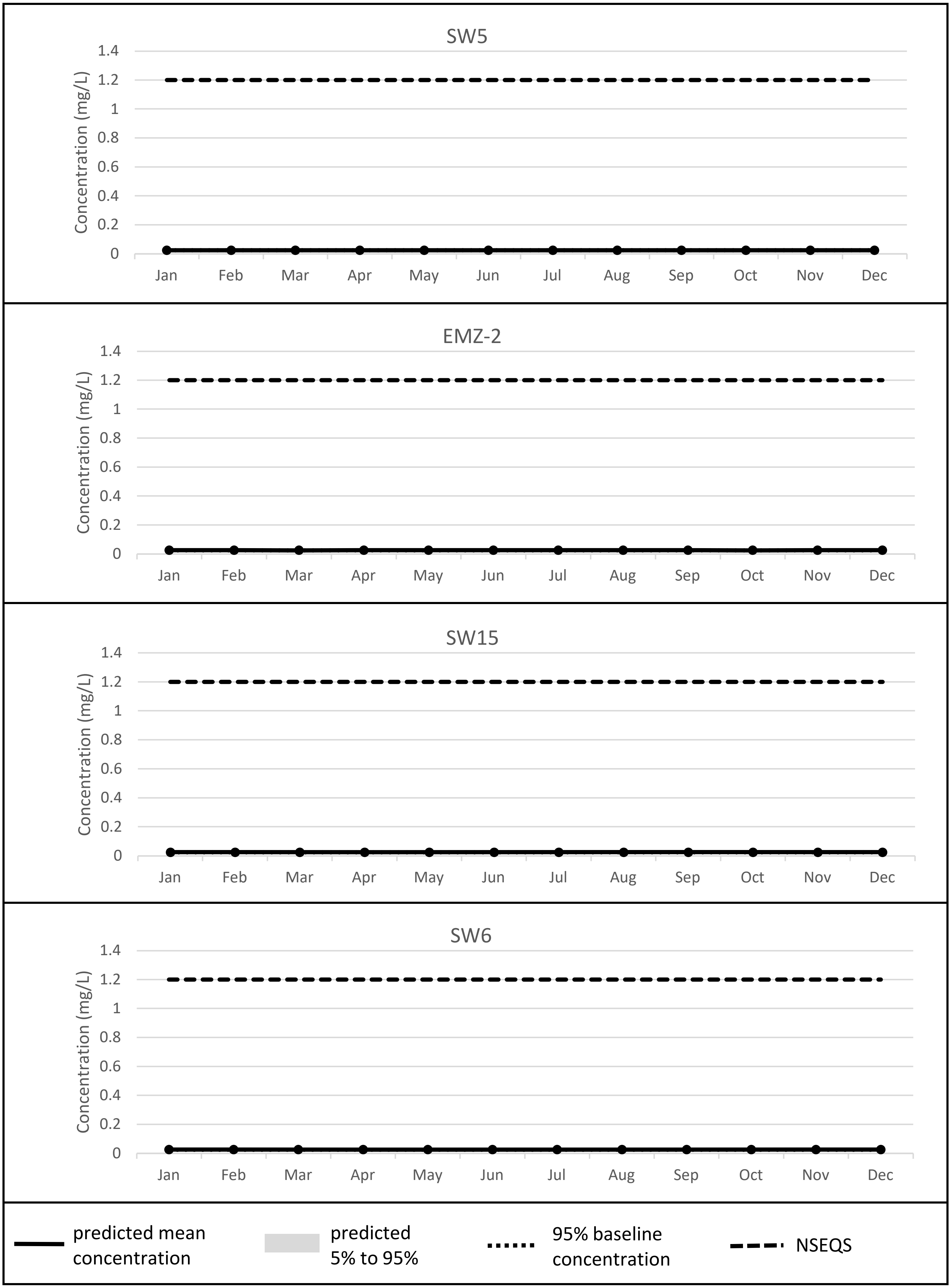


FIGURE C-158: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED BORON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)



PREDICTED CADMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

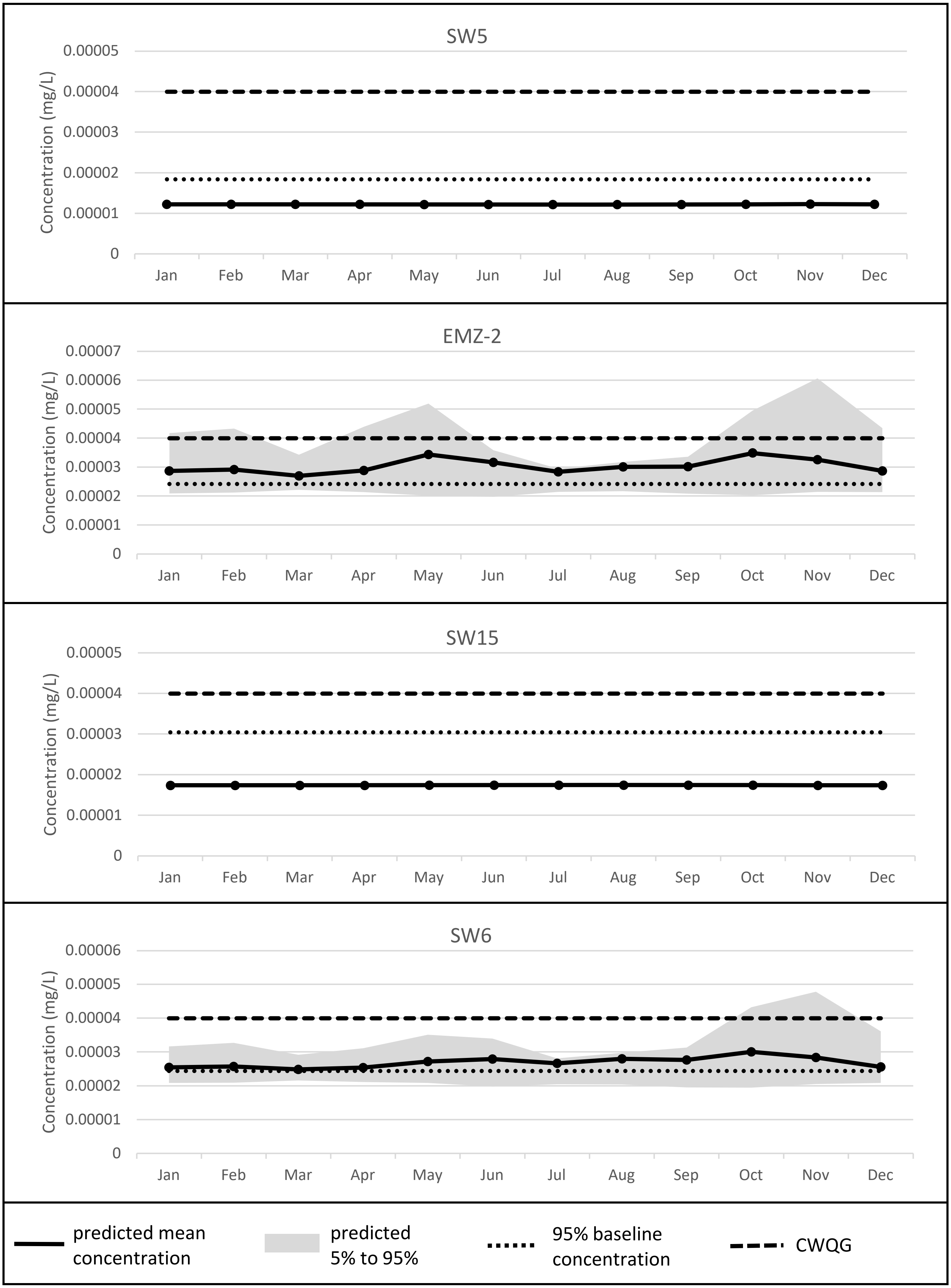


FIGURE C-160: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED CHROMIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

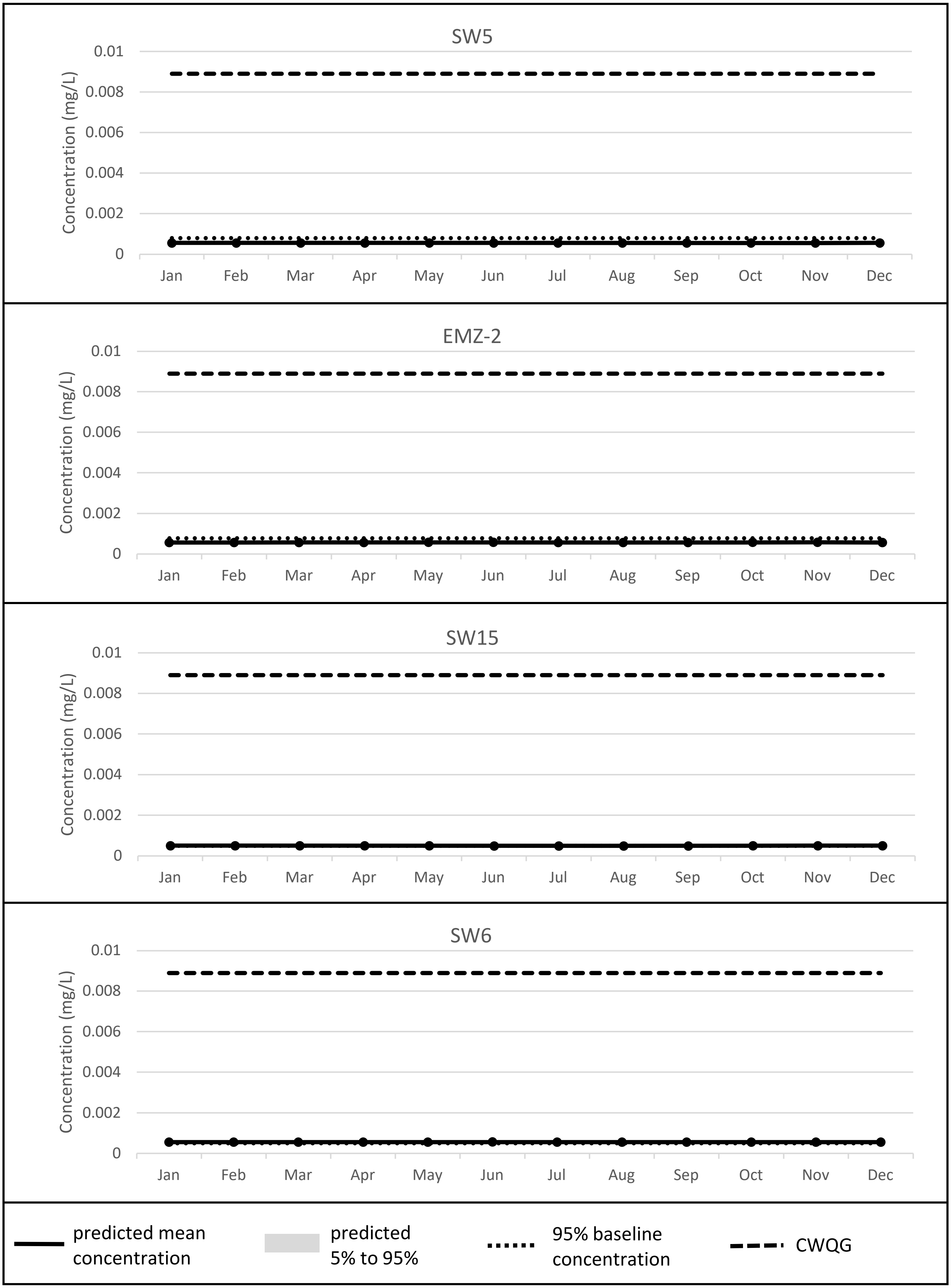


FIGURE C-161: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED COBALT CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

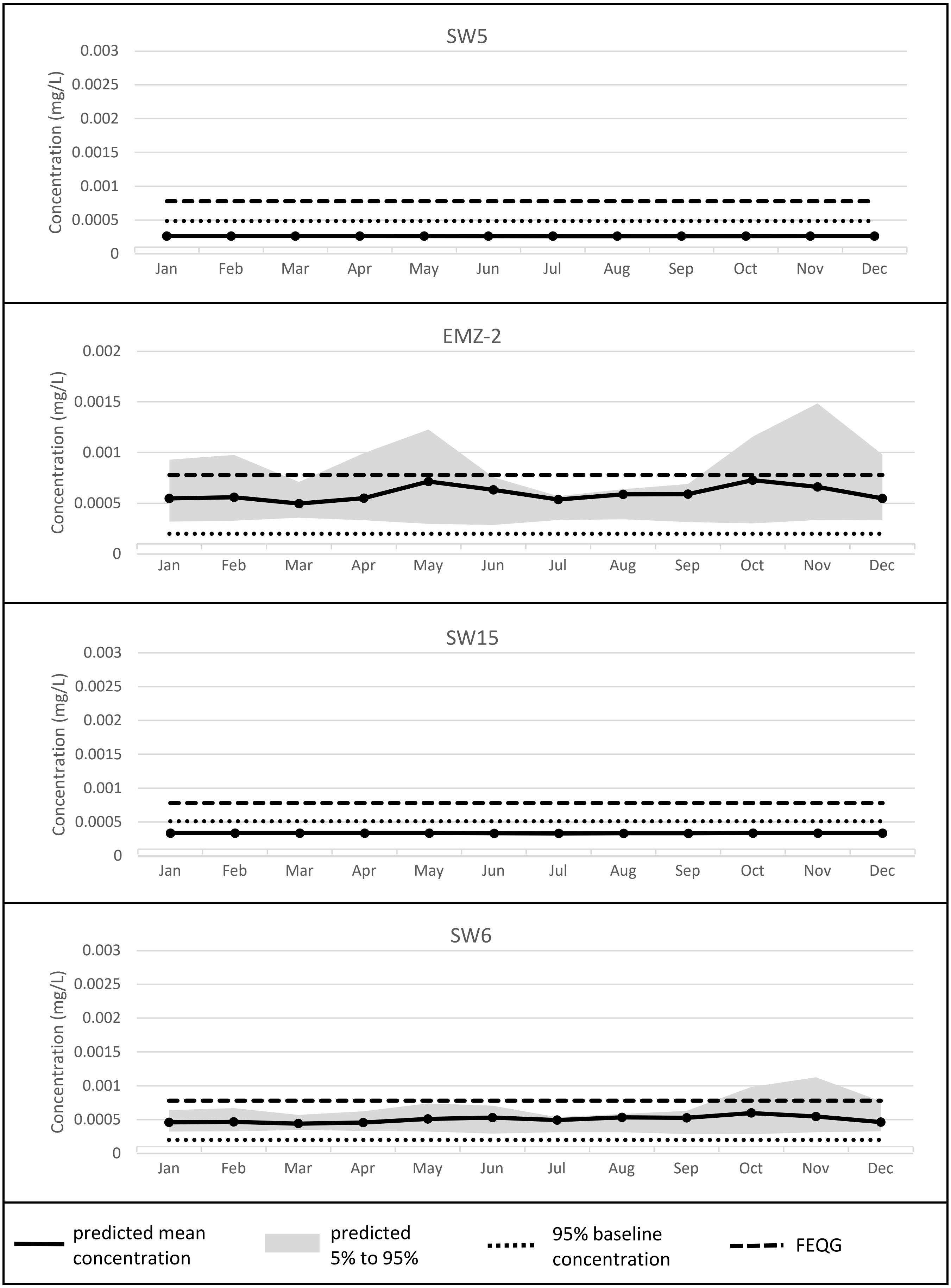


FIGURE C-162: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED COPPER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

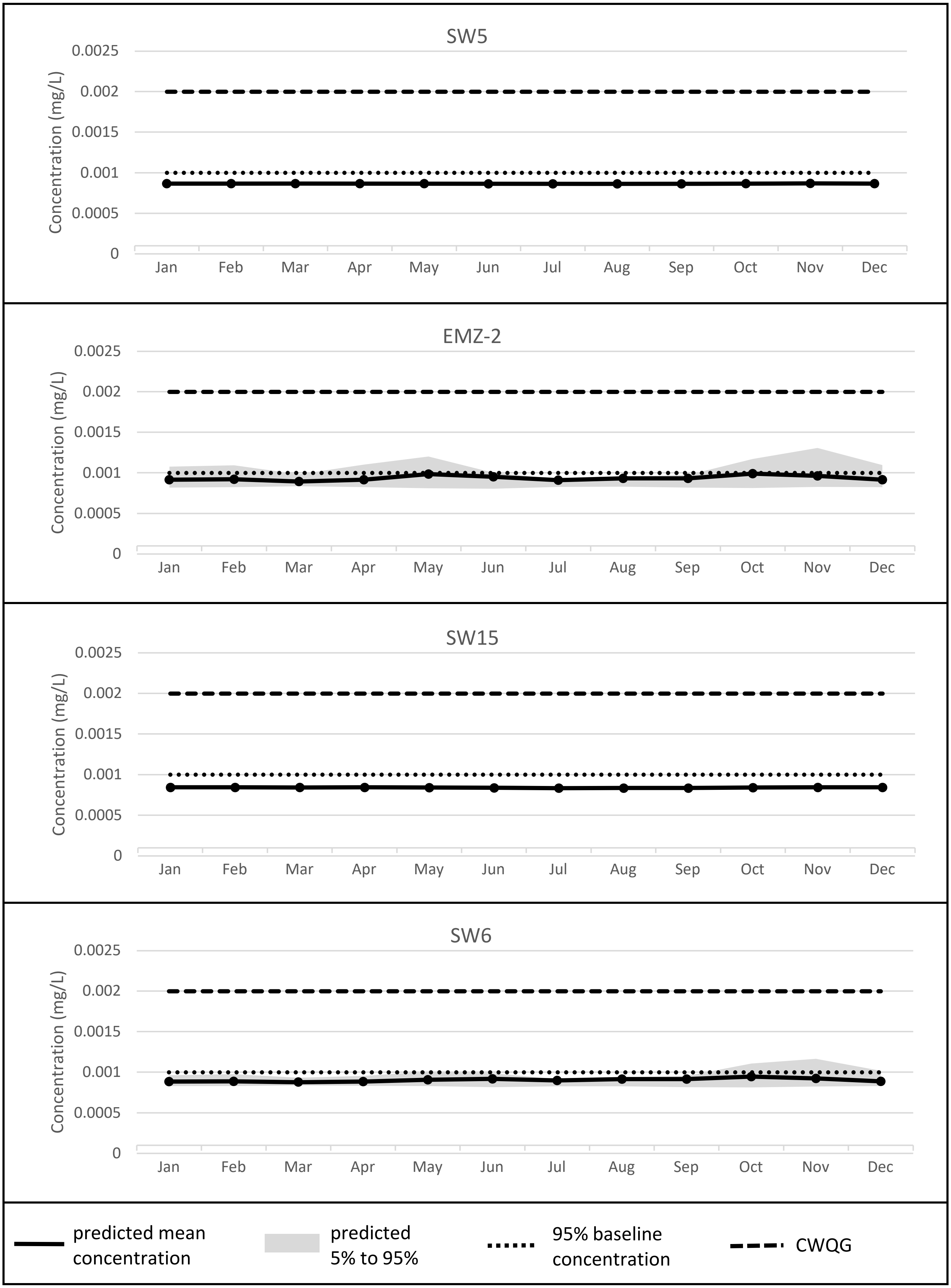


FIGURE C-163: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED IRON CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

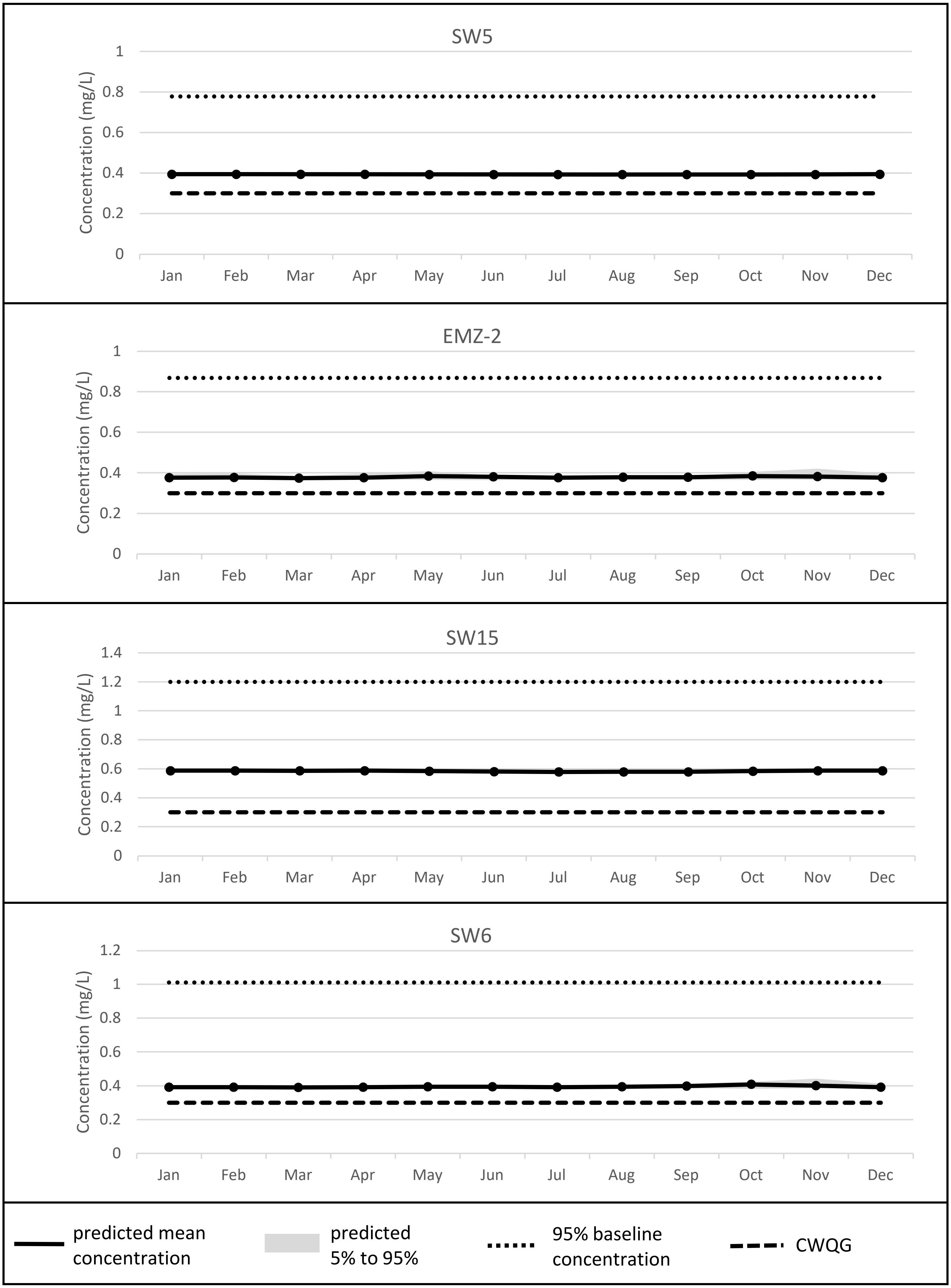


FIGURE C-164: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED LEAD CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

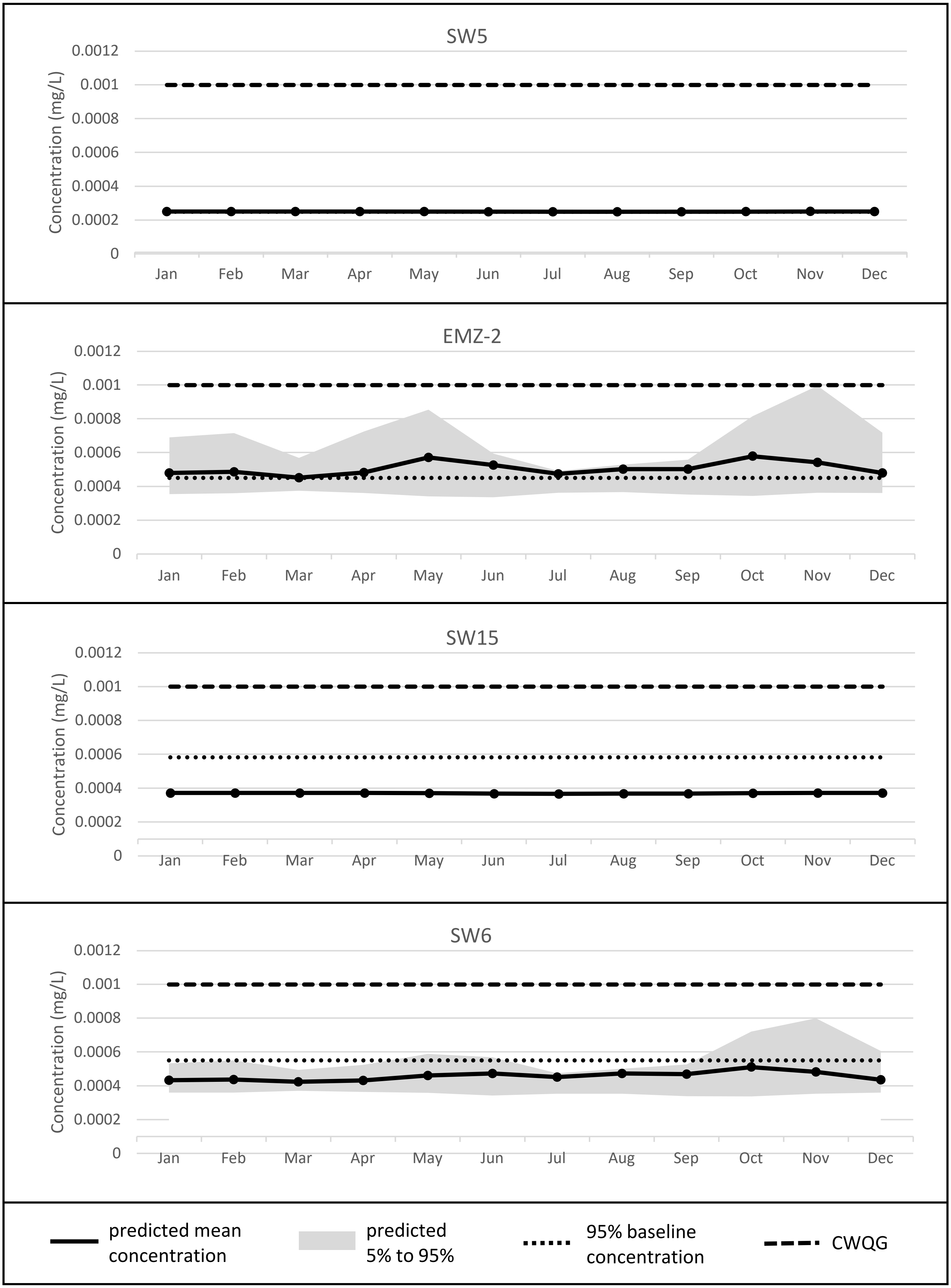


FIGURE C-165: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED MANGANESE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

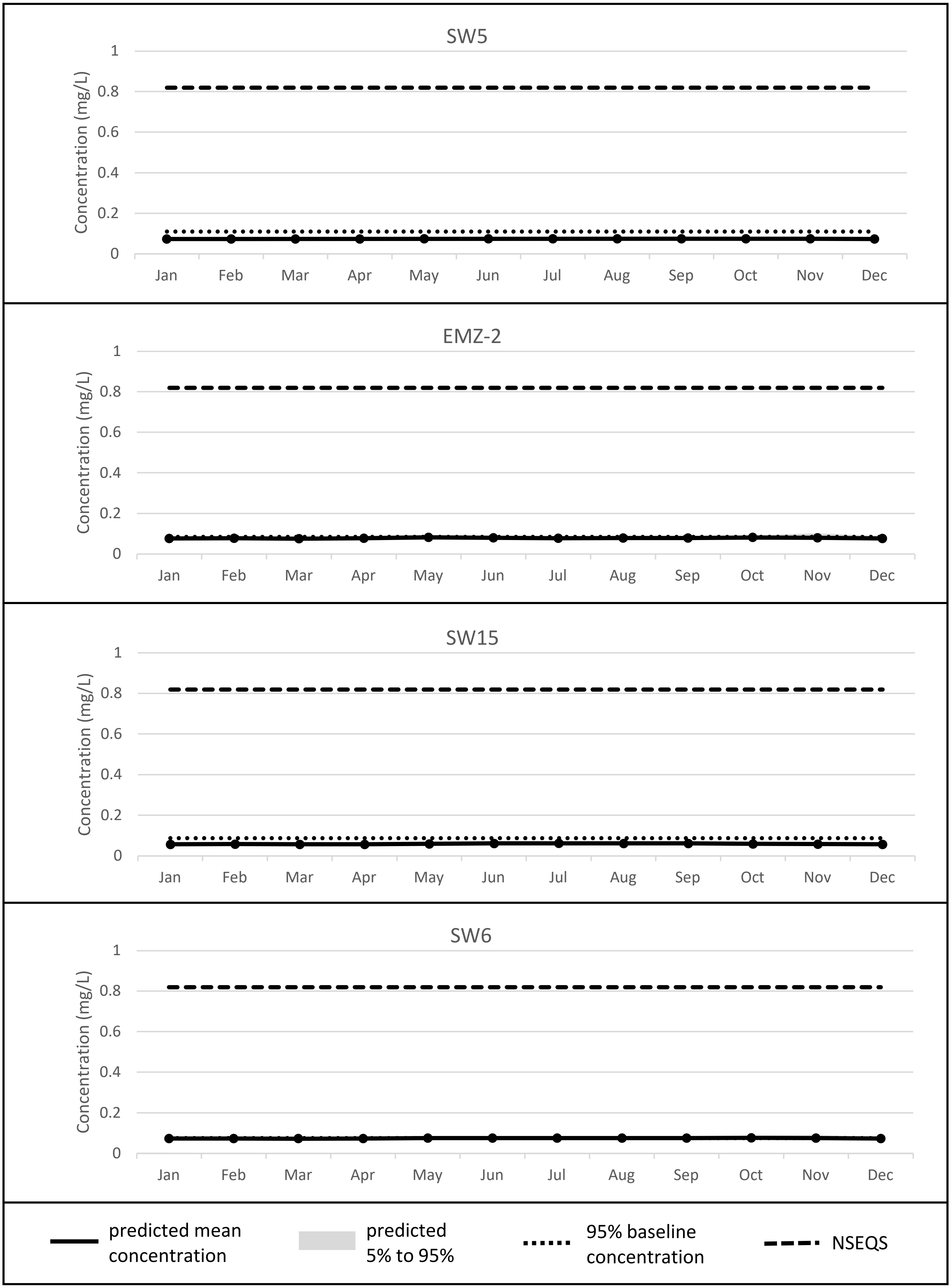


FIGURE C-166: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED MERCURY CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

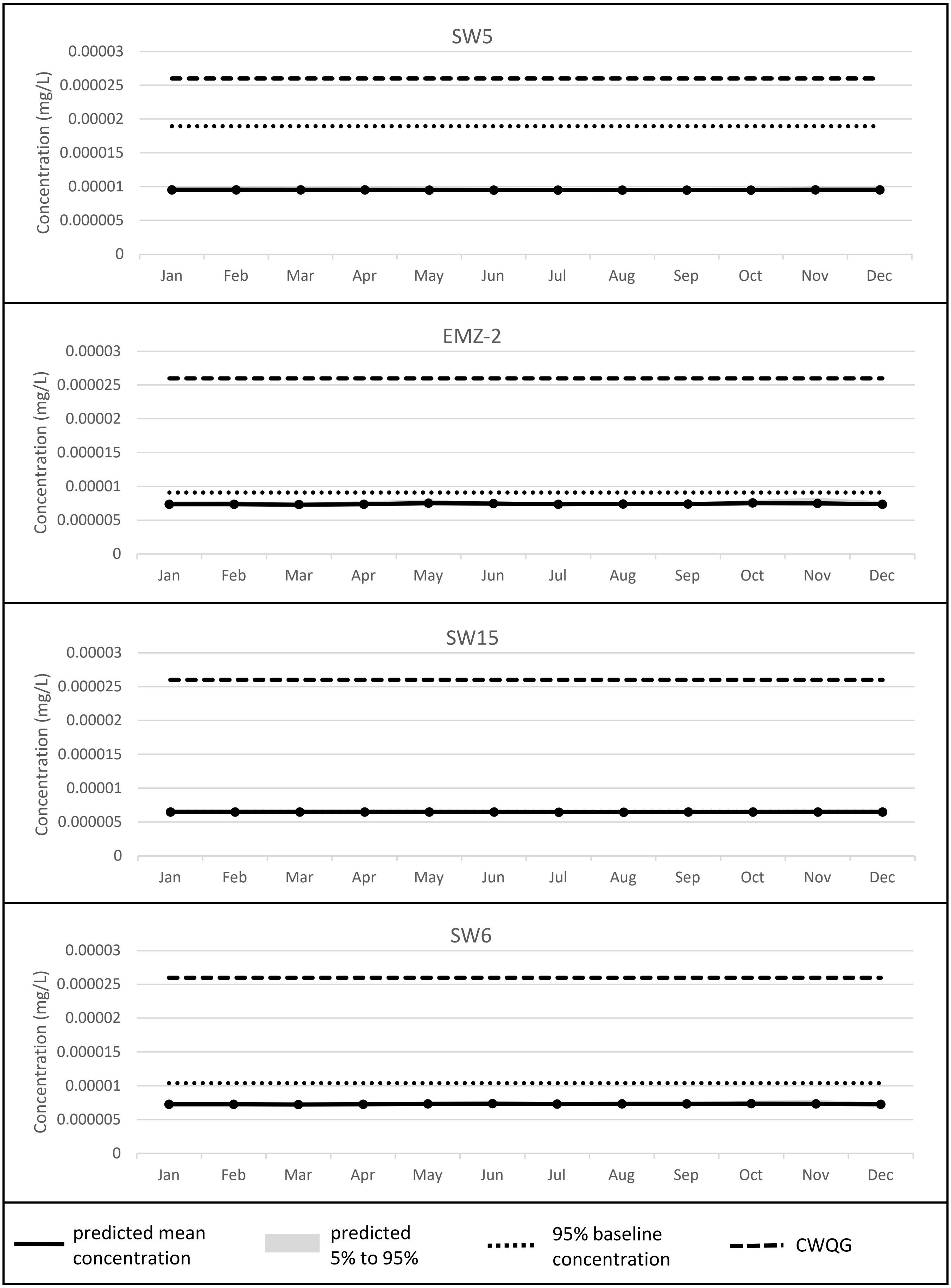


**FIGURE C-167: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED MOLYBDENUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)**

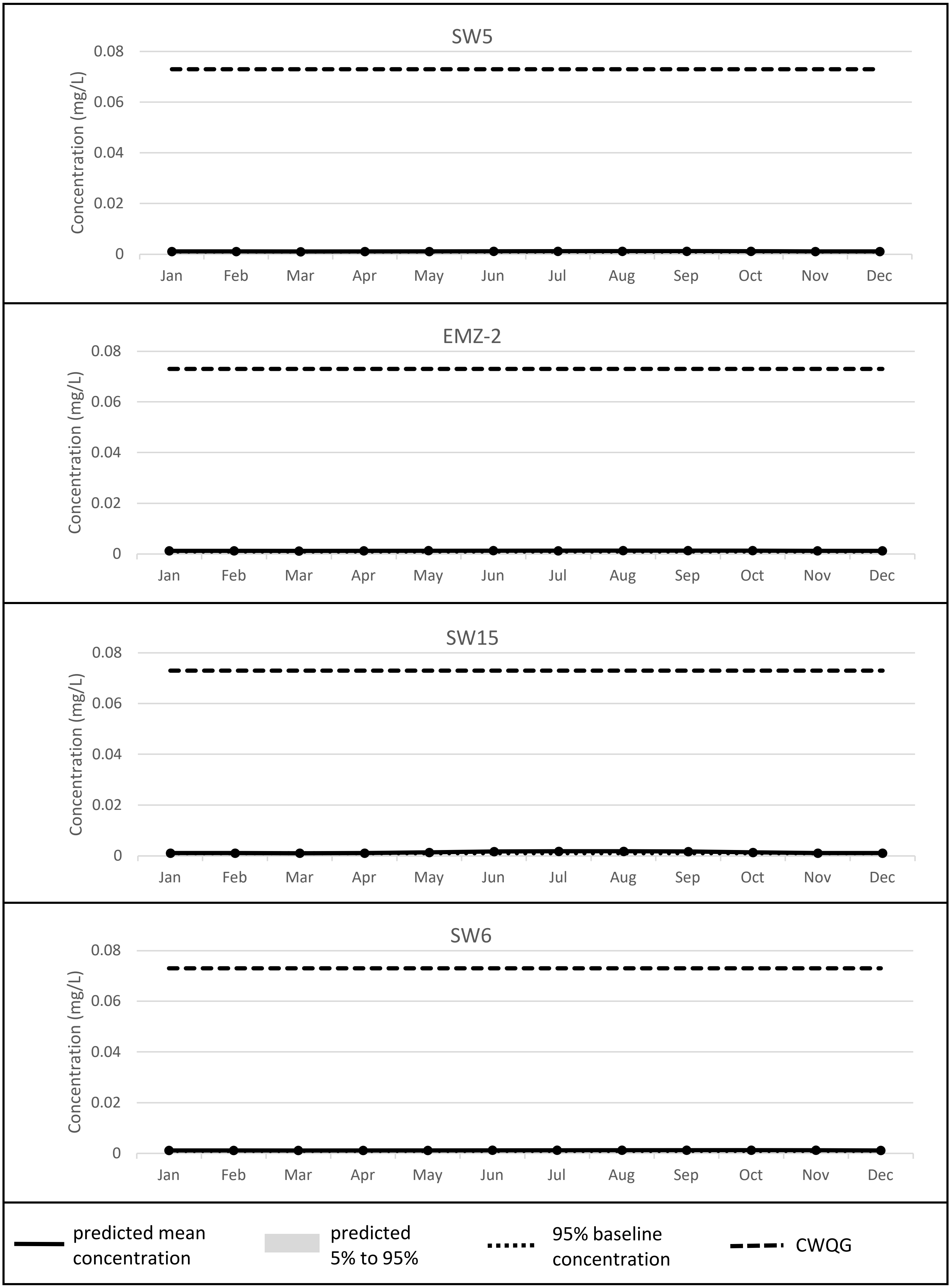


FIGURE C-168: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED NICKEL CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

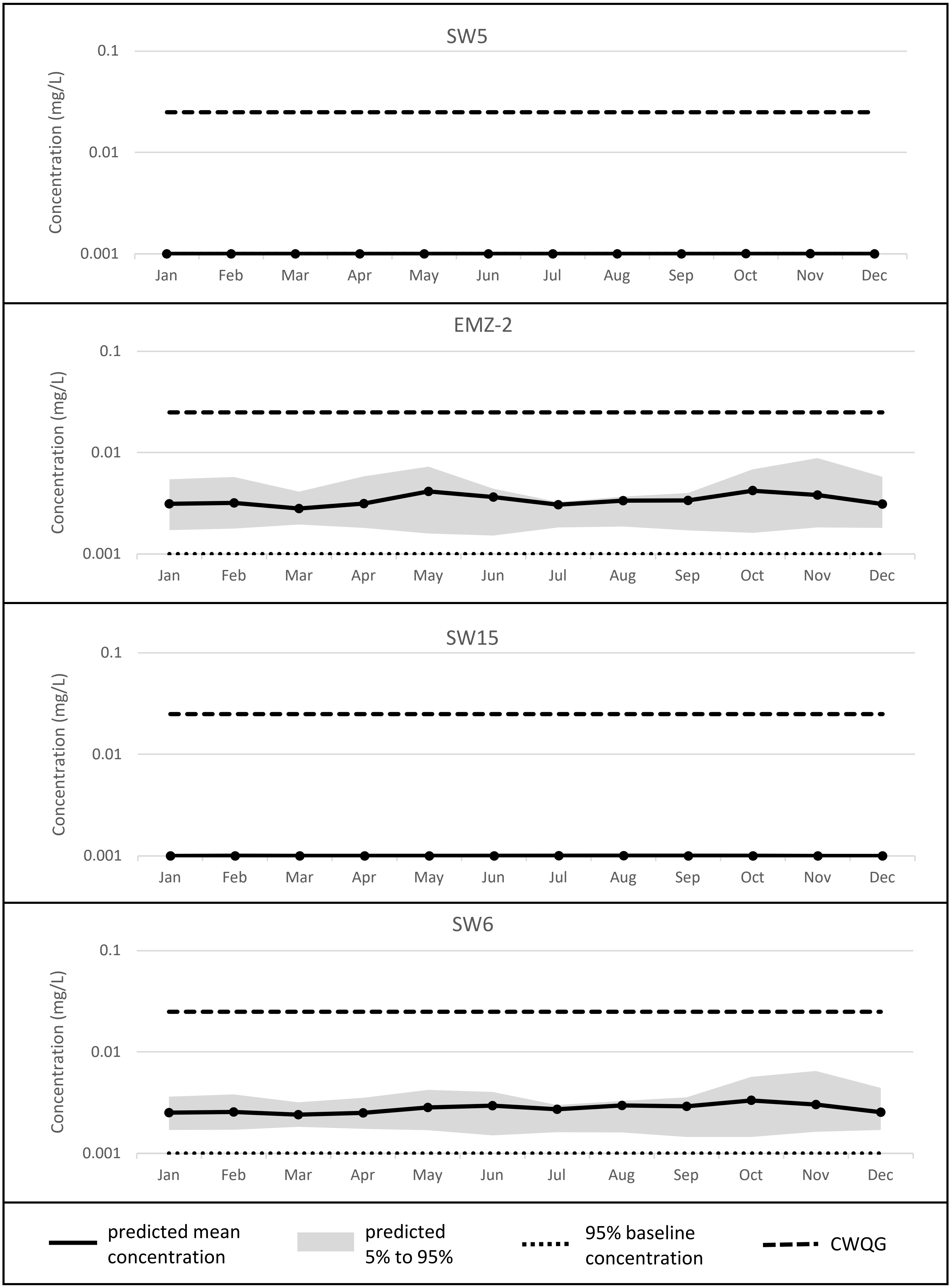


FIGURE C-169: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED NITRATE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

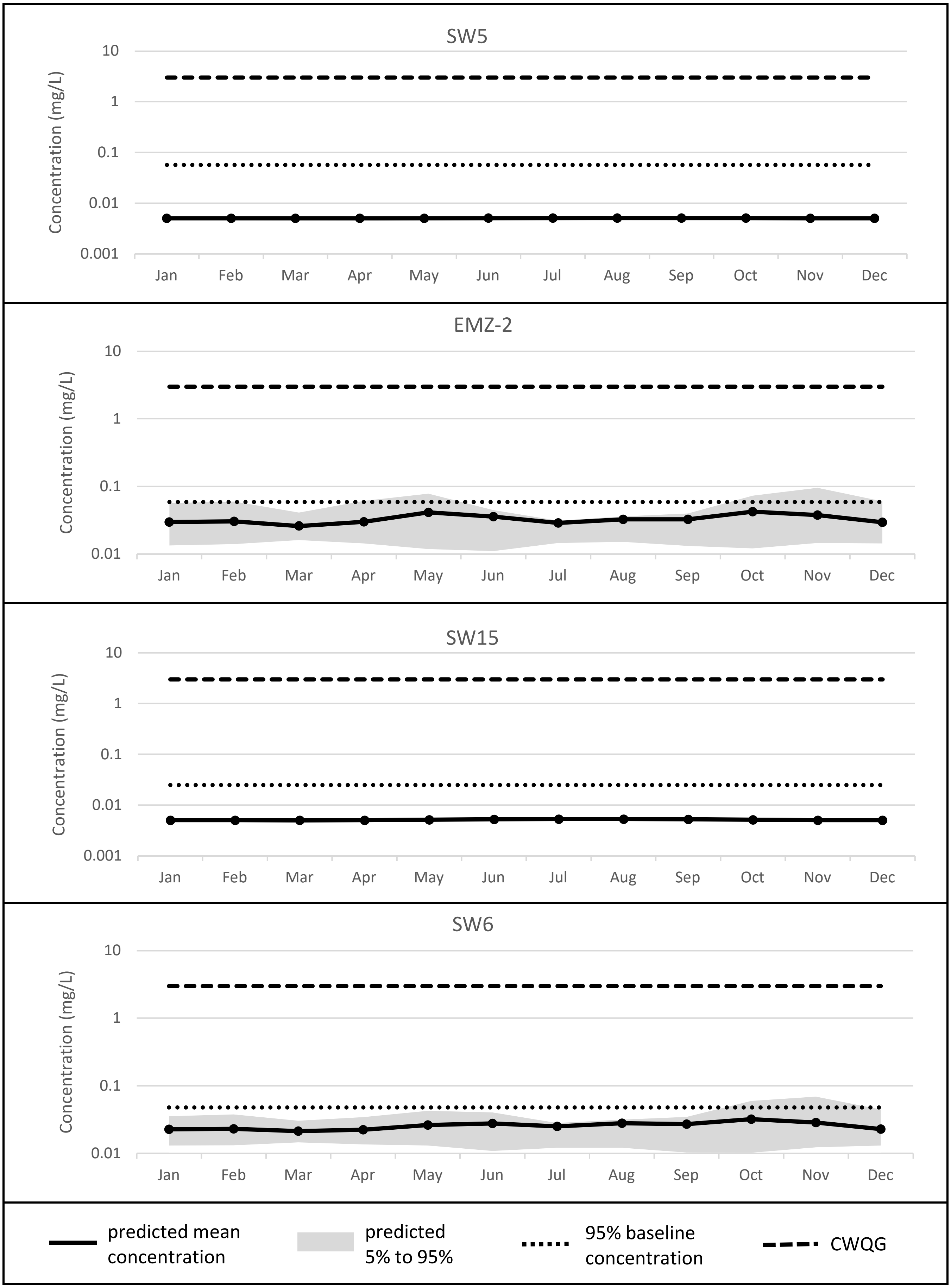


FIGURE C-170: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED NITRITE CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

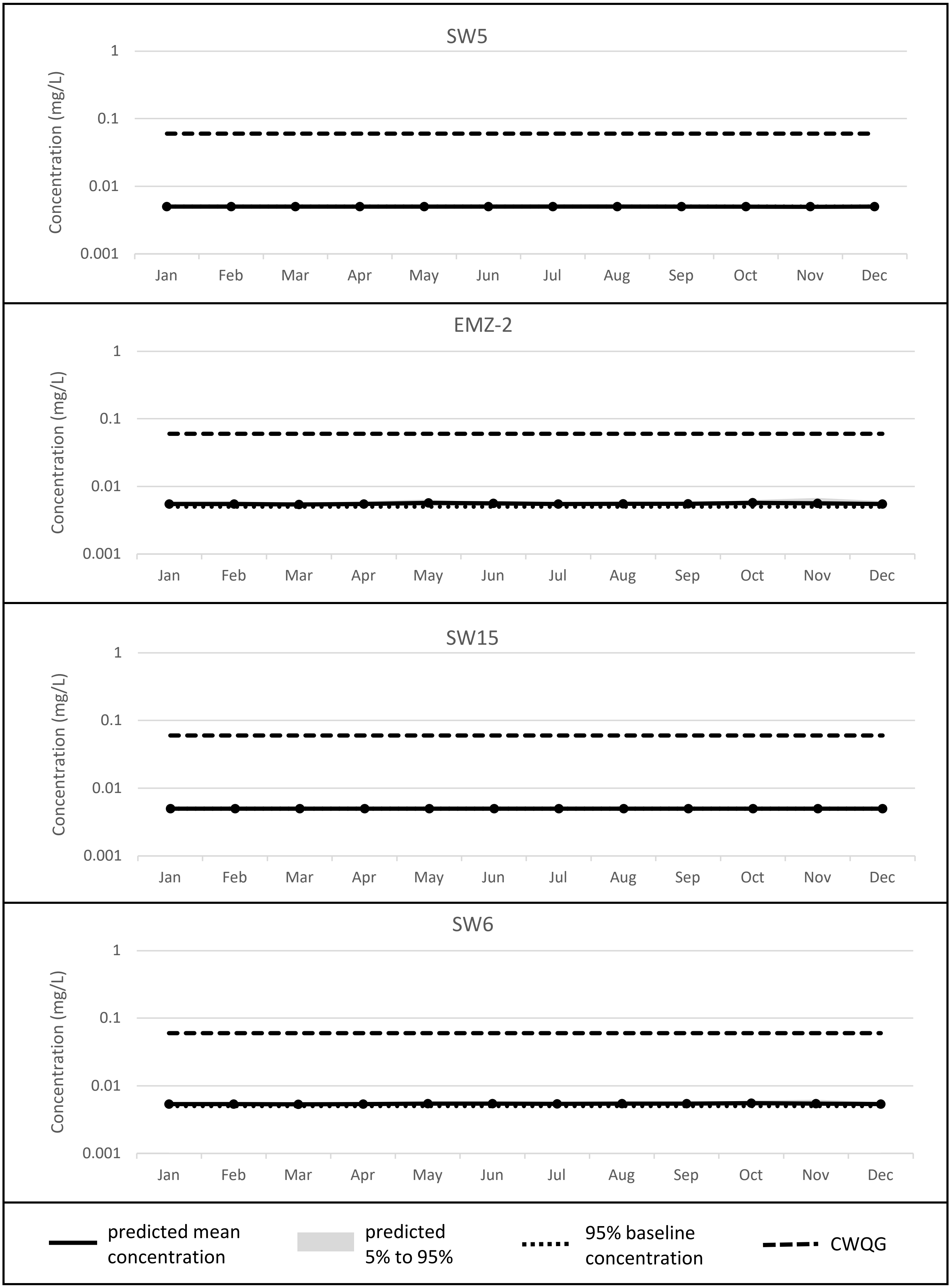


FIGURE C-171: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED SELENIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

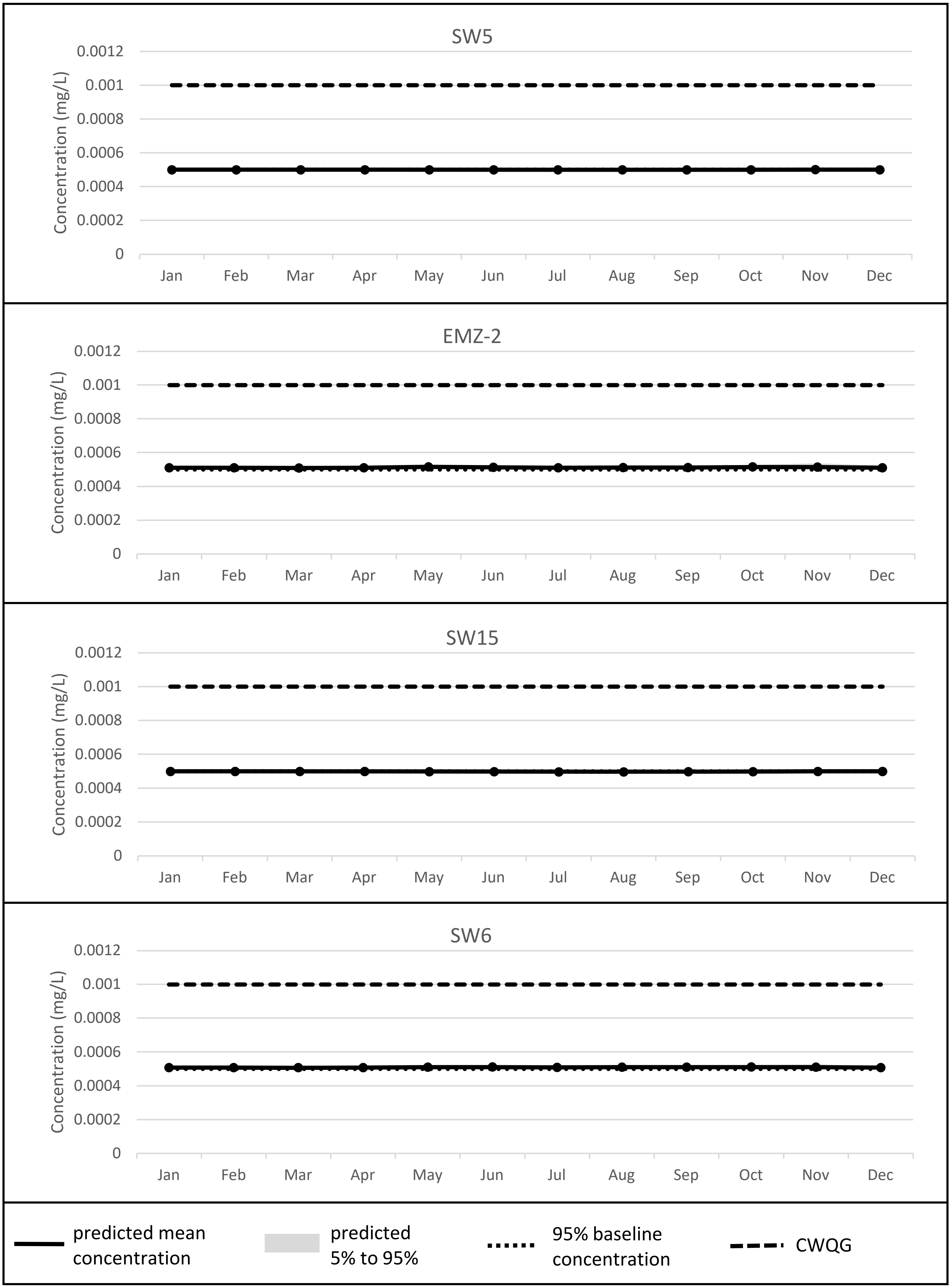


FIGURE C-172: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED SILVER CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

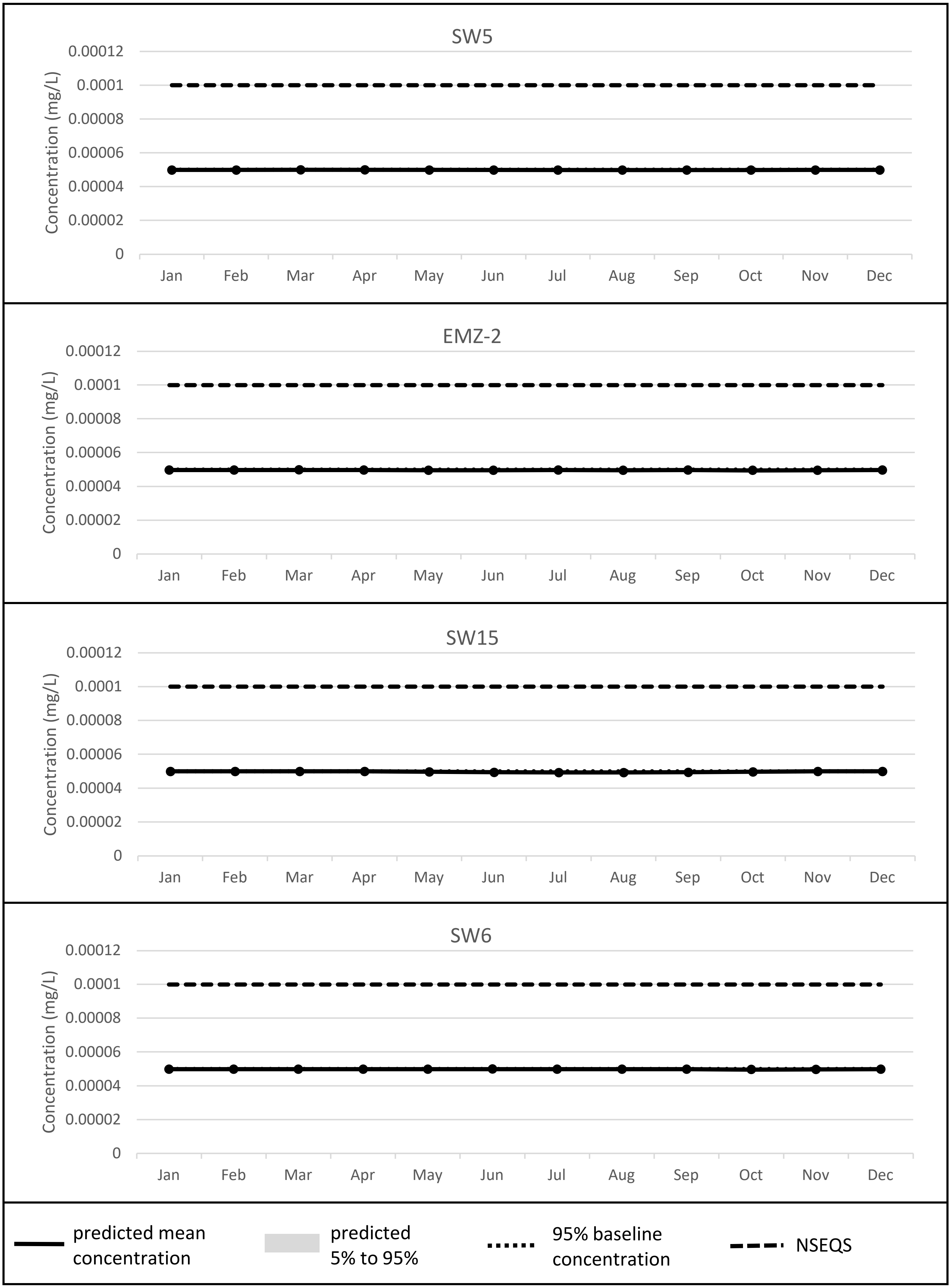


FIGURE C-173: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA PREDICTED THALLIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

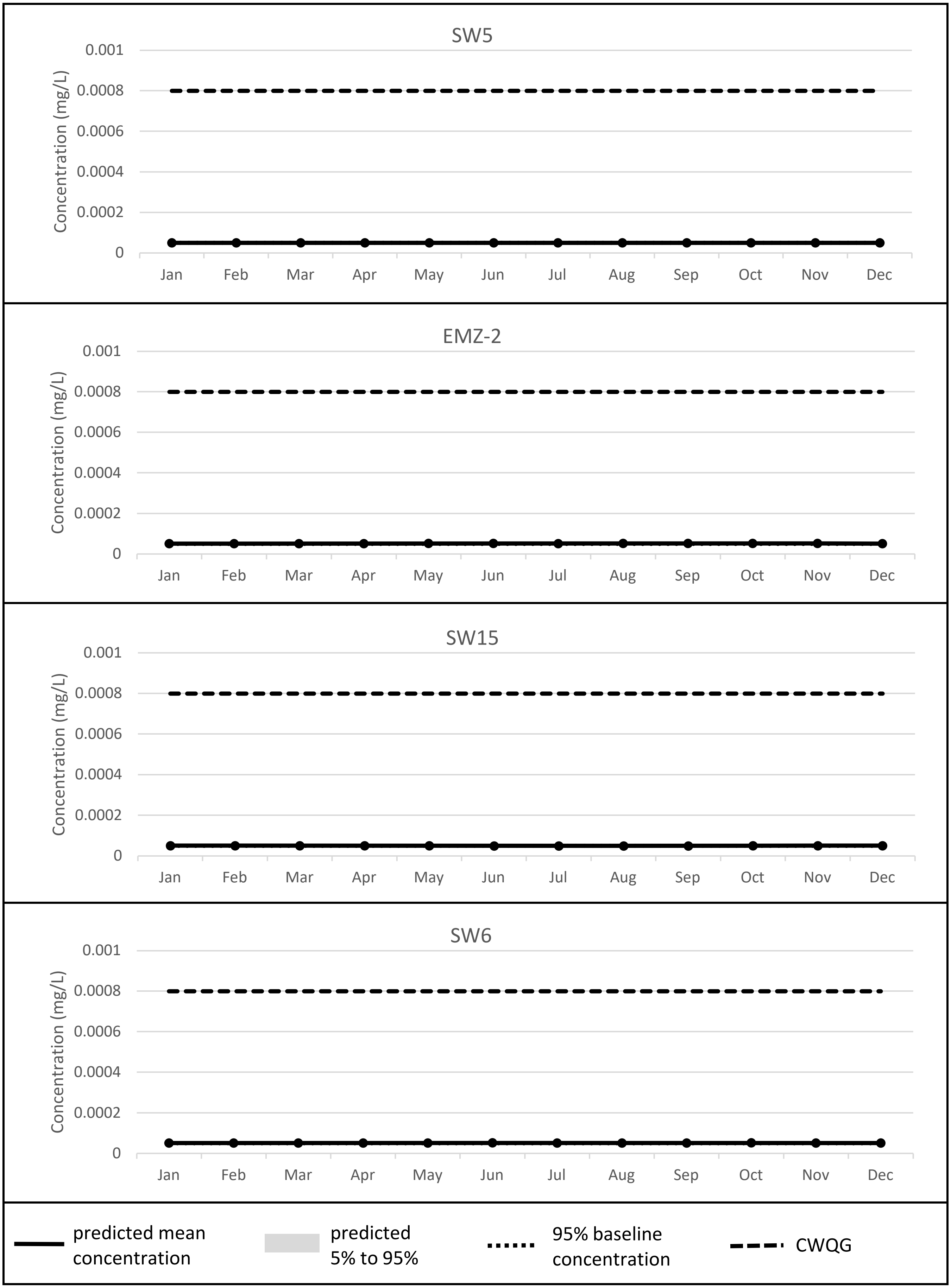


FIGURE C-174: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED UN-IONIZED AMMONIA CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

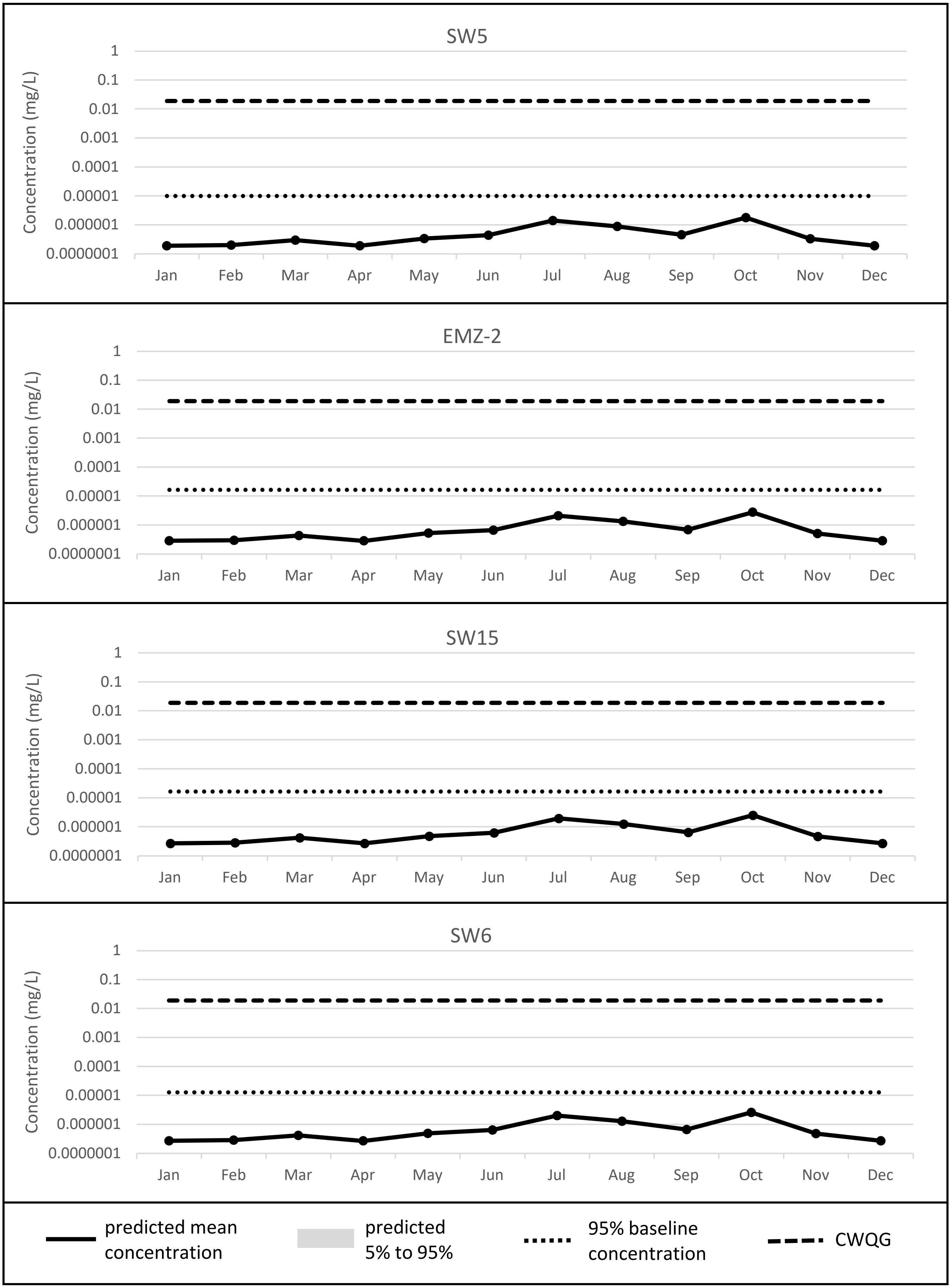


FIGURE C-175: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED URANIUM CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

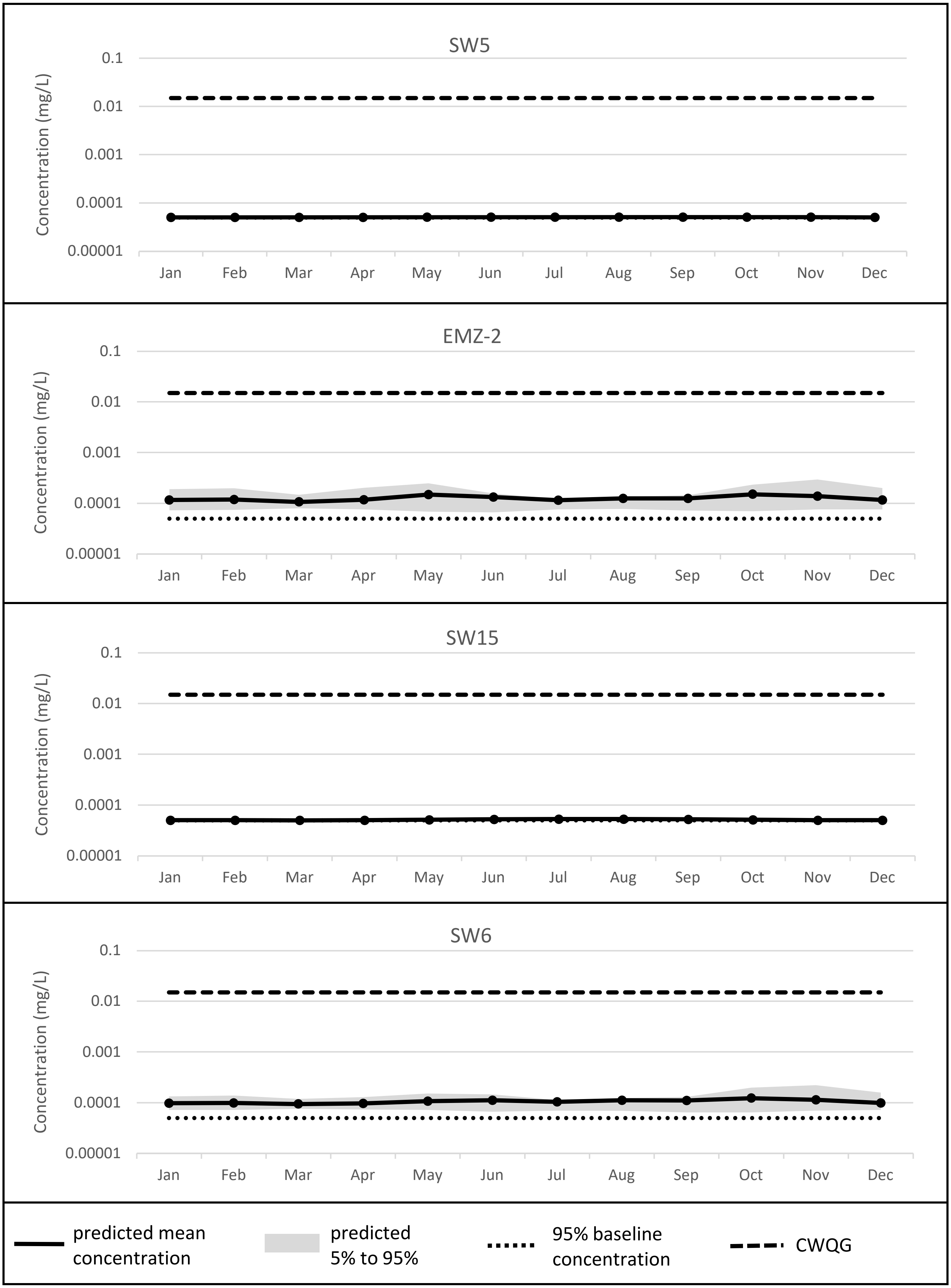


FIGURE C-176: SENSITIVITY ANALYSIS - 2% PAG IN NAG WRSA
PREDICTED ZINC CONCENTRATIONS (USING UPPER CASE SOURCE TERMS)

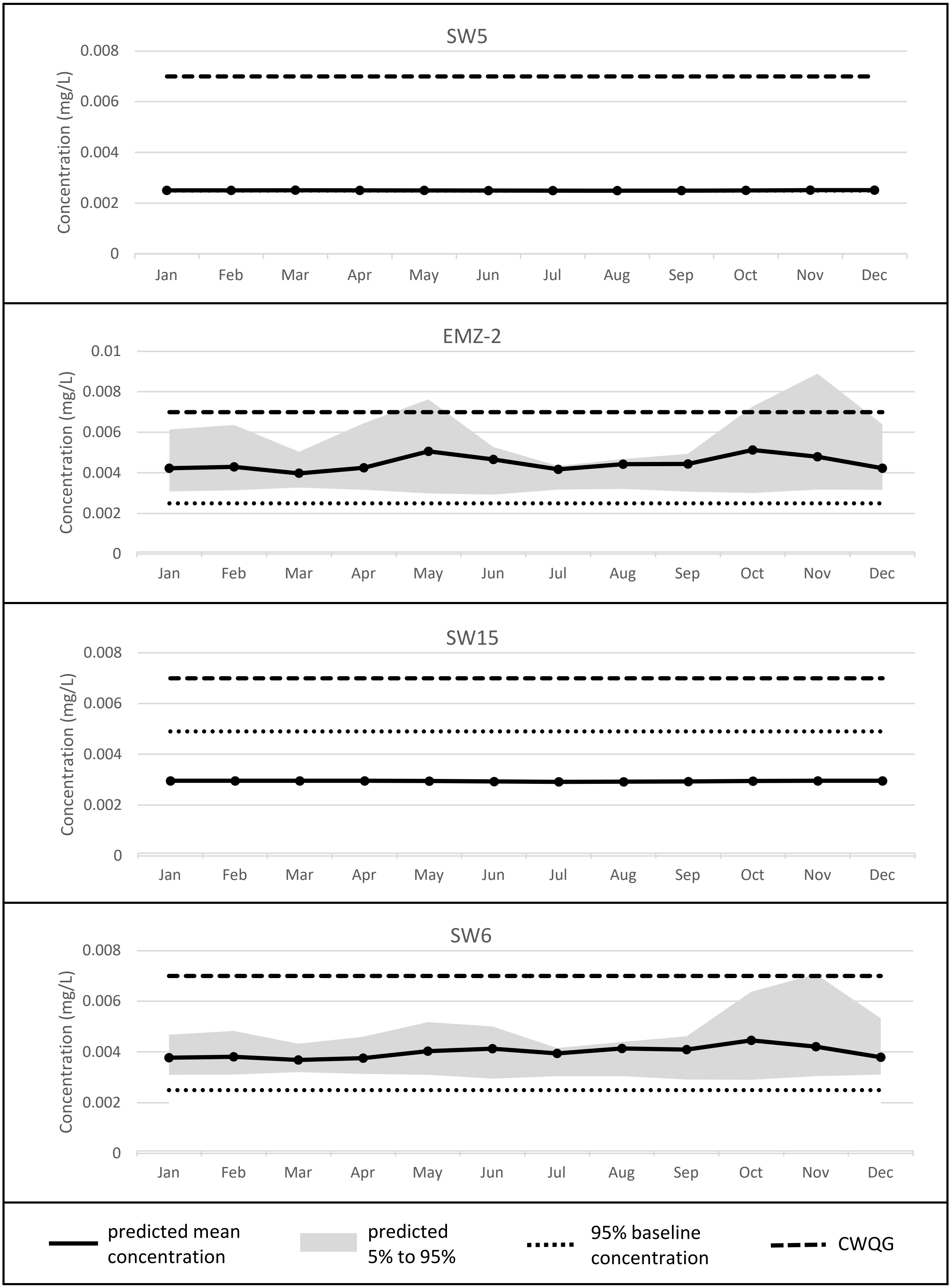
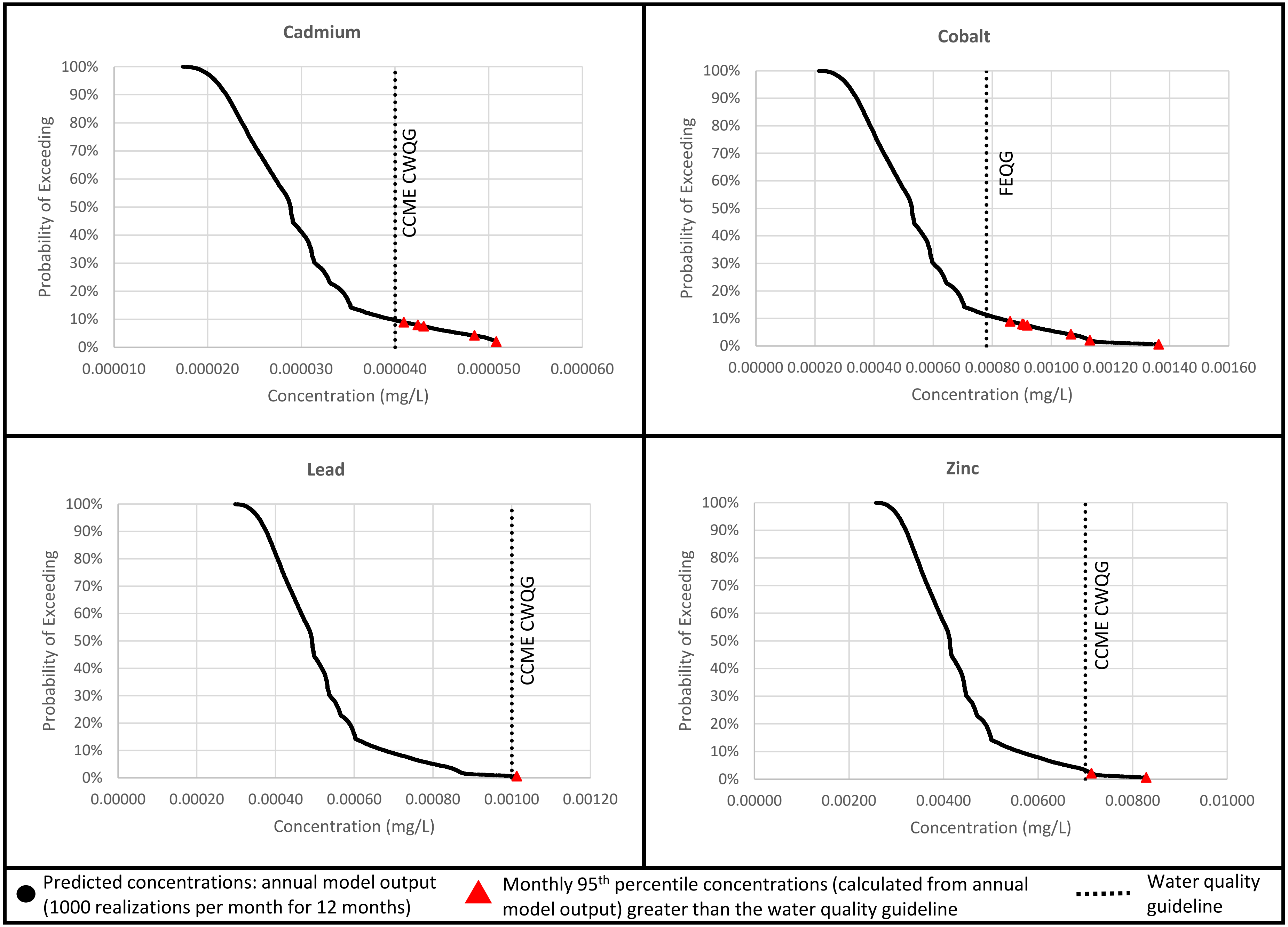
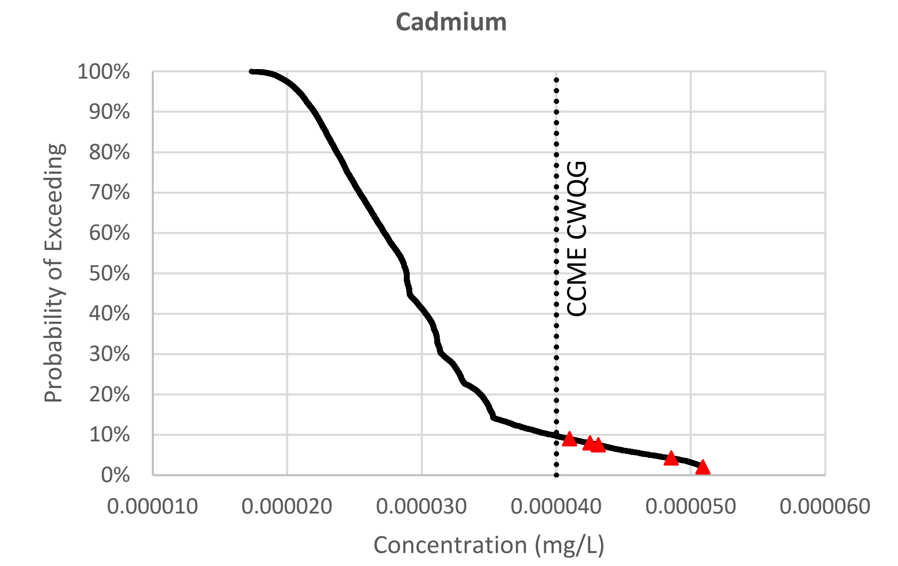
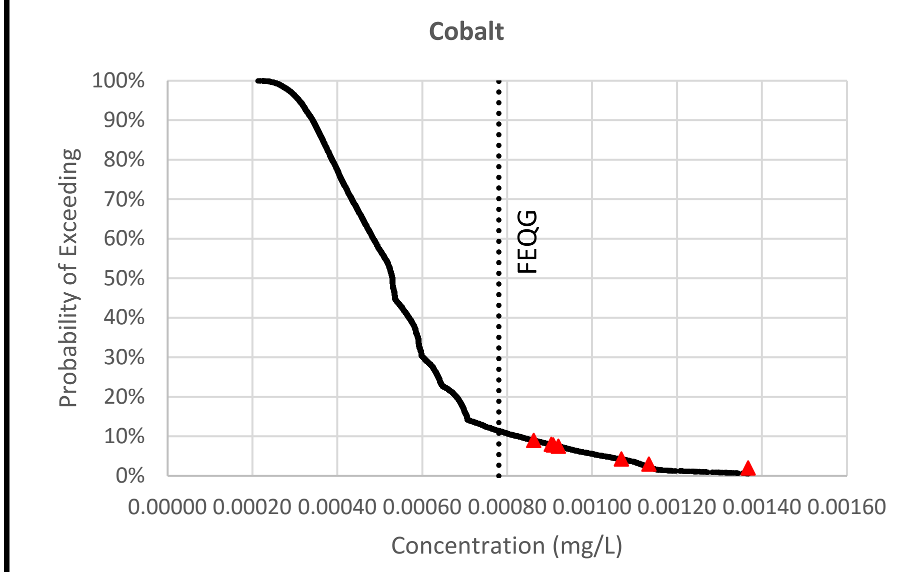


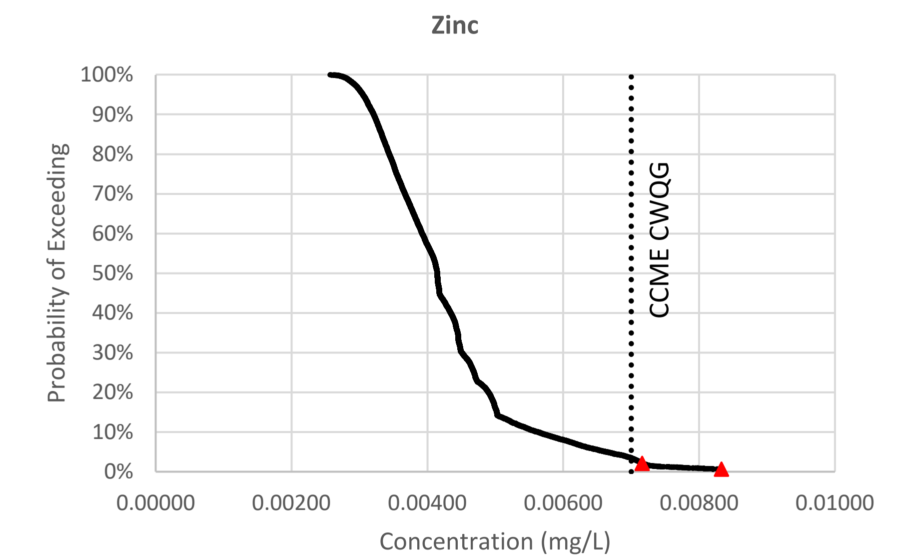
**FIGURE C-177: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 1% PAG IN TMF EMBANKMENTS**



COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 1% PAG IN NAG WRSA





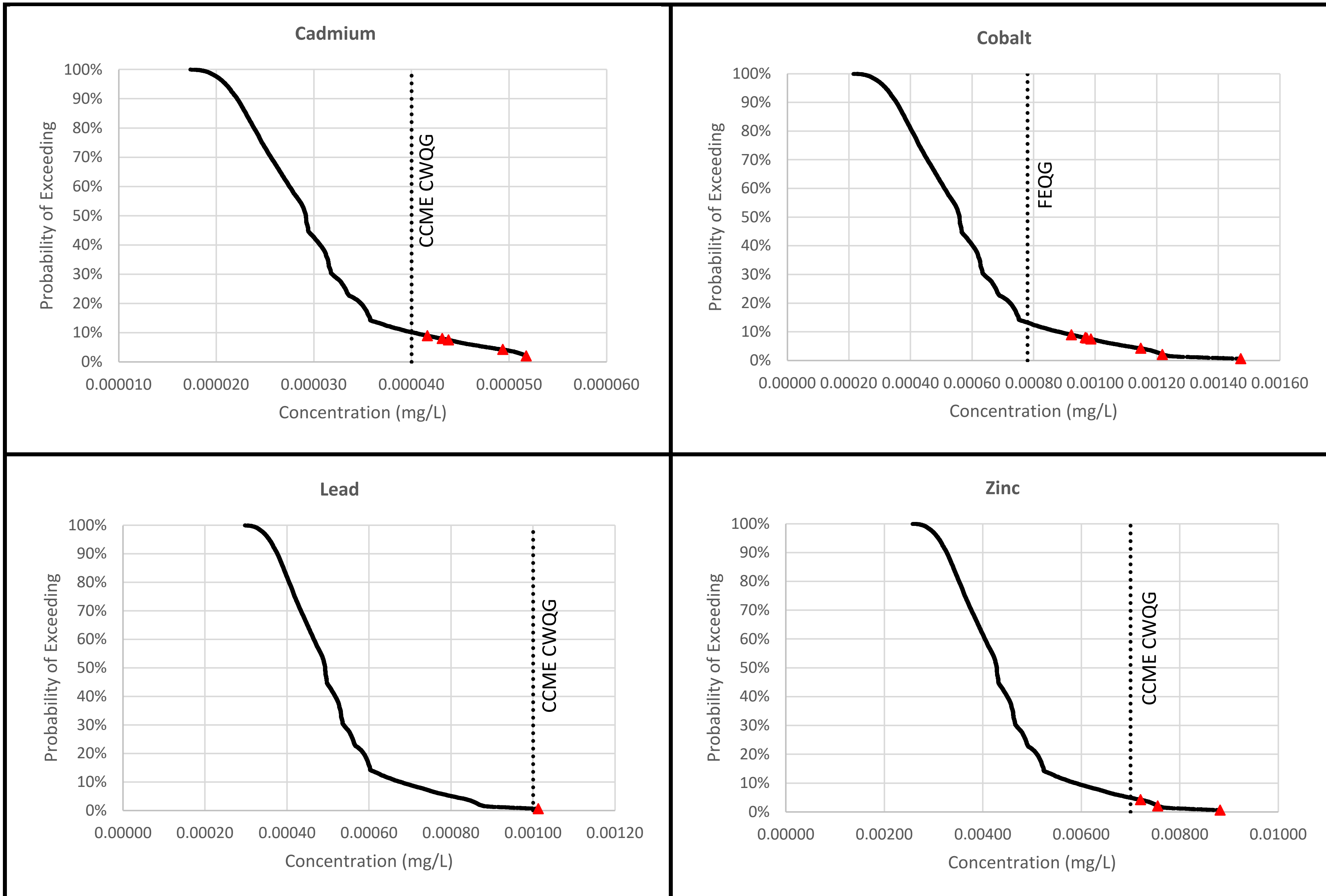


● Predicted concentrations: annual model output (1000 realizations per month for 12 months)

▲ Monthly 95th percentile concentrations (calculated from annual model output) greater than the water quality guideline

...... Water quality guideline

FIGURE C-179: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 2% PAG IN TMF EMBANKMENTS

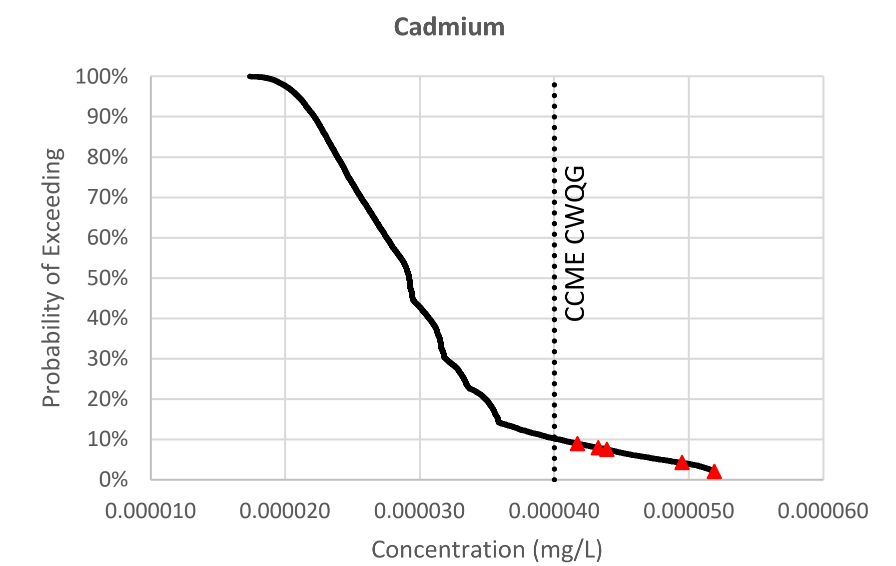


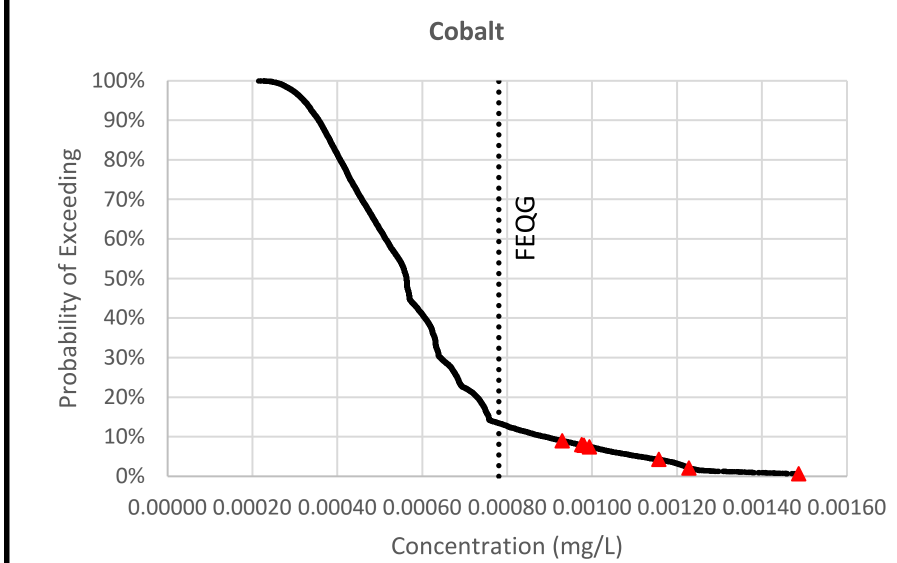
● Predicted concentrations: annual model output (1000 realizations per month for 12 months)

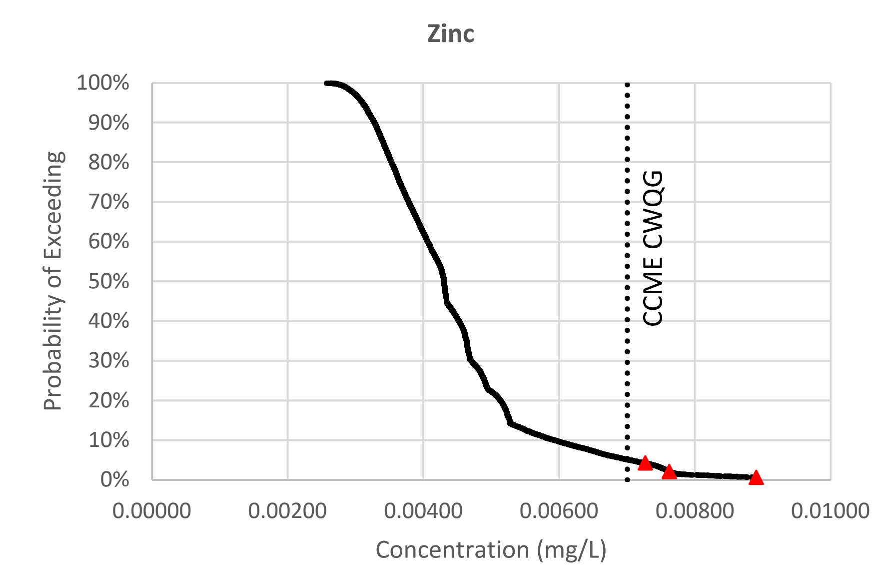
▲ Monthly 95th percentile concentrations (calculated from annual model output) greater than the water quality guideline

...... Water quality guideline

FIGURE C-180: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 2% PAG IN NAG WRSA





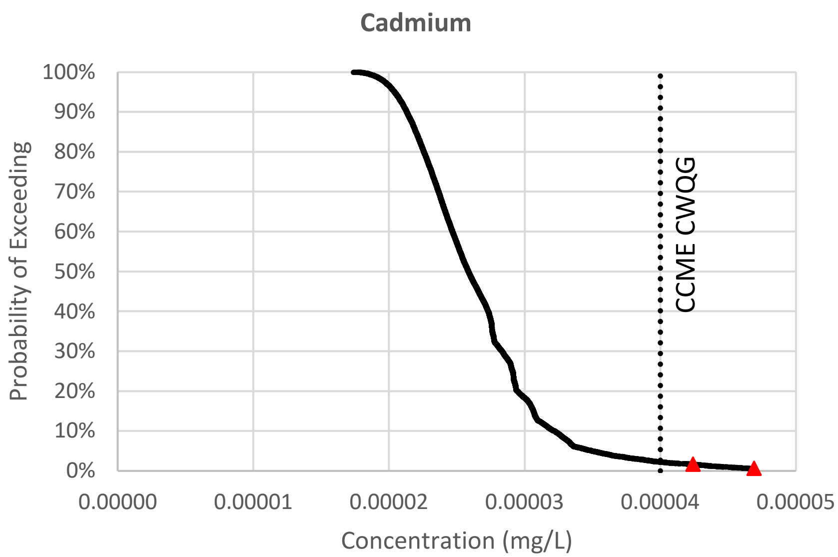


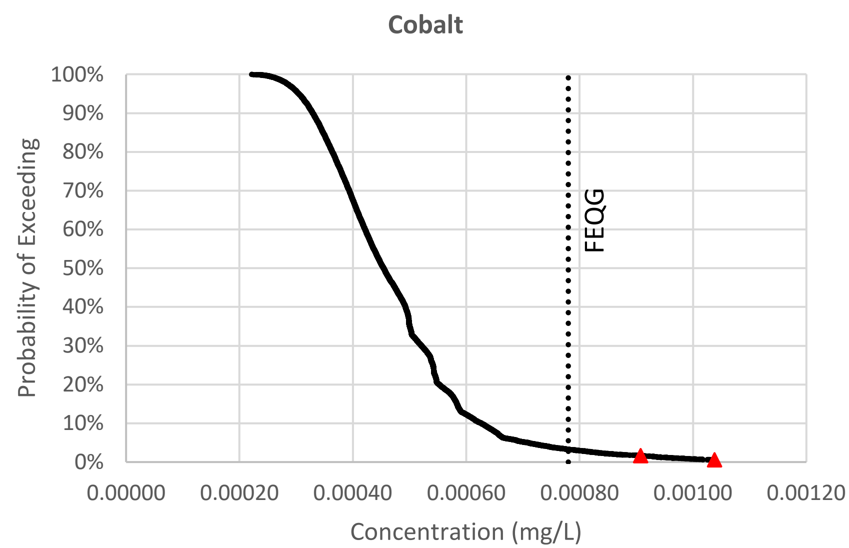
● Predicted concentrations: annual model output (1000 realizations per month for 12 months)

▲ Monthly 95th percentile concentrations (calculated from annual model output) greater than the water quality guideline

...... Water quality guideline

FIGURE C-181: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 1% PAG IN TMF EMBANKMENTS



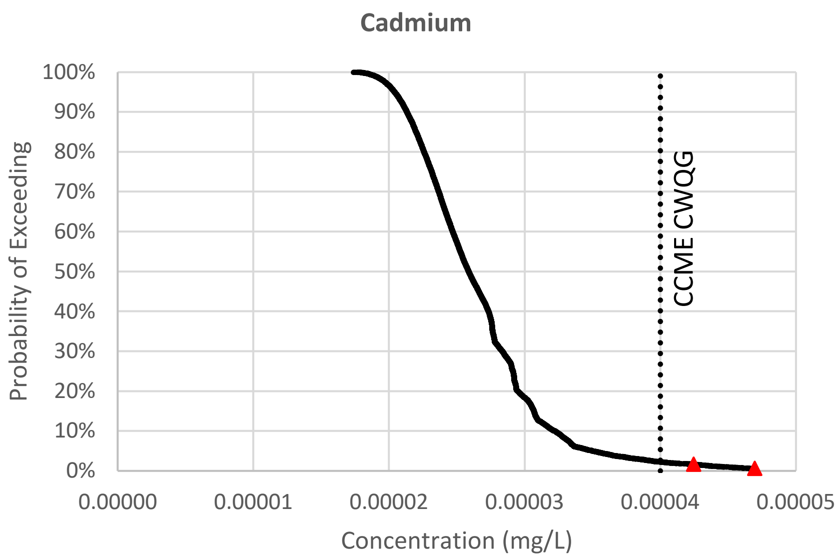


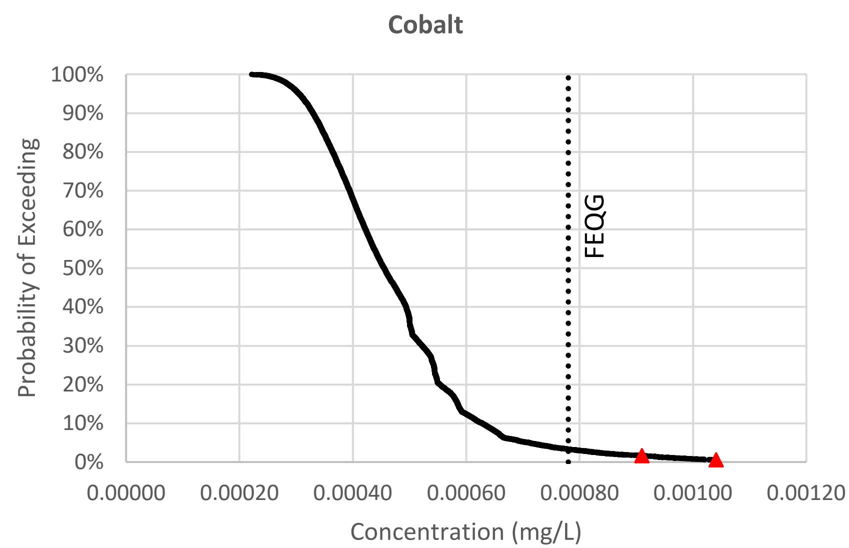
● Predicted concentrations: annual model output (1000 realizations per month for 12 months)

▲ Monthly 95th percentile concentrations (calculated from annual model output) greater than the water quality guideline

.... Water quality guideline

FIGURE C-182: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 1% PAG IN NAG WRSA



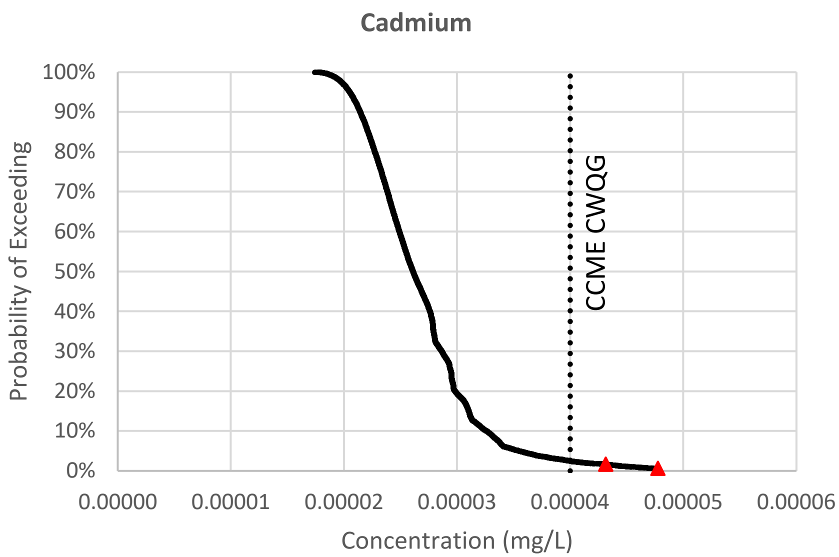


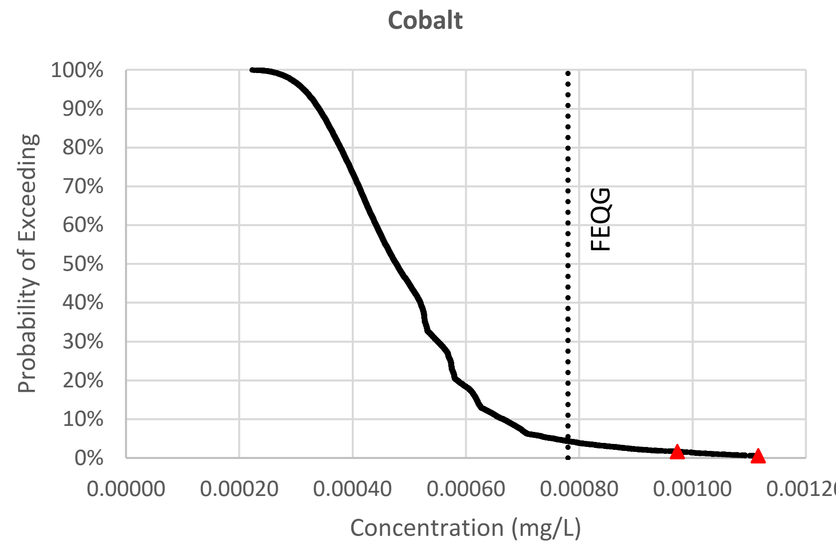
● Predicted concentrations: annual model output (1000 realizations per month for 12 months)

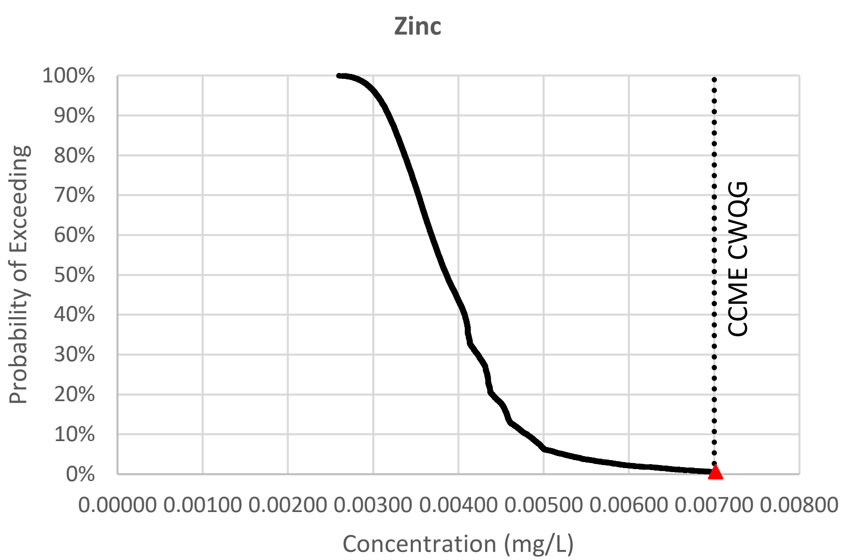
▲ Monthly 95th percentile concentrations (calculated from annual model output) greater than the water quality guideline

.... Water quality guideline

FIGURE C-183: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 2% PAG IN TMF EMBANKMENTS





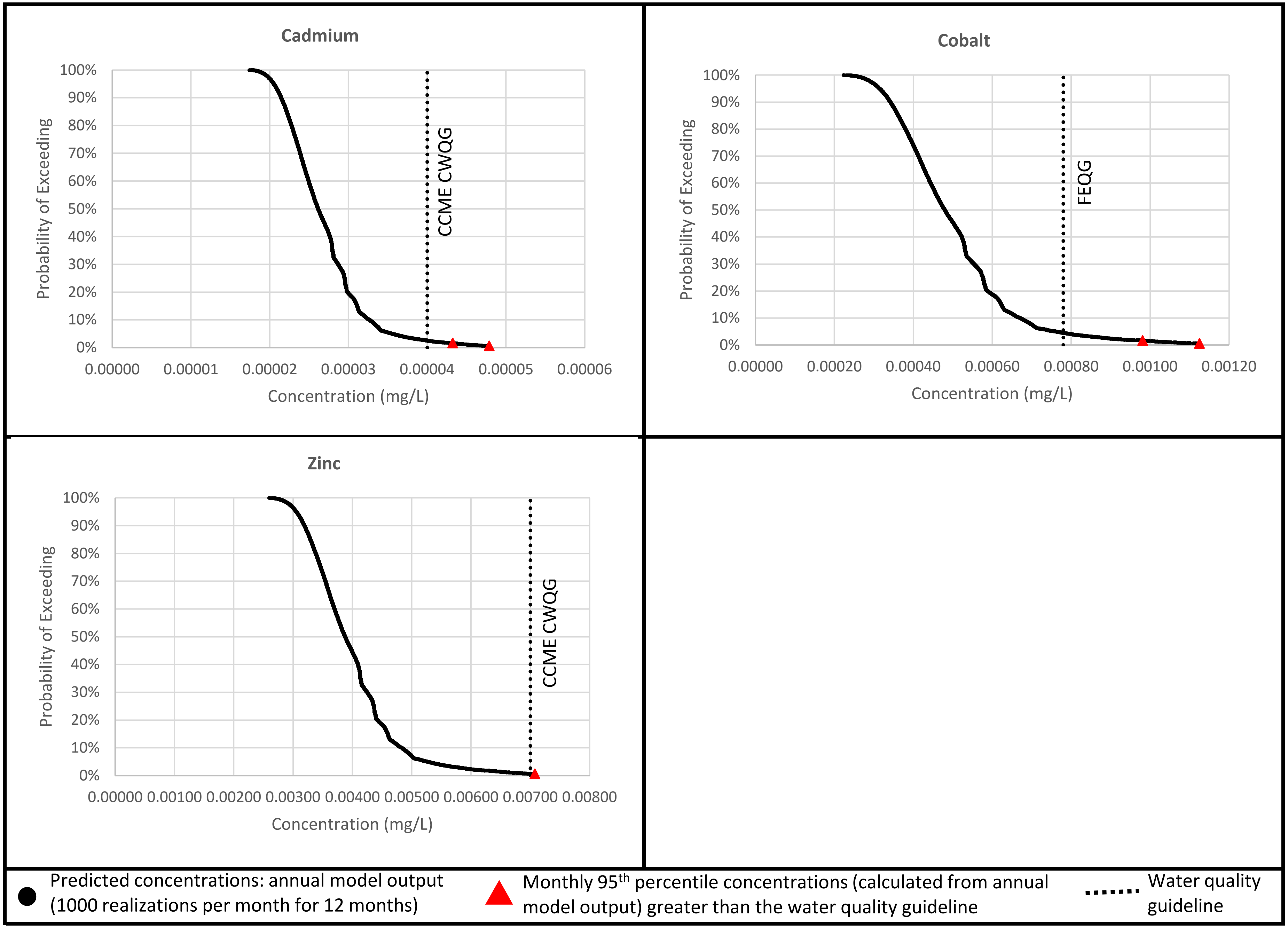


● Predicted concentrations: annual model output (1000 realizations per month for 12 months)

▲ Monthly 95th percentile concentrations (calculated from annual model output) greater than the water quality guideline

...... Water quality guideline

FIGURE C-184: SENSITIVITY ANALYSIS RESULTS - POST-CLOSURE PHASE
COMPLEMENTARY CUMULATIVE FUNCTION PLOTS (USING UPPER CASE SOURCE TERMS) - 2% PAG IN NAG WRSA



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Appendix B.7

Final – Hydrological and SW Quality Modelling Assessments for WaterCourse12
Technical Memo, Golder Associates

GOLDER

TECHNICAL MEMORANDUM

DATE October 1, 2019 **Project No.** 1895674-027-TM-Rev0

TO Meghan Milloy
McCallum Environmental Ltd.

CC Jim Millard, Atlantic Mining NS Corp

FROM Steve Kaufman, Natalie Korczak **EMAIL Steve_Kaufman@golder.com**

HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12
ATLANTIC MINING NS CORP
FIFTEEN MILE STREAM PROJECT

1.0 INTRODUCTION

Atlantic Mining NS Corp (AMNS), a wholly owned subsidiary of St. Barbara Ltd., is planning to develop the Fifteen Mile Stream Gold Project (the Project) located approximately 115 km east of Halifax, in Halifax County, in the province of Nova Scotia. As part of the Environmental Impact Statement (EIS) for the Project, Golder Associates Ltd. (Golder) has prepared hydrology and water quality models for the operations and closure phases of the Project (Golder 2019a, Golder 2019b). The key objective of the modelling was to estimate the changes in the surface water flow system and water quality in the receiving surface water environment, that may occur as a result of the Project.

To supplement the ongoing EIS assessments and specifically to support the aquatics and wetland habitat assessments, additional hydrological and water quality modelling was conducted for a tributary of the Seloam Brook, located to the north of the planned tailings management facility (TMF). This tributary is designated in EIS assessments as Watercourse 12, referred to herein as WC12.

The objectives of the additional hydrological and water quality modelling were as follows:

1) To further delineate the WC12 watershed under existing conditions, the operations phase and the closure phase.

2) To simulate the effect of the proposed open pit berm/stream realignment on the potential for changes in discharge and water level along WC12.

3) To assess the potential effect of TMF seepage on the water quality at WC12 for the operations phase and closure phase.

2.0 BACKGROUND

The WC12 flow system drains an area of approximately 3 km^2. The watercourse is generally low gradient and collects water from the watershed before discharging to the west and becoming a part of Seloam Brook, which flows from Seloam Reservoir and ultimately discharges to Fifteen Mile Stream (Figure 1).

Following construction of the Project, WC12 will parallel the northern boundary of the TMF and will become an inflow to the redirected flows around the northern and western limits of the Open Pit. The re-alignment of Fifteen Mile Stream around Project infrastructure will require the construction of berms and/or channels; the dynamics of the flows through WC12 and the confluence with Seloam Brook; therefore, required additional analysis that was not necessary for the larger flow systems described in the EIS.

3.0 METHODOLOGY

3.1 Hydrology

For WC12, the EIS hydrological model (GoldSim Version 12.1) was modified and supplemented with a site-specific hydraulic model for WC12 (Hydraulic Engineering Centre -River Analysis System; HEC-RAS). The hydrology model was intended to allow for integration with water quality (as per EIS methodology) while the hydraulic model was intended to further detail the potential change in water level, as a consequence of the confluence with Seloam Brook and the realignment feature.

3.1.1 Hydrological Modelling

The existing Fifteen Mile Stream EIS hydrological model was modified to simulate the runoff from the WC12 watershed for existing, operations, and closure phases of the Project. The EIS climatic conditions and modelling methods were utilized with updates to the watershed area and surficial geology considered for WC12. For further details on the development of the hydrological model, refer to Golder (2019).

3.1.1.1 Watershed Delineation

The sub watershed area for the WC12 catchment was delineated based on existing conditions. For the Operations and Closure phases, Knight Piésold (KP) developed water management plans and the facility footprints associated with these water management features. These details were provided by KP and were removed or redistributed from the existing conditions watershed (Table 1).

Table 1: WC12 Watershed Drainage Areas

Watershed ID	Watershed Description	Existing Condition Drainage Area (m^2)	Operations and Closure Drainage Area (m^2)
WC12	Watercourse 12	3,011,400	2,163,700

3.1.1.2 Surficial Geology

Based on the delineated watershed, the surficial soil properties (KP 2018; Nova Scotia 2006) were characterized for the WC12 component (Table 2).

Table 2: WC12 Watershed Surficial Geology

Project Phase	Stony Till Plain (m^2)	Wetland (m^2)	Alluvial Floodplain (m^2)	Kettle Hole (m^2)	Total (m^2)
Existing Conditions (WC12)	2,522,600	454,900	30,300	3,600	3,011,400
Operations and Closure Conditions (WC12)	1,777,900	353,600	30,300	2,000	2,163,700

3.1.2 Hydraulic Modelling

Cross sections along WC12 and Seloam Brook were developed for input to the HEC-RAS model, based on available topographic data and the conceptual design of the realignment berms. Topographic data and imagery were utilized to estimate channel slopes and edge boundaries in WC12, and monthly discharge simulated from the hydrological model for the Existing, Operations, and Closure phases was utilized as the discharge inflow to the hydraulic model.

3.2 Water Quality

3.2.1 Modelling Approach

In support of the assessment of water quality impacts at WC12, water quality models were developed for the Project using GoldSim Version 12.1. GoldSim is a graphical, object-oriented mathematical model where the input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors that influence an engineered or natural system, which allows for estimating the potential changes to surface water quality.

The modelling approach used for the surface water quality predictions is a mass-balance mixing cell model for site-specific components, consisting of both natural components (e.g., natural runoff, rainfall) and Project components (e.g., TMF seepage), that are linked together to form a series of mixing cells. Each mixing cell has two or more sources of mass load that are combined to determine a “mixed” or combined water quality. The surface water quality model was constructed by building upon the GoldSim hydrology model, whereby, geochemical source-terms and baseline water quality inputs were integrated with flow rates to calculate mass loading rates. The flow logic, which forms the basis of the water balance interconnectivity, is used to configure the model linkages, including determining the direction of mass movement along the flow paths and defining the location of mass mixing points. The flow rates were used with baseline water quality and geochemistry inputs to derive mass loading rates for each of the model components. The mass mixing can be represented by the following equation:

$$C_x = \frac{\sum_{i=1}^{n} C_i Q_i}{\sum_{i=1}^{n} Q_i}$$

where:
C_x = predicted concentration of constituent ‘x’ at a given location
C_i = concentration of constituent ‘x’ in inflow ‘i’ discharging to a given location
Q_i = flow rate of inflow ‘i’
n = number of inflows to the location in question

Each flow rate is multiplied by the corresponding input concentration value, and the sum of all these calculations is divided by the sum of each flow rate to predict the final concentration of each parameter in the waterbody.

3.2.2 Project Site Components

During the operations phase, process water will be discharged from the plant site to the TMF pond. Water that infiltrates into the subsurface will, in part, become groundwater and flow toward the perimeter of the TMF. A seepage collection system, including the north and east seepage collection ponds, will be constructed to capture seepage and returns the water back into the TMF pond via a pumpback system. During the post-closure stage of the closure phase, the TMF seepage collection system will remain in place.

The water quality model for the operations phase assumed that 15% of the total seepage that exits from the TMF at perimeter locations, will bypass the perimeter seepage collection system and enter the adjacent surface water environment (14% to the north toward the WC12 watershed and 1% to the south toward the SW15 watershed). It should be noted that while the groundwater modelling results indicate that seepage will not report to the receiving environment during the planned duration of the operations phase, the operations phase water quality model conservatively applies the seepage mass load to the receivers.

The water quality model for the post-closure stage of the closure phase also assumed that 15% of the total seepage that exits from the TMF at perimeter locations, will bypass the perimeter seepage collection system and enter the adjacent surface water environment (14% at the WC12 watershed and 1% at the SW15 watershed).

During the operations and post-closure phases, drainage from the topsoil stockpile area will also report to the WC12 watershed.

3.2.3 Water Quality Model Inputs

3.2.3.1 Project Site Components

Geochemical source terms were provided for the operations (end-of-mine life) and post-closure phases of the Project and are summarized in Table 3 (base case) and Table 4 (upper case). As described in Lorax (2019), the base case source terms are based on the 50th percentile results from applicable humidity cell testing data, while the upper-case source terms are based on the 90th percentile.

Table 3: Base Case Geochemical Source Terms

Parameter	Geochemical Source Terms (1)		
	Topsoil Stockpile	Process Water	Pore Water
	EOM (2) /PC (3)	EOM	PC
Aluminum	0.07	0.026	0.0055
Antimony	0.00005	0.00031	0.000009
Arsenic	0.0025	0.012	0.053
Boron	0.005	0.021	0.052
Cadmium	0.00003	0.000005	0.000011
Calcium	0.95	25	42
Chromium	0.00076	0.0001	0.0001
Cobalt	0.00069	0.000009	0.000005
Copper	0.00095	0.0001	0.00016
Iron	0.23	0.001	0.00063
Lead	0.00013	0.000005	0.000003
Magnesium	2.2	3.5	6.6
Manganese	0.41	0.018	0.22
Mercury	0.000030	0.000005	0.000005
Molybdenum	0.00005	0.016	0.04
Nickel	0.0014	0.00076	0.00073
Potassium	0.67	32	40

Parameter	Geochemical Source Terms [(1)]		
	Topsoil Stockpile	Process Water	Pore Water
	EOM [(2)] /PC [(3)]	EOM	PC
Selenium	0.00077	0.00028	0.00017
Silver	0.00003	0.000005	0.000005
Sodium	1.4	63	89
Sulphate	1.7	135	225
Thallium	0.00005	0.000006	0.000004
Uranium	0.00008	0.00016	0.00023
Zinc	0.005	0.01	0.00021

Notes
[1] Base case geochemical source terms provided by Lorax (2019).
[2] EOM = end of mining; operations phase.
[3] PC = post-closure phase.

Table 4: Upper Case Geochemical Source Terms

Parameter	Geochemical Source Terms [(1)]	
	Topsoil Stockpile	Pore Water
	EOM [(2)] /PC [(3)]	PC
Sulphate	2	244
Aluminum	0.55	0.01
Antimony	0.00005	0.00014
Arsenic	0.007	0.11
Boron	0.005	0.053
Cadmium	0.00006	0.000022
Calcium	1.1	44
Chromium	0.0011	0.0001

Parameter	Geochemical Source Terms [1]	
	Topsoil Stockpile	Pore Water
	EOM [2] /PC [3]	PC
Cobalt	0.00096	0.000007
Copper	0.0027	0.00029
Iron	0.42	0.0011
Lead	0.00094	0.000005
Magnesium	0.53	7.3
Manganese	0.11	0.39
Mercury	0.000030	0.000005
Molybdenum	0.00005	0.055
Nickel	0.0017	0.0012
Potassium	1.4	45
Selenium	0.00096	0.00031
Silver	0.00003	0.000005
Sodium	2.1	92
Thallium	0.00005	0.000006
Uranium	0.0001	0.00025
Zinc	0.0099	0.00028

Notes
[1] Upper case geochemical source terms provided by Lorax (2019). No upper case source term was provided for process water.
[2] EOM = end of mining; operations phase.
[3] PC = post-closure phase.

The model inputs for the quality of the TMF seepage bypassing the seepage collection system and reporting to the WC12 watershed are as follows:

- The process water geochemical source term is used for the operations phase (only a base case source term was developed).

- The pore water geochemical source term (base case and upper case) is used for the post-closure phase.

The water quality model input for the quality of the topsoil stockpile area, reporting to the WC12 watershed, is the topsoil geochemical source term (base case and upper case) for both the operations and post-closure phases.

3.2.3.2 Natural Runoff

Baseline surface water quality monitoring has been conducted at various watercourses in the vicinity of the Project site since 2017. Additional details on the baseline surface water quality monitoring program and results are summarized in Golder (2019c). Baseline water quality data is not available for WC12; as such, the baseline dataset for SW2 is used to represent the quality of natural runoff associated with the WC12 watershed (Table 5). Analytical results for total metals were used to derive water quality model inputs.

Table 5: Natural Runoff Input Quality

Parameter	Average Surface Water Baseline Concentration (mg/L) [(1)]
	SW2
Aluminum	0.13
Ammonia (total)	0.025
Antimony	0.00050
Arsenic	0.00050
Boron	0.025
Cadmium	0.000013
Calcium	0.51
Chromium	0.00056
Cobalt	0.00020
Copper	0.00083
Iron	0.14
Lead	0.00025
Magnesium	0.31
Manganese	0.045
Mercury	0.0000065
Molybdenum	0.0010
Nickel	0.0010
Nitrate	0.0050
Nitrite	0.0050
Potassium	0.26
Selenium	0.00050

Parameter	Average Surface Water Baseline Concentration (mg/L) [(1)]
	SW2
Silver	0.000050
Sodium	2.2
Sulphate	1.0
Thallium	0.000050
Uranium	0.000050
Zinc	0.0025

Notes
[1] Average calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

3.2.4 Water Quality Comparison Criteria

Effluent discharges from the site will be required to adhere to the MDMER maximum allowable concentration limits. For the purposes of comparison and evaluating the overall Project site water quality, the predicted water qualities of the Project site components are compared to the MDMER maximum allowable monthly mean concentration.

The surface water quality predictions for the receiving environment are compared to the following federal and provincial criteria:

- Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQGs)
- Nova Scotia Environmental Quality Standards (NSEQS) for Contaminated Sites (Tier 1) for Surface Water (Fresh Water)
- Environment Canada Federal Environmental Quality Guideline (FEQG) for cobalt

In addition to the guidelines above, a site-specific water quality objective (SSWQO) for arsenic of 0.03 mg/L has been developed as an aquatic risk-based comparator (Intrinsik 2019).

The surface water quality predictions are also compared to the 95th percentile baseline concentrations measured at SW2.

4.0 RESULTS

4.1 Hydrology

4.1.1 Hydrological Model Results

Results for the average, 5th percentile, and 95th percentile surface water discharge through WC12 are presented in Table 6 through Table 8 for Existing, Operations, and Post-Closure Phases of the Project. The predicted potential change in discharge is generally within the existing flow intra-annual flow regime of the waterway, with the exception of July, when average daily discharge was estimated to decrease to below the intra-annual variability by less than 10%.

Table 6: Simulated Average Discharge, WC12

Month	Existing (m^3/day)	Operations (m^3/day)	Closure/ Reclamation (m^3/day)	Closure/ Post Closure (m^3/day)
January	10,000	7,400	7,400	7,600
February	9,100	6,700	6,700	7,000
March	15,000	11,100	11,100	11,300
April	13,800	10,200	10,200	10,400
May	4,600	3,500	3,500	3,700
June	2,200	1,800	1,800	2,000
July	1,300	1,200	1,200	1,300
August	1,500	1,300	1,300	1,500
September	1,700	1,500	1,500	1,700
October	4,200	3,200	3,200	3,400
November	10,800	7,800	7,800	8,100
December	12,000	8,700	8,700	9,000

Table 7: 95th Percentile Simulated Discharge, WC12

Month	Existing (m^3/day)	Operations (m^3/day)	Closure/ Reclamation (m^3/day)	Closure/ Post Closure (m^3/day)
January	22,100	16,200	16,200	16,400
February	19,500	14,300	14,300	14,500
March	25,500	18,600	18,600	18,800
April	29,000	21,200	21,200	21,500
May	14,600	10,700	10,700	11,000
June	9,000	6,600	6,600	6,800
July	3,700	2,600	2,600	2,800
August	5,300	3,600	3,600	4,000
September	6,800	4,600	4,600	5,000
October	14,700	10,600	10,600	11,000
November	22,000	15,600	15,600	16,100
December	23,700	17,300	17,300	17,500

Table 8: 5th Percentile Simulated Discharge, WC12

Month	Existing (m^3/day)	Operations (m^3/day)	Closure/ Reclamation (m^3/day)	Closure/ Post Closure (m^3/day)
January	3,200	2,400	2,400	2,600
February	3,000	2,200	2,200	2,400
March	7,400	5,500	5,500	5,700
April	4,600	3,500	3,500	3,700
May	900	900	900	1,000
June	900	900	900	1,000
July	900	900	900	1,000

Month	Existing (m^3/day)	Operations (m^3/day)	Closure/ Reclamation (m^3/day)	Closure/ Post Closure (m^3/day)
August	900	900	900	1,000
September	900	900	900	1,000
October	900	900	900	1,000
November	2,000	1,700	1,700	1,900
December	3,900	2,700	2,700	3,000

4.1.2 Hydraulic Model Results

Simulated water elevations for the Operations and Post-Closure Phases of the Project are provided in Appendix A. To provide a temporal context, these figures were developed for spring runoff (March) and dry season (July) flow conditions. Regardless of season, these simulations of the WC12/Seloam Brook show the influence of the realignment berms has the potential to create a backwatered effect (i.e., a raised water level, relative to the Existing Conditions) that will facilitate the discharge of water along the natural gradient, along the northern boundary of the Open Pit.

4.2 Water Quality

4.2.1 Project Site Components

The water quality model for the operations phase assumed that seepage bypassing the TMF seepage collection system is represented by the geochemical source term for process water (Table 3 and 4); these concentrations are lower than the MDMERs for all parameters. The concentrations are also lower than the CCME CWQGs, NSEQSs, FEQG, and SSWQO with the exception of aluminum and zinc.

The water quality model for the post-closure phase assumed that seepage bypassing the TMF seepage collection system is represented by the geochemical source term for pore water (Table 3 and 4); these concentrations are lower than the MDMERs for all parameters. The concentrations are also lower than the CCME CWQGs, NSEQSs, FEQG, and SSWQO, with the exception of aluminum (using base case and upper case source terms) and arsenic (using base case and upper case source terms).

The quality of the drainage from the topsoil stockpile area is assumed to be represented by the geochemical source term for the stockpile (Table 3 and 4); these concentrations are lower than the MDMERs for all parameters. The concentrations are also lower than the CCME CWQGs, NSEQSs, FEQG, and SSWQO, with the exception of aluminum (using base case and upper case source terms), mercury (using base case and upper case source terms), cadmium (using upper case source terms), cobalt (using upper case source terms), copper (using upper case source terms), iron (using upper case source terms), and zinc (using upper case source terms).

4.2.2 Watercourse 12

Predicted effects on receiving environment surface water quality for the average, 5th percentile, and 95th percentile flow were simulated by the operations phase and post-closure phase water quality models at WC12. Predicted annual concentrations of these parameters (average, 5th percentile, and 95th percentile) in the receiving surface water environment, using both base and upper case geochemical source terms, are presented in Appendix B and compared to the 95th percentile baseline concentrations and the CCME CWQGs, NSEQSs, FEQG, and SSWQO, as applicable.

In addition to the annual average statistical summary, predicted monthly concentrations (average, 5th percentile, and 95th percentile) are presented graphically in Appendix B.

4.2.2.1 Operations Phase

The annual and monthly concentrations at WC12 for the operations phase, using both the base case and upper case geochemical source terms, are predicted to be lower than the applicable CCME CWQG, NSEQS, FEQG, and SSWQO for all parameters except aluminum; however, the aluminum concentrations are lower than the 95th percentile baseline concentrations (which are also greater than the CCME CWQGs and NSEQS). The predicted concentrations are similar to the natural runoff model input, due to the small contribution of flow from project site components to the overall flow at WC12.

4.2.2.2 Post-Closure Phase

The annual and monthly concentrations at WC12 for the post-closure phase, using both the base case and upper case geochemical source terms, are predicted to be lower than the applicable CCME CWQG, NSEQS, FEQG, and SSWQO for all parameters except aluminum; however, the aluminum concentrations are lower than the 95th percentile baseline concentrations (which are also greater than the CCME CWQGs and NSEQS). The predicted concentrations are similar to the natural runoff model input, due to the small contribution of flow from project site components to the overall flow at WC12.

4.3 Discussion

The residual effect relevant to the surface water quantity and quality valued component during the operations and post-closure phases, is a change in water quantity and/or quality associated with Project activities. Based on the threshold for determination of significance of effects presented in the EIS document, the magnitude of the predicted change in surface water at WC12 as a result of change to watershed area and realignment, seepage from the TMF for the operations and post-closure phases ranges from negligible to low, depending on parameter.

5.0 REFERENCES

Golder. 2019a. Atlantic Mining NS Corp Fifteen Mile Stream Gold Project, Hydrological Modelling Assessment.

Golder. 2019b. Atlantic Mining NS Corp Fifteen Mile Stream Gold Project, Surface Water Quality Modelling Assessment.

Golder. 2019c. Atlantic Mining NS Corp Fifteen Mile Stream Gold Project, Surface Water Quality Baseline Report.

Knight Piésold Ltd. 2018. Fifteen Mile Stream Project - Desktop Terrain Analysis Study. File No. VA101-00708/02-A.01

Nova Scotia 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500,000, by R.R. Stea, H. Conley and Y. Brown, 1992.

6.0 CLOSURE

We trust that this technical memorandum meets your current requirements. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Golder Associates Ltd.

THE ASSOCIATION OF PROFESSIONAL GEOSCIENTISTS OF NOVA SCOTIA est. 1997 LP134

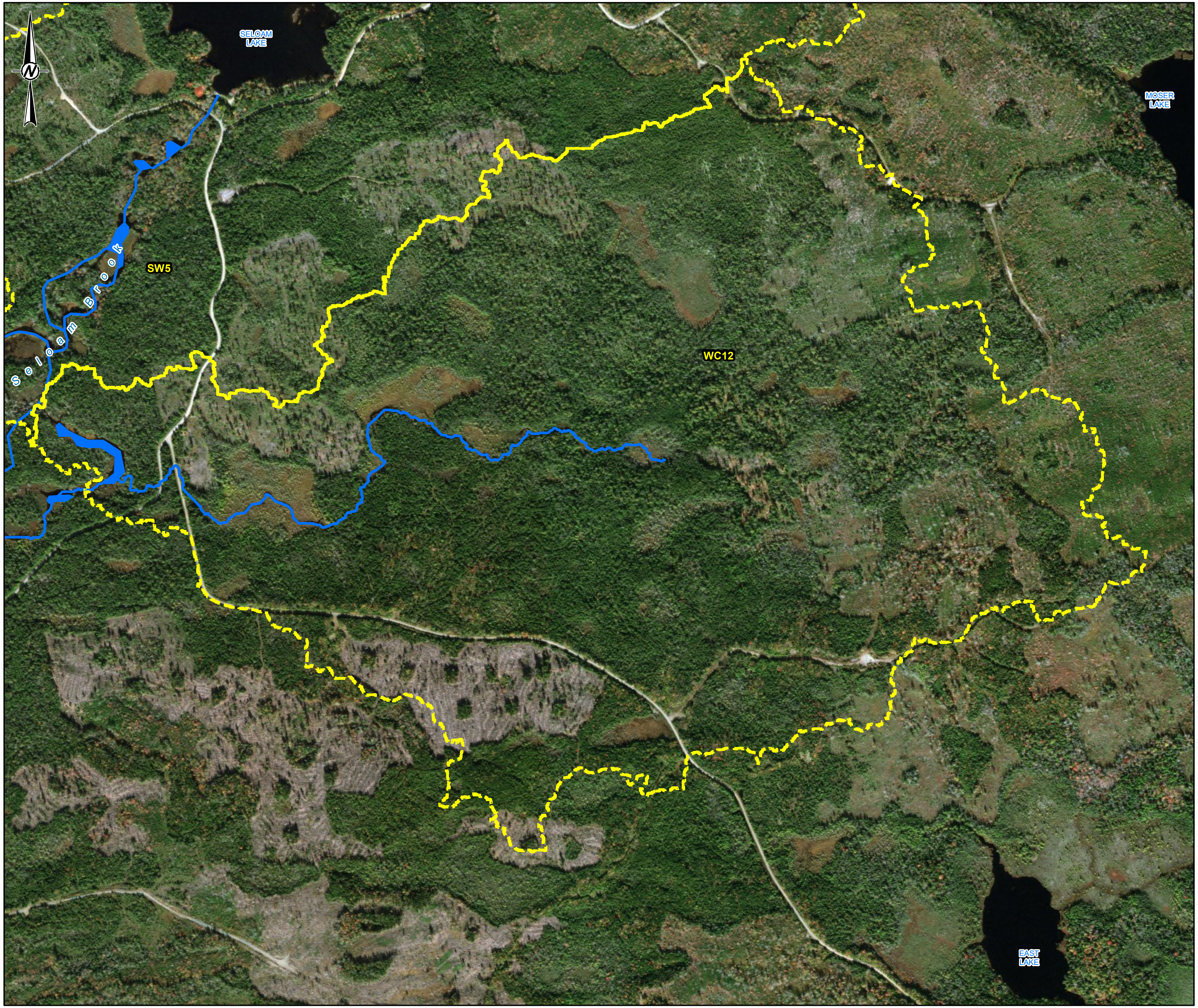
Signature: Natalie Korczak
Date: October 1, 2019

Natalie Korczak, M.Sc., P.Geo. (NS)
Geochemist

Steve Kaufman, M.Sc., EP
Associate, Hydrologist

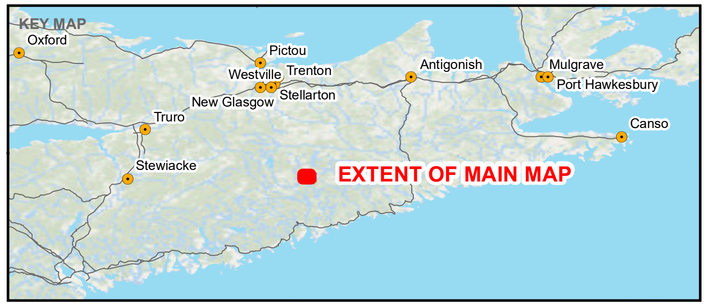
NK/SP/DB/SK/sm

https://golderassociates.sharepoint.com/sites/23819g/deliverables/1895674-027-tm-wc12 model fms/rev 0/1895674-027-tm-rev0-wc12 model fms-0110_19.docx



LEGEND

- Watercourse
- Watershed Boundary



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NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. MCCALLUM ENVIRONMENTAL LTD. EIS PROJECT AREA, (VER.190313, RECEIVED 2019-03-18).
2. MCCALLUM ENVIRONMENTAL LTD. PROPOSED INFRASTRUCTURE, (VER.190620, RECEIVED 2019-06-28).

PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
SITE PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2019-10-01
DESIGNED	---
PREPARED	RRD
REVIEWED	SK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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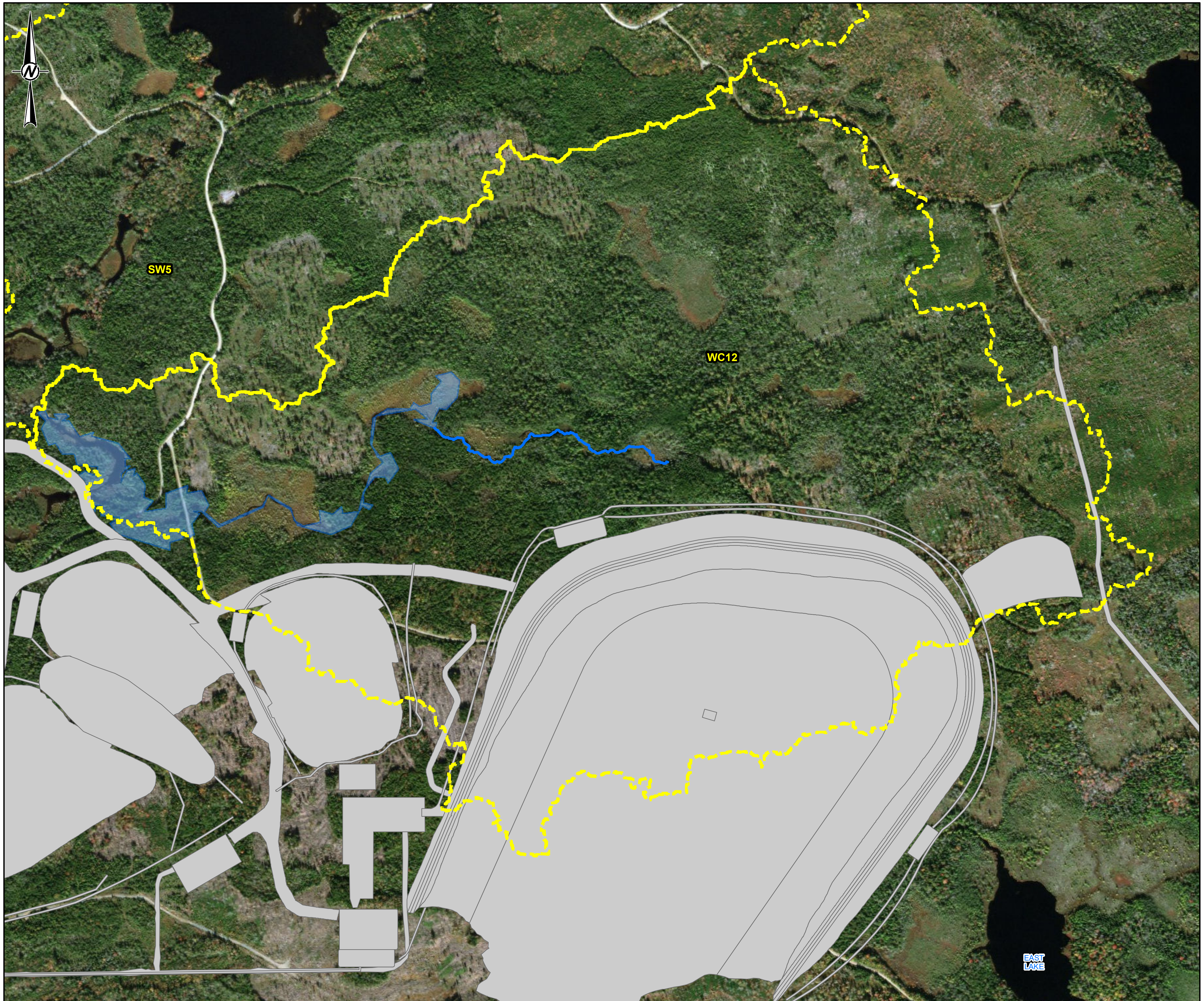
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

WC12 Water Level Figures



LEGEND

- Flooded Extent
- Infrastructure
- Watershed Boundary

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NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
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CLIENT
ATLANTIC MINING NS CORP
Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
FLOOD EXTENT
OPERATIONS PHASE MARCH FLOW

CONSULTANT
GOLDER

YYYY-MM-DD	2019-10-01
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PREPARED	RRD
REVIEWED	SK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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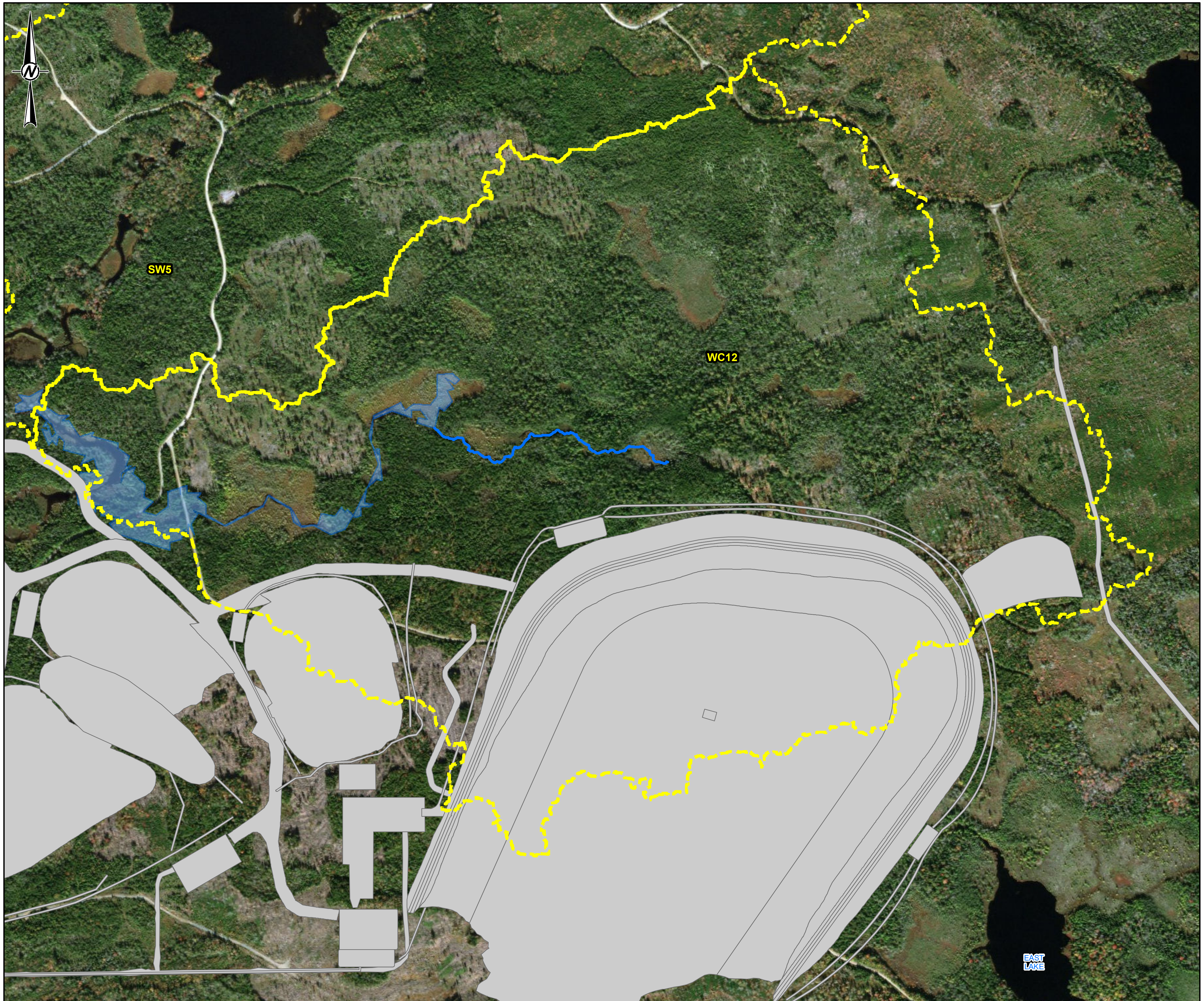

LEGEND

- Flooded Extent
- Infrastructure
- Watershed Boundary

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NOTE(S)

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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
FLOOD EXTENT
OPERATIONS PHASE JULY FLOW

CONSULTANT
GOLDER

YYYY-MM-DD	2019-10-01
DESIGNED	---
PREPARED	RRD
REVIEWED	SK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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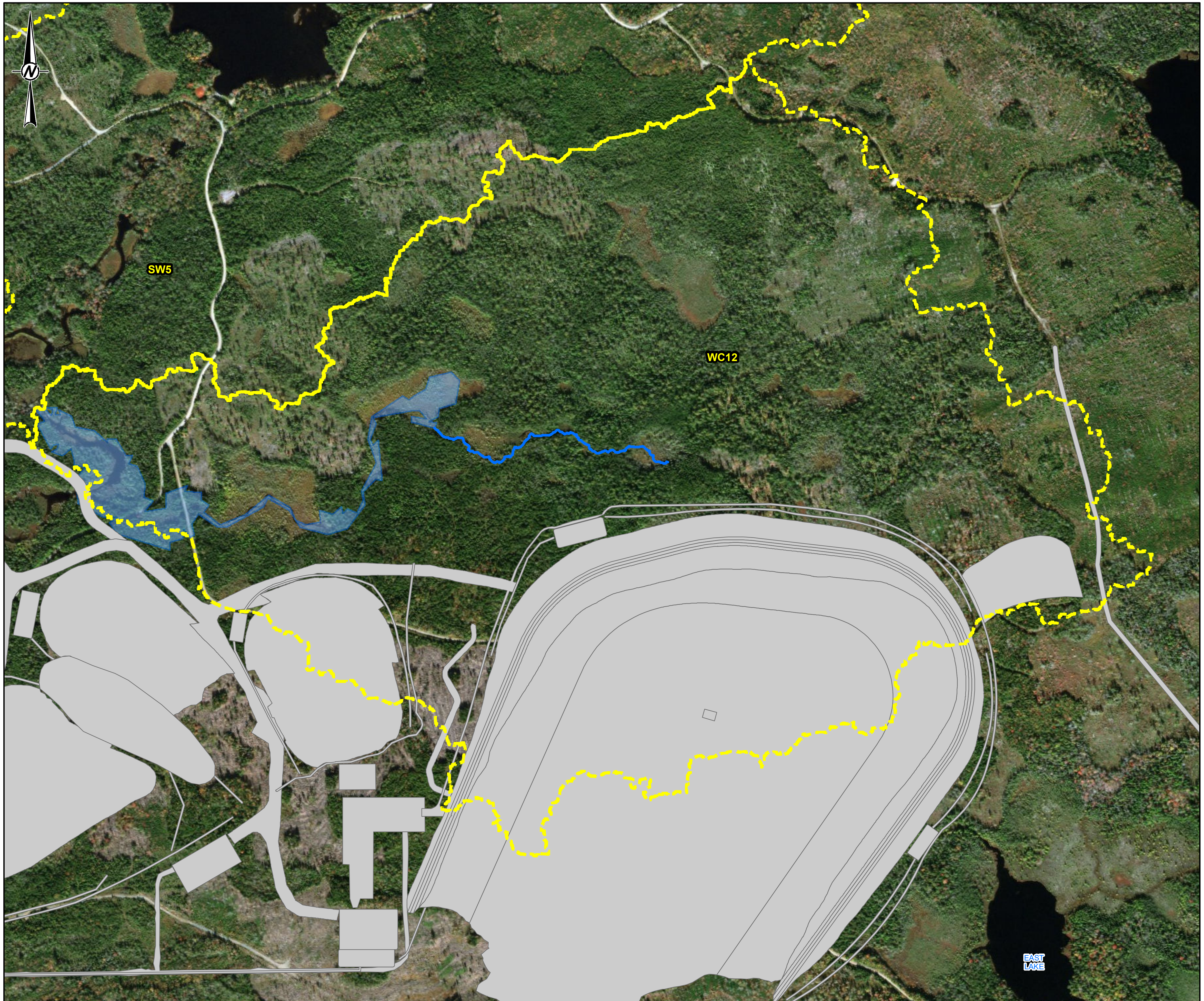

LEGEND

- Flooded Extent
- Infrastructure
- Watershed Boundary

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NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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1. MCCALLUM ENVIRONMENTAL LTD. EIS PROJECT AREA, (VER.190313, RECEIVED 2019-03-18).
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
FLOOD EXTENT
CLOSURE PHASE / RECLAMATION STAGE MARCH FLOW

CONSULTANT

GOLDER

YYYY-MM-DD	2019-10-01
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REVIEWED	SK
APPROVED	SK

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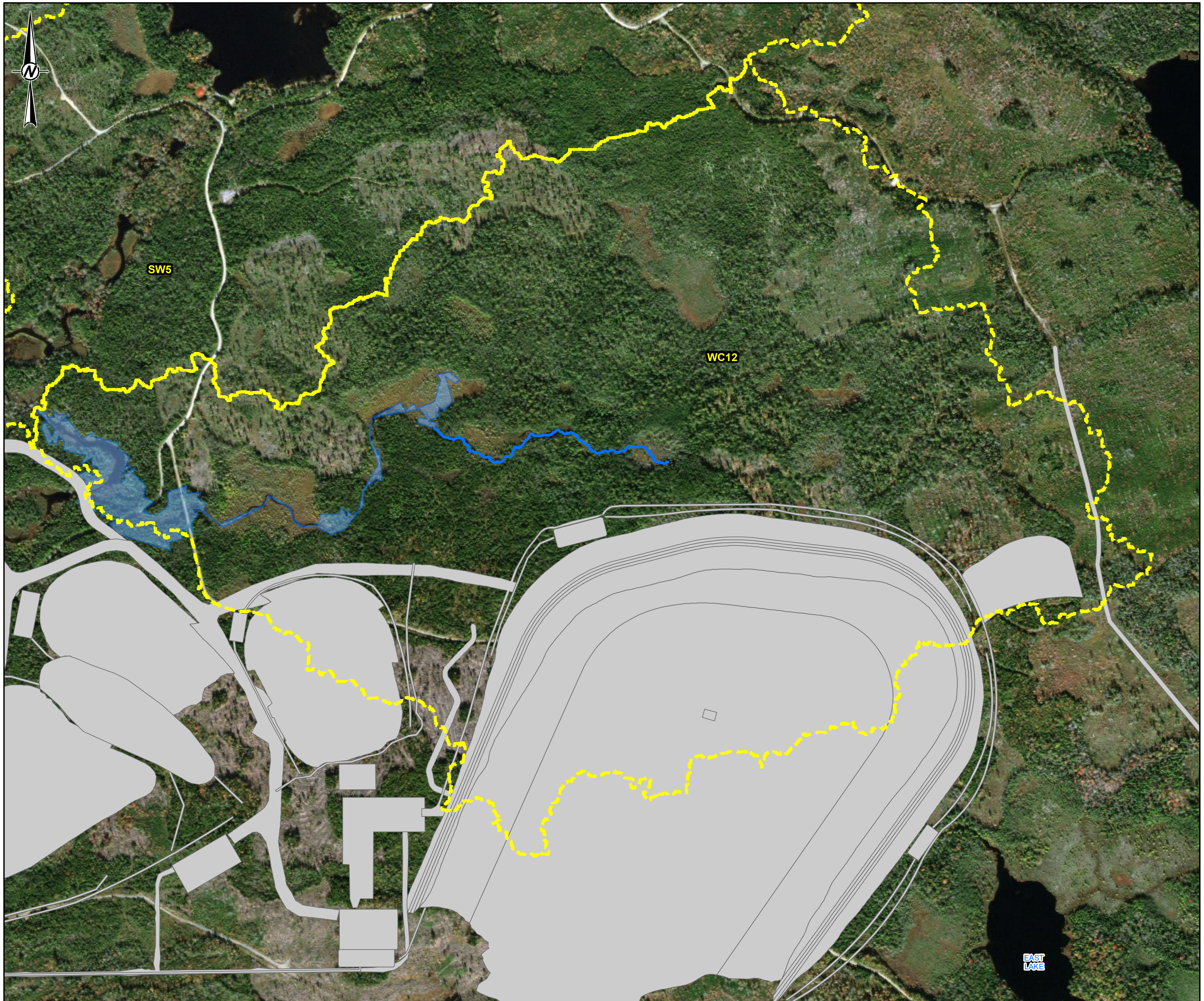

LEGEND

- Flooded Extent
- Infrastructure
- Watershed Boundary

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NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
FLOOD EXTENT
CLOSURE PHASE / RECLAMATION STAGE JULY FLOW

CONSULTANT

GOLDER

YYYY-MM-DD	2019-10-01
DESIGNED	---
PREPARED	RRD
REVIEWED	SK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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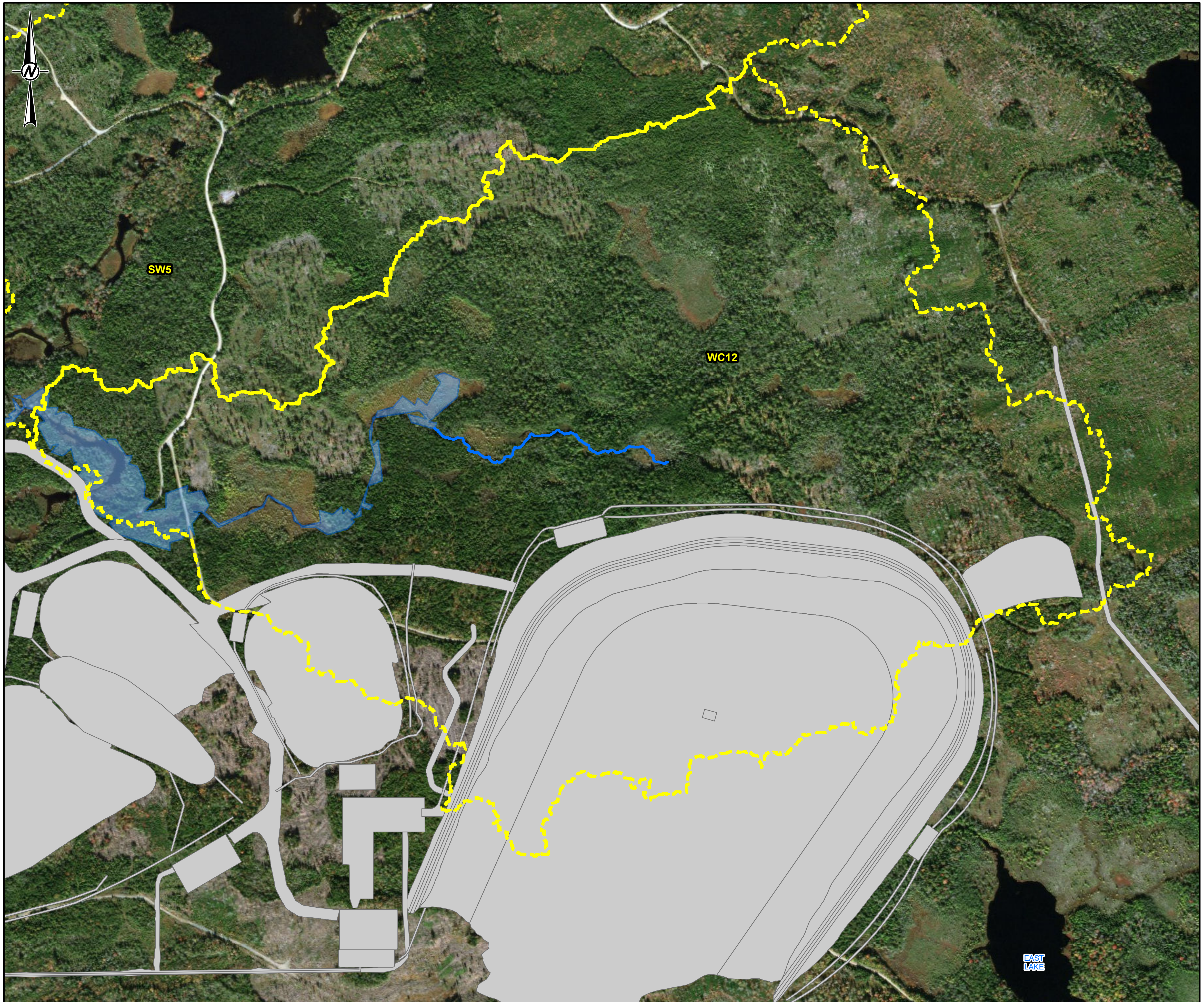

LEGEND

- Flooded Extent
- Infrastructure
- Watershed Boundary

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NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

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2. MCCALLUM ENVIRONMENTAL LTD. PROPOSED INFRASTRUCTURE, (VER.190620, RECEIVED 2019-06-28).
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP
Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
FLOOD EXTENT
CLOSURE PHASE / POST-CLOSURE STAGE MARCH FLOW

CONSULTANT
GOLDER

YYYY-MM-DD	2019-10-01
DESIGNED	---
PREPARED	RRD
REVIEWED	SK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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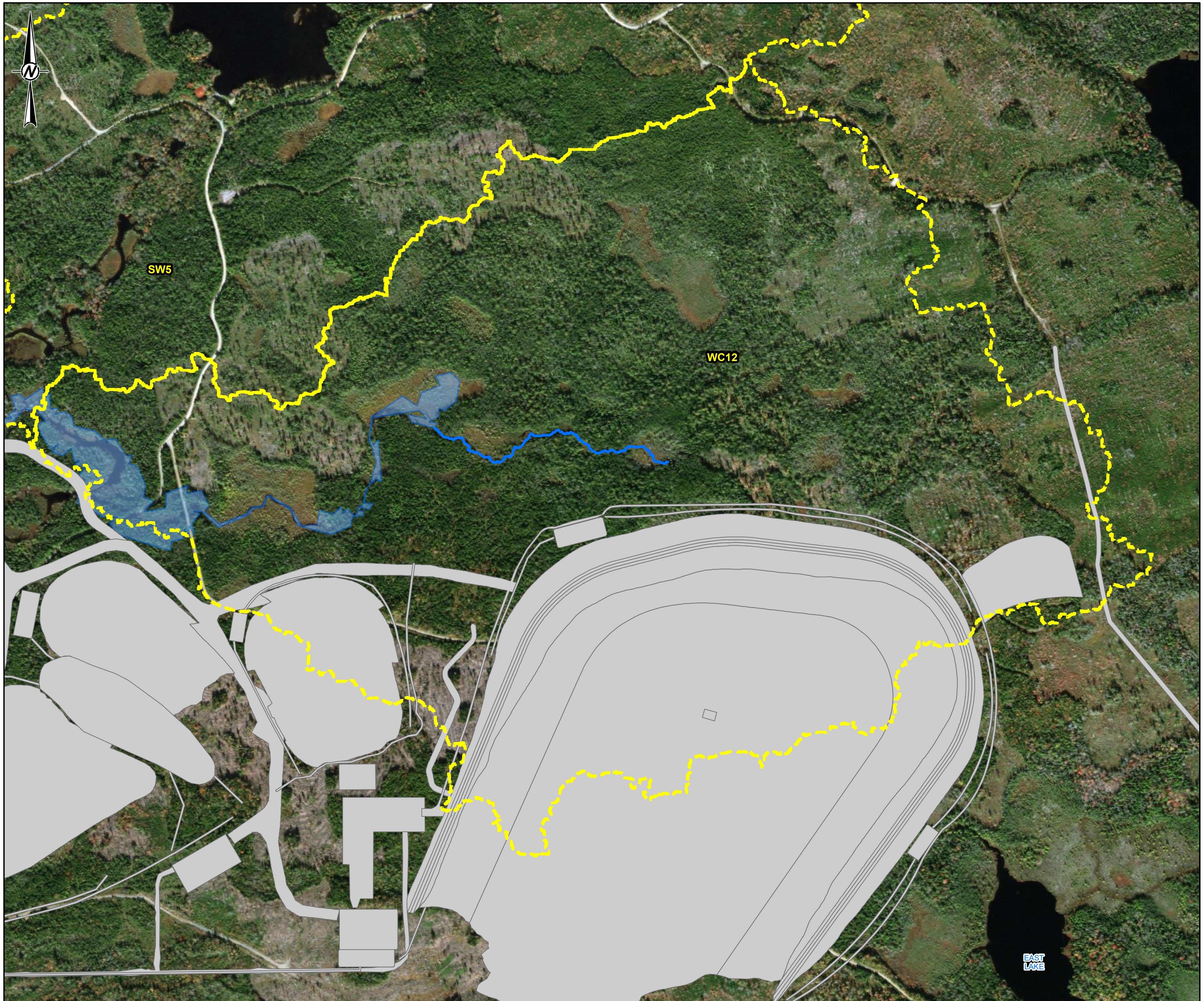

LEGEND

- Flooded Extent
- Infrastructure
- Watershed Boundary

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NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC MINING NS CORP

Atlantic Gold

PROJECT
HYDROLOGICAL AND SURFACE WATER QUALITY MODELLING ASSESSMENTS FOR WATERCOURSE 12, FIFTEEN MILE STREAM PROJECT

TITLE
FLOOD EXTENT
CLOSURE PHASE / POST-CLOSURE STAGE JULY FLOW

CONSULTANT

GOLDER

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REVIEWED	SK
APPROVED	SK

PROJECT NO.	CONTROL	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX B

Water Quality Results

Parameter	CCME CWQG [1] (mg/L)	NSEQS [2] (mg/L)	FEQG [3] (mg/L)	SSWQO [4] (mg/L)	95th Percentile Baseline Concentration (mg/L) [4]	Predicted Concentration (mg/L) [5]		
					SW2	WC12		
						mean	5%	95%
Aluminum	0.0050 [7]	0.0050	-	-	**0.16**	**0.13**	**0.12**	**0.13**
Ammonia (total)	-	-	-	-	0.025	0.024	0.023	0.024
Ammonia (un-ionized)	0.019	-	-	-	0.0000208	0.00000052	0.00000051	0.00000054
Antimony	-	0.020	-	-	0.00050	0.00049	0.00048	0.00049
Arsenic	0.0050	0.0050	-	0.03	0.00050	0.00098	0.00069	0.00119
Boron	1.5	1.20	-	-	0.025	0.025	0.024	0.025
Cadmium	0.000040 [8]	- [9]	-	-	0.000019	0.000013	0.000013	0.000014
Calcium	-	-	-	-	0.58	1.5	0.86	1.9
Chromium	0.0089	-	-	-	0.00080	0.00054	0.00053	0.00055
Cobalt	-	0.010	0.00078 [10]	-	0.00020	0.00020	0.00019	0.00021
Copper	0.0020 [10]	0.0020	-	-	0.0010	0.00080	0.00079	0.00082
Iron	0.30	0.30	-	-	0.20	0.13	0.13	0.14
Lead	0.0010 [10]	0.0010	-	-	0.00025	0.00024	0.00023	0.00024
Magnesium	-	-	-	-	0.36	0.44	0.36	0.50
Manganese	-	0.820	-	-	0.079	0.044	0.044	0.045
Mercury	0.000026	0.000026	-	-	0.0000065	0.0000067	0.0000066	0.0000070
Molybdenum	0.073	0.073	-	-	0.0010	0.0016	0.0012	0.0019
Nickel	0.025 [10]	0.025	-	-	0.0010	0.0010	0.0010	0.0010
Nitrate	3	-	-	-	0.025	0.0047	0.0047	0.0049
Nitrite	0.060	-	-	-	0.0050	0.0047	0.0047	0.0049
Potassium	-	-	-	-	0.30	1.5	0.72	2.1
Selenium	0.0010	0.0010	-	-	0.00050	0.00049	0.00049	0.00050
Silver	0.00025	0.00010	-	-	0.000050	0.000048	0.000047	0.000049
Sodium	-	-	-	-	2.4	4.7	3.1	5.8
Sulphate	-	-	-	-	1.0	6.4	2.9	8.9
Thallium	0.00080	0.00080	-	-	0.000050	0.000048	0.000047	0.000049
Uranium	0.015	0.30	-	-	0.000050	0.000055	0.000052	0.000057
Zinc	0.007 [11]	0.030	-	-	0.0025	0.0028	0.0026	0.0030

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

(6) - Predicted annual concentration calculated from the GoldSim stochastic model using the base case geochemical source terms (Lorax 2019); statistics presented are the mean, 5th percentile and 95th percentile.

(7) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(8) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(9) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(10) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(11) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

APPENDIX B: WATER QUALITY MODEL RESULTS, OPERATIONS PHASE - PREDICTED CONCENTRATIONS IN RECEIVER WATER BODIES (USING UPPER CASE SOURCE TERMS)

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentration (mg/L) (5)	Predicted Concentration (mg/L) (6)		
					SW2	WC12		
						mean	5%	95%
Aluminum	0.0050 (7)	0.0050	-	-	**0.16**	**0.13**	**0.13**	**0.14**
Ammonia (total)	-	-	-	-	0.025	0.024	0.023	0.024
Ammonia (un-ionized)	0.019	-	-	-	0.000021	0.00000052	0.00000051	0.00000054
Antimony	-	0.020	-	-	0.00050	0.00049	0.00048	0.00049
Arsenic	0.0050	0.0050	-	0.03	0.00050	0.0010	0.00076	0.0012
Boron	1.5	1.20	-	-	0.025	0.025	0.024	0.025
Cadmium	0.000040 (8)	- (9)	-	-	0.000019	0.000014	0.000013	0.000014
Calcium	-	-	-	-	0.58	1.5	0.86	1.9
Chromium	0.0089	-	-	-	0.00080	0.00054	0.00053	0.00056
Cobalt	-	0.010	0.00078 (10)	-	0.00020	0.00020	0.00019	0.00021
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.00082	0.00081	0.00086
Iron	0.30	0.30	-	-	0.20	0.14	0.13	0.14
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00025	0.00024	0.00026
Magnesium	-	-	-	-	0.36	0.44	0.36	0.50
Manganese	-	0.820	-	-	0.079	0.045	0.044	0.046
Mercury	0.000026	0.000026	-	-	0.0000065	0.0000067	0.0000066	0.0000070
Molybdenum	0.073	0.073	-	-	0.0010	0.0016	0.0012	0.0019
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010
Nitrate	3	-	-	-	0.025	0.0047	0.0047	0.0049
Nitrite	0.060	-	-	-	0.0050	0.0047	0.0047	0.0049
Potassium	-	-	-	-	0.30	1.6	0.73	2.1
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00049	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000048	0.000047	0.000049
Sodium	-	-	-	-	2.4	4.7	3.1	5.8
Sulphate	-	-	-	-	1.0	6.4	2.9	8.9
Thallium	0.00080	0.00080	-	-	0.000050	0.000048	0.000047	0.000049
Uranium	0.015	0.30	-	-	0.000050	0.000055	0.000052	0.000057
Zinc	0.007 (11)	0.030	-	-	0.0025	0.0029	0.0027	0.0030

Notes

(1) - Canadian Council of Ministers of the Environment (1999 updated in 2019). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Accessed February 6, 2019.

(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

(3) - Environment Canada Federal Environmental Quality Guideline: Cobalt (May 2017).

(4) - Site-specific water quality objective for arsenic (Intrinsik 2019).

(5) - Statistics calculated from the available surface water quality baseline dataset (June 2017 to June 2019).

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(7) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(8) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(9) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(10) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(11) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentration (mg/L) (5)	Predicted Concentration (mg/L) (6)		
					SW2	WC12		
						mean	5%	95%
Aluminum	0.0050 (7)	0.0050	-	-	**0.16**	**0.13**	**0.12**	**0.13**
Ammonia (total)	-	-	-	-	0.025	0.025	0.025	0.025
Ammonia (un-ionized)	0.019	-	-	-	0.0000208	0.00000055	0.00000055	0.00000056
Antimony	-	0.020	-	-	0.00050	0.00048	0.00047	0.00049
Arsenic	0.0050	0.0050	-	0.03	0.00050	0.0024	0.00120	0.0032
Boron	1.5	1.20	-	-	0.025	0.026	0.025	0.026
Cadmium	0.000040 (8)	- (9)	-	-	0.000019	0.000013	0.000013	0.000014
Calcium	-	-	-	-	0.58	2.0	1.1	2.7
Chromium	0.0089	-	-	-	0.00080	0.00054	0.00053	0.00055
Cobalt	-	0.010	0.00078 (10)	-	0.00020	0.00020	0.00019	0.00021
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.0008	0.0008	0.0008
Iron	0.30	0.30	-	-	0.20	0.13	0.13	0.14
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00024	0.00024	0.00025
Magnesium	-	-	-	-	0.36	0.54	0.40	0.64
Manganese	-	0.820	-	-	0.079	0.052	0.048	0.055
Mercury	0.000026	0.000026	-	-	0.0000065	0.0000067	0.0000066	0.0000069
Molybdenum	0.073	0.073	-	-	0.0010	0.0024	0.0015	0.0030
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010
Nitrate	3	-	-	-	0.025	0.0049	0.0049	0.0050
Nitrite	0.060	-	-	-	0.0050	0.0049	0.0049	0.0050
Potassium	-	-	-	-	0.30	1.7	0.78	2.3
Selenium	0.0010	0.0010	-	-	0.00050	0.00049	0.00049	0.00050
Silver	0.00025	0.00010	-	-	0.000050	0.000048	0.000048	0.000049
Sodium	-	-	-	-	2.4	5.3	3.3	6.7
Sulphate	-	-	-	-	1.0	8.9	3.9	12
Thallium	0.00080	0.00080	-	-	0.000050	0.000048	0.000048	0.000049
Uranium	0.015	0.30	-	-	0.000050	0.000057	0.000053	0.000060
Zinc	0.007 (11)	0.030	-	-	0.0025	0.0024	0.0024	0.0025

Notes

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(2) - Nova Scotia Environment Environmental Quality Standards for Surface Water, Table 3 (July 2013).

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(7) - Guideline is variable and dependent on pH values. Refer to CCME (2019) for method of calculation.

(8) - Guideline is variable and dependent on hardness concentrations. Refer to CCME (2019) for method of calculation.

(9) - The NSEQS for cadmium is based on a 2007 CCME CWQG and is not considered herein; rather, the updated 2014 CCME CWQG is used as the comparison criteria.

(10) - Guideline is variable and dependent on hardness. Refer to Environment Canada (2017) for method of calculation.

(11) - Guideline is for dissolved zinc; guideline is variable and dependent on hardness, dissolved organic carbon, and pH. Refer to CCME (2019) for method of calculation.

0.1	Bolding indicates a concentration greater than the CCME CWQG.
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

Parameter	CCME CWQG (1) (mg/L)	NSEQS (2) (mg/L)	FEQG (3) (mg/L)	SSWQO (4) (mg/L)	95th Percentile Baseline Concentration (mg/L) (5)	Predicted Concentration (mg/L) (6)		
					SW2	WC12		
						mean	5%	95%
Aluminum	0.0050 (7)	0.0050	-	-	**0.16**	**0.13**	**0.13**	**0.14**
Ammonia (total)	-	-	-	-	0.025	0.025	0.025	0.025
Ammonia (un-ionized)	0.019	-	-	-	0.0000208	0.00000055	0.00000055	0.00000056
Antimony	-	0.020	-	-	0.00050	0.00048	0.00048	0.00049
Arsenic	0.0050	0.0050	-	0.03	0.00050	0.0043	0.0020	**0.0060**
Boron	1.5	1.20	-	-	0.025	0.026	0.025	0.026
Cadmium	0.000040 (8)	- (9)	-	-	0.000019	0.000014	0.000014	0.000015
Calcium	-	-	-	-	0.58	2.1	1.1	2.8
Chromium	0.0089	-	-	-	0.00080	0.00055	0.00054	0.00056
Cobalt	-	0.010	0.00078 (10)	-	0.00020	0.00020	0.00020	0.00021
Copper	0.0020 (10)	0.0020	-	-	0.0010	0.00083	0.00082	0.00086
Iron	0.30	0.30	-	-	0.20	0.14	0.13	0.14
Lead	0.0010 (10)	0.0010	-	-	0.00025	0.00025	0.00024	0.00026
Magnesium	-	-	-	-	0.36	0.56	0.41	0.67
Manganese	-	0.820	-	-	0.079	0.058	0.050	0.063
Mercury	0.000026	0.000026	-	-	0.0000065	0.0000067	0.0000066	0.0000069
Molybdenum	0.073	0.073	-	-	0.0010	0.0029	0.0017	0.0038
Nickel	0.025 (10)	0.025	-	-	0.0010	0.0010	0.0010	0.0010
Nitrate	3	-	-	-	0.025	0.0057	0.0052	0.0060
Nitrite	0.060	-	-	-	0.0050	0.0049	0.0049	0.0050
Potassium	-	-	-	-	0.30	1.9	0.86	2.6
Selenium	0.0010	0.0010	-	-	0.00050	0.00050	0.00049	0.00051
Silver	0.00025	0.00010	-	-	0.000050	0.000048	0.000048	0.000049
Sodium	-	-	-	-	2.4	5.4	3.4	6.8
Sulphate	-	-	-	-	1.0	9.6	4.1	13.5
Thallium	0.00080	0.00080	-	-	0.000050	0.000048	0.000048	0.000049
Uranium	0.015	0.30	-	-	0.000050	0.000058	0.000053	0.000061
Zinc	0.007 (11)	0.030	-	-	0.0025	0.0025	0.0024	0.0026

Notes

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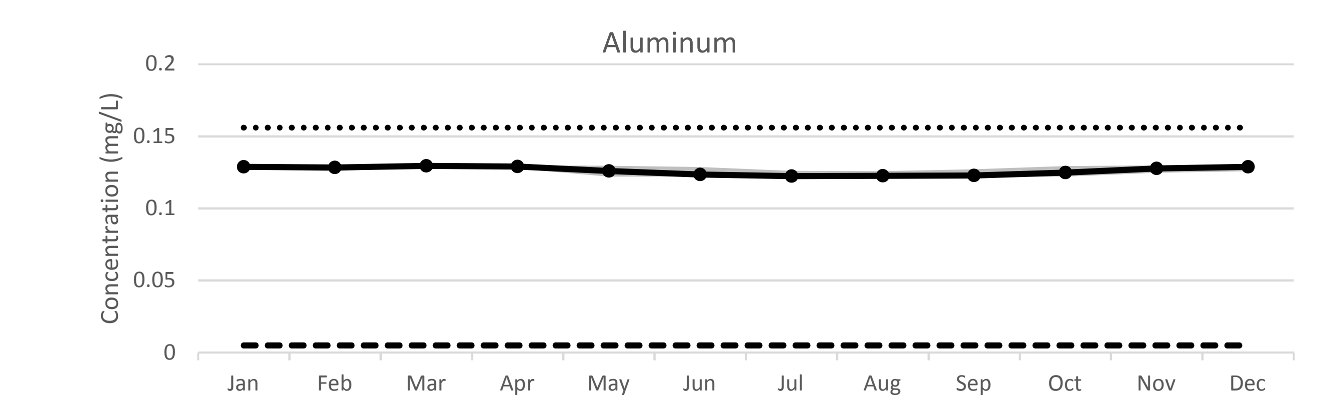
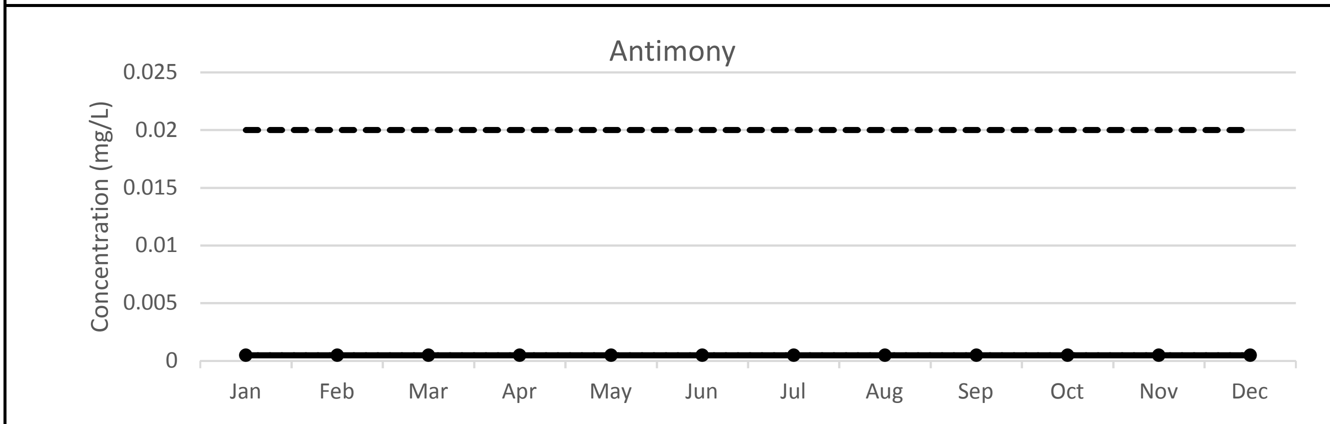
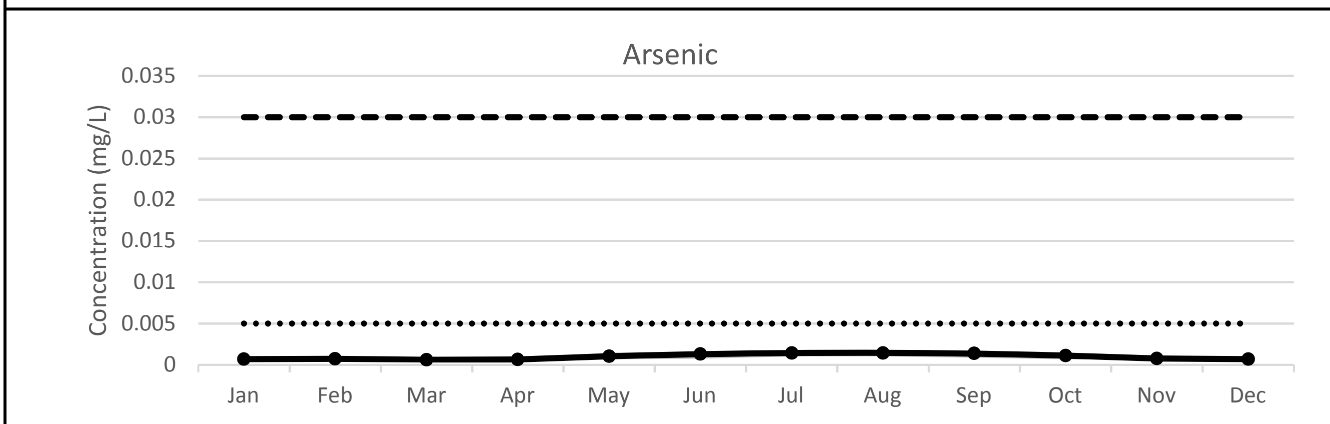
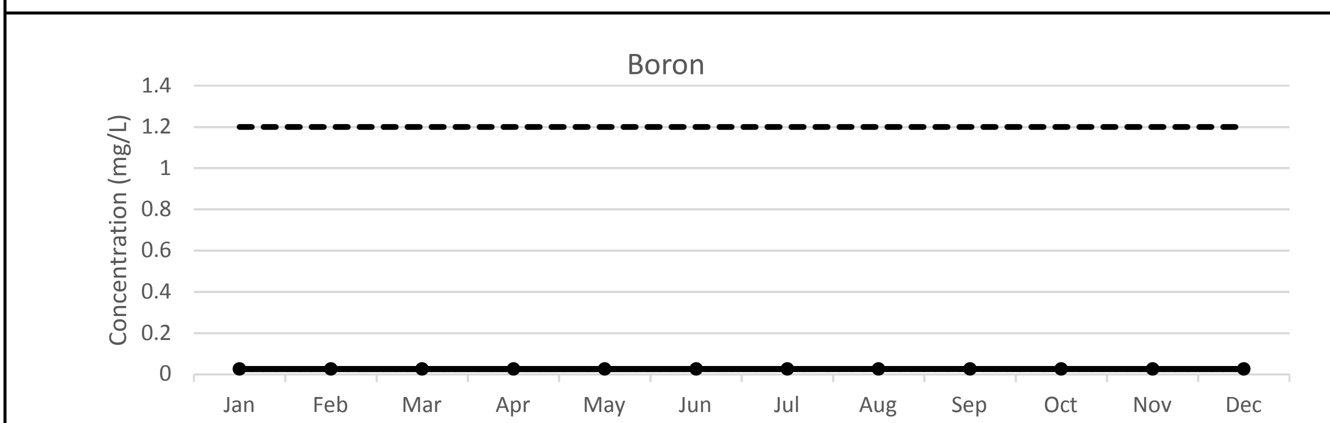
0.1	Grey shading indicates a concentration greater than the NSEQS.
0.1	Double outline indicates a concentration greater than the FEQG.
0.1	Bold outline indicates a concentration greater than the SSWQO.
0.1	Underlining indicates a concentration greater than the 95th percentile baseline concentration.

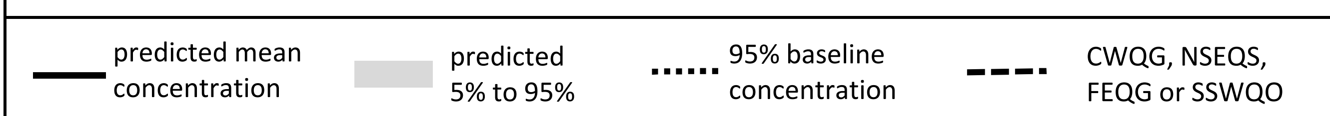
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)



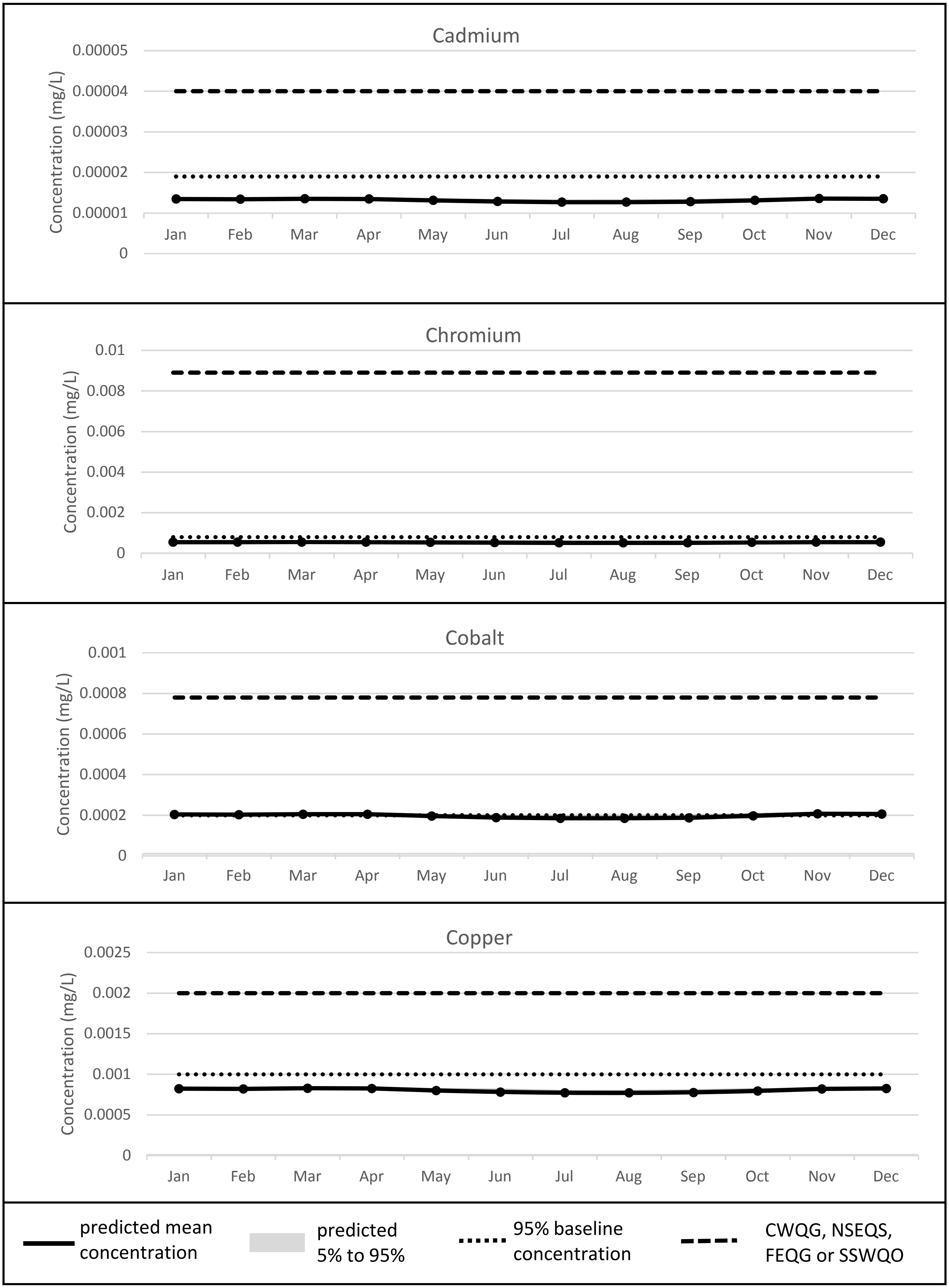




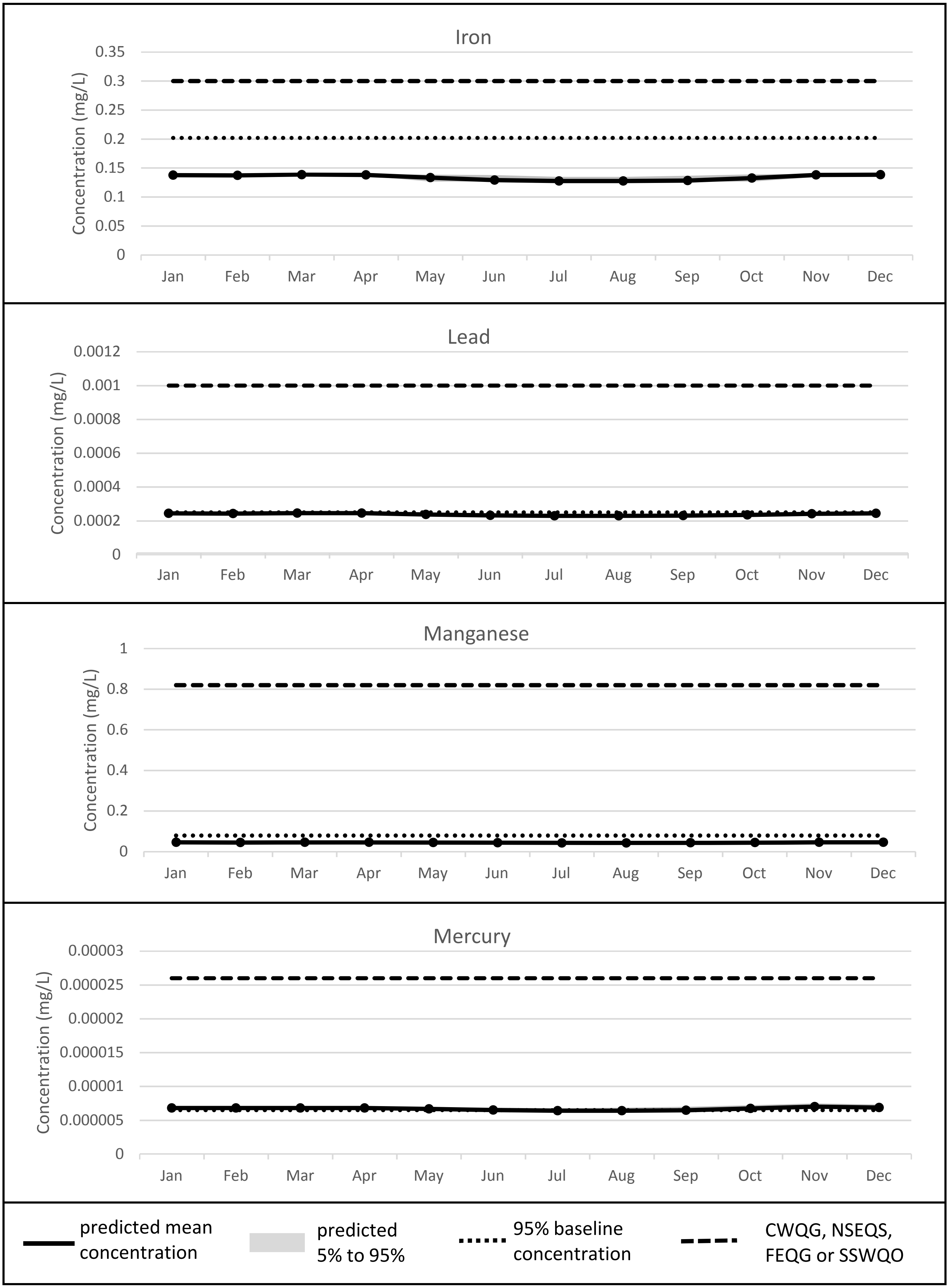




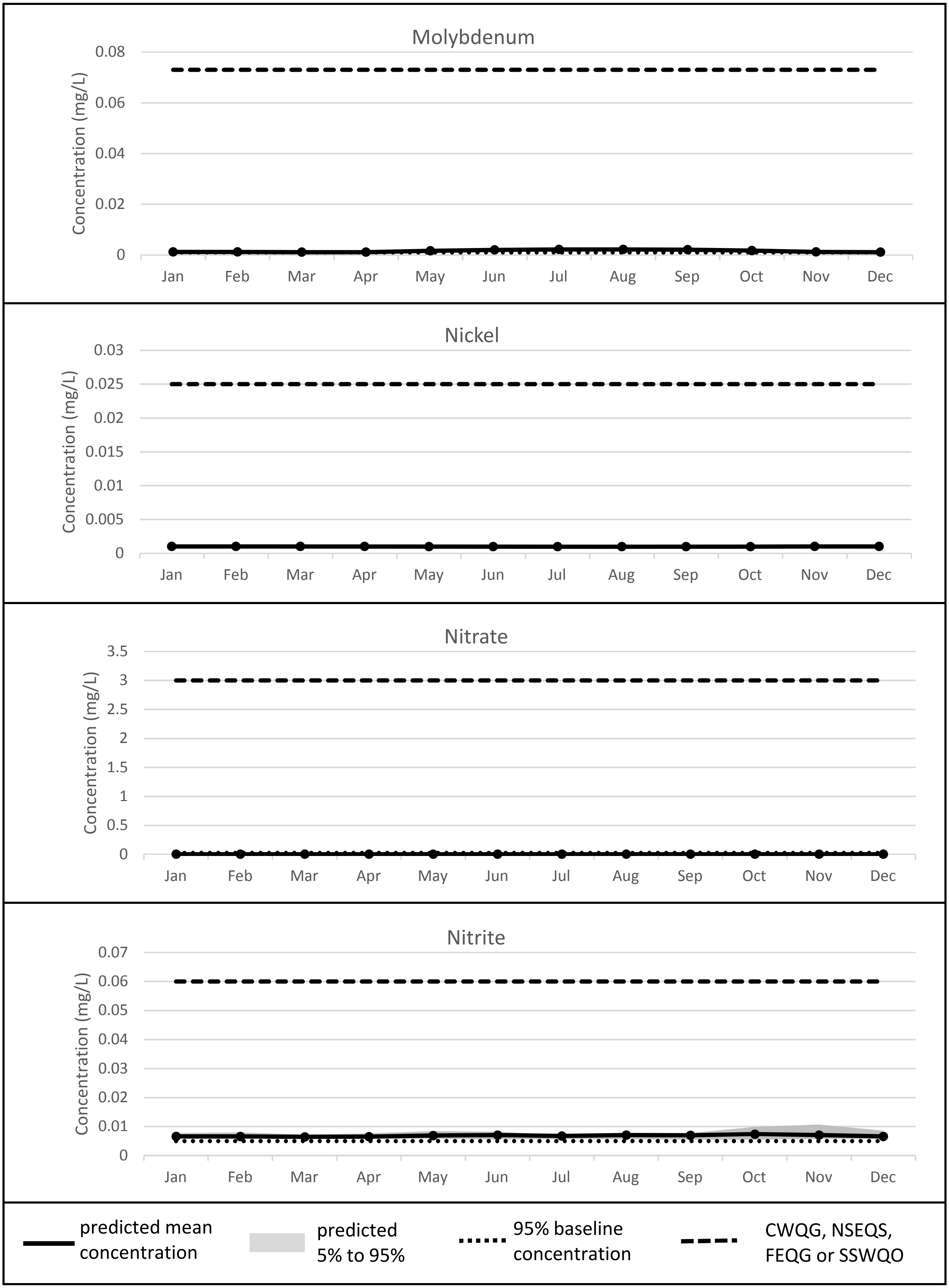
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)



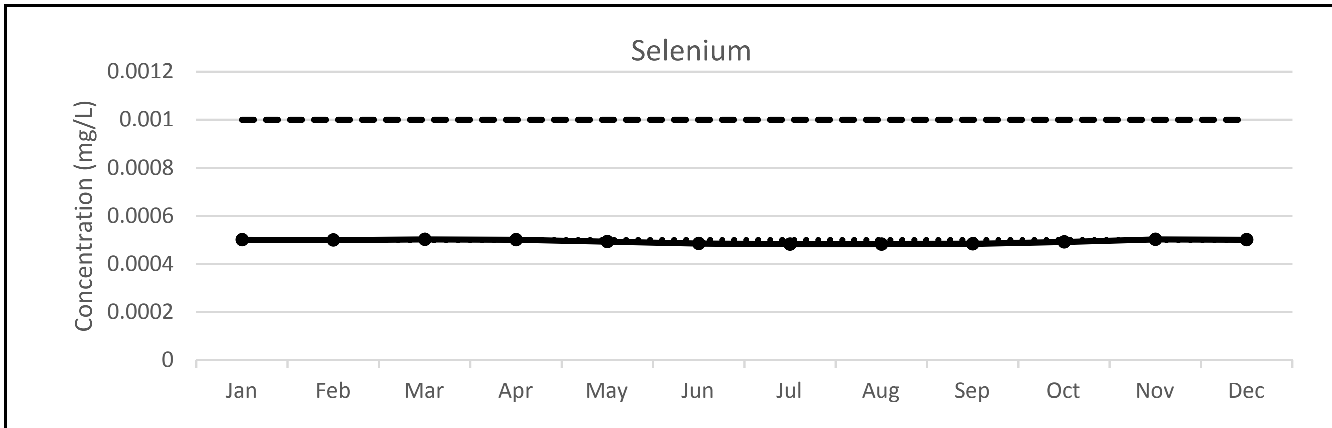
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)

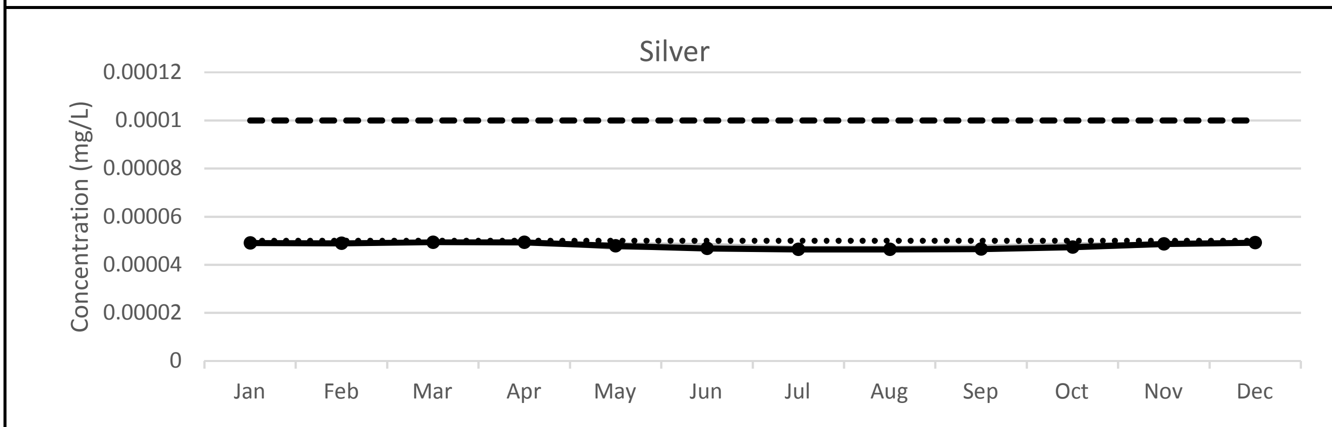


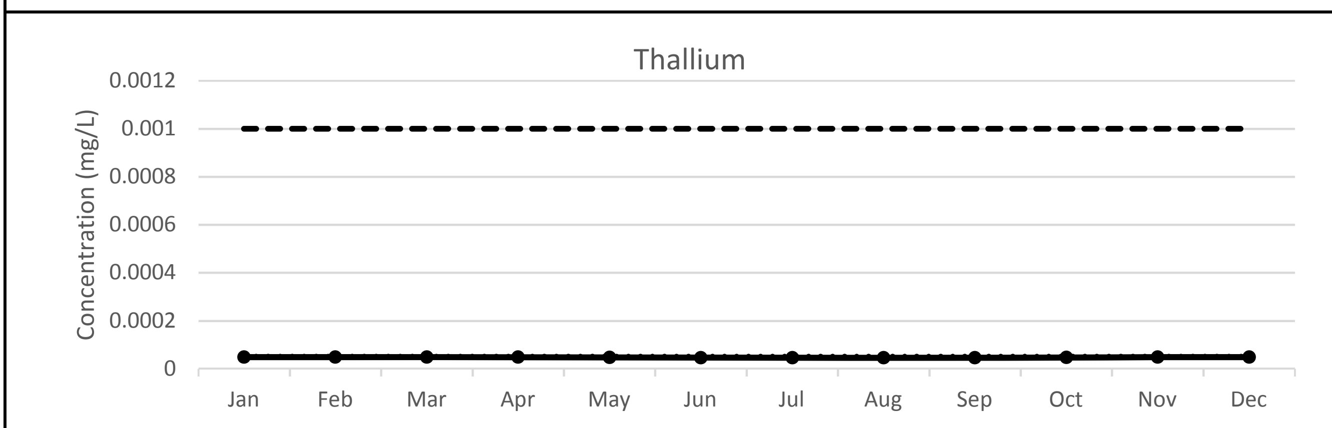
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)

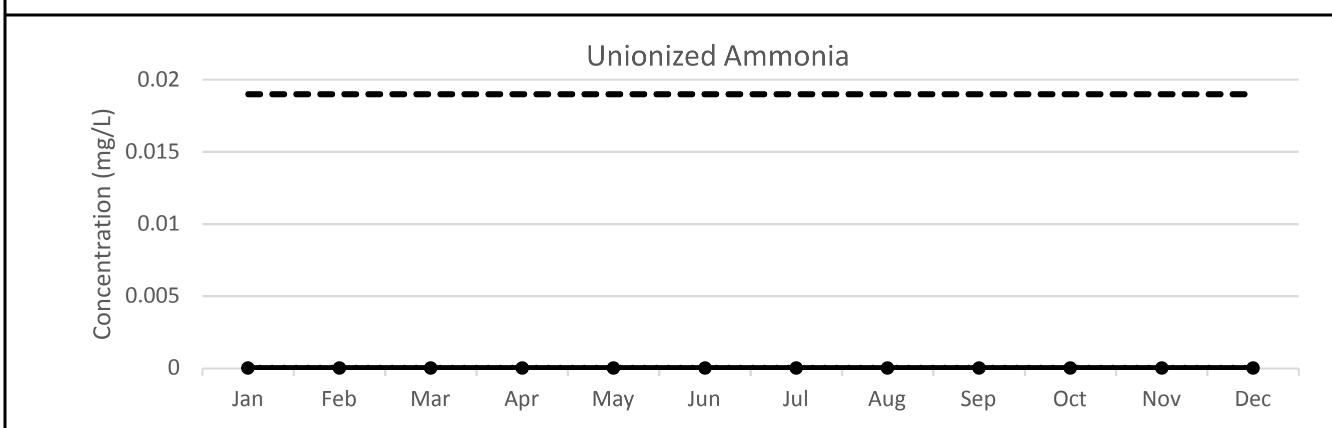


PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)



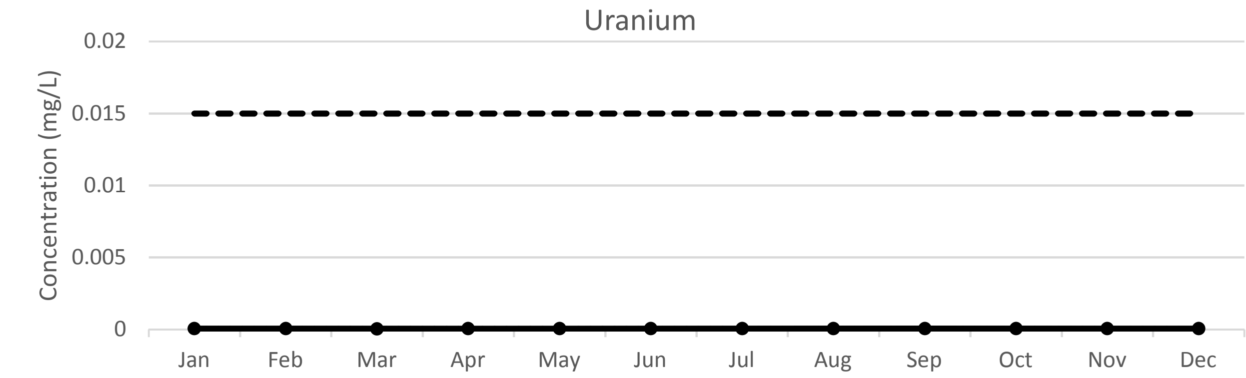


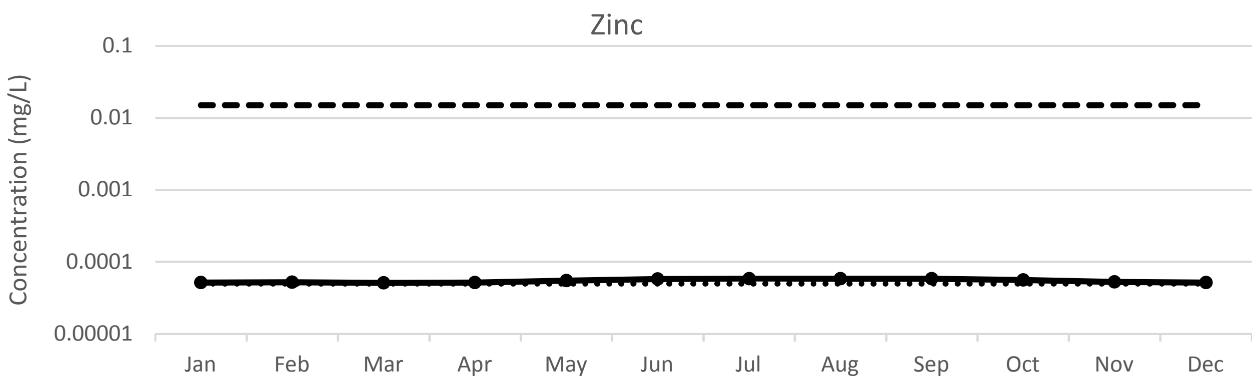




predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

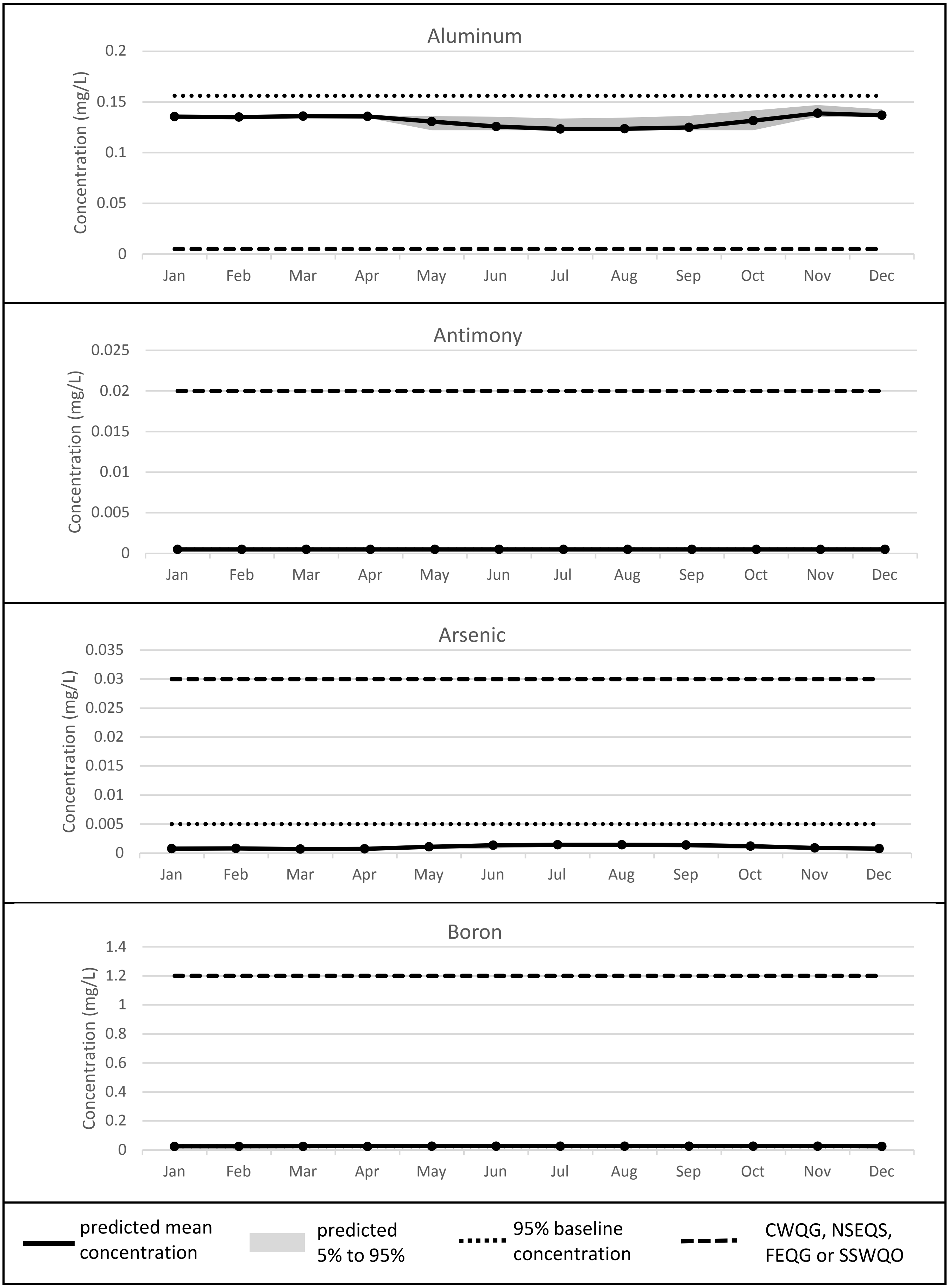
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)



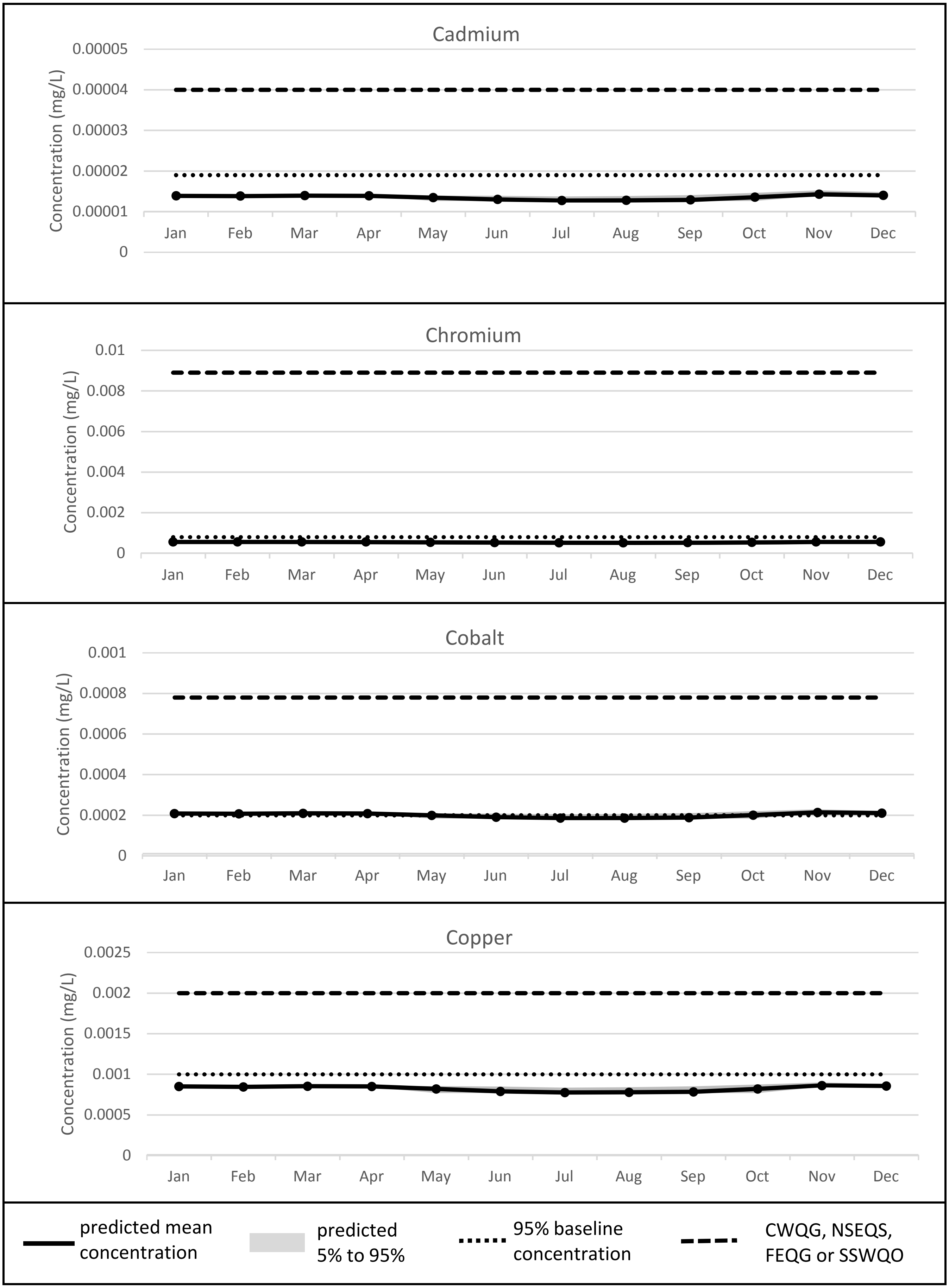


predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

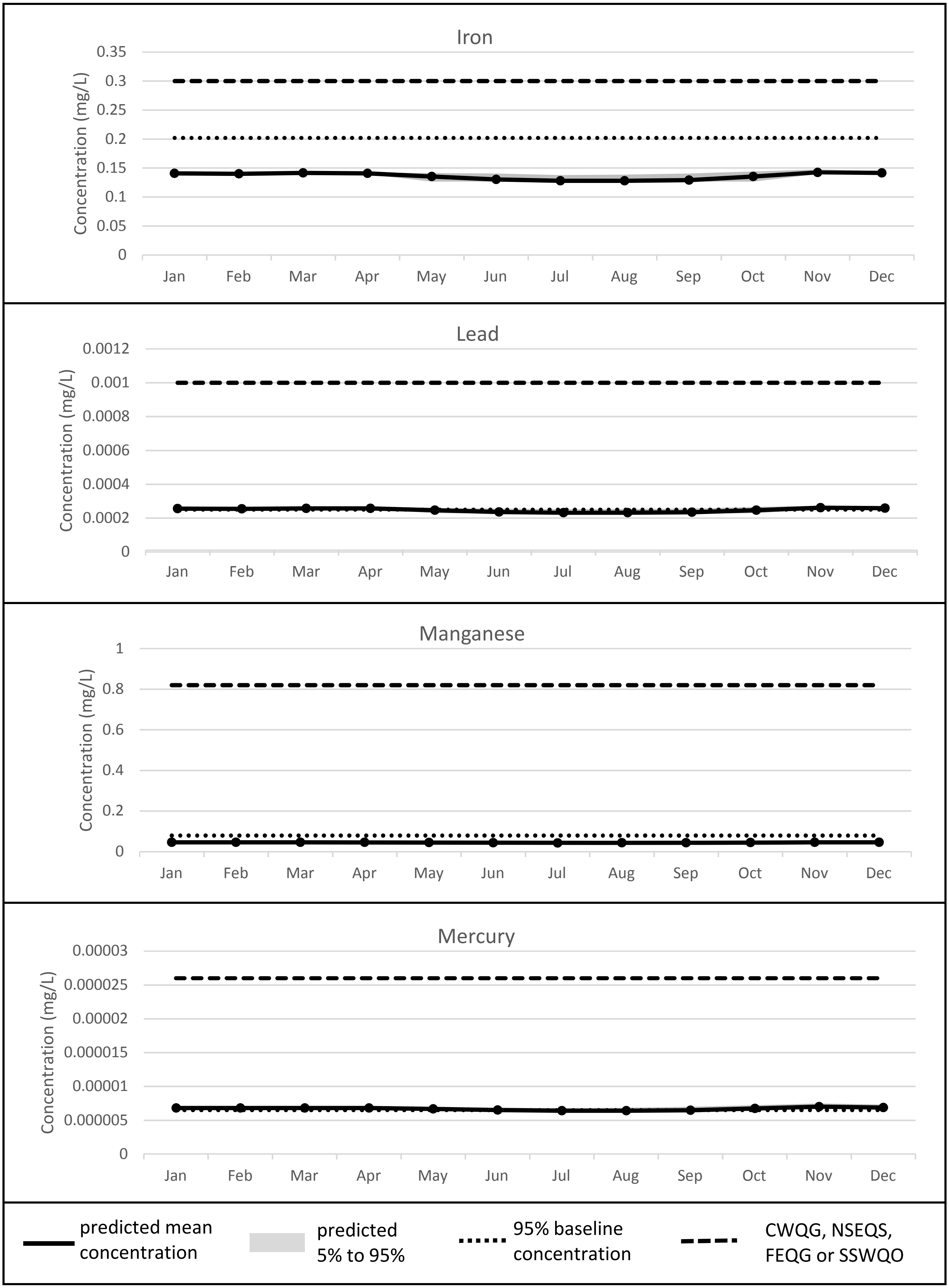
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)



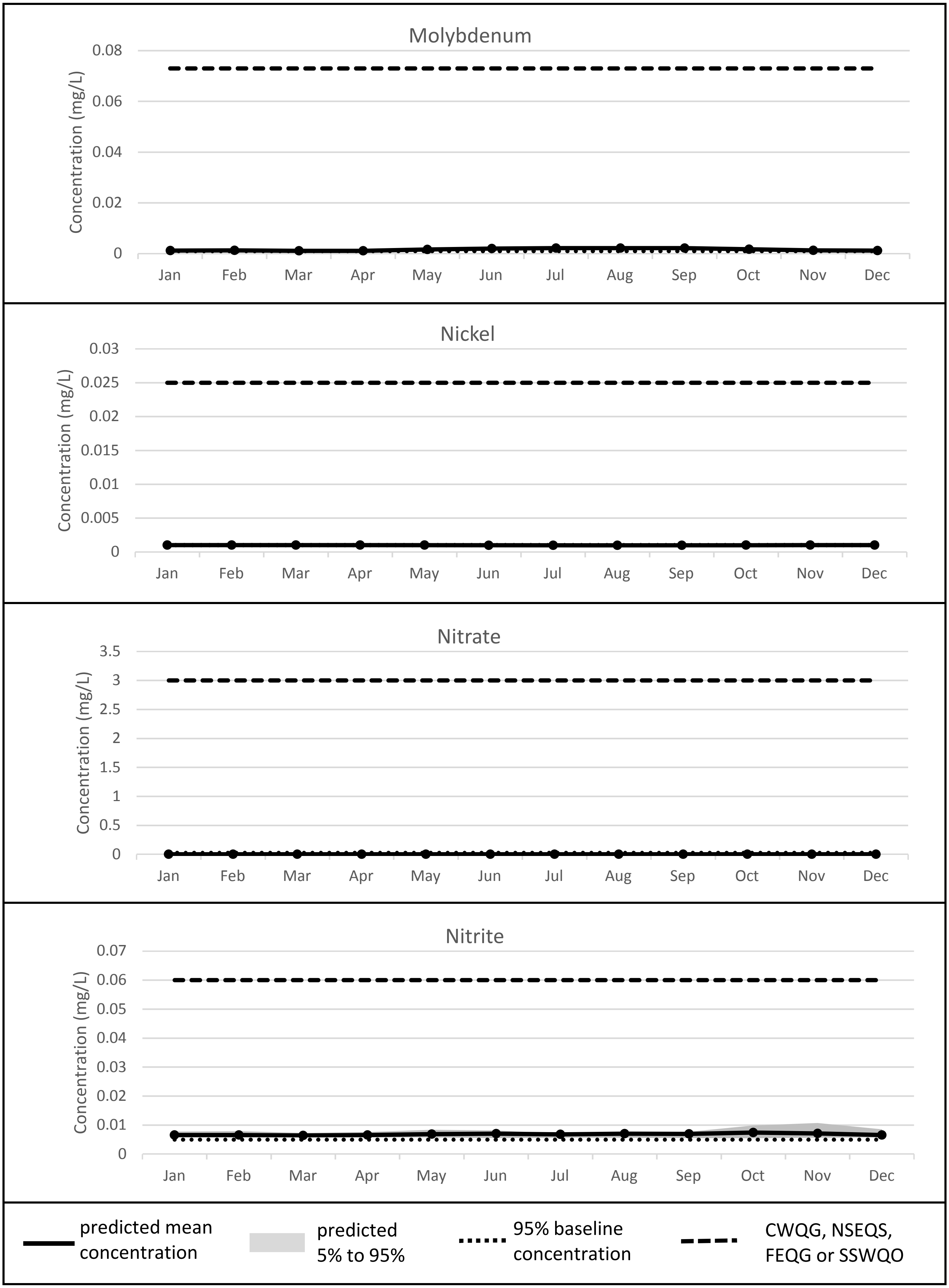
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)

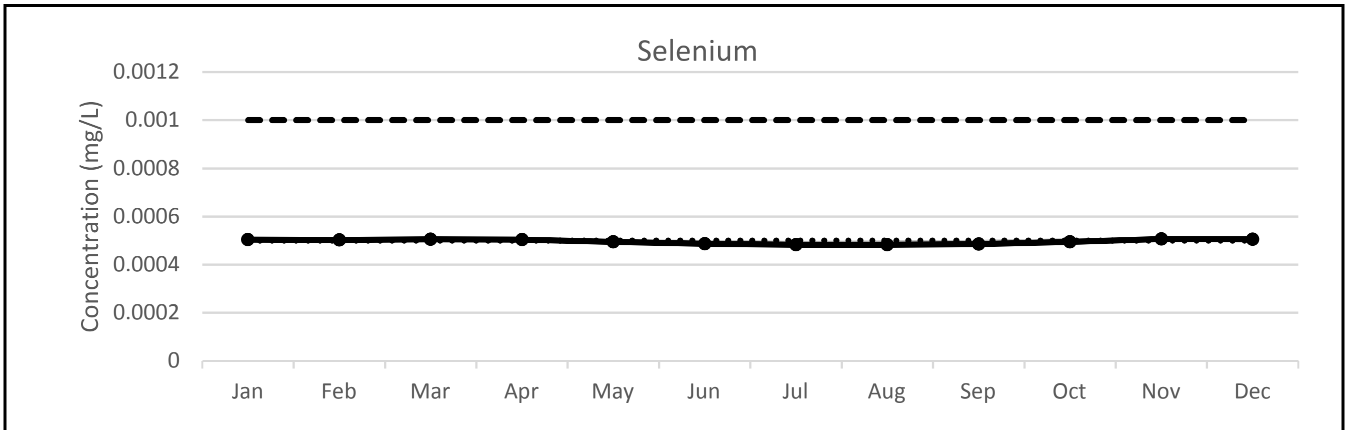


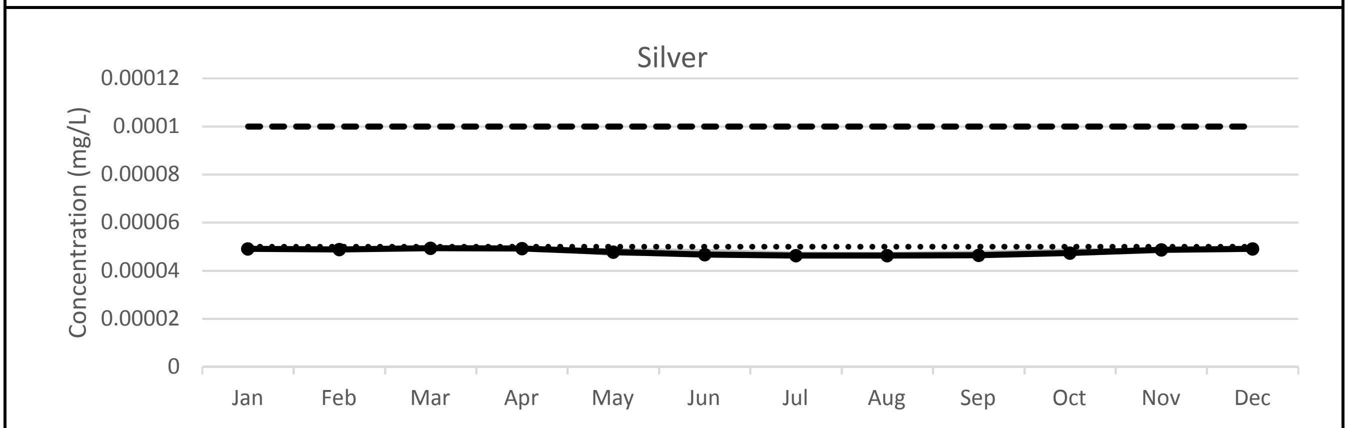
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)



PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)




Selenium
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


Silver
Concentration (mg/L)
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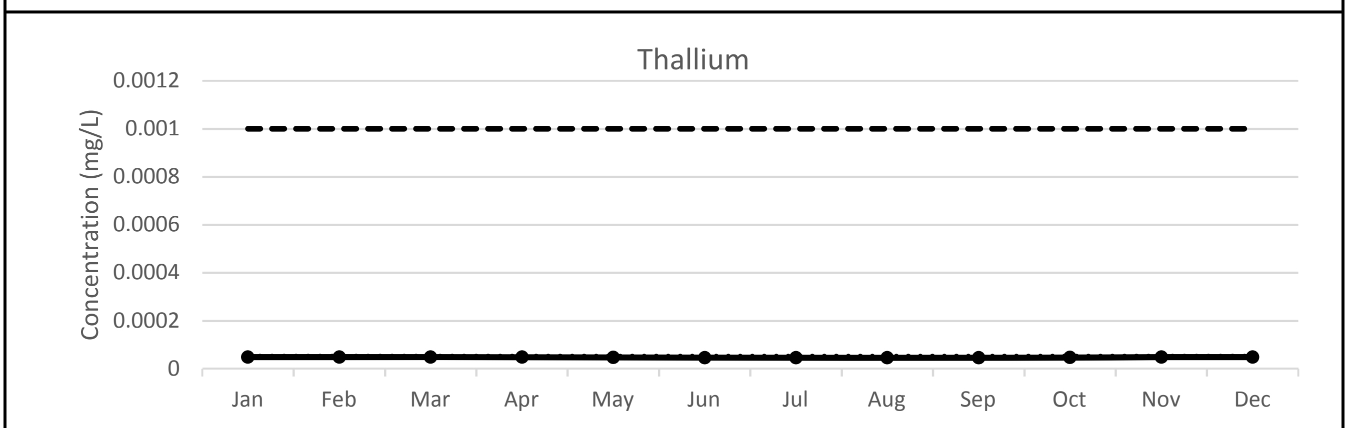
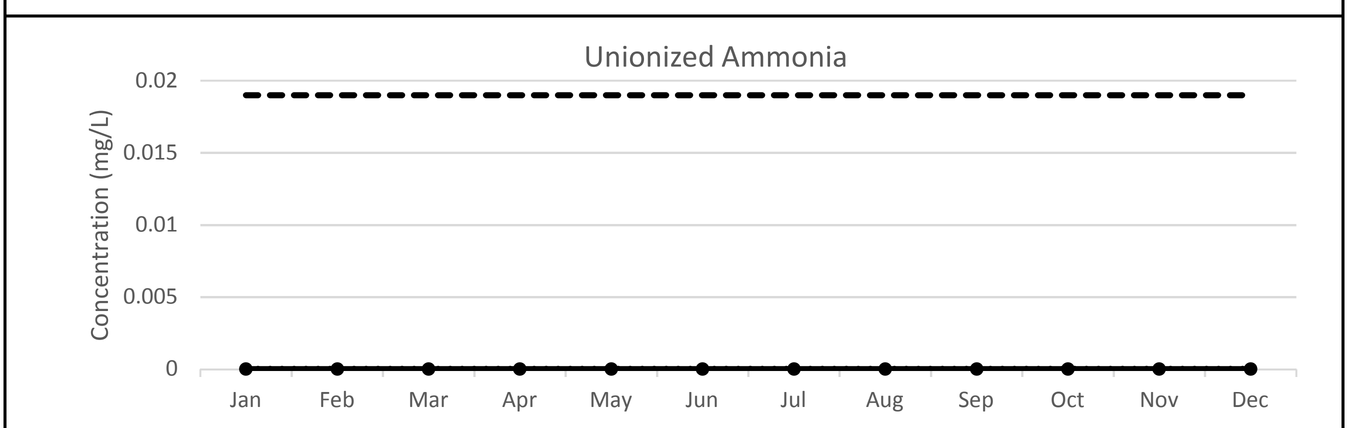
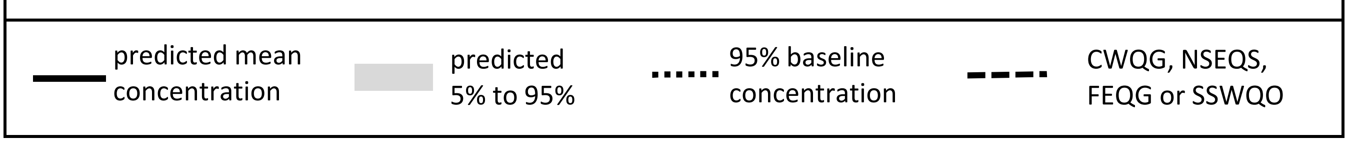
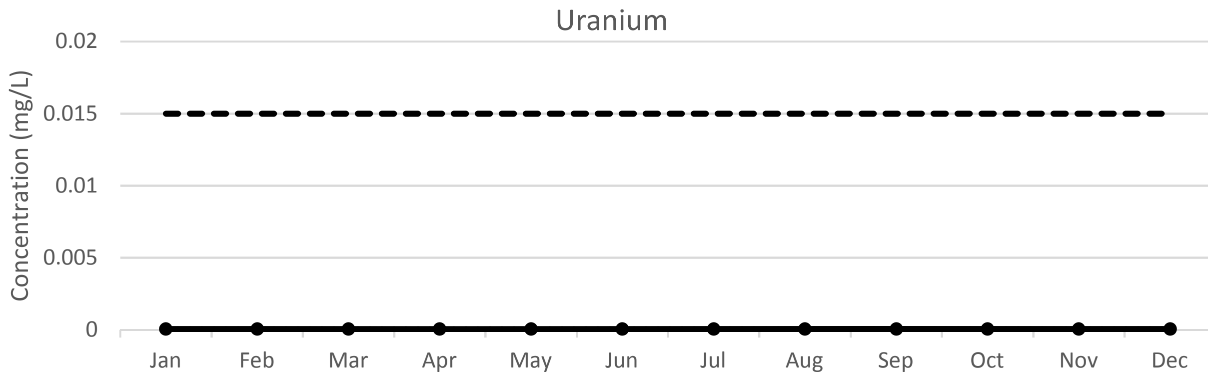
0.0001
0.00008
0.00006
0.00004
0.00002
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

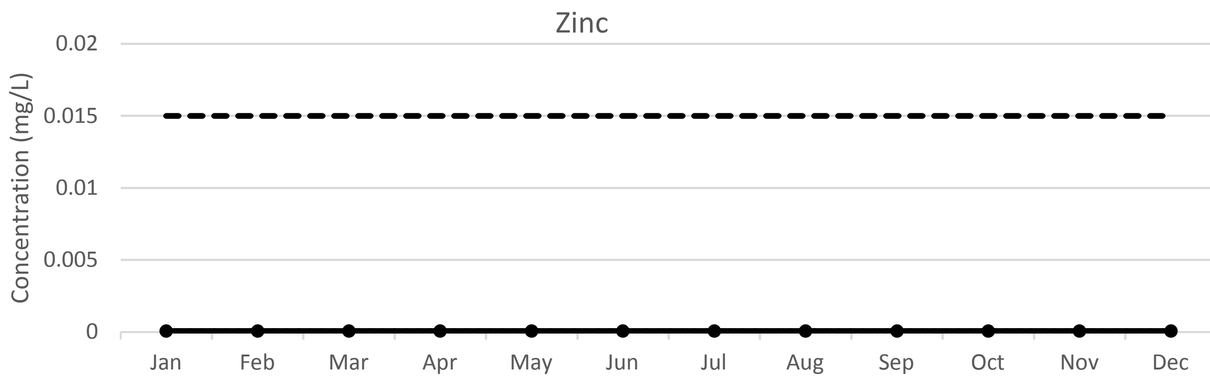

Thallium
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


Unionized Ammonia
Concentration (mg/L)
0.02
0.015
0.01
0.005
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


predicted mean concentration
predicted 5% to 95%
95% baseline concentration
CWQG, NSEQS, FEQG or SSWQO

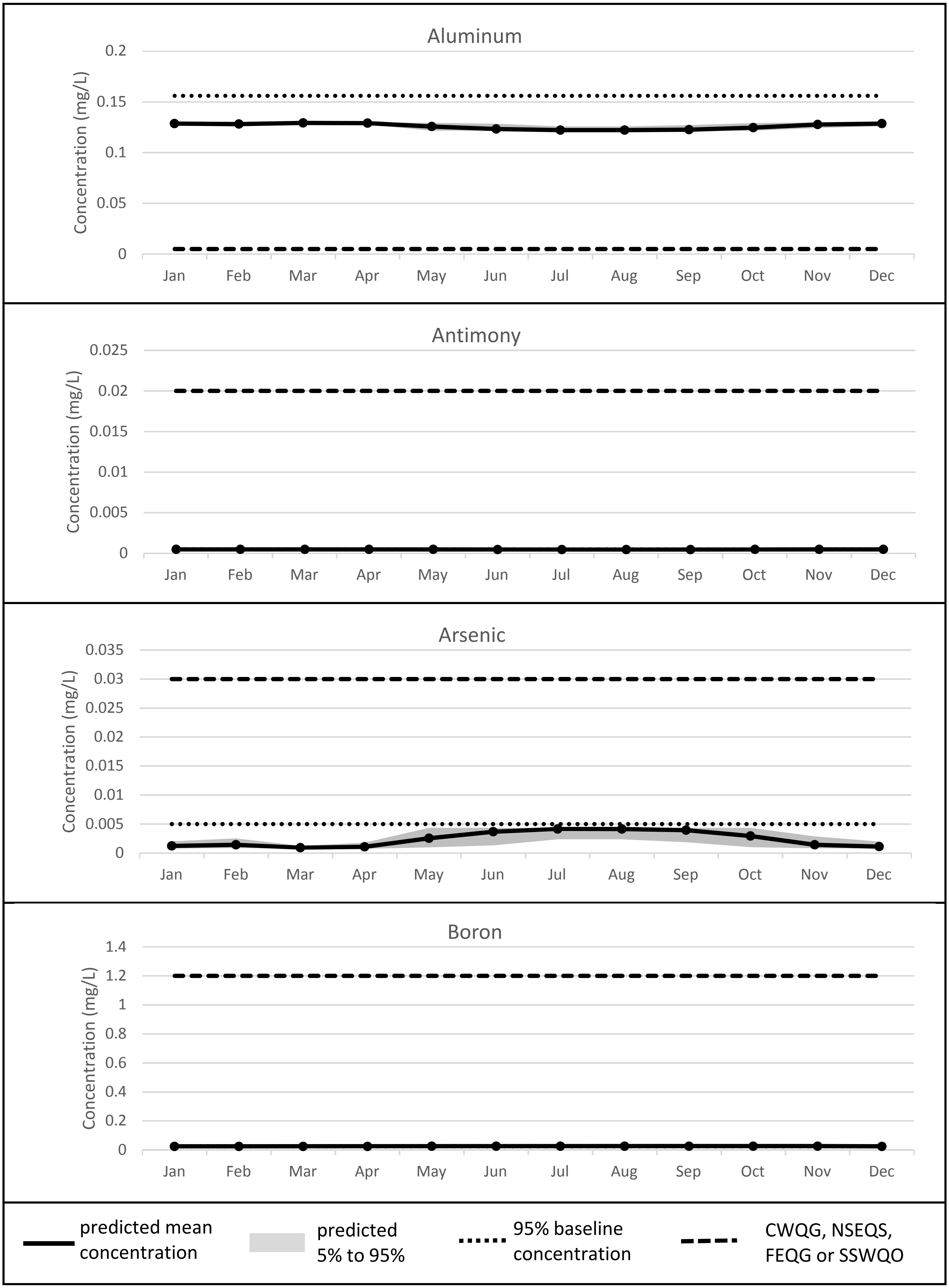
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)



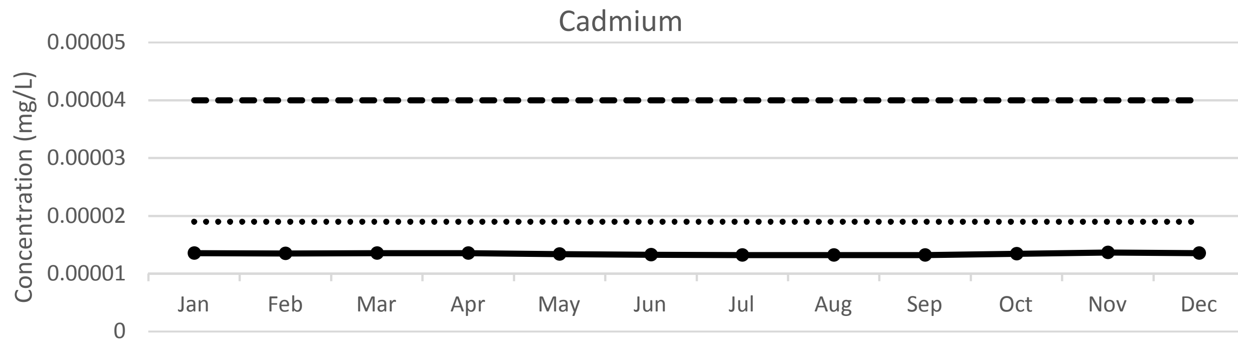


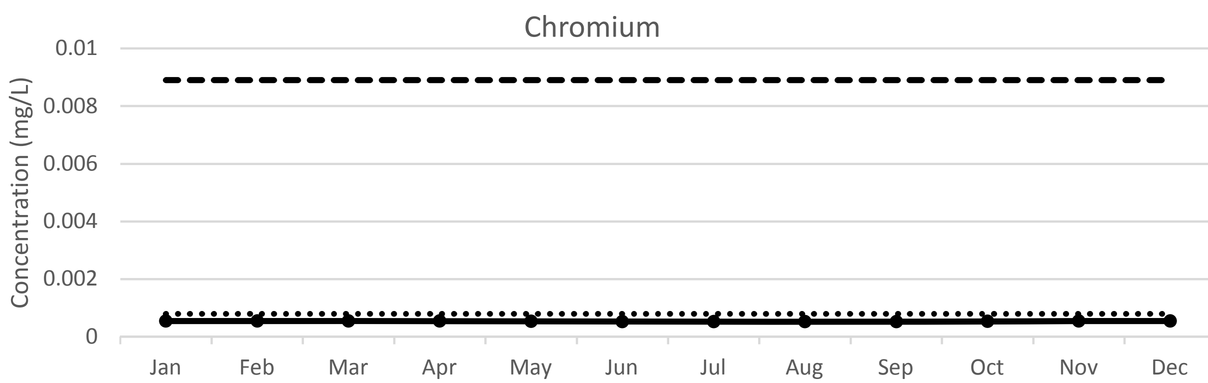
predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

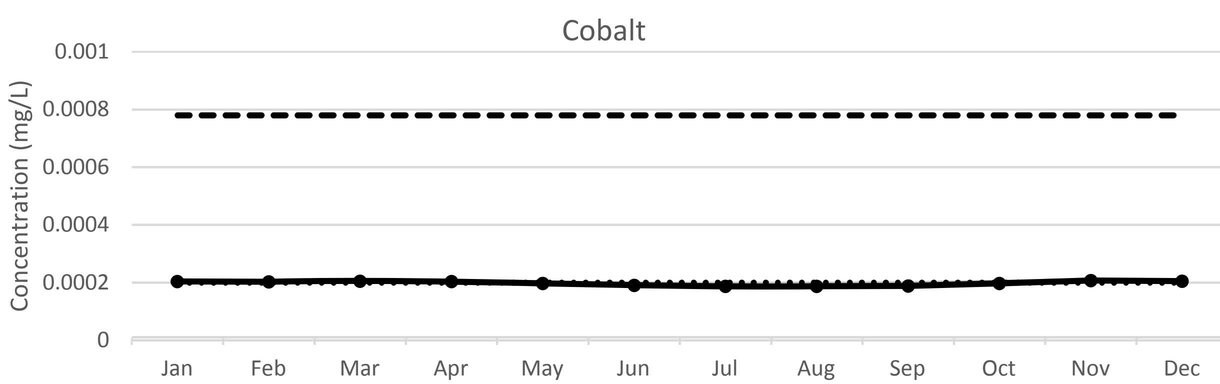
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)

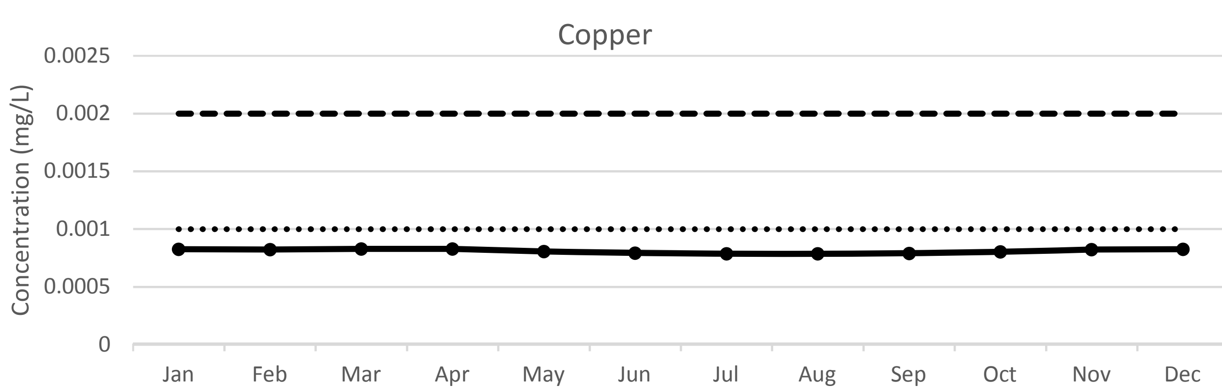


PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)



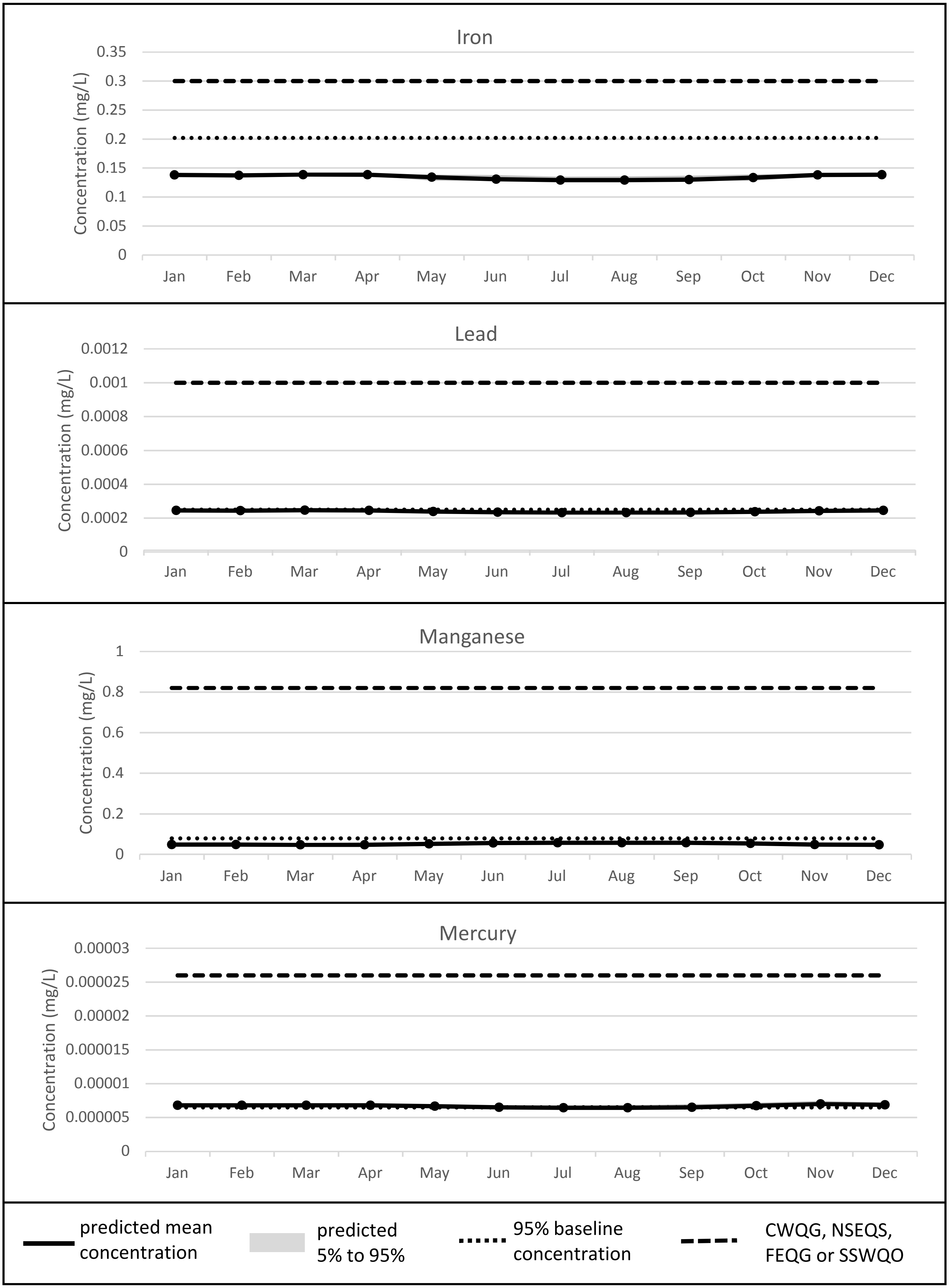






predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)



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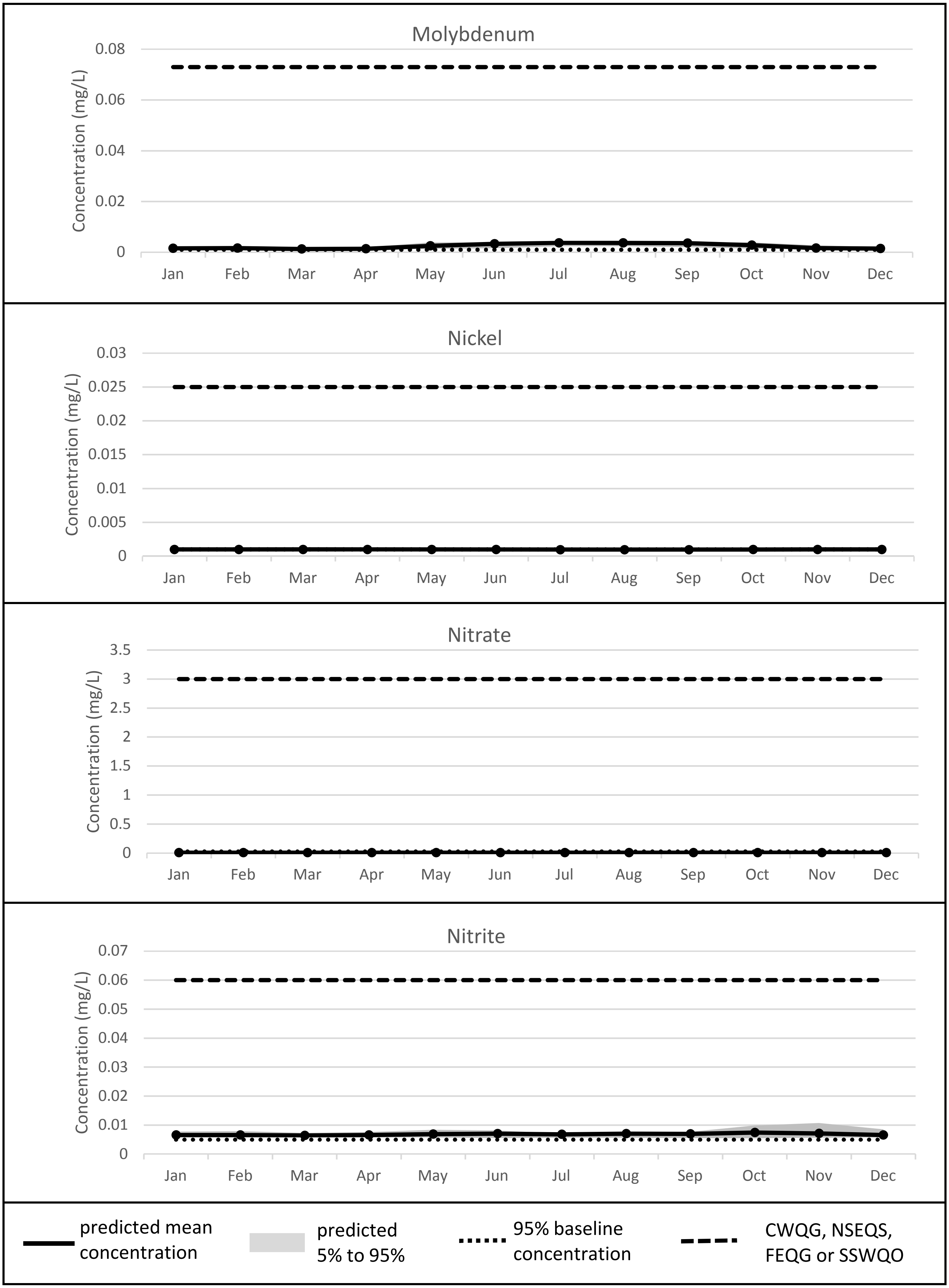

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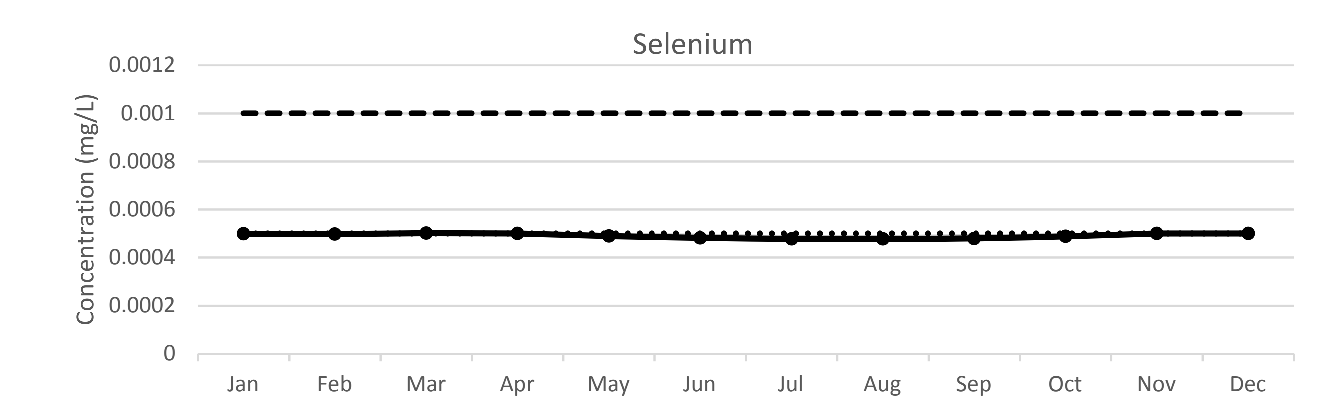
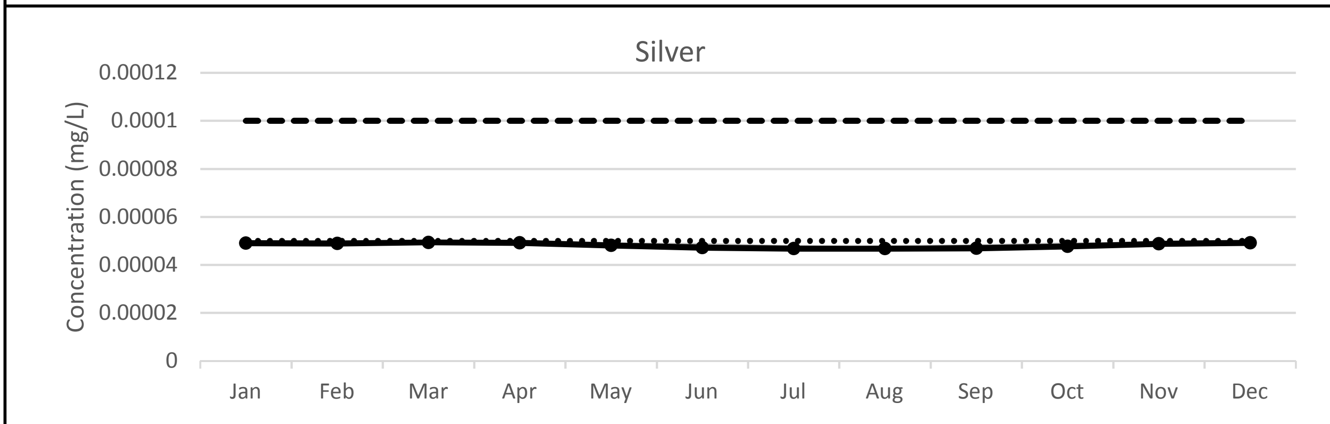
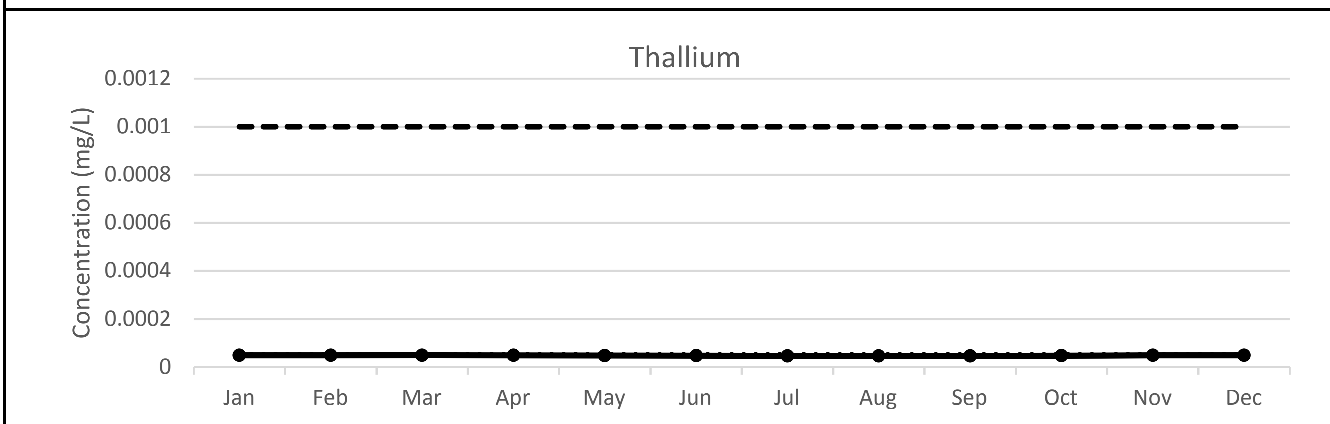
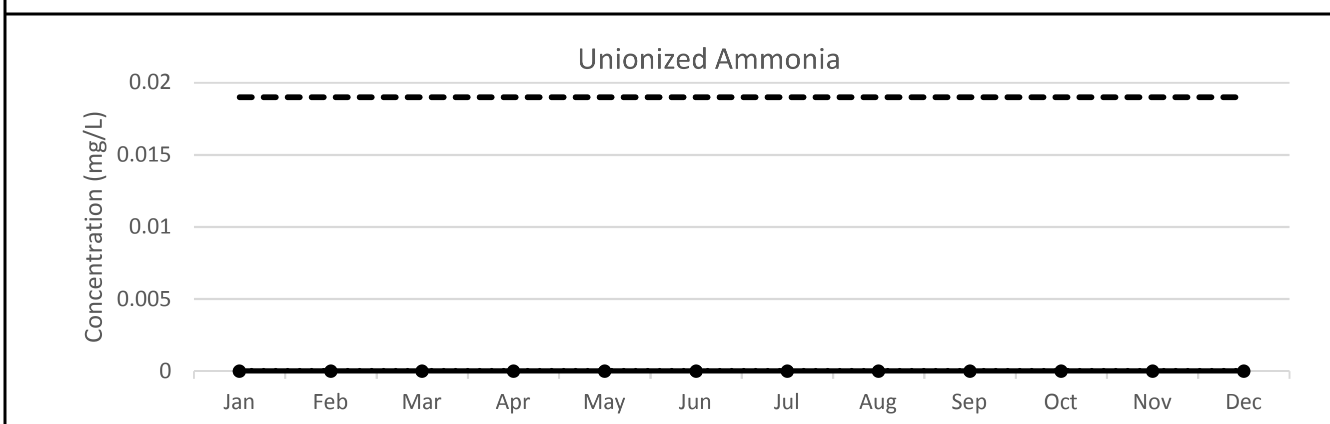


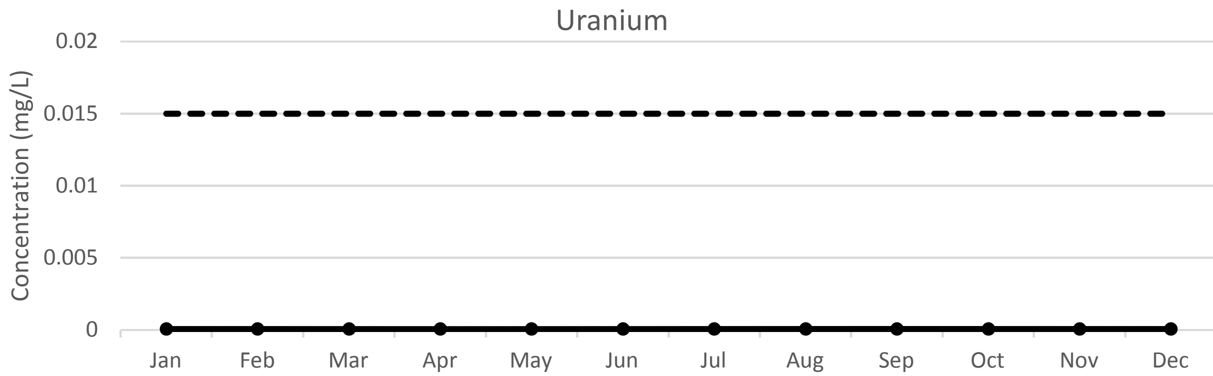


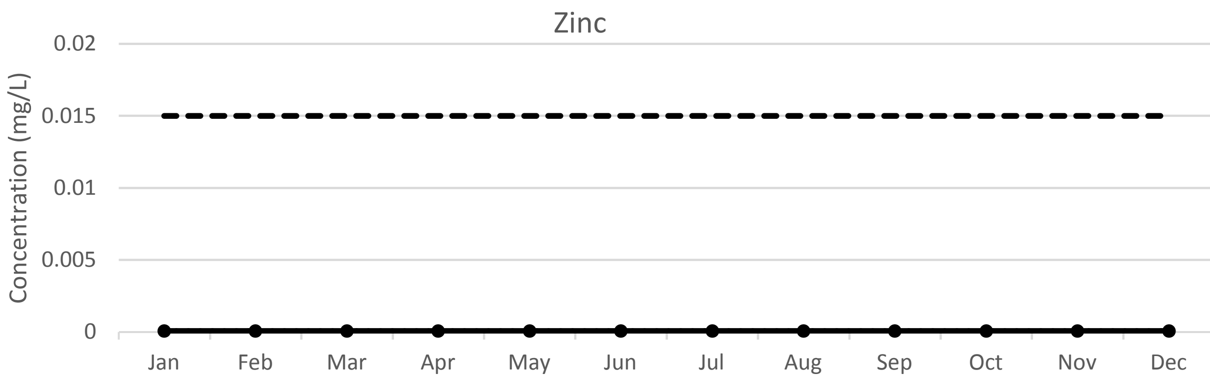




predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

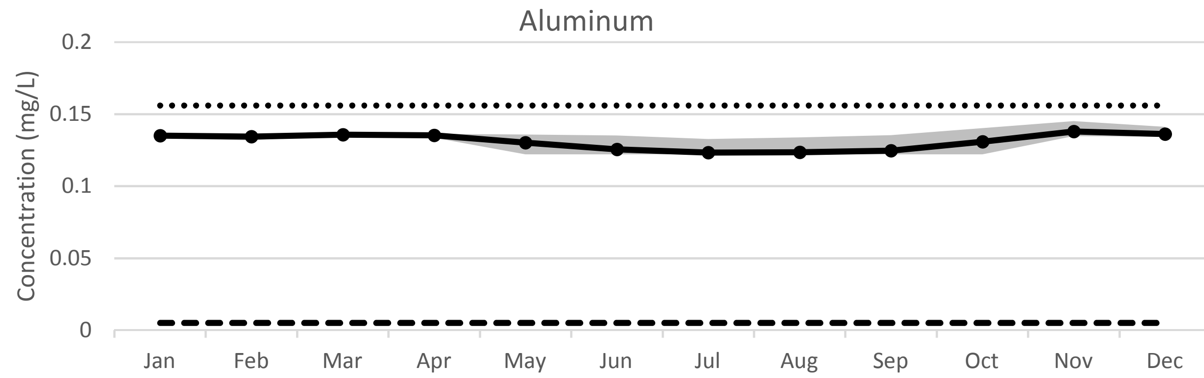
PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING BASE CASE SOURCE TERMS)

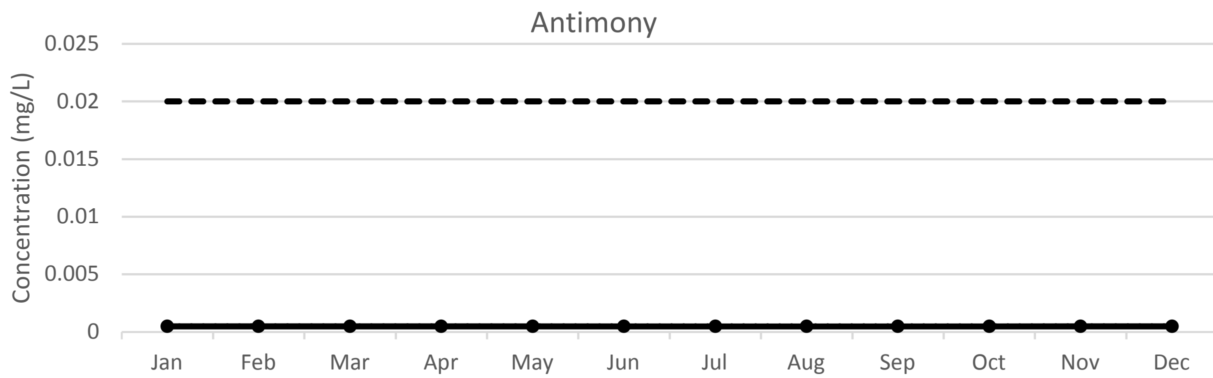


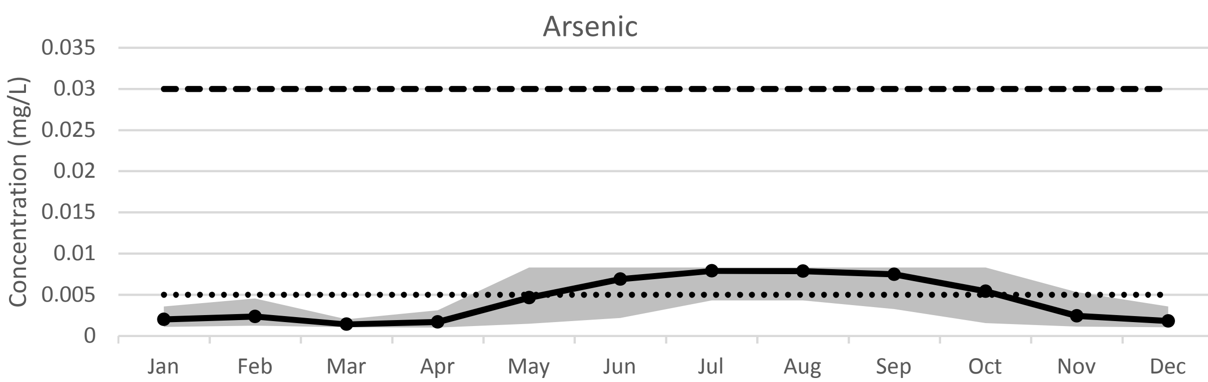


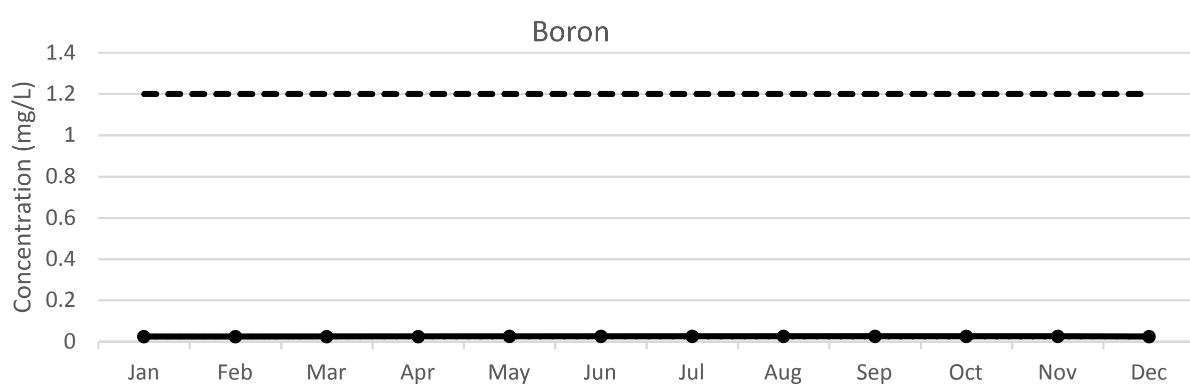
predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)



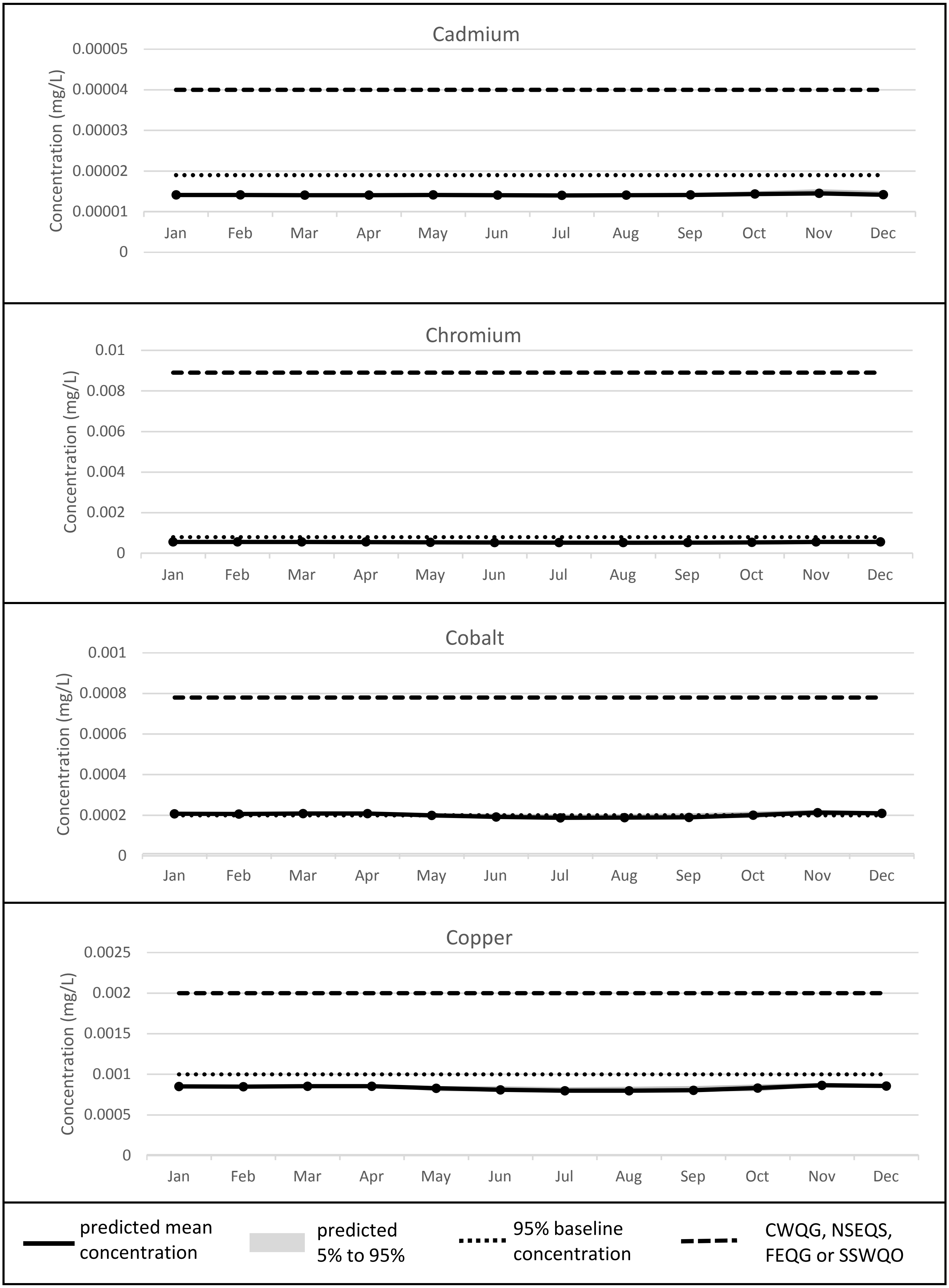






predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)



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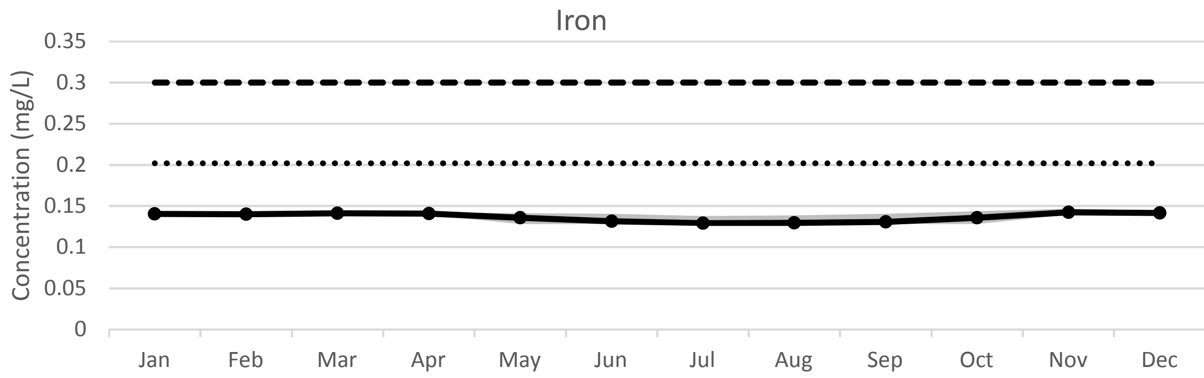

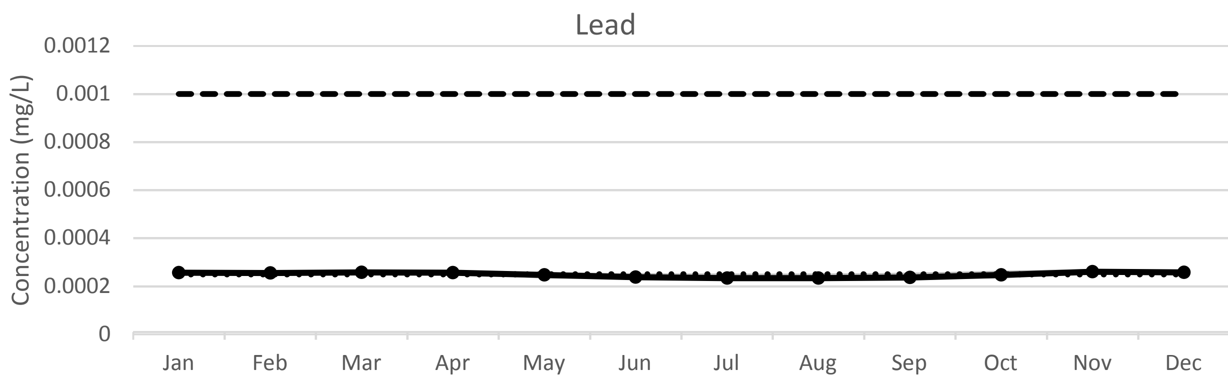

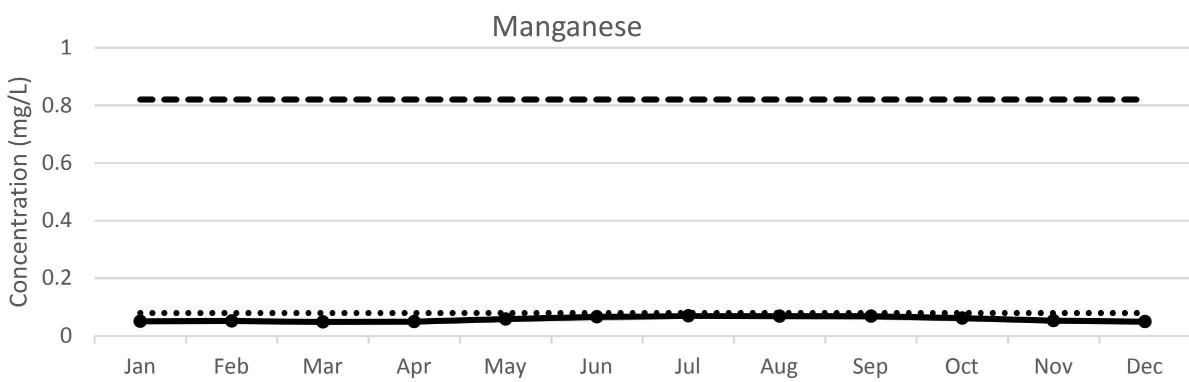

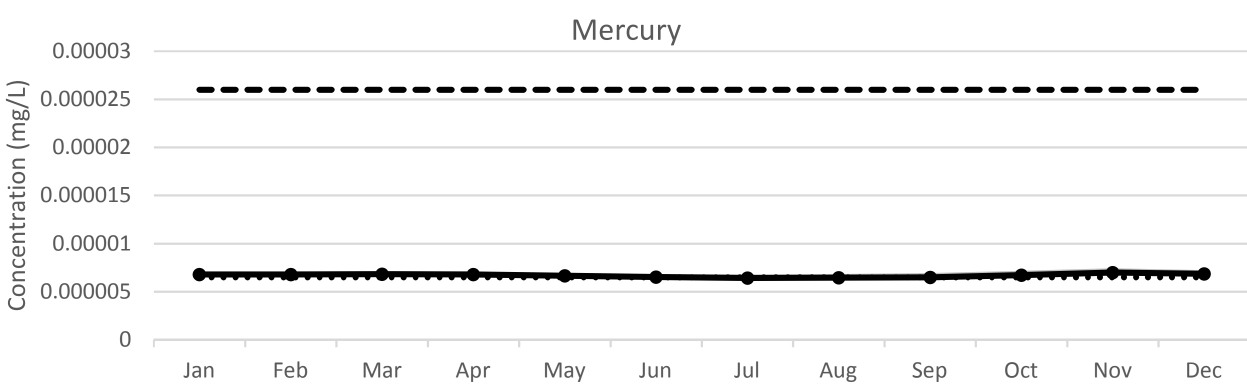

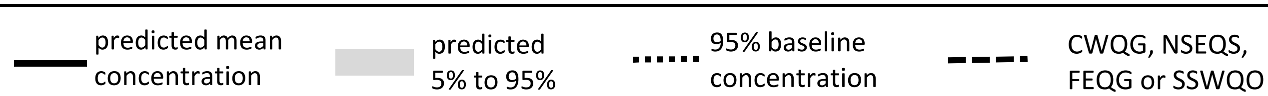

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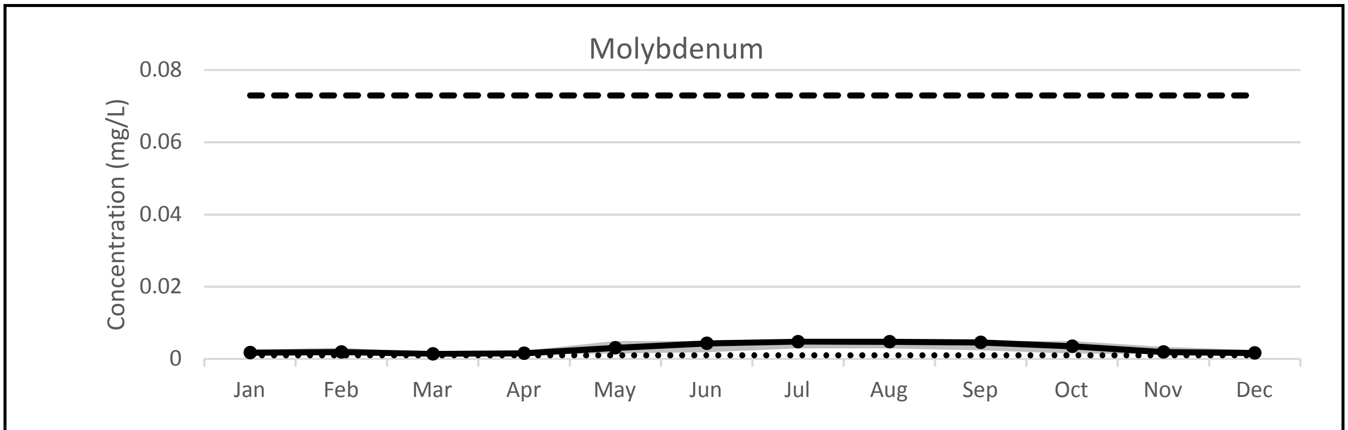
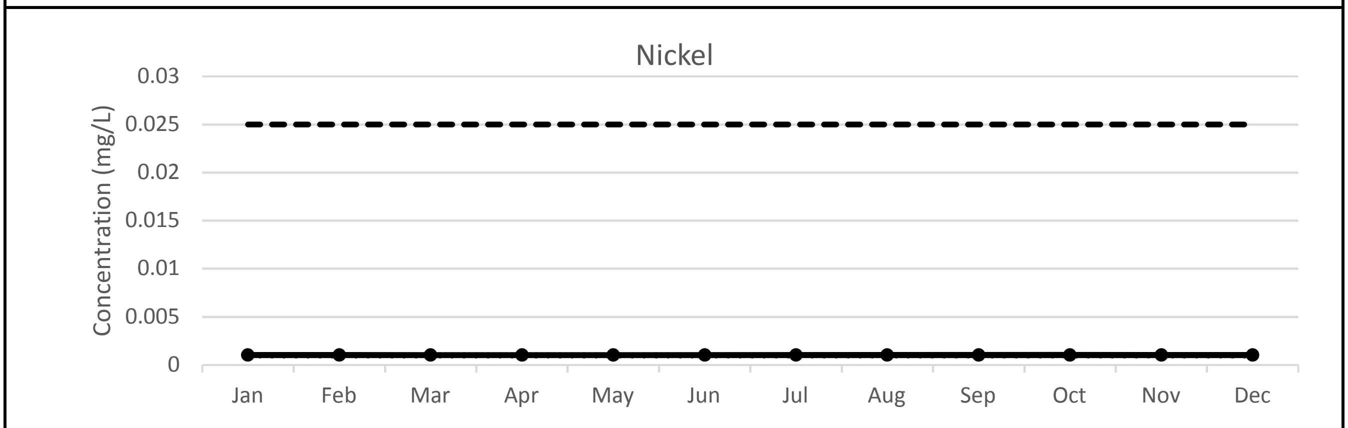
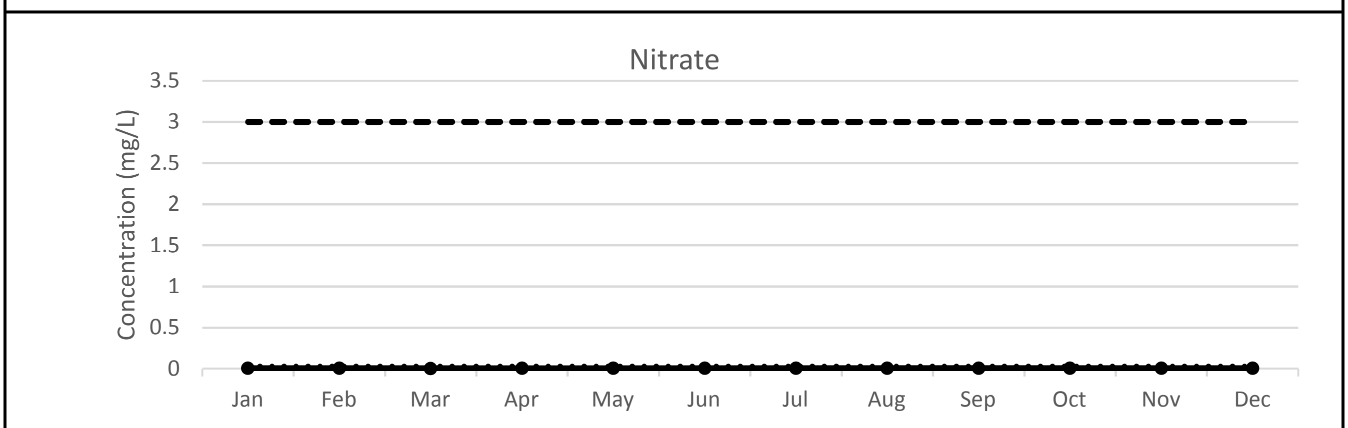
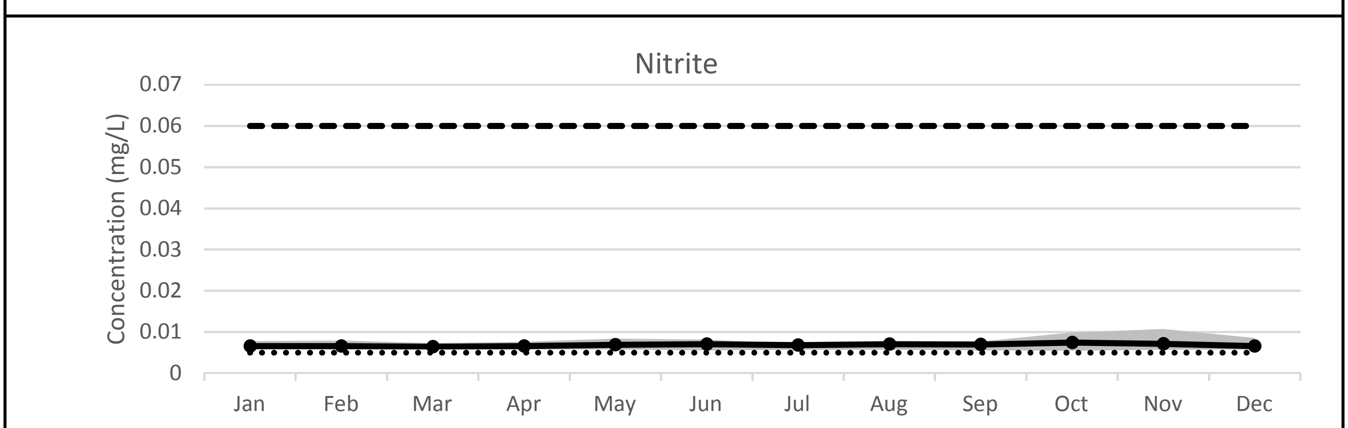


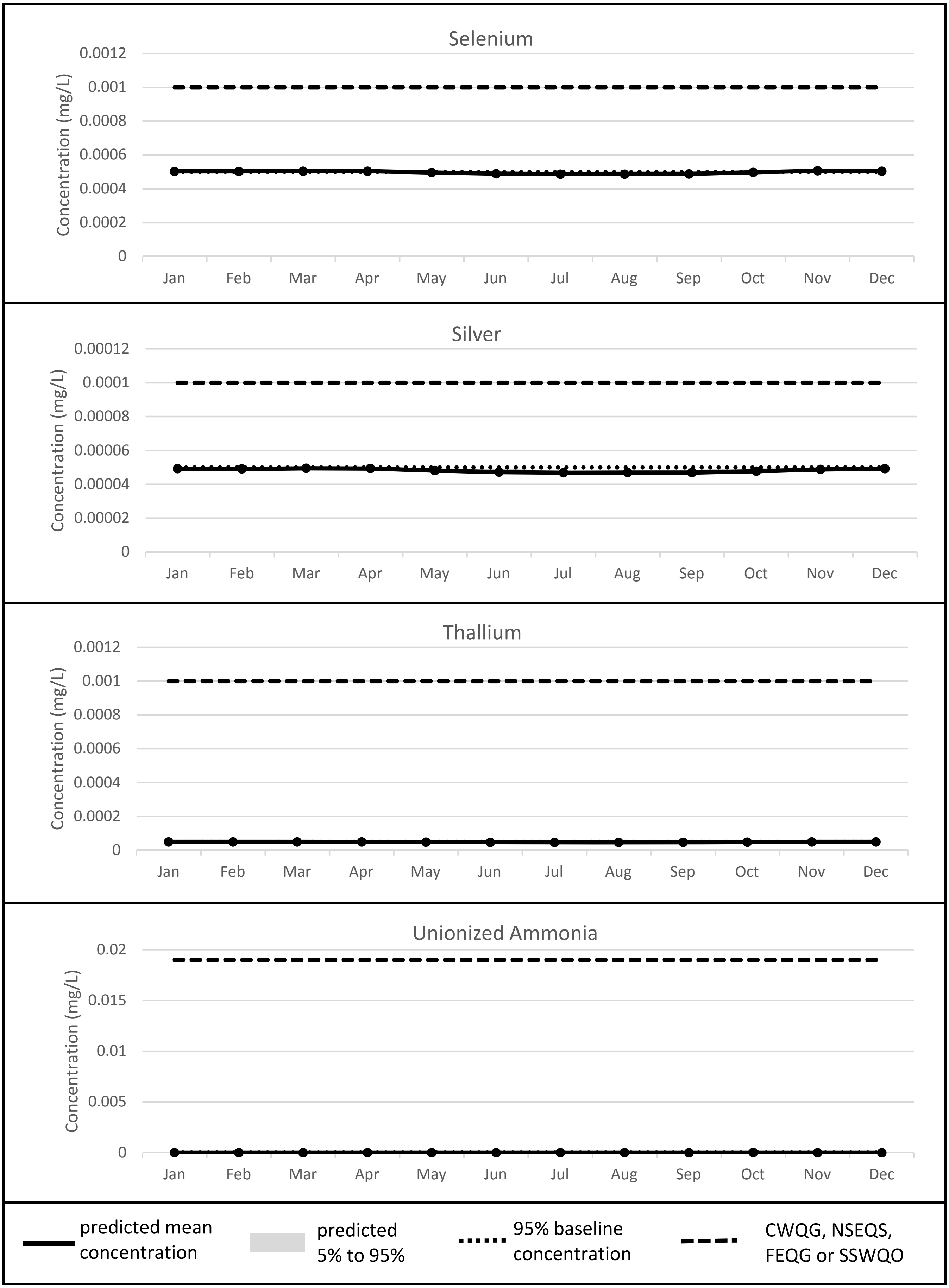


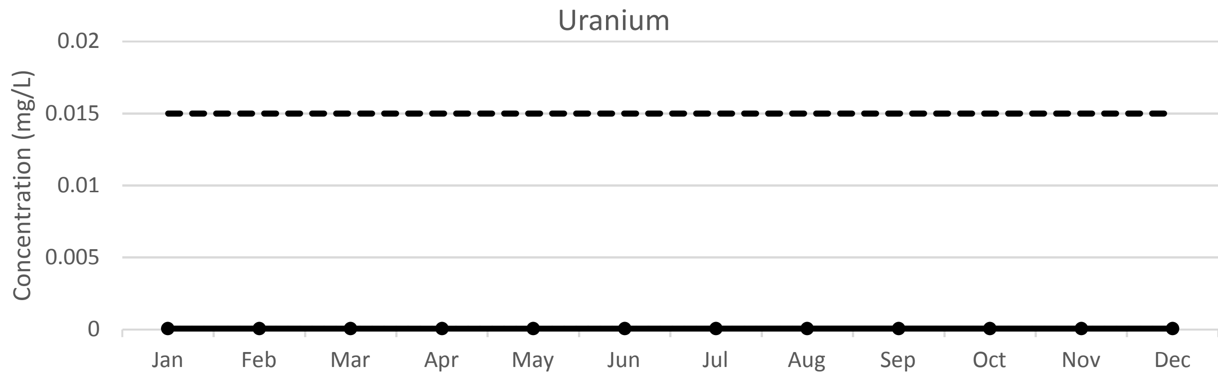


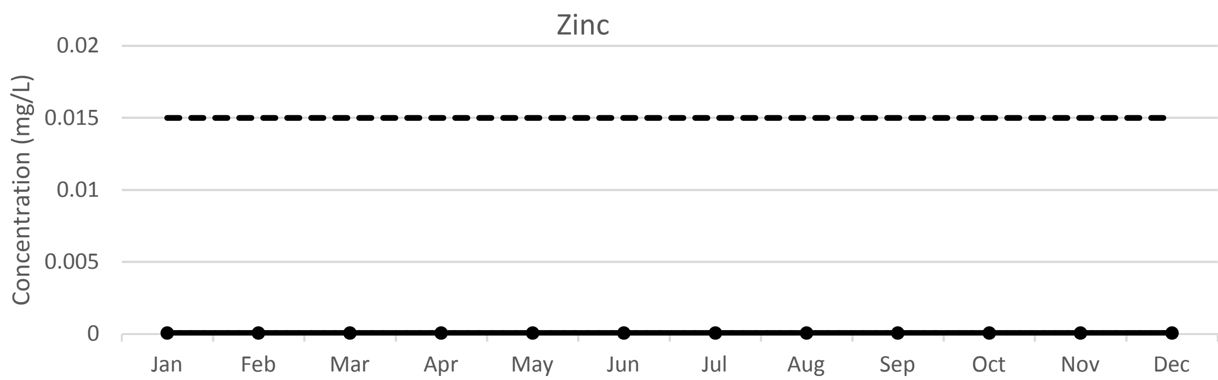


predicted mean concentration | predicted 5% to 95% | 95% baseline concentration | CWQG, NSEQS, FEQG or SSWQO

PREDICTED CONCENTRATIONS AT WATERCOURSE 12 (USING UPPER CASE SOURCE TERMS)







predicted mean concentration	predicted 5% to 95%	95% baseline concentration	CWQG, NSEQS, FEQG or SSWQO

Atlantic Gold

Appendix B.8

Final – 2017 Geotechnical Hydraulic Conductivity Data, Golder Associates

B.9 2017 GEOTECHNICAL HYDRAULIC CONDUCTIVITY DATA SUMMARY

Figure B.1 – 2017 Geotechnical Borehole Locations

Figure B.2 – Coordinate Definition

Figure B.3 – Hydraulic Conductivity Testing Results at Fifteen Mile Stream – Plan View

Figure B.4 – Hydraulic Conductivity Testing Results at Fifteen Mile Steam – Geological Interpretation

Figures B.5 to B.10 – Cross-section for each borehole

LEGEND

LOCATION OF 2017 GEOTECHNICAL BOREHOLE

0 250 500 750
1:20,000 METRES

DRAFT

NOTE(S)
1. BOREHOLE LOCATION SURVEYING WAS CONDUCTED BY WSP, RECEIVED OCTOBER 18, 2018. DUE TO THE DELAY IN SURVEYING FOLLOWING DRILLING COMPLETION, SOME BOREHOLE MARKERS WERE UNLABELLED OR MISSING. IF THE BOREHOLE MARKER WAS MISSING, THE COORDINATES FROM A HANDHELD GPS WERE USED. THE ACCURACY OF THE GPS COORDINATES IS +/- 3 M.
2. THIS FIGURE WAS PREPATED FOR ATLANTIC GOLD AND IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1895674

REFERENCE(S)
BASE MAP DATA: ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 20 VERTICAL DATUM: CGVD28

CLIENT
ATLANTIC GOLD CORPORATION

PROJECT
FIFTEEN MILE STREAM ENVIRONMENTAL ASSESSMENT

TITLE
2017 GEOTECHNICAL BOREHOLE LOCATIONS

CONSULTANT

YYYY-MM-DD	2019-03-12
DESIGNED	---
PREPARED	RRD
REVIEWED	--
APPROVED	--

PROJECT NO.	CONTROL	REV.	FIGURE
1895674	0018	A	B.1

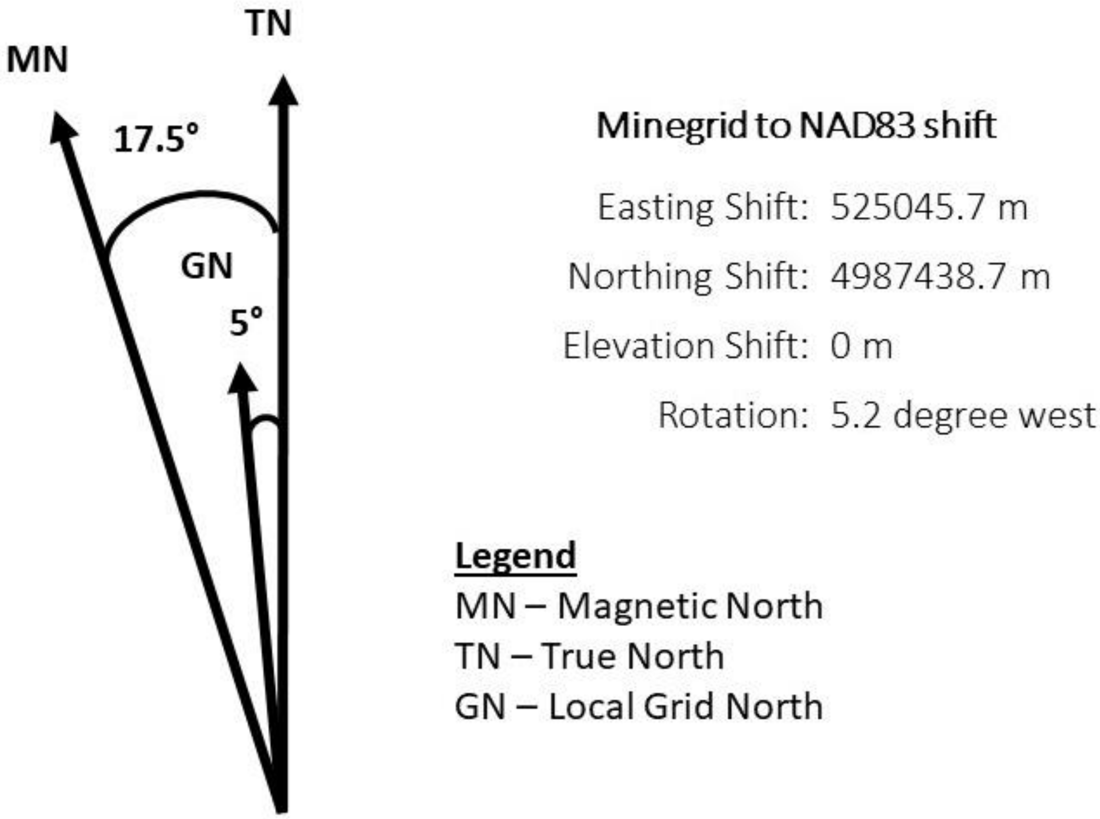


Figure B.2: Coordinates Definition at Fifteen Mile Stream

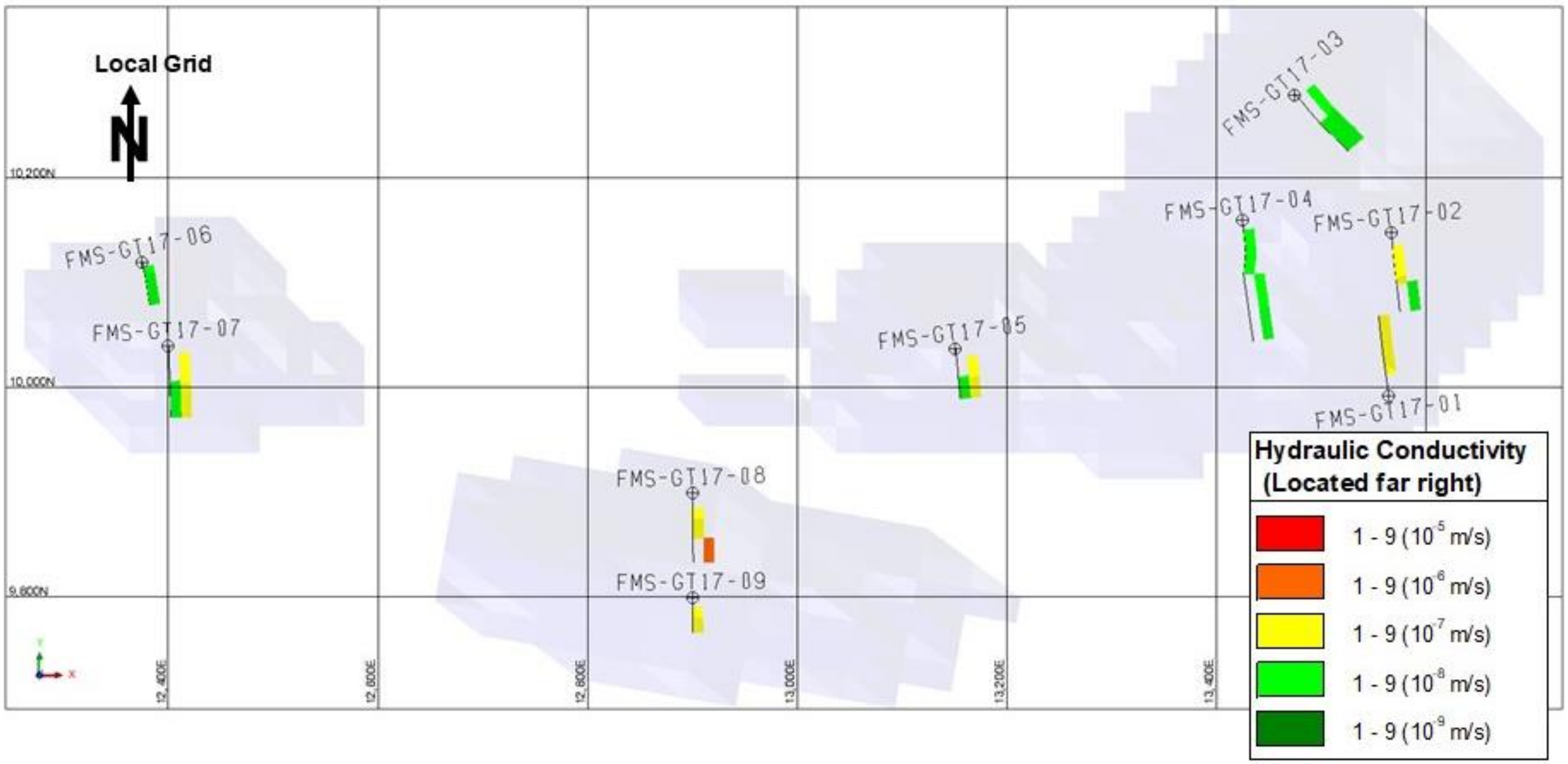


Figure B.3: Hydraulic Conductivity at Fifteen Mile Stream

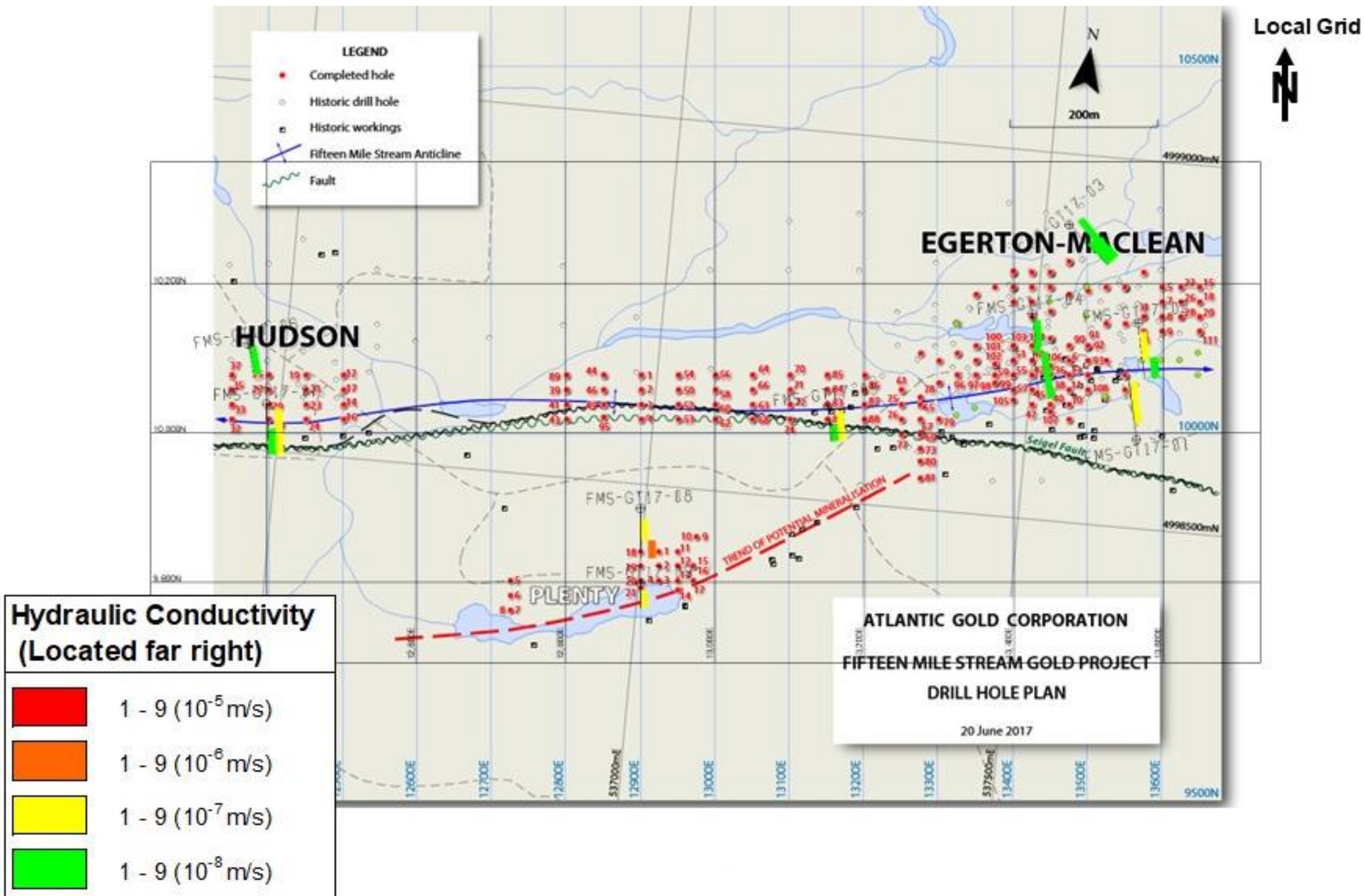


*Figure prepared based on the interpretation of major contacts and faults provided by Atlantic Gold on October 20th, 2017

Figure B.4: Hydraulic Conductivity Testing at Fifteen Mile Stream – Geological Interpretation

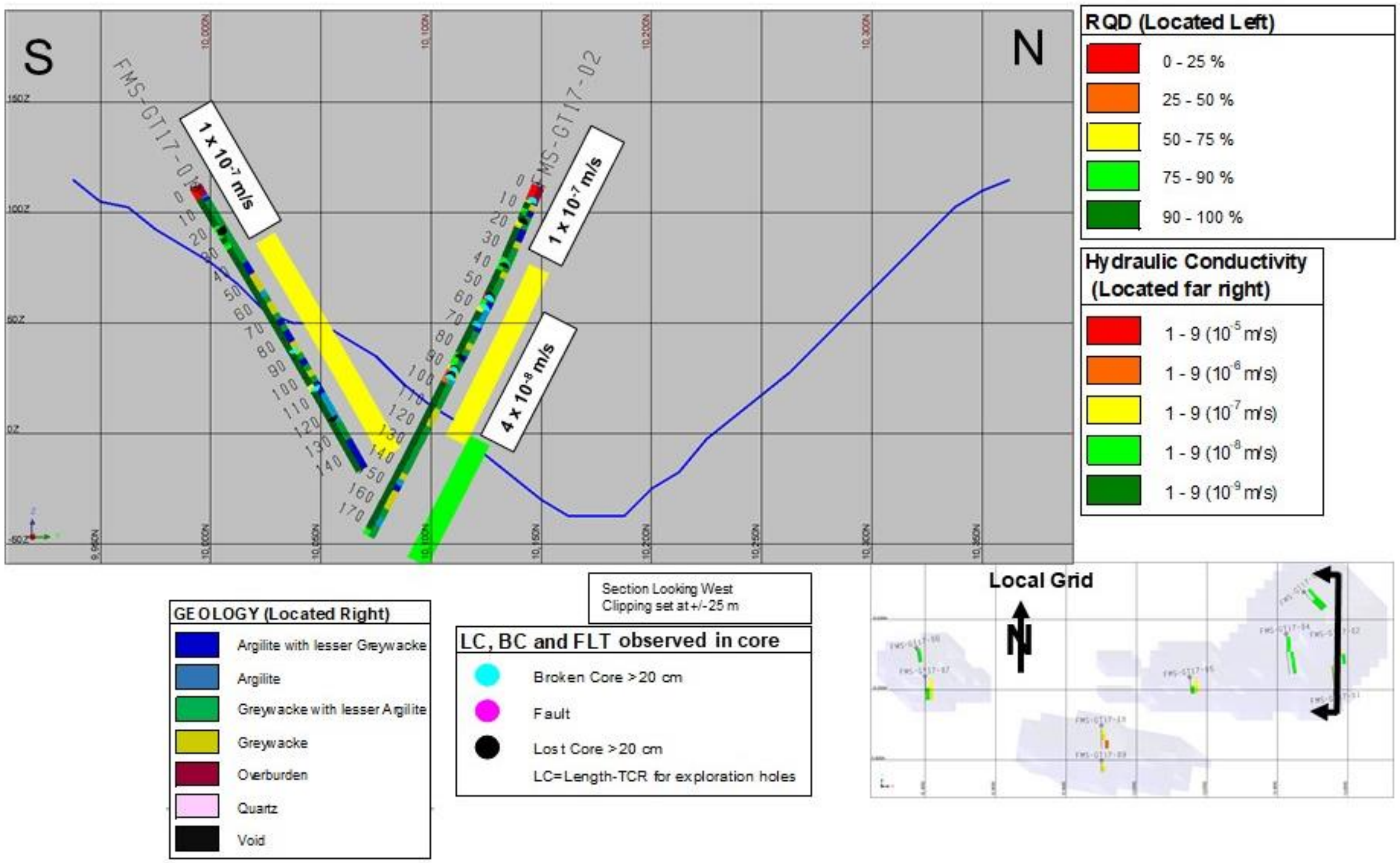


Figure B.5: Cross-section – FMS-GT17-01 and FMS-GT17-02

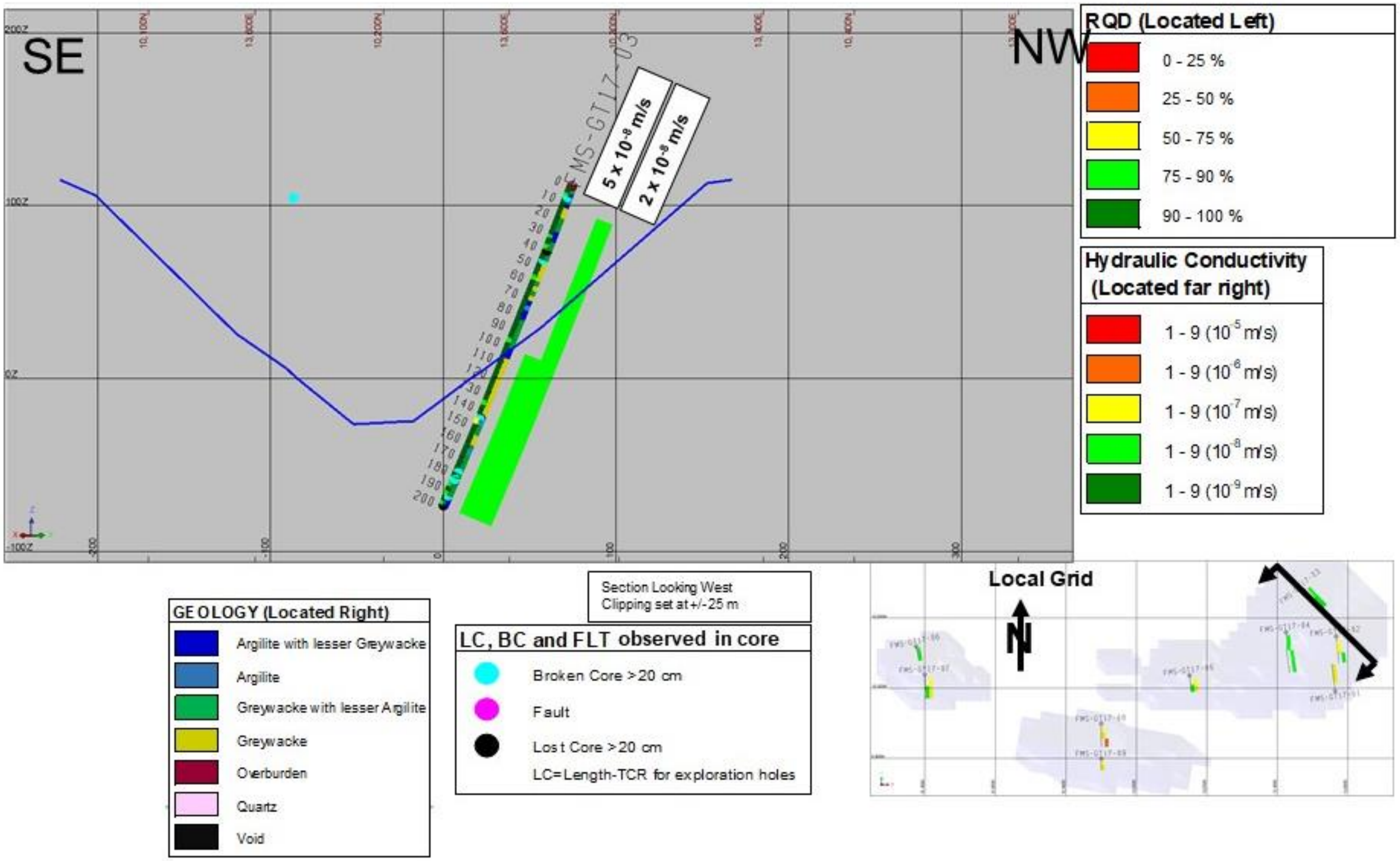


Figure B.6: Cross-section – FMS-GT17-03

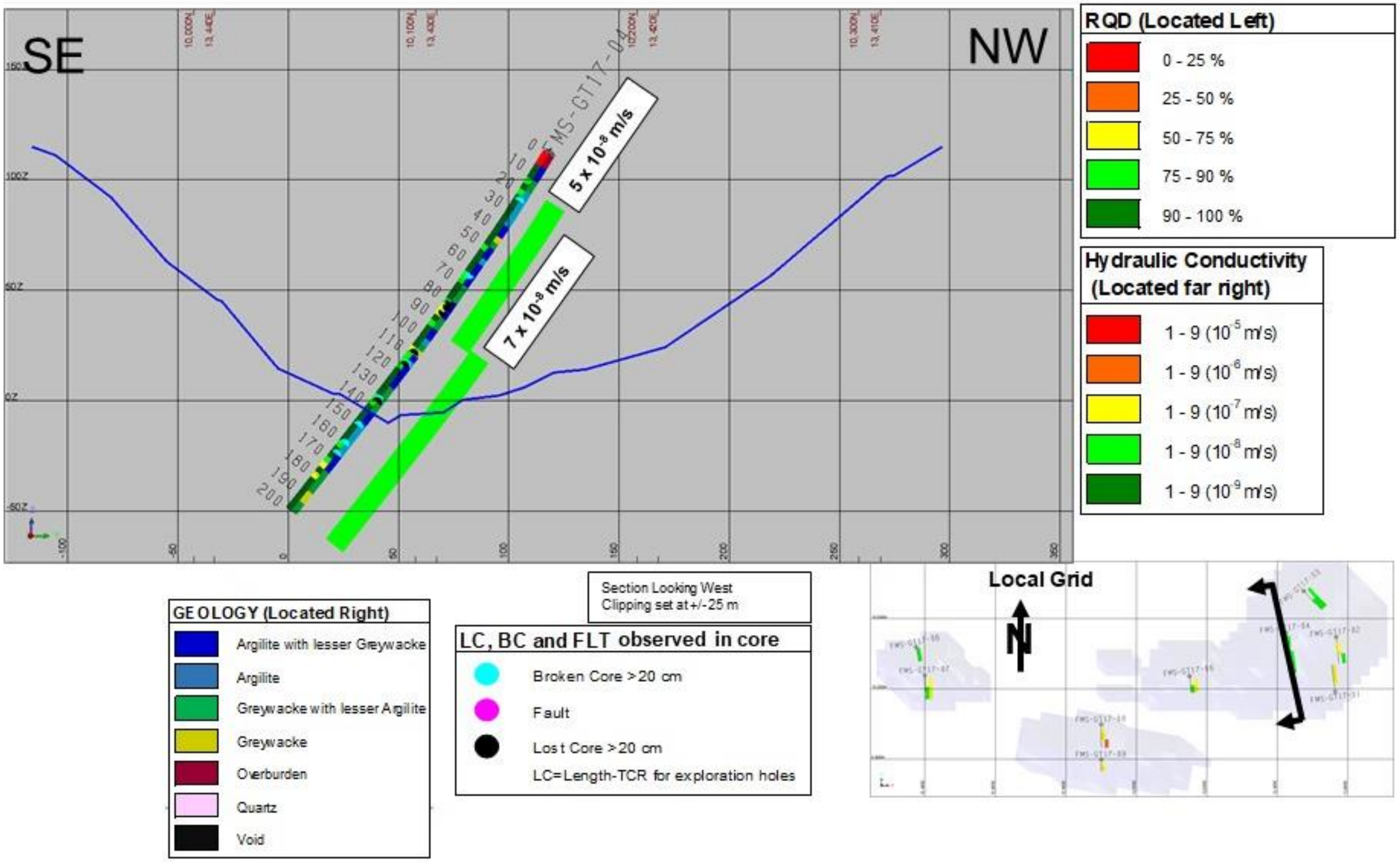


Figure B.7: Cross-section – FMS-GT17-04

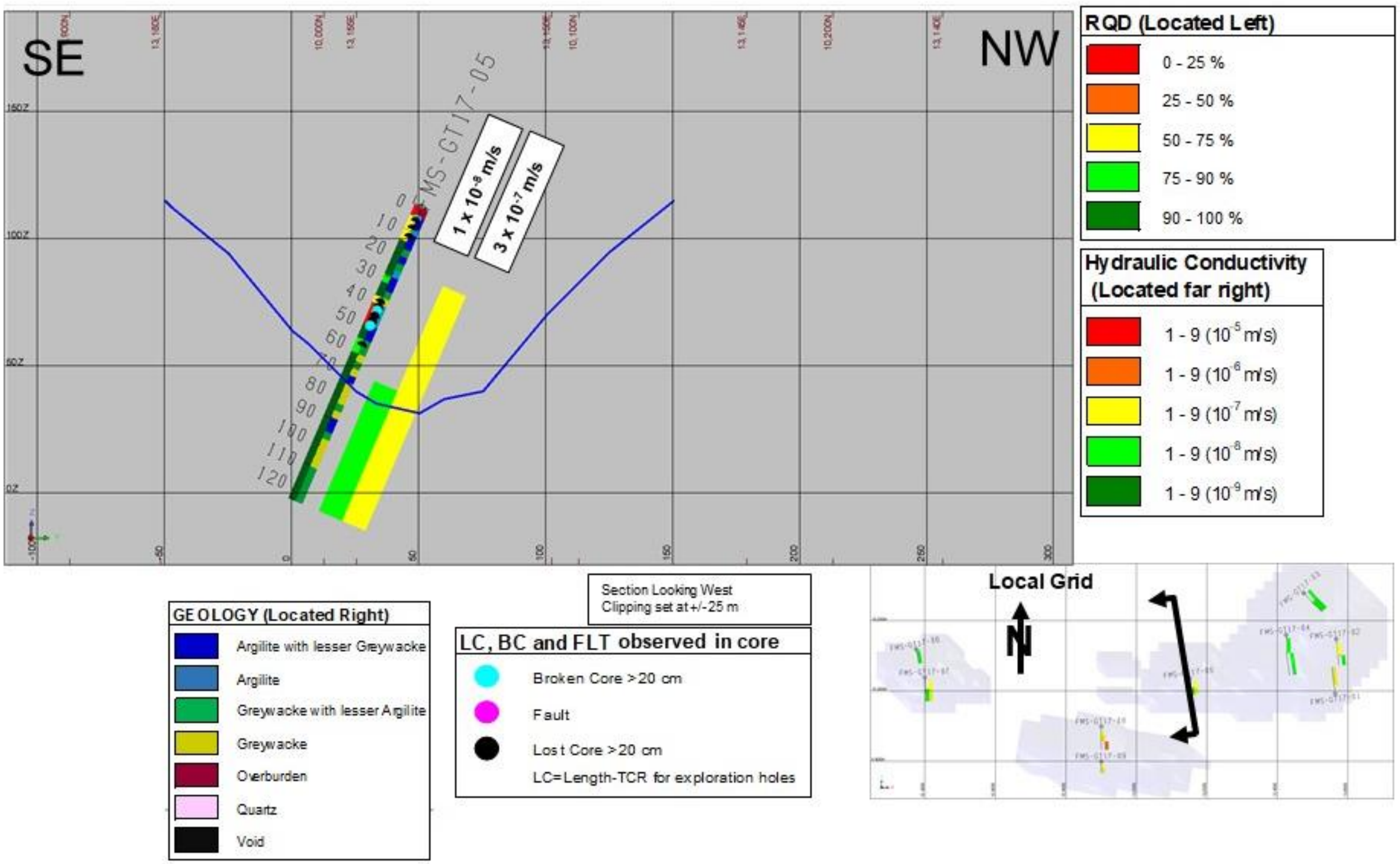


Figure B.8: Cross-section – FMS-GT17-05

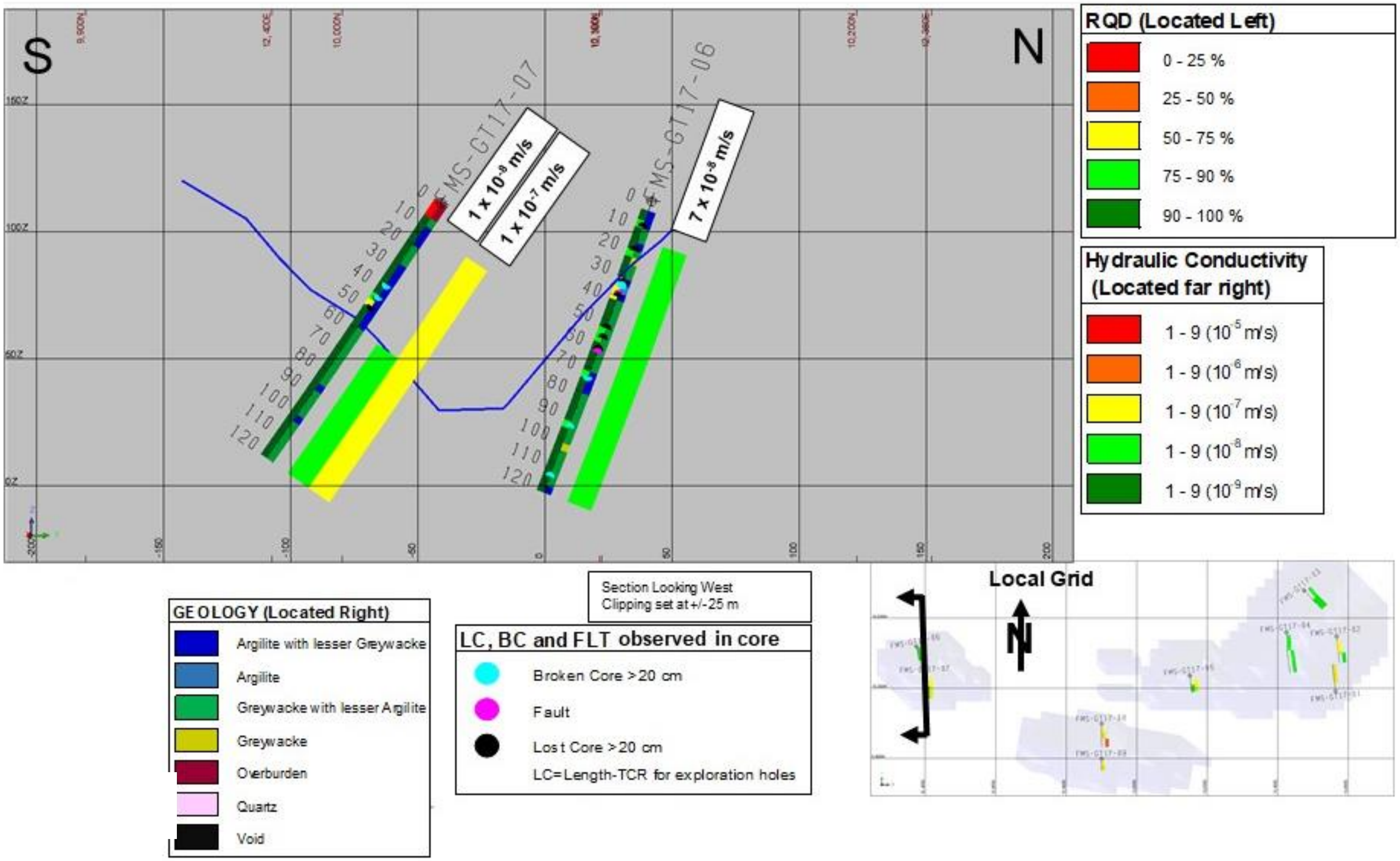


Figure B.9: Cross-section – FMS-GT17-06 and FMS-GT17-07

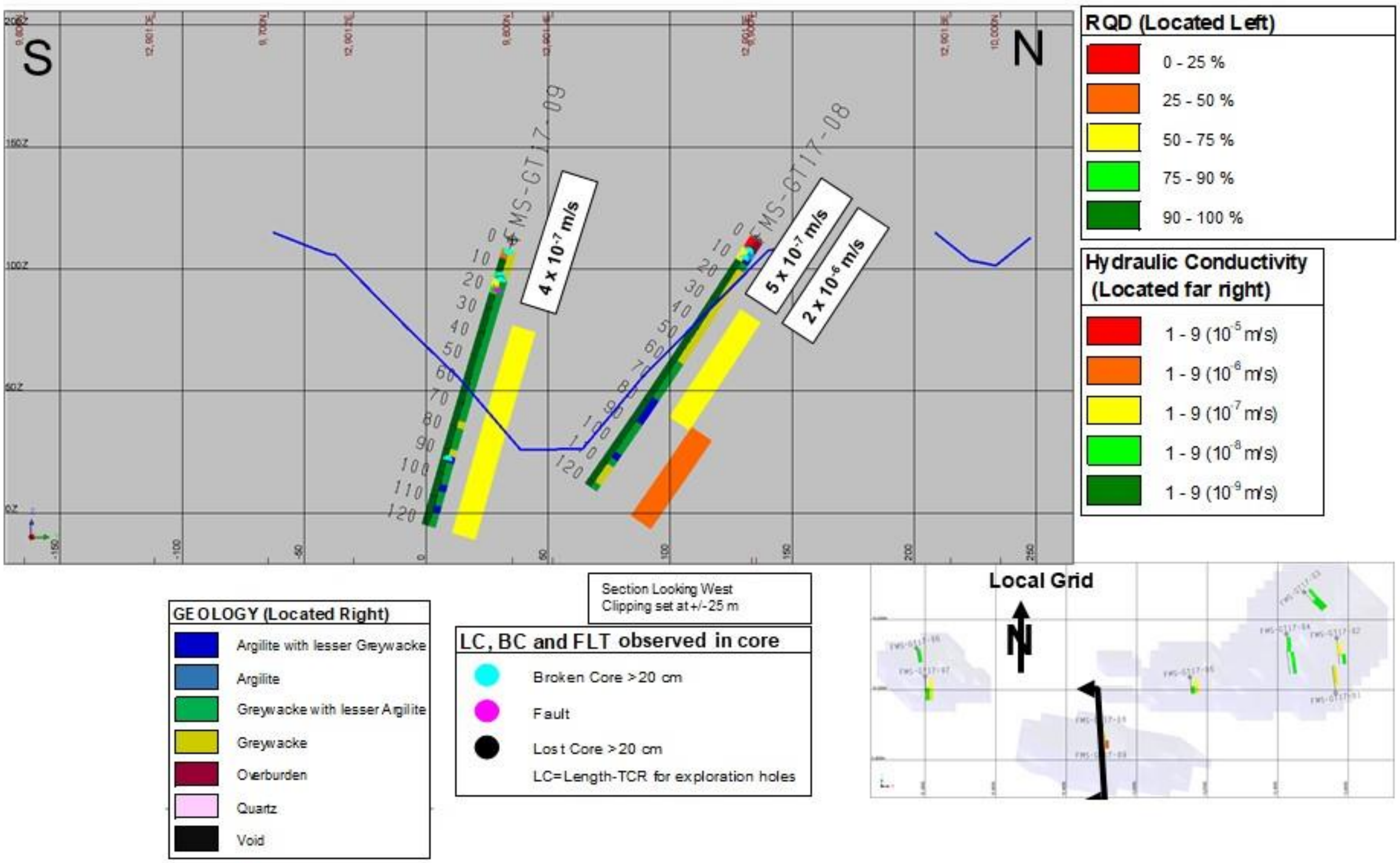


Figure B.10: Cross-section – FMS-GT17-08 and FMS-GT17-09