Appendix I

Fish Tissue Projections

Appendix I
Fish Tissue Projections Methods and Calculations

Fish Projection Methodology

Fish trending was conducted for five groupings of fish samples defined herein as fish trending Aquatic Biota Sampling Areas (ABSAs). These fish trending ABSAs were chosen to represent Area 1 as presented in the FS and are named as follows: ABSA-03, ABSA-04, ABSA-05, Urban, and Dams. The Urban and Dams designations were used to separate the river into two segments where Urban represents the free-flowing portion of the Kalamazoo starting in an urban area near Portage Creek, and Dams represents the quiescent portion of the Kalamazoo near the two Plainwell dams. The regression equations for these five fish trending ABSAs were used to project future fish tissue concentrations in Area 1. The original ABSA boundaries were established in *Final (Revised) Baseline Ecological Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site* (Site-wide BERA) CDM (2003a) and the Urban and Dams fish trending ABSAs were developed during discussions with the Kalamazoo Work Group, which consists of representatives from Georgia-Pacific, USEPA, and MDEQ. The fish trending ABSAs are defined as follows:

ABSA-03: Morrow Lake Dam to Mosel Avenue
ABSA-04: Mosel Avenue to Hwy 131 Bridge
ABSA-05: Hwy 131 Bridge to Former Plainwell Dam
Urban: Kalamazoo Avenue to D Avenue
Dams: D Avenue to Former Plainwell Dam

Each ABSA included one or more fish collection location(s). These collection locations are included in the fish trending ABSAs as follows:

Fish Trending ABSAs	Fish Sampling Locations					
	ABSA-3 Downstream of Morrow Dam	ABSA-3.5 Kalamazoo Avenue	ABSA-4 Mosel Avenue	ABSA-4.5 D Avenue	ABSA-4.6 Plainwell #2 Dam Area	ABSA-5 Former Plainwell Dam Area
ABSA-03	X	X				
ABSA-04			X	X	X	
ABSA-05						X
Urban		X	X	X		
Dams					X	X

Initial Fish Concentrations

Initial fish tissue concentrations were based on the median fish tissue concentrations for the Urban and Dams Areas from the 2006 - 2011 data. Starting concentrations are:

Areas	Smallmouth Bass Fillet*	Smallmouth Bass Young of Year Whole Body*	Common Carp Fillet*
Urban	0.22	0.73	4.1
Dams	0.38	1.3	3.3

*All concentrations are in mg/kg

Fish Concentration Risk Thresholds and Reference Concentrations

A number of fish concentration thresholds and reference concentrations were identified to aid the risk manager in selecting the remedial alternative. These concentrations are based on reference concentrations upstream of Area 1, ecological or human health risk-based concentrations, and State of Michigan fish consumption advisory level guidelines. Upstream reference concentrations were calculated as the median of the most recent year of data for each fish type for fish collected in Morrow Lake and in Ceresco Reservoir. The concentrations used as thresholds are:

	Smallmouth Bass Fillet	Smallmouth Bass Young of Year Whole Body	Common Carp Fillet§
Mink RBC*	NA	0.60	NA
Morrow Lake Reference*	0.23 (2012)	0.34 (2006)	0.29 (2012)
MDCH Fish Consumption Advisory: 2 meals per month*	0.11	NA	0.11
Human Health Fish Consumption RBC: High End Sports Angler (HQ = 1)*	0.072	NA	0.072
Human Health Fish Consumption RBC: High End Sports Angler (10^{-5})*	0.042	NA	0.042
Ceresco Reservoir Reference*	0.026 (2006)	0.12 (2006)	0.13 (2006)

RBC = Risk-based Concentration NA = Not applicable
*All concentrations are in mg/kg (Year) of median concentration
§MDCH does not currently recommend eating common carp from this section of the Kalamazoo. These values are presented as future goals.

SWAC Calculations

SWAC values for the top six inches (Interval 1) were used to represent the potential exposure of fish to sediment pre- and post-remediation. SWACs were calculated by arithmetic and GIS-based methods with upper and lower bounds as discussed during the November 21, 2013 meeting between GP/AMEC, USEPA, and MDEQ. The SWACs specific to Sections 2, 3 and 4 were used for remedial alternatives S-3 and S-4 projection calculations in the Urban Area because only these sections will be affected by these alternatives. The Interval 1 SWACs calculated using the arithmetic and GIS-based methods are (also see Table 4-4):

Alternative S-3	Remedial Reach SWACs (mg/kg) Interval 1		
	LCL	Best Est.(S-3C)	UCL
Pre Remediation	0.49	1.76	2.33
Post Remediation	0.35	1.09	1.06

Alternative S-4	Remedial Reach SWACs (mg/kg) Interval 1		
	LCL	Best Est. (S-4F)	UCL
Pre Remediation	0.49	1.76	2.23
Post Remediation	0.34	0.60	0.90

The area-wide SWACs were used for the remedial alternative S-5 projection calculations for the Urban and Dams Areas because S-5 affects Area 1 river-wide. The area-wide SWAC calculations for remedial alternative S-5 resulted in a pre-remediation SWAC of 0.59 mg/kg and post-remediation SWAC of 0.23 mg/kg and were used as the basis for the step down calculations in the fish projections.

Remediation and Step Down

Remedial activities, and the estimated time frame within which these occur, are discussed in Section 4.3 through 4.5 of the Area 1 FS. To project recovery times under each alternative, step down concentrations were calculated via two methods: a log-linear regression equation and a 10 percent fish to sediment ratio (fish:sediment).

The data from OU-5 indicate that a percent change in sediment concentration does not directly result in an equivalent percent change in fish tissue concentration because the biota-sediment accumulation factor (BSAF) does not remain constant with varying PCB concentrations in sediment. This is based on two lines of evidence: 1) a statistical evaluation provided by Kern (Enclosure 1 of MDEQ comments; MDEQ, 2013) and 2) data from the Bryant Mill Pond remediation area in Portage Creek, a tributary flowing into the Kalamazoo River in Area 1.

BSAF values from the Kalamazoo River were shown to exhibit a statistically significant difference as a function of sediment concentrations (MDEQ, 2013). In this evaluation, a log-linear regression equation was developed to express the relationship between fish tissue and sediment PCB concentrations. The log-linear regression equation was used to predict the Lower Bound scenario and Mid scenario for the step down in fish tissue concentration resulting from the change in sediment SWAC values associated with each remedial alternative. The log-linear regression equation (Equation 1) used to calculate fish concentrations after remedial activities are completed was calculated based on sediment concentrations pre- and post-remediation, fish concentrations prior to remedial activities, and the regression coefficient provided for each species (MDEQ, 2013) as follows:

$$C_{fish(post)} = C_{fish(pre)} * \left(\frac{C_{sediment\ (post)}}{C_{sediment\ (pre)}}\right)^{\beta_3} \qquad \textit{Equation 1}$$

Where C = concentration of designated media, β_3 = 0.62 for smallmouth bass fillets, β_3 = 0.61 for smallmouth bass young of year whole body, and β_3 = 0.73 for common carp fillets.

Empirical data from Bryant Mill Pond were used to predict the Upper Bound scenario for the step down for each fish species. The 10 percent fish:sediment ratio, based on Bryant Mill Pond data that was used to calculate the predicted step down in fish concentrations is dependent on the change in sediment concentrations from pre- to post-remedial activities. Post-remediation TCRA sediment concentrations decreased by two orders of magnitude from pre-remediation TCRA sediment concentrations at Bryant Mill Pond (Enclosure 1 of MDEQ comments; MDEQ, 2013). Post-remediation fish concentrations decreased by one order of magnitude from pre-remediation fish concentrations at Bryant Mill Pond (Enclosure 1 of MDEQ comments; MDEQ, 2013). This results in a ratio of 0.10 (fish:sediment) or 10 percent. The change in fish concentrations was calculated as 10 percent of the difference in pre- and post-remedial activity SWACs for sediment (Equation 2).

$$C_{fish(post)} = C_{fish(pre)} - \left(\frac{(C_{sediment(pre)} - C_{sediment(post)})}{C_{sediment(pre)}} * Ratio * C_{fish(pre)}\right)$$ *Equation 2*

The SWACs specific to the remedial reach in Sections 2, 3 and 4 were used for S-3 and S-4 projection calculations in the Urban Area and the area-wide SWACs were used for S-5 projection calculations for the Urban and Dams Areas.

The step down calculation method and inputs are specific for each fish type and provide Mid, Upper Bound, and Lower Bound Scenarios as follows:

Smallmouth bass fillet, smallmouth bass young of year whole body, and common carp fillet tissues:

- The 10 percent fish:sediment ratio was used to calculate the step down for the Upper Bound scenario
- The log-linear regression equation was used to calculate the step down for the Mid and Lower Bound scenarios

No change in concentrations is shown during the majority of the time period in which sediment remedial activities occur. The step down is shown as occurring during the last year of the remedial action period.

Projected Fish Concentration Reductions

Regression equations from fish trending ABSAs in the urban/free-flowing portions of the river (ABSA-03, ABSA-04, or Urban 1) were used to project fish concentrations for each of the remedial alternatives that affect the urban/free-flowing environment. Regression equations from fish trending ABSAs in the impounded or previously impounded portions of the river (ABSA-05 or Dams) were used to project fish concentrations for each of the remedial alternatives that affect the Dams Area. The following criteria were used to select the appropriate regression equations for the six ABSAs representative of Area 1. Regression equation selections are summarized on Tables I-1.1a, I-2.1a, and I-3.1a. Tables I-1.1b, I-2.1b, and I-3.1b present the reduction percentages associated with each selected regression equation.

Projection Criteria:

1. Regression equations were statistically tested for significance and those significantly different than zero ($p < 0.05$) were considered for potential use to project declines for the most likely concentration reduction scenario (Mid). If the available regression equations did not include a p-value < 0.05, an equation with a p-value approaching 0.05 was used.
2. Monitored Natural Recovery (MNR) percentages were selected as follows:
    - The regression equation that resulted in the median average annual percent decline (AAPD) was selected to represent the Mid-line. If only two significant regression equations were available, the lower of the AAPDs was selected to calculate a conservative projection.
    - The lower confidence limit (LCL) of the regression equation with the lowest AAPD was selected to represent the “upper bound” of time.
    - The upper confidence limit (UCL) of the regression equation with the highest AAPD was selected to represent the “lower bound” of time.
3. Recovery percentages were selected as follows:

- Upper Bound: The AAPD was used from the Mid scenario for MNR.
- Mid: An AADP was used with a power equation (i.e., calculated like reverse compound interest) and produces a curve with a decreasing slope over time. The selected AAPD was greater than the Mid AAPD for MNR and less than the AAPD for the lower bound.
- Lower Bound: The UCL of the highest AAPD from MNR was retained for the "lower bound".

Rationale for Regression Line Selection

Smallmouth Bass Fillet – Urban Area
S-2 (MNR):

Mid: Used the only significant (at an alpha of 0.05) AAPD available (ABSA-03).
Upper Bound: At least one regression was not significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations.
Lower Bound: The ABSA-03 regression line was significantly different than zero; the UCL of this regression was used to project the fastest potential rate of tissue decline for the lower bound.

S-3 (Removal of Hotspots in the Remedial Reach):

Mid: Used the only significant AAPD available (ABSA-03). A value of 4 percent for recovery was between the upper and lower bounds and, based on the scale of the remedial alternative, selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: At least one regression was not significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations. The ABSA-03 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: The ABSA-03 regression line was significantly different than zero; the UCL of this regression was used to project the fastest potential rate of tissue decline for the lower bound. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

S-4 (Removal of Hotspots in the Remedial Reach and Section 3 River Channel Edges):

Mid: Used the only significant AAPD available (ABSA-03). A value of 4 percent for recovery was between the upper and lower bounds and, based on the scale of the remedial alternative, selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: At least one regression was not significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations. The ABSA-03 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: The ABSA-03 regression line was significantly different than zero; the UCL of this regression was used to project the fastest potential rate of tissue decline for the lower bound. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

S-5 (Area 1-wide Removal):

Mid: Used the only significant AAPD available (ABSA-03). A value of 4.5 percent for recovery was between the upper and lower bounds and, based on the scale of the remedial alternative, selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.

Upper Bound: At least one regression was not significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations. The ABSA-03 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.

Lower Bound: The ABSA-03 regression line was significantly different than zero; the UCL of this regression was used to project the fastest potential rate of tissue decline for the lower bound. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

Smallmouth Bass Fillet – Dams Area

S-2 (MNR):

Mid: Used the lower of the two AAPDs from regression lines that were significantly different than zero.

Upper Bound: Used the lowest LCL of the two AAPDs from regression lines that were significantly different than zero.

Lower Bound: Used the highest UCL of the two AAPDs from regression lines that were significantly different than zero.

S-3 (Removal of Hotspots in the Remedial Reach):

No time projection calculated for this scenario because no remedial activities are planned to occur in the Dams Area for this alternative.

S-4 (Removal of Hotspots in the Remedial Reach and Section 3 River Channel Edges):

No time projection calculated for this scenario because no remedial activities are planned to occur in the Dams Area for this alternative.

S-5 (Area 1-wide Removal):

Mid: Used the lower of the two AAPDs from regression lines that were significantly different than zero. A value of 4 percent for recovery consistent with the Urban Area recovery was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.

Upper Bound: Used the lowest LCL of the two AAPDs from regression lines that were significantly different than zero. The ABSA-05 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.

Lower Bound: Used the highest UCL of the two AAPDs from regression lines that were significantly different than zero. The Dams UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

Smallmouth Bass Young of Year Whole Body – Urban Area
S-2 (MNR):

Mid: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because the regression was significantly different than zero (p = 0.057) at an alpha of 0.10.
Upper Bound: None of the calculated regression lines were significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations.
Lower Bound: None of the calculated regression lines were significantly different than zero. The UCL of the regression for ABSA-03 was used because it was the only regression significantly different than zero (p = 0.057) when an alpha value of 0.10 was considered.

S-3 (Removal of Hotspots in the Remedial Reach):

Mid: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because the regression was significantly different than zero (p = 0.057) at an alpha of 0.10. A value of 4 percent for recovery was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: None of the calculated regression lines were significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations. The ABSA-03 regression line was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because it was the only regression significantly different than zero (p = 0.057) when an alpha value of 0.10 was considered. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

S-4 (Removal of Hotspots in the Remedial Reach and Section 3 River Channel Edges):

Mid: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because the regression was significantly different than zero (p = 0.057) at an alpha of 0.10. A value of 4 percent for recovery was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: None of the calculated regression lines were significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations. The ABSA-03 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because it was the only regression significantly different than zero (p = 0.057) when an alpha value of 0.10 was considered. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

S-5 (Area 1-wide Removal):

Mid: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because the regression was significantly different than zero (p = 0.057) at an alpha of 0.10. A value of 4.5 percent for recovery that was between the upper and lower bounds and based on the scale of the remedial alternative was selected

for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: None of the calculated regression lines were significantly different than zero; an AAPD of zero was used to indicate no change in fish concentrations. The ABSA-03 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: None of the calculated regression lines were significantly different than zero. The regression for ABSA-03 was used because it was the only regression significantly different than zero ($p = 0.057$) when an alpha value of 0.10 was considered. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

Smallmouth Bass Young of Year Whole Body – Dams Area
S-2 (MNR):
Mid: Used the lower of the two AAPDs from regression lines that were significantly different than zero.
Upper Bound: Used the lowest LCL of the two AAPDs from regression lines that were significantly different than zero.
Lower Bound: Used the highest UCL of the two AAPDs from regression lines that were significantly different than zero.

S-3 (Removal of Hotspots in the Remedial Reach):
No time projection calculated for this scenario because no remedial activities are planned to occur in the Dams Area for this alternative.

S-4 (Removal of Hotspots in the Remedial Reach and Section 3 River Channel Edges):
No time projection calculated for this scenario because no remedial activities are planned to occur in the Dams Area for this alternative.

S-5 (Area 1-wide Removal):
Mid: Used the lower of the two AAPDs from regression lines that were significantly different than zero. A value of 8 percent for recovery was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: Used the lowest LCL of the two AAPDs from regression lines that were significantly different than zero. The Dams regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: Used the highest UCL of the two AAPDs from regression lines that were significantly different than zero. The ABSA-05 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

Common Carp Fillet – Urban Area
S-2 (MNR):
Mid: The median AAPD was used.
Upper Bound: The lowest LCL of the regression lines was used.
Lower Bound: The highest UCL of the regression lines was used.

S-3 (Removal of Hotspots in the Remedial Reach):

Mid: The median AAPD was used. A value of 3.5 percent for recovery that was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.

Upper Bound: The lowest LCL of the regression lines was used. The Urban 1regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.

Lower Bound: The highest UCL of the regression lines was used. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

S-4 (Removal of Hotspots in the Remedial Reach and Section 3 River Channel Edges):

Mid: The median AAPD was used. A value of 3.5 percent for recovery that was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.

Upper Bound: The lowest LCL of the regression lines was used. The Urban 1 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.

Lower Bound: The highest UCL of the regression lines was used. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

S-5 (Area 1-wide Removal):

Mid: The median AAPD was used. A value of 4.5 percent for recovery was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.

Upper Bound: The lowest LCL of the regression lines was used. The Urban 1 regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.

Lower Bound: The highest UCL of the regression lines was used. The ABSA-03 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

Common Carp Fillet – Dams Area

S-2 (MNR):

Mid: Used the lower of the two AAPDs from regression lines that were significantly different than zero.

Upper Bound: Used the lower LCL of the two AAPDs from regression lines that were significantly different than zero.

Lower Bound: Used the higher UCL of the two AAPDs from regression lines that were significantly different than zero.

S-3 (Removal of Hotspots in the Remedial Reach):

No time projection calculated for this scenario because no remedial activities are planned to occur in the Dams Area for this alternative.

S-4 (Removal of Hotspots in the Remedial Reach and Section 3 River Channel Edges):
No time projection calculated for this scenario because no remedial activities are planned to occur in the Dams Area for this alternative.

S-5 (Area 1-wide Removal):
Mid: Used the lower of the two AAPDs from regression lines that were significantly different than zero. A value of 3.5 percent for recovery was between the upper and lower bounds and based on the scale of the remedial alternative was selected for use in a power equation. Step down due to remediation quantified by using the log-linear regression equation.
Upper Bound: Used the lower LCL of the two AAPDs from regression lines that were significantly different than zero. The Dams regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the 10 percent fish:sediment ratio.
Lower Bound: Used the higher UCL of the two AAPDs from regression lines that were significantly different than zero. ABSA-05 UCL of the regression was used to calculate the recovery percentage. Step down due to remediation quantified by using the log-linear regression equation.

References

CDM. 2003a. *Final (Revised) Baseline Ecological Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site* (Site-Wide BERA). Prepared on behalf of the MDEQ Remediation and Redevelopment Division. April 2003.

Michigan Department of Environmental Quality (MDEQ). 2013. Enclosure 1: Temporal Trends and Analysis of Selected Remedial Alternatives for Area 1 of the Kalamazoo River Superfund Site *in* MDEQ comments for Draft Area 1 Feasibility Study Report – Morrow Dam to Former Plainwell Dam, Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. February 15, 2013.

Table I-1.1a Smallmouth Bass Fillet Equations

S-2 (Includes Urban and Dam)						
	Urban Area			Dams Area		
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
MNR	0%	ABSA-03	ABSA-03 UCL	ABSA-05 LCL	ABSA-05	Dams UCL
Recovery	0%	ABSA-03	ABSA-03 UCL	ABSA-05 LCL	ABSA-05	Dams UCL
S-3 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	0%	ABSA-03	ABSA-03 UCL	--	--	--
2 Year Step Down	0.1	LogLinear	LogLinear	--	--	--
Recovery	ABSA-03	(power)	ABSA-03 UCL	--	--	--
S-4 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	0%	ABSA-03	ABSA-03 UCL	--	--	--
4 Year Step Down	0.1	LogLinear	LogLinear	--	--	--
Recovery	ABSA-03	(power)	ABSA-03 UCL	--	--	--
S-5 (Includes Urban and Dam)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	0%	ABSA-03	ABSA-03 UCL	ABSA-05 LCL	ABSA-05	Dams UCL
10 Year Step Down	0.1	LogLinear	LogLinear	0.1	LogLinear	LogLinear
Recovery	ABSA-03	(power)	ABSA-03 UCL	ABSA-05	(power)	Dams UCL

Notes:
ABSA notation refers to the fish regression equations for Aquatic Biota Sampling Areas (ABSA) presented in Appendix B
-- Not calculated

Prepared by/Date: LSV 10/30/13
Checked by/Date: EFC 10/30/13
Revised by/Date: NSR 10/29/14
Checked by/Date: EFC 10/29/14

Table I-1.1b Smallmouth Bass Fillet Percentages

S-2 (Includes Urban and Dam)						
	Urban Area			Dams Area		
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
MNR	0%	3.4%	5.1%	0.33%	2.3%	4.1%
Recovery	0%	3.4%	5.1%	0.33%	2.3%	4.1%

Notes:
Percentages with no (explanation) calculated from the log-linear regression

S-3 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0%	3.4%	5.1%	--	--	--
2 Year Step Down (mg/kg)	0.0063	0.049	0.066	--	--	--
Recovery (%)	3.4%	4% (power)	5.1%	--	--	--

Notes:
Used SWACs based on GIS and Arithmetic approaches for Remedial Reach (see Table 4-4 for SWAC values)
-- Not calculated
Percentages with no (explanation) calculated from the log-linear regression

S-4 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0%	1.9%	5.1%	--	--	--
4 Year Step Down (mg/kg)	0.0067	0.092	0.075	--	--	--
Recovery (%)	3.4%	4% (power)	5.1%	--	--	--

Notes:
Used SWACs based on GIS and Arithmetic approaches for Remedial Reach (see Table 4-4 for SWAC values)
-- Not calculated
Percentages with no (explanation) calculated from the log-linear regression

S-5 (Includes Urban and Dam)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0%	1.9%	5.1%	0.33%	2.3%	4.1%
10 Year Step Down (mg/kg)	0.013	0.084	0.077	0.023	0.15	0.14
Recovery (%)	3.4%	4.5% (power)	5.1%	2.3%	4% (power)	4.1%

Notes:
Used Area 1 Wide SWAC (see Section 4.7.2.1)
Percentages with no (explanation) calculated from a log-linear regression

Prepared by/Date: NHS 01/14/14
Checked by/Date: LSV 01/14/14
Revised by/Date: NSR 10/29/14
Checked by/Date: EFC 10/29/14

Table I-1.2
Summary of Years from Initiation of Remediation to Achieve Smallmouth Bass Fillet Concentration Thresholds
Area 1, OU5 Kalamazoo River

		Fish Concentration Thresholds									
		2012 Morrow Lake Reference Concentration 0.23 mg/kg		MDCH: 2 Meals Per Month 0.11 mg/kg		Human Health Fish Consumption RBC: High End Sport Angler (HQ =1) 0.072 mg/kg		Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) 0.042 mg/kg		2006 Ceresco Reservoir Reference Concentration 0.026 mg/kg	
	Remedial Alternative Scenarios	Urban	Dam	Urban	Dam	Urban	Dam	Urban	Dam	Urban	Dam
S-2	Lower Bound S-2: (MNR)	Achieved	9	9	25	17	35	26	47	34	57
	S-2: (MNR)	Achieved	18	16	47	29	65	43	87	56	106
	Upper Bound S-2: (MNR)	Achieved	151	NA	375	NA	504	NA	667	NA	813
S-3	Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)	Achieved	NC	2	NC	9	NC	18	NC	26	NC
	S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	Achieved	NC	7	NC	19	NC	32	NC	43	NC
	Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	Achieved	NC	19	NC	32	NC	46	NC	59	NC
S-4	Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)	Achieved	NC	4	NC	10	NC	19	NC	27	NC
	S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	Achieved	NC	4	NC	12	NC	25	NC	36	NC
	Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	Achieved	NC	21	NC	34	NC	48	NC	61	NC
S-5	Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)	Achieved	10	10	20	15	30	24	42	32	52
	S-5: Area-wide Removal (Mid Approximation Step Down)	Achieved	10	10	23	19	34	30	47	41	59
	Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)	Achieved	29	26	56	39	74	53	96	66	115

Notes:
NA = Not Achievable under this scenario
NC = Not Calculated
RBC = Risk-Based Concentration
MDCH = Michigan Department of Community Health
mg/kg = milligrams per kilogram

Prepared by/Date: NHS 11/14/13
Checked by/Date: NTG 01/11/14
Revised by/Date: NSR 10/29/14
Checked by/Date: EFC 10/29/14

Table I-1.3a
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-2
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[a]
Urban	0.22	0.23	0.11	0.072	0.042	0.026
Dams	0.38	0.23	0.11	0.072	0.042	0.026

S-2
0 years for remediation and step down

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-2 MNR	0	-0.00329	-0.0369	-0.0248	-0.0592	-0.0455

Upper Bound S-2: (MNR)

	Years to Reach:				
	0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	Achieved	Concentration Not Achievable			
Dams	151	375	504	667	813

S-2: (MNR)

	Years to Reach:				
	0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	Achieved	16	29	43	56
Dams	18	47	65	87	106

Lower Bound S-2: (MNR)

	Years to Reach:				
	0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	Achieved	9	17	26	34
Dams	9	25	35	47	57

	Process	Upper Bound S-2: (MNR)		Process	S-2: (MNR)		Process	Lower Bound S-2: (MNR)	
Years[d]	Occurring	Urban	Dams	Occurring	Urban	Dams	Occurring	Urban	Dams
2011	Current	0.22	0.38	Current	0.22	0.38	Current	0.22	0.38
2012	MNR	0.22	0.38	MNR	0.21	0.37	MNR	0.21	0.36
0	MNR	0.22	0.38	MNR	0.20	0.36	MNR	0.20	0.35
1	MNR	0.22	0.38	MNR	0.20	0.35	MNR	0.18	0.33
2	MNR	0.22	0.38	MNR	0.19	0.34	MNR	0.17	0.32
3	MNR	0.22	0.37	MNR	0.18	0.34	MNR	0.16	0.30
4	MNR	0.22	0.37	MNR	0.18	0.33	MNR	0.15	0.29
5	MNR	0.22	0.37	MNR	0.17	0.32	MNR	0.15	0.28
6	MNR	0.22	0.37	MNR	0.16	0.31	MNR	0.14	0.26
7	MNR	0.22	0.37	MNR	0.16	0.30	MNR	0.13	0.25
8	MNR	0.22	0.37	MNR	0.15	0.30	MNR	0.12	0.24
9	MNR	0.22	0.37	MNR	0.15	0.29	MNR	0.11	0.23
10	MNR	0.22	0.37	MNR	0.14	0.28	MNR	0.11	0.22
11	MNR	0.22	0.36	MNR	0.14	0.28	MNR	0.10	0.21
12	MNR	0.22	0.36	MNR	0.13	0.27	MNR	0.10	0.20
13	MNR	0.22	0.36	MNR	0.13	0.26	MNR	0.090	0.19
14	MNR	0.22	0.36	MNR	0.12	0.26	MNR	0.085	0.18
15	MNR	0.22	0.36	MNR	0.12	0.25	MNR	0.080	0.18
16	MNR	0.22	0.36	MNR	0.11	0.24	MNR	0.076	0.17
17	MNR	0.22	0.36	MNR	0.11	0.24	MNR	0.071	0.16
18	MNR	0.22	0.36	MNR	0.11	0.23	MNR	0.067	0.15
19	MNR	0.22	0.35	MNR	0.10	0.23	MNR	0.063	0.15
20	MNR	0.22	0.35	MNR	0.10	0.22	MNR	0.060	0.14
21	MNR	0.22	0.35	MNR	0.094	0.21	MNR	0.056	0.13
22	MNR	0.22	0.35	MNR	0.091	0.21	MNR	0.053	0.13
23	MNR	0.22	0.35	MNR	0.087	0.20	MNR	0.050	0.12
24	MNR	0.22	0.35	MNR	0.084	0.20	MNR	0.047	0.12
25	MNR	0.22	0.35	MNR	0.081	0.19	MNR	0.044	0.11
26	MNR	0.22	0.35	MNR	0.078	0.19	MNR	0.042	0.11
27	MNR	0.22	0.35	MNR	0.075	0.18	MNR	0.039	0.10
28	MNR	0.22	0.34	MNR	0.073	0.18	MNR	0.037	0.10
29	MNR	0.22	0.34	MNR	0.070	0.18	MNR	0.035	0.093
30	MNR	0.22	0.34	MNR	0.068	0.17	MNR	0.033	0.089
31	MNR	0.22	0.34	MNR	0.065	0.17	MNR	0.031	0.085
32	MNR	0.22	0.34	MNR	0.063	0.16	MNR	0.029	0.081
33	MNR	0.22	0.34	MNR	0.060	0.16	MNR	0.028	0.077
34	MNR	0.22	0.34	MNR	0.058	0.16	MNR	0.026	0.074
35	MNR	0.22	0.34	MNR	0.056	0.15	MNR		0.071
36	MNR	0.22	0.34	MNR	0.054	0.15	MNR		0.068
37	MNR	0.22	0.33	MNR	0.052	0.14	MNR		0.065
38	MNR	0.22	0.33	MNR	0.050	0.14	MNR		0.062
39	MNR	0.22	0.33	MNR	0.048	0.14	MNR		0.059
40	MNR	0.22	0.33	MNR	0.047	0.13	MNR		0.056
41	MNR	0.22	0.33	MNR	0.045	0.13	MNR		0.054
42	MNR	0.22	0.33	MNR	0.043	0.13	MNR		0.051
43	MNR	0.22	0.33	MNR	0.042	0.12	MNR		0.049

Table I-1.3a
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-2
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[a]
Urban	0.22	0.23	0.11	0.072	0.042	0.026
Dams	0.38	0.23	0.11	0.072	0.042	0.026

S-2
0 years for remediation and step down

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-2 MNR	0	-0.00329	-0.0369	-0.0248	-0.0592	-0.0455

Upper Bound S-2: (MNR)

	Years to Reach:				
	0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	Achieved	Concentration Not Achievable			
Dams	151	375	504	667	813

S-2: (MNR)

	Years to Reach:				
	0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	Achieved	16	29	43	56
Dams	18	47	65	87	106

Lower Bound S-2: (MNR)

	Years to Reach:				
	0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	Achieved	9	17	26	34
Dams	9	25	35	47	57

	Process	Upper Bound S-2: (MNR)		Process	S-2: (MNR)		Process	Lower Bound S-2: (MNR)	
Years[d]	Occurring	Urban	Dams	Occurring	Urban	Dams	Occurring	Urban	Dams
44	MNR	0.22	0.33	MNR	0.040	0.12	MNR		0.047
45	MNR	0.22	0.33	MNR	0.039	0.12	MNR		0.045
46	MNR	0.22	0.32	MNR	0.037	0.12	MNR		0.043
47	MNR	0.22	0.32	MNR	0.036	0.11	MNR		0.041
48	MNR	0.22	0.32	MNR	0.035	0.11	MNR		0.039
49	MNR	0.22	0.32	MNR	0.033	0.11	MNR		0.037
50	MNR	0.22	0.32	MNR	0.032	0.10	MNR		0.036
51	MNR	0.22	0.32	MNR	0.031	0.10	MNR		0.034
52	MNR	0.22	0.32	MNR	0.030	0.10	MNR		0.033
53	MNR	0.22	0.32	MNR	0.029	0.10	MNR		0.031
54	MNR	0.22	0.32	MNR	0.028	0.095	MNR		0.030
55	MNR	0.22	0.32	MNR	0.027	0.092	MNR		0.028
56	MNR	0.22	0.31	MNR	0.026	0.090	MNR		0.027
57	MNR	0.22	0.31	MNR		0.088	MNR		0.026
58	MNR	0.22	0.31	MNR		0.086			
59	MNR	0.22	0.31	MNR		0.083			
60	MNR	0.22	0.31	MNR		0.081			
61	MNR	0.22	0.31	MNR		0.079			
62	MNR	0.22	0.31	MNR		0.077			
63	MNR	0.22	0.31	MNR		0.076			
64	MNR	0.22	0.31	MNR		0.074			
65	MNR	0.22	0.30	MNR		0.072			
66	MNR	0.22	0.30	MNR		0.070			
67	MNR	0.22	0.30	MNR		0.068			
68	MNR	0.22	0.30	MNR		0.067			
69	MNR	0.22	0.30	MNR		0.065			
70	MNR	0.22	0.30	MNR		0.064			
71	MNR	0.22	0.30	MNR		0.062			
72	MNR	0.22	0.30	MNR		0.060			
73	MNR	0.22	0.30	MNR		0.059			
74	MNR	0.22	0.30	MNR		0.057			
75	MNR	0.22	0.29	MNR		0.056			
76	MNR	0.22	0.29	MNR		0.055			
77	MNR	0.22	0.29	MNR		0.053			
78	MNR	0.22	0.29	MNR		0.052			
79	MNR	0.22	0.29	MNR		0.051			
80	MNR	0.22	0.29	MNR		0.050			
81	MNR	0.22	0.29	MNR		0.048			
82	MNR	0.22	0.29	MNR		0.047			
83	MNR	0.22	0.29	MNR		0.046			
84	MNR	0.22	0.29	MNR		0.045			
85	MNR	0.22	0.29	MNR		0.044			
86	MNR	0.22	0.28	MNR		0.043			
87	MNR	0.22	0.28	MNR		0.042			
88	MNR	0.22	0.28	MNR		0.041			
89	MNR	0.22	0.28	MNR		0.040			
90	MNR	0.22	0.28	MNR		0.039			
91	MNR	0.22	0.28	MNR		0.038			
92	MNR	0.22	0.28	MNR		0.037			
93	MNR	0.22	0.28	MNR		0.036			
94	MNR	0.22	0.28	MNR		0.035			
95	MNR	0.22	0.28	MNR		0.034			
96	MNR	0.22	0.28	MNR		0.033			
97	MNR	0.22	0.27	MNR		0.032			
98	MNR	0.22	0.27	MNR		0.032			
99	MNR	0.22	0.27	MNR		0.031			
100	MNR	0.22	0.27	MNR		0.030			
101	MNR	0.22	0.27	MNR		0.029			
102	MNR	0.22	0.27	MNR		0.029			
103	MNR	0.22	0.27	MNR		0.028			
104	MNR	0.22	0.27	MNR		0.027			
105	MNR	0.22	0.27	MNR		0.027			
106	MNR	0.22	0.27	MNR		0.026			
107	MNR	0.22	0.27						
108	MNR	0.22	0.26						
109	MNR	0.22	0.26						
110	MNR	0.22	0.26						
111	MNR	0.22	0.26						
112	MNR	0.22	0.26						
113	MNR	0.22	0.26						
114	MNR	0.22	0.26						
115	MNR	0.22	0.26						
116	MNR	0.22	0.26						
117	MNR	0.22	0.26						

Notes:
(a) Ceresco Reservoir fish concentration is less than MDCH Fish Consumption Advisory Level. Therefore, MDCH value is concentration to achieve.
(b) See Calculation Below
(c) Years calculated since remediation started, for S-2 this is at Year 0
(d) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-based Concentration
MDCH = Michigan Department of Community Health
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

Table I-1.3b
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-3
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[a]
Urban	0.22	0.23	0.11	0.072	0.042	0.026

S-3
2 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.33
Post SWAC =	0.35	1.09	1.06

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-3 MNR	0	-0.0369	-0.0592
S-3 Recovery	-0.0369	4	-0.0592

Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	19	32	46	59

S-3: Section 2-4 Hotspots (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	7	19	32	43

Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	2	9	18	26

Years[d]	Process Occurring	Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	Process Occurring	S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	Process Occurring	Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)
2011	Current	0.22	Current	0.22	Current	0.22
2012	MNR	0.22	MNR	0.21	MNR	0.21
2013	MNR	0.22	MNR	0.20	MNR	0.20
2014/ROD	MNR	0.22	MNR	0.20	MNR	0.18
RD 1	MNR	0.22	MNR	0.19	MNR	0.17
1	2 years for Removal	0.22	2 years for Removal	0.19	2 years for Removal Action	0.17
2	Action and Step Down	0.21	Action and Step Down	0.14	and Step Down	0.11
3	Recovery	0.21	Recovery	0.14	Recovery	0.10
4	Recovery	0.20	Recovery	0.13	Recovery	0.095
5	Recovery	0.19	Recovery	0.12	Recovery	0.089
6	Recovery	0.18	Recovery	0.12	Recovery	0.084
7	Recovery	0.18	Recovery	0.11	Recovery	0.079
8	Recovery	0.17	Recovery	0.11	Recovery	0.075
9	Recovery	0.17	Recovery	0.11	Recovery	0.070
10	Recovery	0.16	Recovery	0.10	Recovery	0.066
11	Recovery	0.15	Recovery	0.098	Recovery	0.063
12	Recovery	0.15	Recovery	0.094	Recovery	0.059
13	Recovery	0.14	Recovery	0.090	Recovery	0.056
14	Recovery	0.14	Recovery	0.086	Recovery	0.052
15	Recovery	0.13	Recovery	0.083	Recovery	0.049
16	Recovery	0.13	Recovery	0.080	Recovery	0.046
17	Recovery	0.12	Recovery	0.076	Recovery	0.044
18	Recovery	0.12	Recovery	0.073	Recovery	0.041
19	Recovery	0.11	Recovery	0.070	Recovery	0.039
20	Recovery	0.11	Recovery	0.068	Recovery	0.037
21	Recovery	0.11	Recovery	0.065	Recovery	0.035
22	Recovery	0.10	Recovery	0.062	Recovery	0.033
23	Recovery	0.098	Recovery	0.060	Recovery	0.031
24	Recovery	0.095	Recovery	0.057	Recovery	0.029
25	Recovery	0.091	Recovery	0.055	Recovery	0.027
26	Recovery	0.088	Recovery	0.053	Recovery	0.026
27	Recovery	0.085	Recovery	0.051		
28	Recovery	0.082	Recovery	0.049		
29	Recovery	0.079	Recovery	0.047		
30	Recovery	0.076	Recovery	0.045		
31	Recovery	0.073	Recovery	0.043		
32	Recovery	0.071	Recovery	0.041		
33	Recovery	0.068	Recovery	0.040		
34	Recovery	0.066	Recovery	0.038		
35	Recovery	0.063	Recovery	0.037		
36	Recovery	0.061	Recovery	0.035		
37	Recovery	0.059	Recovery	0.034		
38	Recovery	0.057	Recovery	0.032		
39	Recovery	0.055	Recovery	0.031		
40	Recovery	0.053	Recovery	0.030		
41	Recovery	0.051	Recovery	0.029		

Table I-1.3b
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-3
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[a]
Urban	0.22	0.23	0.11	0.072	0.042	0.026

S-3
2 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.33
Post SWAC =	0.35	1.09	1.06

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-3 MNR	0	-0.0369	-0.0592
S-3 Recovery	-0.0369	4	-0.0592

Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	19	32	46	59

S-3: Section 2-4 Hotspots (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	7	19	32	43

Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	2	9	18	26

Years[d]	Process Occurring	Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	Process Occurring	S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	Process Occurring	Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)
42	Recovery	0.049	Recovery	0.028		
43	Recovery	0.047	Recovery	0.026		
44	Recovery	0.045				
45	Recovery	0.044				
46	Recovery	0.042				
47	Recovery	0.041				
48	Recovery	0.039				
49	Recovery	0.038				
50	Recovery	0.036				
51	Recovery	0.035				
52	Recovery	0.034				
53	Recovery	0.033				
54	Recovery	0.031				
55	Recovery	0.030				
56	Recovery	0.029				
57	Recovery	0.028				
58	Recovery	0.027				
59	Recovery	0.026				
60						
61						
62						
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Notes:
(a) Ceresco Reservoir fish concentration is less than MDCH Fish Consumption Advisory Level. Therefore, MDCH value is concentration to achieve.
(b) See Calculation Below
(c) Years calculated since remediation started, for S-2 this is at Year 0
(d) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-based Concentration
MDCH = Michigan Department of Community Health
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

Table I-1.3c
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-4
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[(a)]
Urban	0.22	0.23	0.11	0.072	0.042	0.026

S-4
4 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.23
Post SWAC =	0.34	0.60	0.90

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-4 MNR	0	-0.0369	-0.0592
S-4 Recovery	-0.0369	4	-0.0592

Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[(b,c)]	0.11 mg/kg[(b,c)]	0.072 mg/kg[(b,c)]	0.042 mg/kg[(b,c)]	0.026 mg/kg[(b,c)]
Urban	2	Achieved	21	34	48	61

S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[(b,c)]	0.11 mg/kg[(b,c)]	0.072 mg/kg[(b,c)]	0.042 mg/kg[(b,c)]	0.026 mg/kg[(b,c)]
Urban	2	Achieved	4	12	25	36

Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[(b,c)]	0.11 mg/kg[(b,c)]	0.072 mg/kg[(b,c)]	0.042 mg/kg[(b,c)]	0.026 mg/kg[(b,c)]
Urban	2	Achieved	4	10	19	27

Years[d]	Process Occurring	Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	Process Occurring	S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	Process Occurring	Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)
2011	Current	0.22	Current	0.22	Current	0.22
2012	MNR	0.22	MNR	0.21	MNR	0.21
2013	MNR	0.22	MNR	0.20	MNR	0.20
2014/ROD	MNR	0.22	MNR	0.20	MNR	0.18
RD 1	MNR	0.22	MNR	0.19	MNR	0.17
1		0.22		0.19		0.17
2	4 years for Removal	0.22	4 years for	0.19	4 years for Removal	0.17
3	Action and Step Down	0.22	Removal Action	0.19	Action and Step Down	0.17
4		0.21	and Step Down	0.097		0.099
5	Recovery	0.21	Recovery	0.093	Recovery	0.093
6	Recovery	0.20	Recovery	0.090	Recovery	0.088
7	Recovery	0.19	Recovery	0.086	Recovery	0.083
8	Recovery	0.18	Recovery	0.083	Recovery	0.078
9	Recovery	0.18	Recovery	0.079	Recovery	0.074
10	Recovery	0.17	Recovery	0.076	Recovery	0.069
11	Recovery	0.16	Recovery	0.073	Recovery	0.065
12	Recovery	0.16	Recovery	0.070	Recovery	0.062
13	Recovery	0.15	Recovery	0.067	Recovery	0.058
14	Recovery	0.15	Recovery	0.065	Recovery	0.055
15	Recovery	0.14	Recovery	0.062	Recovery	0.052
16	Recovery	0.14	Recovery	0.060	Recovery	0.049
17	Recovery	0.13	Recovery	0.057	Recovery	0.046
18	Recovery	0.13	Recovery	0.055	Recovery	0.043
19	Recovery	0.12	Recovery	0.053	Recovery	0.041
20	Recovery	0.12	Recovery	0.051	Recovery	0.038
21	Recovery	0.11	Recovery	0.049	Recovery	0.036
22	Recovery	0.11	Recovery	0.047	Recovery	0.034
23	Recovery	0.11	Recovery	0.045	Recovery	0.032
24	Recovery	0.10	Recovery	0.043	Recovery	0.030
25	Recovery	0.10	Recovery	0.041	Recovery	0.029
26	Recovery	0.095	Recovery	0.040	Recovery	0.027
27	Recovery	0.091	Recovery	0.038	Recovery	0.025
28	Recovery	0.088	Recovery	0.037		
29	Recovery	0.085	Recovery	0.035		
30	Recovery	0.082	Recovery	0.034		
31	Recovery	0.079	Recovery	0.032		
32	Recovery	0.076	Recovery	0.031		
33	Recovery	0.073	Recovery	0.030		
34	Recovery	0.070	Recovery	0.029		
35	Recovery	0.068	Recovery	0.027		
36	Recovery	0.065	Recovery	0.026		
37	Recovery	0.063				
38	Recovery	0.061				
39	Recovery	0.059				
40	Recovery	0.056				
41	Recovery	0.054				

Table I-1.3c
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-4
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[(a)]
Urban	0.22	0.23	0.11	0.072	0.042	0.026

S-4
4 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.23
Post SWAC =	0.34	0.60	0.90

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-4 MNR	0	-0.0369	-0.0592
S-4 Recovery	-0.0369	4	-0.0592

Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[(b,c)]	0.11 mg/kg[(b,c)]	0.072 mg/kg[(b,c)]	0.042 mg/kg[(b,c)]	0.026 mg/kg[(b,c)]
Urban	2	Achieved	21	34	48	61

S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[(b,c)]	0.11 mg/kg[(b,c)]	0.072 mg/kg[(b,c)]	0.042 mg/kg[(b,c)]	0.026 mg/kg[(b,c)]
Urban	2	Achieved	4	12	25	36

Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[(b,c)]	0.11 mg/kg[(b,c)]	0.072 mg/kg[(b,c)]	0.042 mg/kg[(b,c)]	0.026 mg/kg[(b,c)]
Urban	2	Achieved	4	10	19	27

Years[d]	Process Occurring	Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	Process Occurring	S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	Process Occurring	Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)
42	Recovery	0.052				
43	Recovery	0.051				
44	Recovery	0.049				
45	Recovery	0.047				
46	Recovery	0.045				
47	Recovery	0.044				
48	Recovery	0.042				
49	Recovery	0.041				
50	Recovery	0.039				
51	Recovery	0.038				
52	Recovery	0.036				
53	Recovery	0.035				
54	Recovery	0.034				
55	Recovery	0.032				
56	Recovery	0.031				
57	Recovery	0.030				
58	Recovery	0.029				
59	Recovery	0.028				
60	Recovery	0.027				
61	Recovery	0.026				

Notes:
(a) Ceresco Reservoir fish concentration is less than MDCH Fish Consumption Advisory Level. Therefore, MDCH value is concentration to achieve.
(b) See Calculation Below
(c) Years calculated since remediation started, for S-2 this is at Year 0
(d) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-based Concentration
MDCH = Michigan Department of Community Health
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

Table I-1.3d
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-5
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[a]
Urban	0.22	0.23	0.11	0.072	0.042	0.026
Dams	0.38	0.23	0.11	0.072	0.042	0.026

S-5
10 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.59	0.59	0.59
Post SWAC =	0.23	0.23	0.23

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-5 MNR	0	-0.00329	-0.0369	-0.0248	-0.0592	-0.0455
S-5 Recovery	-0.0369	-0.0248	4.5	4	-0.0592	-0.0455

Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	26	39	53	66
Dams	2	29	56	74	96	115

S-5: Area-wide Removal (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	10	19	30	41
Dams	2	10	23	34	47	59

Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	10	15	24	32
Dams	2	10	20	30	42	52

	Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)			S-5: Area-wide Removal (Mid Approximation Step Down)			Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)		
Years[d]	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams
2011	Current	0.22	0.38	Current	0.22	0.38	Current	0.22	0.38
2012	MNR	0.22	0.38	MNR	0.21	0.37	MNR	0.21	0.36
2013	MNR	0.22	0.38	MNR	0.20	0.36	MNR	0.20	0.35
2014/ROD	MNR	0.22	0.38	MNR	0.20	0.35	MNR	0.18	0.33
RD 1	MNR	0.22	0.38	MNR	0.19	0.34	MNR	0.17	0.32
1		0.22	0.38		0.19	0.34		0.17	0.32
2		0.22	0.38		0.19	0.34		0.17	0.32
3		0.22	0.38		0.19	0.34		0.17	0.32
4		0.22	0.38		0.19	0.34		0.17	0.32
5	10 years for Removal Action and Step Down	0.22	0.38	10 years for Removal Action and Step Down	0.19	0.34	10 years for Removal Action and Step Down	0.17	0.32
6		0.22	0.38		0.19	0.34		0.17	0.32
7		0.22	0.38		0.19	0.34		0.17	0.32
8		0.22	0.38		0.19	0.34		0.17	0.32
9		0.22	0.38		0.19	0.34		0.17	0.32
10		0.21	0.35		0.11	0.19		0.10	0.18
11	Recovery	0.20	0.34	Recovery	0.10	0.18	Recovery	0.091	0.17
12	Recovery	0.19	0.34	Recovery	0.10	0.18	Recovery	0.086	0.16
13	Recovery	0.18	0.33	Recovery	0.092	0.17	Recovery	0.081	0.15
14	Recovery	0.18	0.32	Recovery	0.088	0.16	Recovery	0.076	0.15
15	Recovery	0.17	0.31	Recovery	0.084	0.16	Recovery	0.072	0.14
16	Recovery	0.17	0.30	Recovery	0.080	0.15	Recovery	0.068	0.13
17	Recovery	0.16	0.30	Recovery	0.077	0.14	Recovery	0.064	0.13
18	Recovery	0.15	0.29	Recovery	0.073	0.14	Recovery	0.060	0.12
19	Recovery	0.15	0.28	Recovery	0.070	0.13	Recovery	0.057	0.12
20	Recovery	0.14	0.27	Recovery	0.067	0.13	Recovery	0.054	0.11
21	Recovery	0.14	0.27	Recovery	0.064	0.12	Recovery	0.050	0.11
22	Recovery	0.13	0.26	Recovery	0.061	0.12	Recovery	0.048	0.10
23	Recovery	0.13	0.25	Recovery	0.058	0.11	Recovery	0.045	0.10
24	Recovery	0.12	0.25	Recovery	0.056	0.11	Recovery	0.042	0.093
25	Recovery	0.12	0.24	Recovery	0.053	0.10	Recovery	0.040	0.089
26	Recovery	0.11	0.24	Recovery	0.051	0.10	Recovery	0.038	0.085
27	Recovery	0.11	0.23	Recovery	0.048	0.10	Recovery	0.035	0.082
28	Recovery	0.11	0.23	Recovery	0.046	0.092	Recovery	0.033	0.078
29	Recovery	0.10	0.22	Recovery	0.044	0.088	Recovery	0.031	0.074
30	Recovery	0.10	0.21	Recovery	0.042	0.085	Recovery	0.030	0.071
31	Recovery	0.095	0.21	Recovery	0.040	0.081	Recovery	0.028	0.068
32	Recovery	0.092	0.20	Recovery	0.038	0.078	Recovery	0.026	0.065
33	Recovery	0.088	0.20	Recovery	0.037	0.075	Recovery		0.062
34	Recovery	0.085	0.19	Recovery	0.035	0.072	Recovery		0.059
35	Recovery	0.082	0.19	Recovery	0.033	0.069	Recovery		0.057
36	Recovery	0.079	0.18	Recovery	0.032	0.066	Recovery		0.054
37	Recovery	0.076	0.18	Recovery	0.031	0.064	Recovery		0.052
38	Recovery	0.073	0.18	Recovery	0.029	0.061	Recovery		0.049
39	Recovery	0.071	0.17	Recovery	0.028	0.059	Recovery		0.047
40	Recovery	0.068	0.17	Recovery	0.027	0.056	Recovery		0.045
41	Recovery	0.066	0.16	Recovery	0.025	0.054	Recovery		0.043

Table I-1.3d
Calculation of Smallmouth Bass Fillet Tissue Projections for Remedial Alternative S-5
Area 1, OU5 Kalamazoo River

	Current Concentration (2006 - 2011 median)	2012 Morrow Lake Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler (HQ =1)	Human Health Fish Consumption RBC: High End Sport Angler (10^{-5})	2006 Ceresco Reservoir Reference Concentration[a]
Urban	0.22	0.23	0.11	0.072	0.042	0.026
Dams	0.38	0.23	0.11	0.072	0.042	0.026

S-5
10 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.59	0.59	0.59
Post SWAC =	0.23	0.23	0.23

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-5 MNR	0	-0.00329	-0.0369	-0.0248	-0.0592	-0.0455
S-5 Recovery	-0.0369	-0.0248	4.5	4	-0.0592	-0.0455

Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	26	39	53	66
Dams	2	29	56	74	96	115

S-5: Area-wide Removal (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	10	19	30	41
Dams	2	10	23	34	47	59

Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

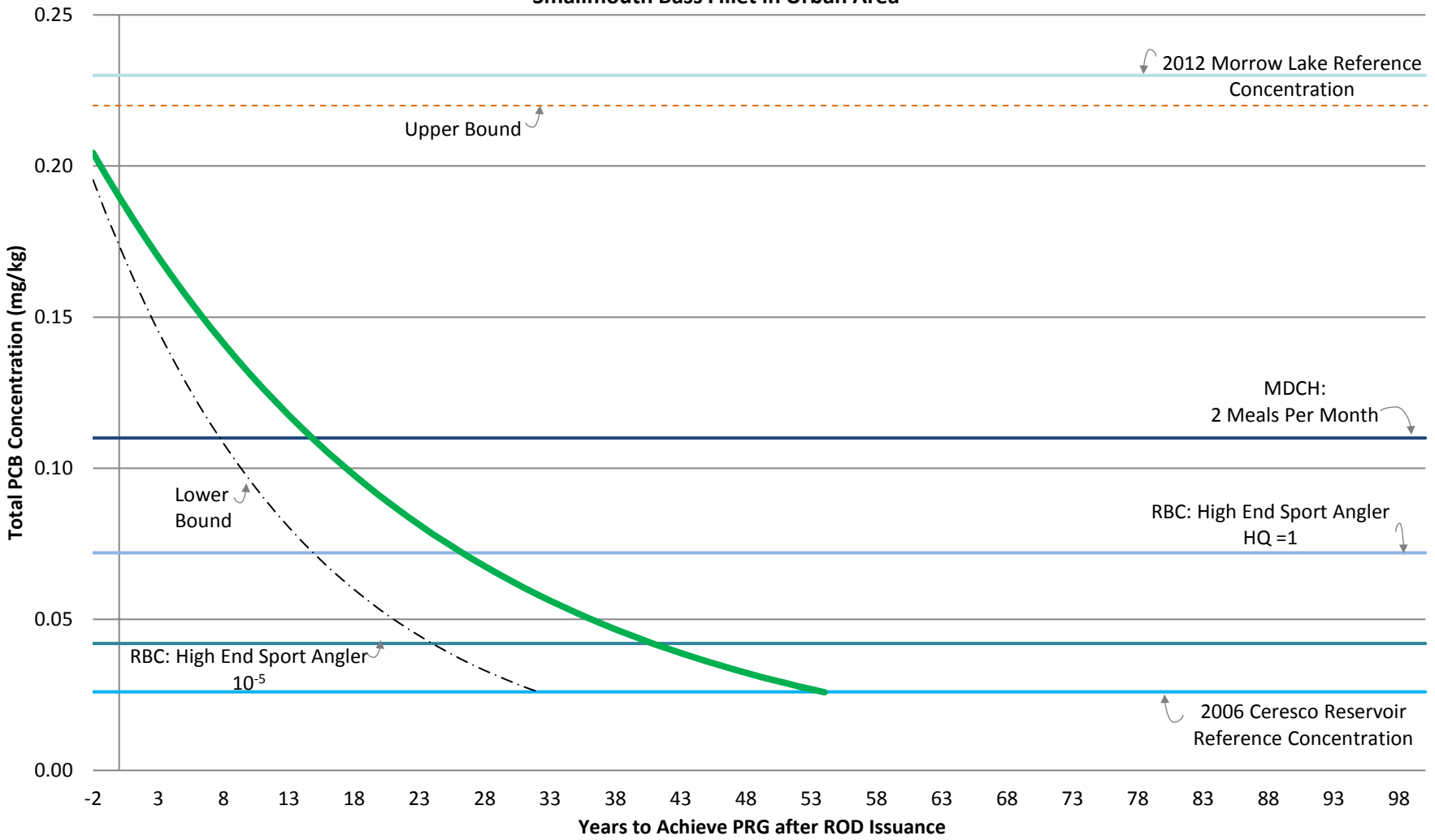
	Years of MNR	Years to Reach: 0.23 mg/kg[b,c]	0.11 mg/kg[b,c]	0.072 mg/kg[b,c]	0.042 mg/kg[b,c]	0.026 mg/kg[b,c]
Urban	2	Achieved	10	15	24	32
Dams	2	10	20	30	42	52

	Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)			S-5: Area-wide Removal (Mid Approximation Step Down)			Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)		
Years[d]	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams
42	Recovery	0.063	0.16	Recovery		0.052	Recovery		0.041
43	Recovery	0.061	0.16	Recovery		0.050	Recovery		0.039
44	Recovery	0.059	0.15	Recovery		0.048	Recovery		0.038
45	Recovery	0.057	0.15	Recovery		0.046	Recovery		0.036
46	Recovery	0.055	0.14	Recovery		0.044	Recovery		0.034
47	Recovery	0.053	0.14	Recovery		0.042	Recovery		0.033
48	Recovery	0.051	0.14	Recovery		0.041	Recovery		0.031
49	Recovery	0.049	0.13	Recovery		0.039	Recovery		0.030
50	Recovery	0.047	0.13	Recovery		0.037	Recovery		0.029
51	Recovery	0.045	0.13	Recovery		0.036	Recovery		0.027
52	Recovery	0.044	0.12	Recovery		0.035	Recovery		0.026
53	Recovery	0.042	0.12	Recovery		0.033			
54	Recovery	0.041	0.12	Recovery		0.032			
55	Recovery	0.039	0.12	Recovery		0.031			
56	Recovery	0.038	0.11	Recovery		0.029			
57	Recovery	0.036	0.11	Recovery		0.028			
58	Recovery	0.035	0.11	Recovery		0.027			
59	Recovery	0.034	0.10	Recovery		0.026			
60	Recovery	0.033	0.10						
61	Recovery	0.031	0.10						
62	Recovery	0.030	0.10						
63	Recovery	0.029	0.094						
64	Recovery	0.028	0.092						
65	Recovery	0.027	0.090						
66	Recovery	0.026	0.088						
67	Recovery		0.085						
68	Recovery		0.083						
69	Recovery		0.081						
70	Recovery		0.079						
71	Recovery		0.077						
72	Recovery		0.075						
73	Recovery		0.074						
74	Recovery		0.072						
75	Recovery		0.070						
76	Recovery		0.068						
77	Recovery		0.067						
78	Recovery		0.065						
79	Recovery		0.063						
80	Recovery		0.062						
81	Recovery		0.060						
82	Recovery		0.059						
83	Recovery		0.057						
84	Recovery		0.056						
85	Recovery		0.055						
86	Recovery		0.053						
87	Recovery		0.052						
88	Recovery		0.051						
89	Recovery		0.049						
90	Recovery		0.048						
91	Recovery		0.047						
92	Recovery		0.046						
93	Recovery		0.045						
94	Recovery		0.044						
95	Recovery		0.043						
96	Recovery		0.042						
97	Recovery		0.041						
98	Recovery		0.040						
99	Recovery		0.039						
100	Recovery		0.038						
101	Recovery		0.037						
102	Recovery		0.036						
103	Recovery		0.035						
104	Recovery		0.034						
105	Recovery		0.033						
106	Recovery		0.032						
107	Recovery		0.032						
108	Recovery		0.031						
109	Recovery		0.030						
110	Recovery		0.029						
111	Recovery		0.029						
112	Recovery		0.028						
113	Recovery		0.027						
114	Recovery		0.027						
115	Recovery		0.026						

Notes:
(a) Ceresco Reservoir fish concentration is less than MDCH Fish Consumption Advisory Level. Therefore, MDCH value is concentration to achieve.
(b) See Calculation Below
(c) Years calculated since remediation started, for S-2 this is at Year 0
(d) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-based Concentration
MDCH = Michigan Department of Community Health
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

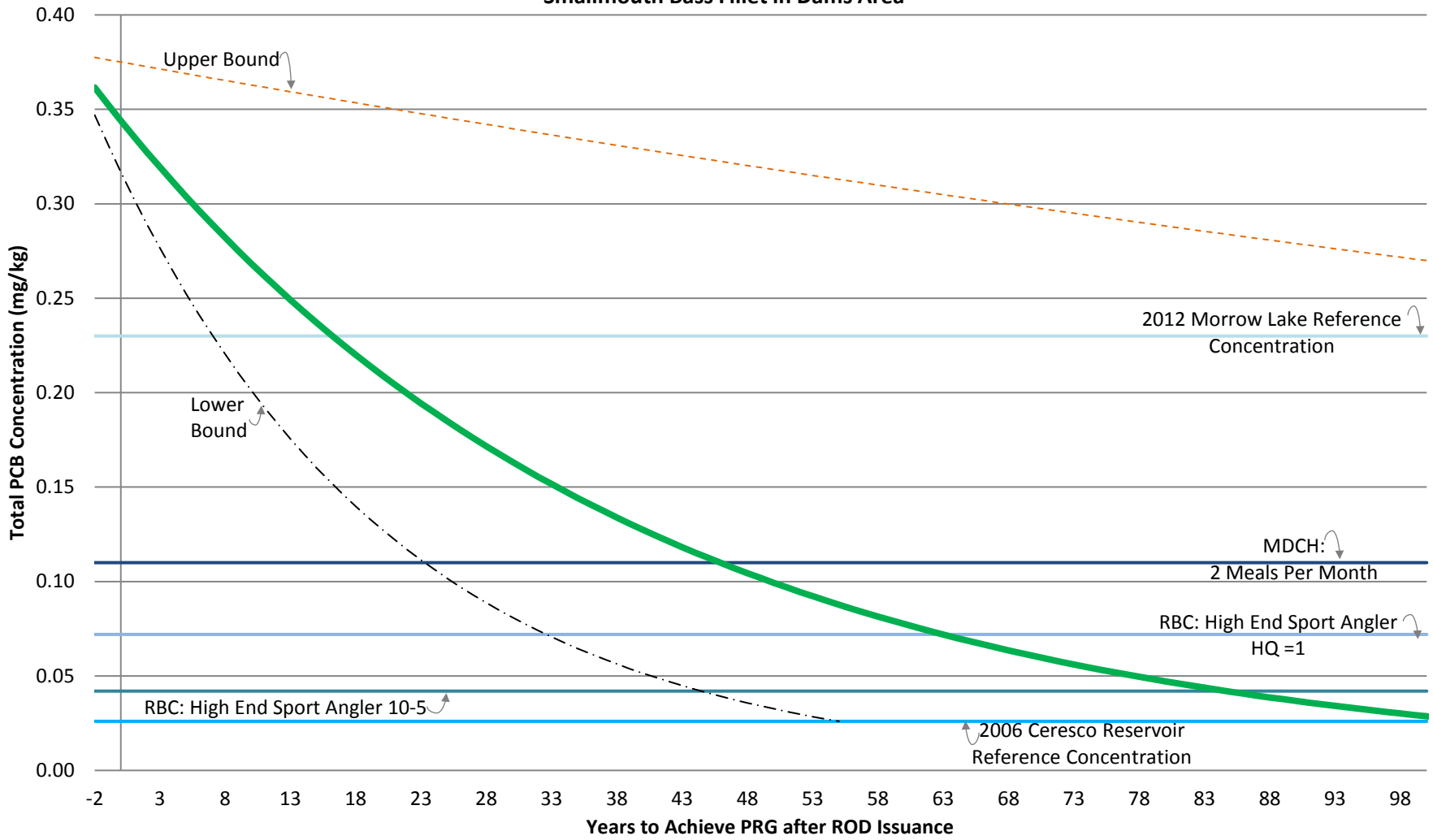
Figure I-1.1a
Fish Tissue Projections for S-2:
Smallmouth Bass Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.23 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ = 1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.026 mg/kg
Refer to Table I-1.1 for definition of segments

Upper Bound S-2: (MNR)
S-2: (MNR)
Lower Bound S-2: (MNR)

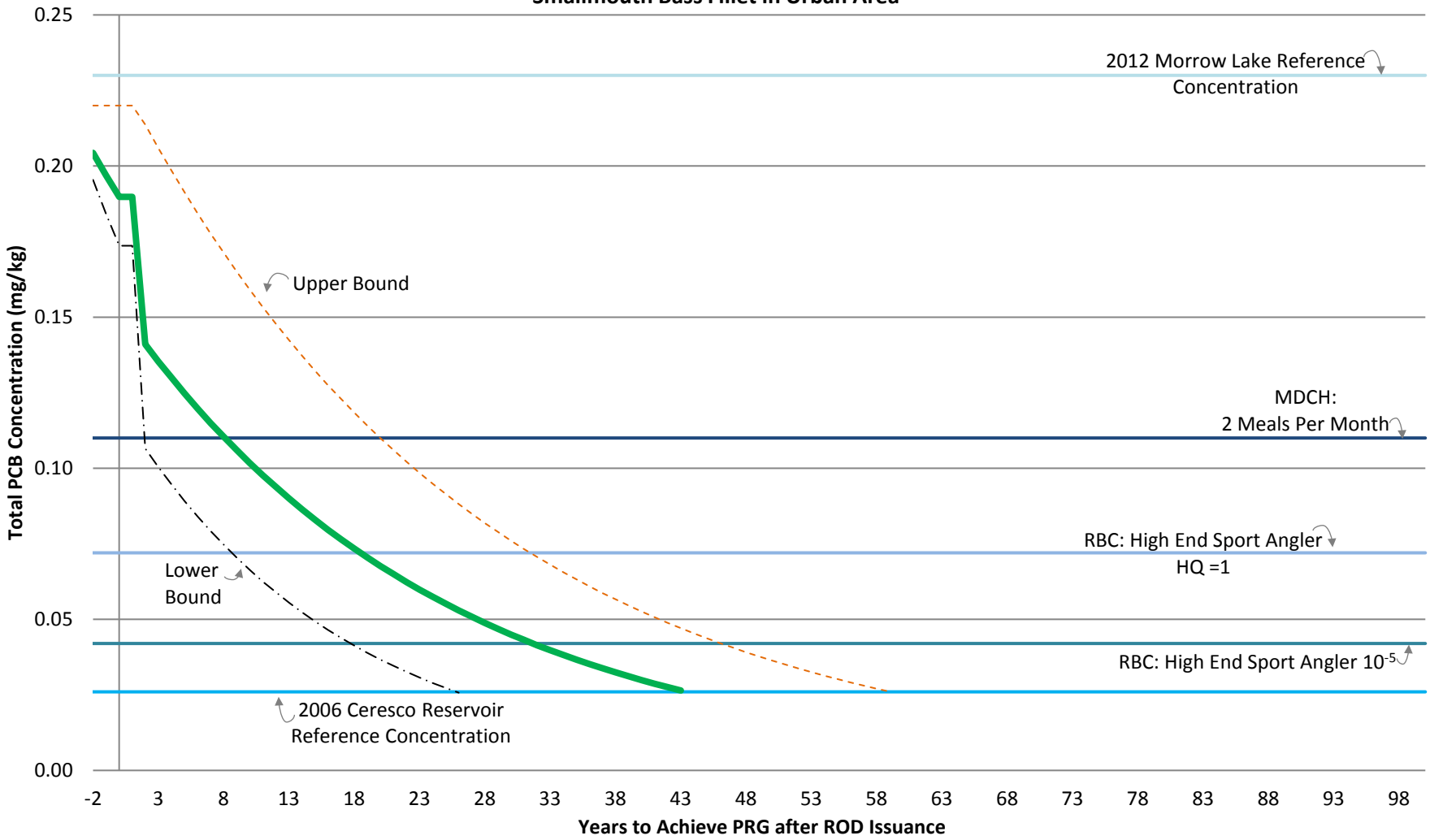
Figure I-1.1b
Fish Tissue Projections for S-2:
Smallmouth Bass Fillet in Dams Area



2012 Morrow Lake Reference Concentration = 0.23 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ = 1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.026 mg/kg
Refer to Table I-1.1 for definition of segments

Upper Bound S-2: (MNR)
S-2: (MNR)
Lower Bound S-2: (MNR)

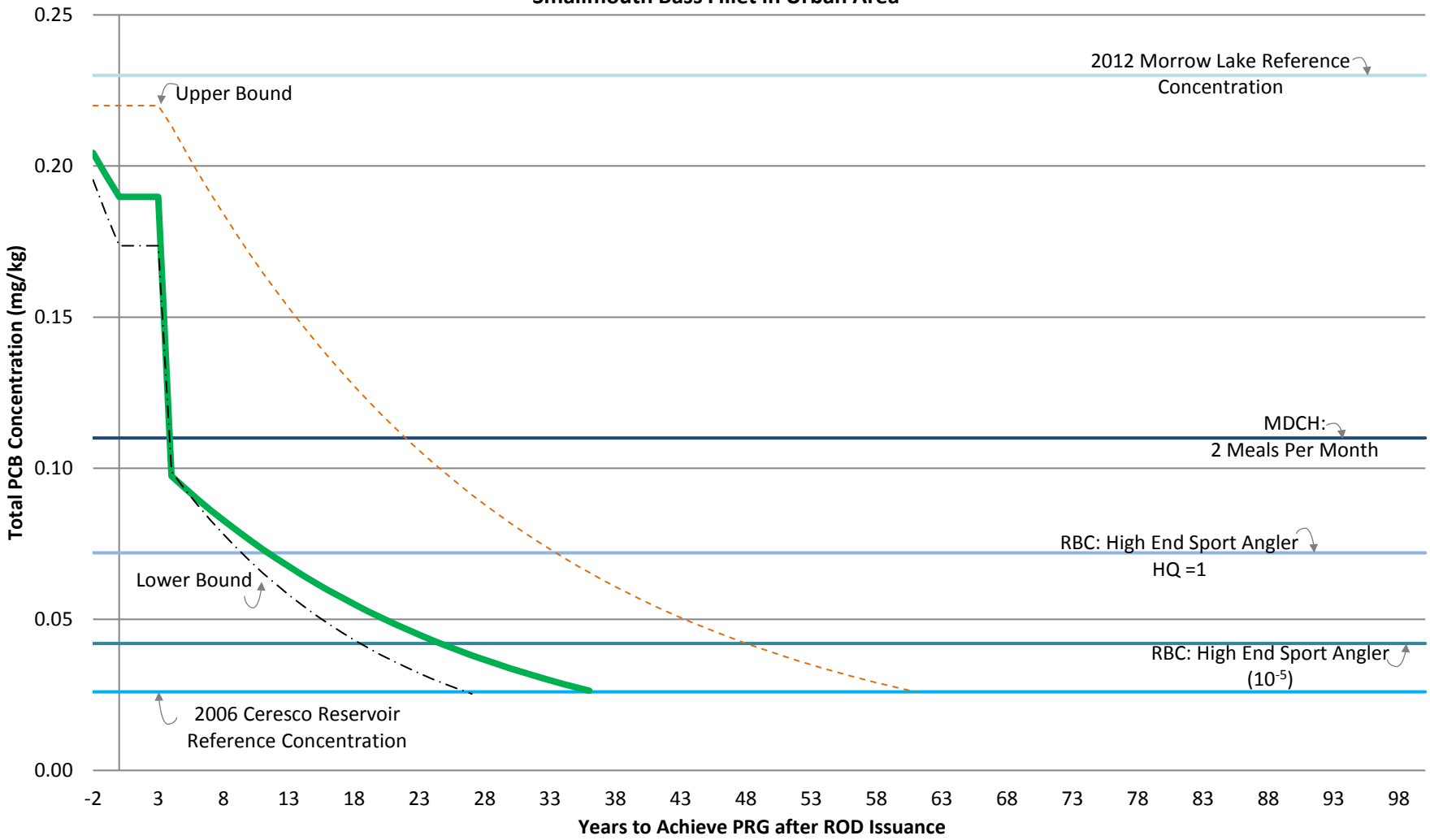
Figure I-1.2
Fish Tissue Projections for S-3:
Smallmouth Bass Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.23 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ = 1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.026 mg/kg
Refer to Table I-1.2 for definition of segments

- - - - Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)
—— S-3: Section 2-4 Hotspots (Mid Approximation Step Down)
—·—·- Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

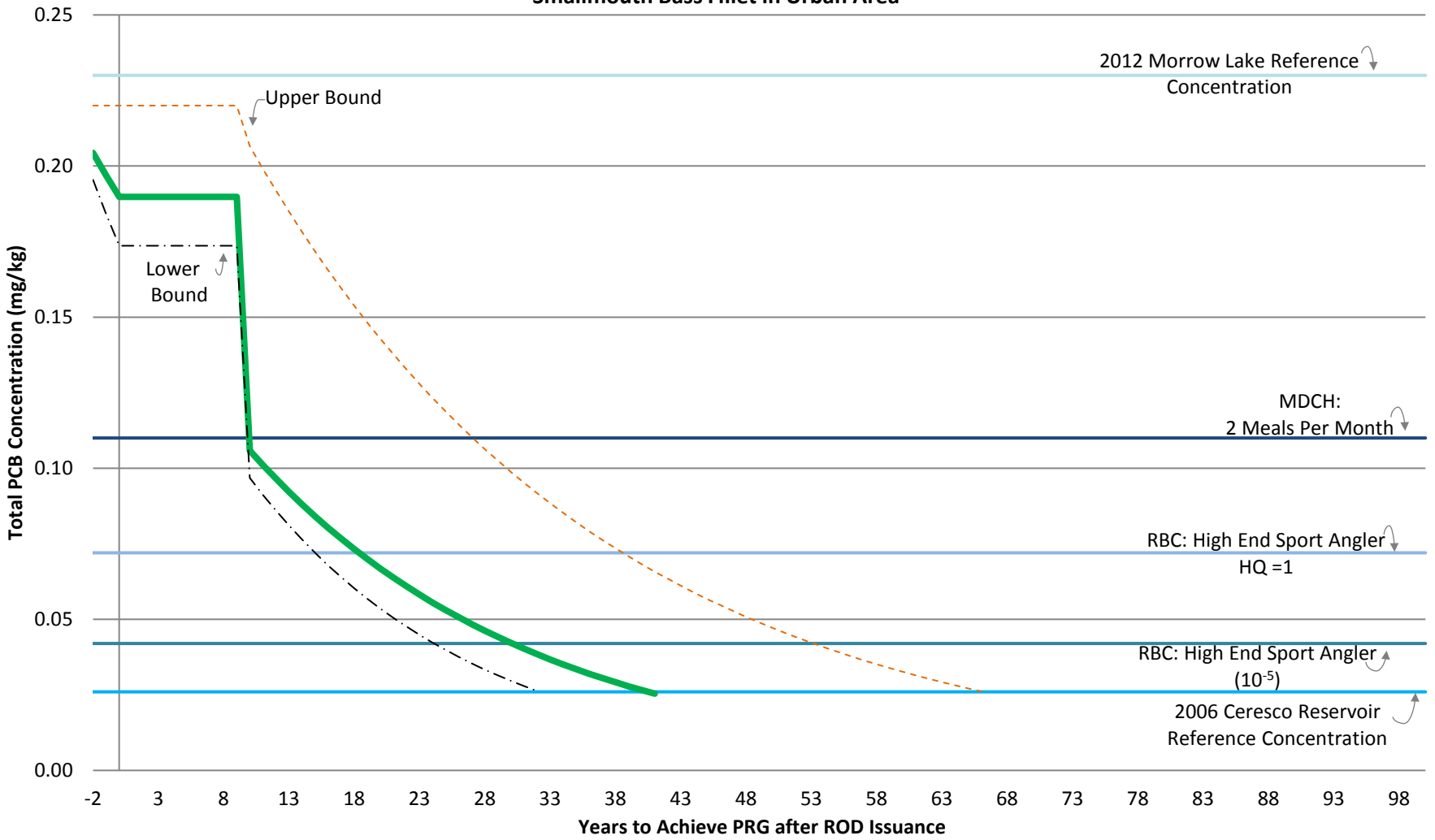
Figure I-1.3
Fish Tissue Projections for S-4:
Smallmouth Bass Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.23 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ = 1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.026 mg/kg
Refer to Table I-1.3 for definition of segments

- - - - - Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)
——— S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)
—·—·- Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

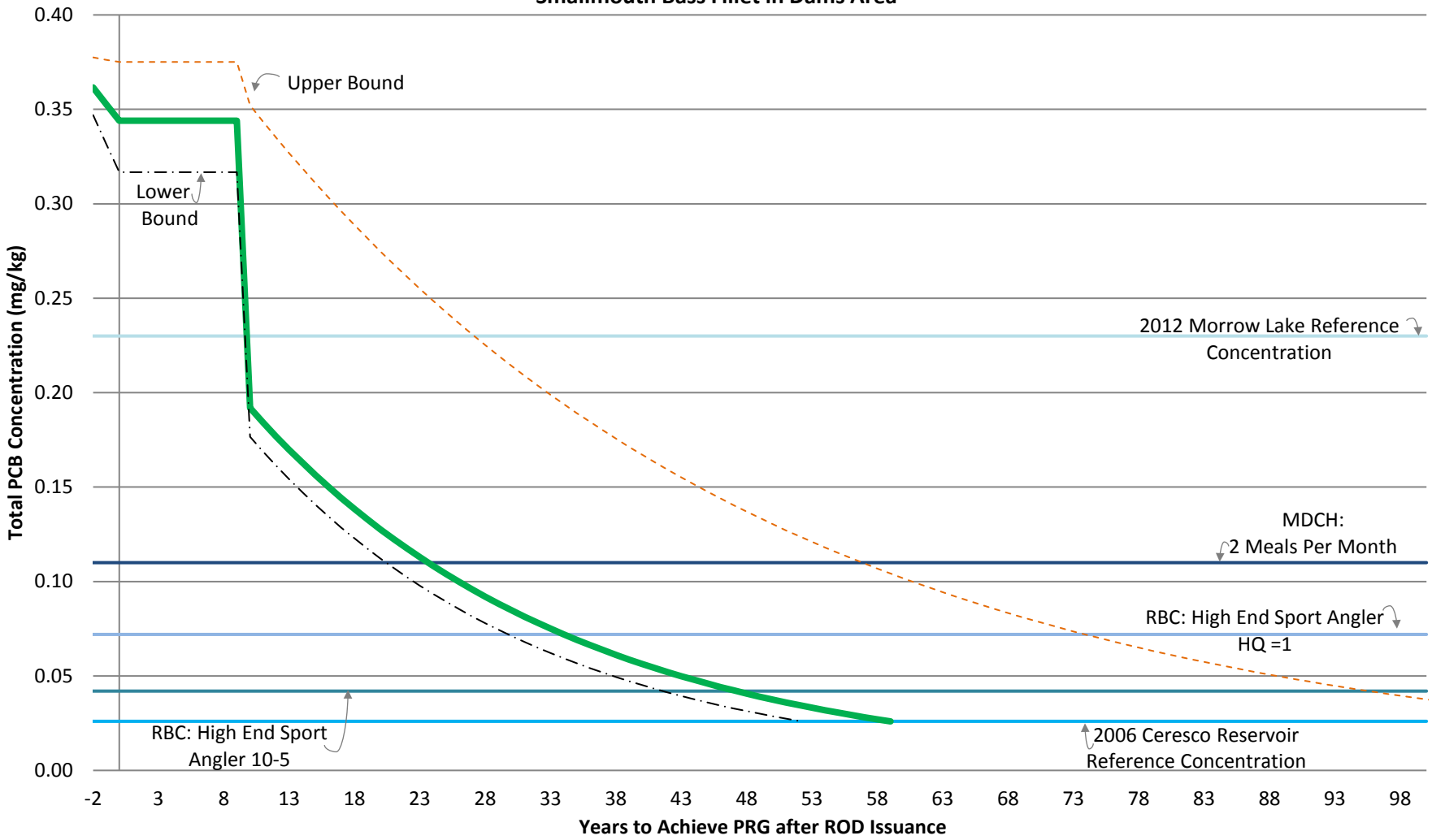
Figure I-1.4a
Fish Tissue Projections for S-5:
Smallmouth Bass Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.23 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ = 1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.026 mg/kg
Refer to Table I-1.4 for definition of segments

- - - - Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)
S-5: Area-wide Removal (Mid Approximation Step Down)
— · — · - Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

Figure I-1.4b
Fish Tissue Projections for S-5:
Smallmouth Bass Fillet in Dams Area



2012 Morrow Lake Reference Concentration = 0.23 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ = 1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.026 mg/kg
Refer to Table I-1.4 for definition of segments

- - - - - Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)
——— S-5: Area-wide Removal (Mid Approximation Step Down)
—·—·- Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

Table I-2.1a Smallmouth Bass Whole Body (Young of Year) Equations

S-2 (Includes Urban and Dam)						
	Urban Area			Dams Area		
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
MNR	0%	ABSA-03	ABSA-03 UCL	Dams LCL	Dams	ABSA-05 UCL
Recovery	0%	ABSA-03	ABSA-03 UCL	Dams LCL	Dams	ABSA-05 UCL
S-3 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	0%	ABSA-03	ABSA-03 UCL	--	--	--
2 Year Step Down	0.1	LogLinear	LogLinear	--	--	--
Recovery	ABSA-03	(power)	ABSA-03 UCL	--	--	--
S-4 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	0%	ABSA-03	ABSA-03 UCL	--	--	--
4 Year Step Down	0.1	LogLinear	LogLinear	--	--	--
Recovery	ABSA-03	(power)	ABSA-03 UCL	--	--	--
S-5 (Includes Urban and Dam)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	0%	ABSA-03	ABSA-03 UCL	Dams LCL	Dams	ABSA-05 UCL
10 Year Step Down	0.1	LogLinear	LogLinear	0.1	LogLinear	LogLinear
Recovery	ABSA-03	(power)	ABSA-03 UCL	Dams	(power)	ABSA-05 UCL

Notes:
ABSA denotation refers to the fish regression equations for Aquatic Biota Sampling Areas (ABSA) presented in Appendix B
-- Not calculated

Prepared by/Date: LSV 11/07/13
Checked by/Date: MKB 11/07/13
Revised by/Date: NSR 11/06/14
Checked by/Date: LSV 11/06/14

Table I-2.1b Smallmouth Bass Whole Body (Young of Year) Percentages

S-2 (Includes Urban and Dam)						
	Urban Area			Dams Area		
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
MNR (%)	0%	3.2%	5.7%	6.3%	7.5%	8.9%
Recovery (%)	0%	3.2%	5.7%	6.3%	7.5%	8.9%

Notes:
SWAC Area 1 Wide
Percentages with no (explanation) calculated from the log-linear regression

S-3 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0%	3.2%	5.7%	--	--	--
2 Year Step Down (mg/kg)	0.021	0.16	0.21	--	--	--
Recovery (%)	3.2%	4% (power)	5.7%	--	--	--

Notes:
Used SWACs based on GIS and Arithmetic approaches for Remedial Reach (see Table 4-4 for SWAC values)
-- Not calculated
Percentages with no (explanation) calculated from the log-linear regression

S-4 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0%	3.2%	5.7%	--	--	--
4 Year Step Down (mg/kg)	0.022	0.30	0.24	--	--	--
Recovery (%)	3.2%	4% (power)	5.7%	--	--	--

Notes:
Used SWACs based on GIS and Arithmetic approaches for Remedial Reach (see Table 4-4 for SWAC values)
-- Not calculated
Percentages with no (explanation) calculated from the log-linear regression

S-5 (Includes Urban and Dam)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0%	3.2%	5.7%	6.3%	7.5%	8.9%
10 Year Step Down (mg/kg)	0.045	0.28	0.24	0.059	0.39	0.36
Recovery (%)	3.2%	4.5% (power)	5.7%	7.5%	8% (power)	8.9%

Notes:
Used Area 1 Wide SWAC (see Section 4.7.2.1)
Percentages with no (explanation) calculated from a log-linear regression

Prepared by/Date: NHS 01/14/14
Checked by/Date: LSV 01/14/14
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Checked by/Date: LSV 11/06/14

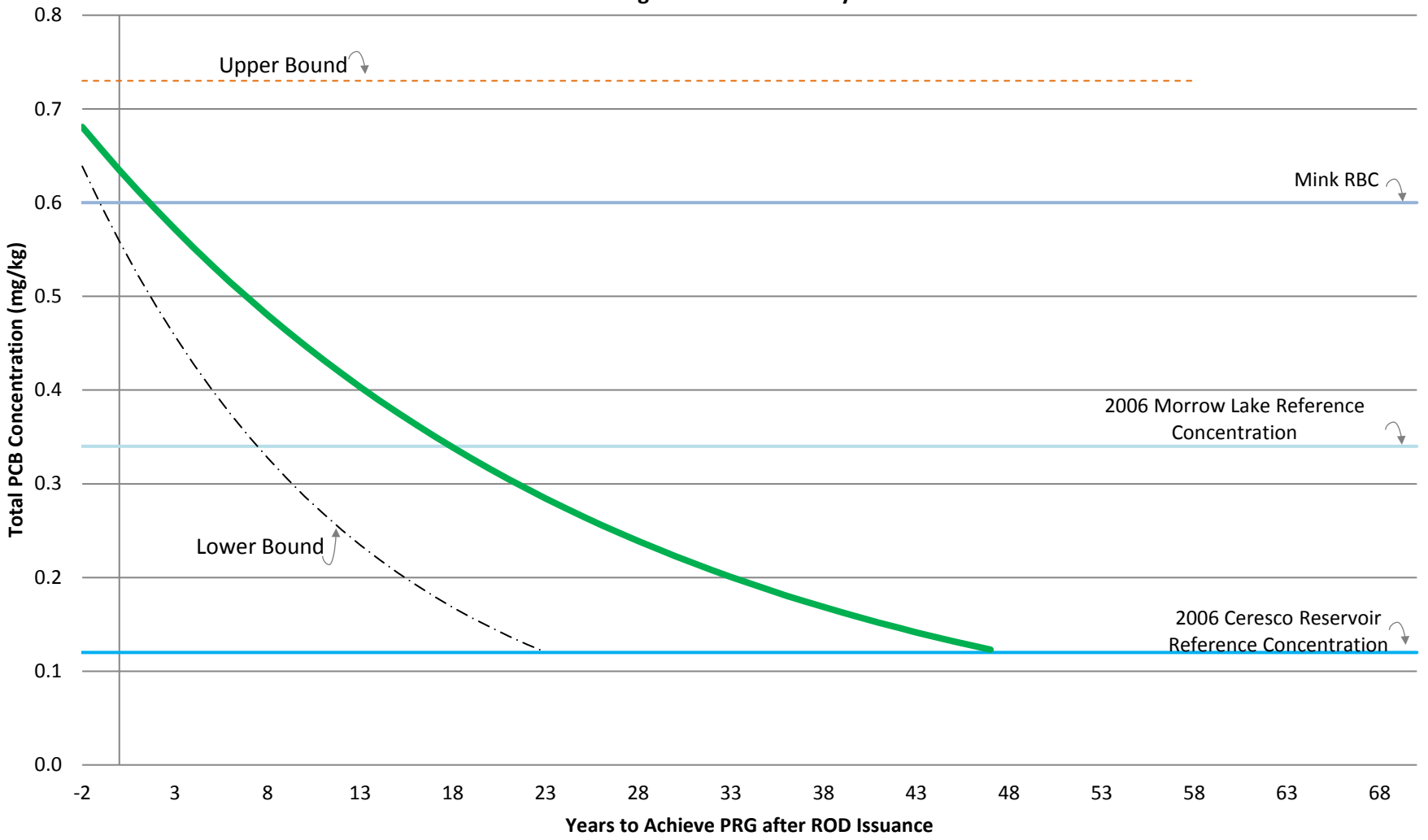
Table I-2.2
Summary of Years from Initiation of Remediation to Achieve Smallmouth Bass Young of Year Whole Body Concentration Thresholds
Area 1, OU5 Kalamazoo River

		Fish Concentration Thresholds					
		Mink RBC 0.60 mg/kg		2006 Morrow Lake Reference Concentration 0.34 mg/kg		2006 Ceresco Reservoir Reference Concentration 0.12 mg/kg	
	Remedial Alternative Scenarios	Urban	Dam	Urban	Dam	Urban	Dam
S-2	Lower Bound S-2: (MNR)	1	5	10	10	25	18
	S-2: (MNR)	4	7	20	13	49	24
	Upper Bound S-2: (MNR)	NA	9	NA	16	NA	30
S-3	Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)	Achieved	NC	3	NC	18	NC
	S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	2	NC	10	NC	35	NC
	Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	7	NC	23	NC	52	NC
S-4	Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)	Achieved	NC	4	NC	19	NC
	S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	4	NC	4	NC	28	NC
	Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	9	NC	25	NC	54	NC
S-5	Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)	Achieved	10	10	13	24	22
	S-5: Area-wide Removal (Mid Approximation Step Down)	10	10	11	15	33	27
	Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)	14	15	30	21	59	32

Notes:
NA = Not Achievable under this scenario
NC = Not Calculated
RBC = Risk-Based Concentration
MDCH = Michigan Department of Community Health
mg/kg = milligrams per kilogram

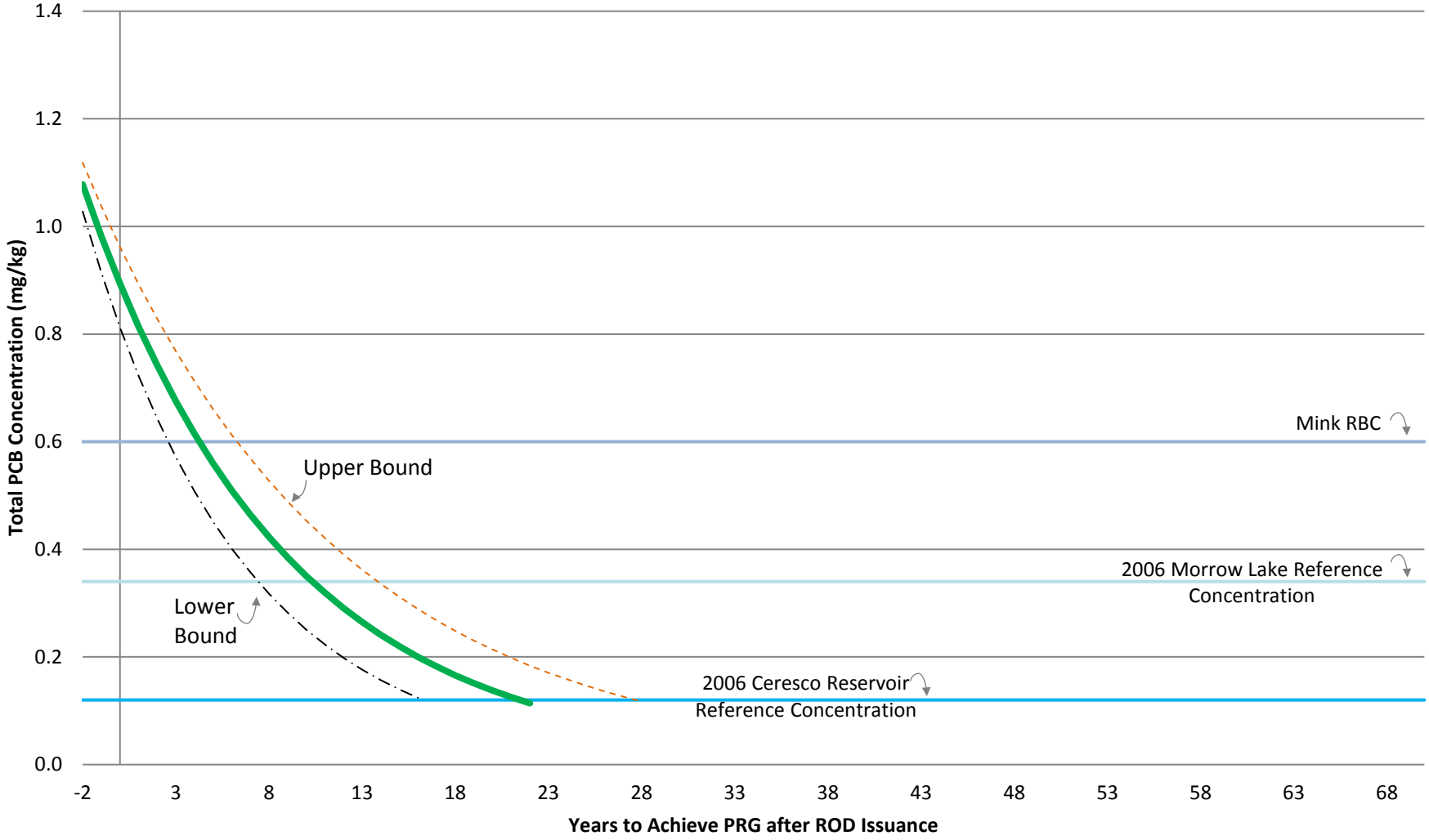
Prepared by/Date: NHS 11/14/13
Checked by/Date: NTG 01/17/14
Revised by/Date: NSR 11/06/14
Checked by/Date: LSV 11/06/14

Figure I-2.1a
Fish Tissue Projections for S-2:
Smallmouth Bass Young of Year Whole Body in Urban Area



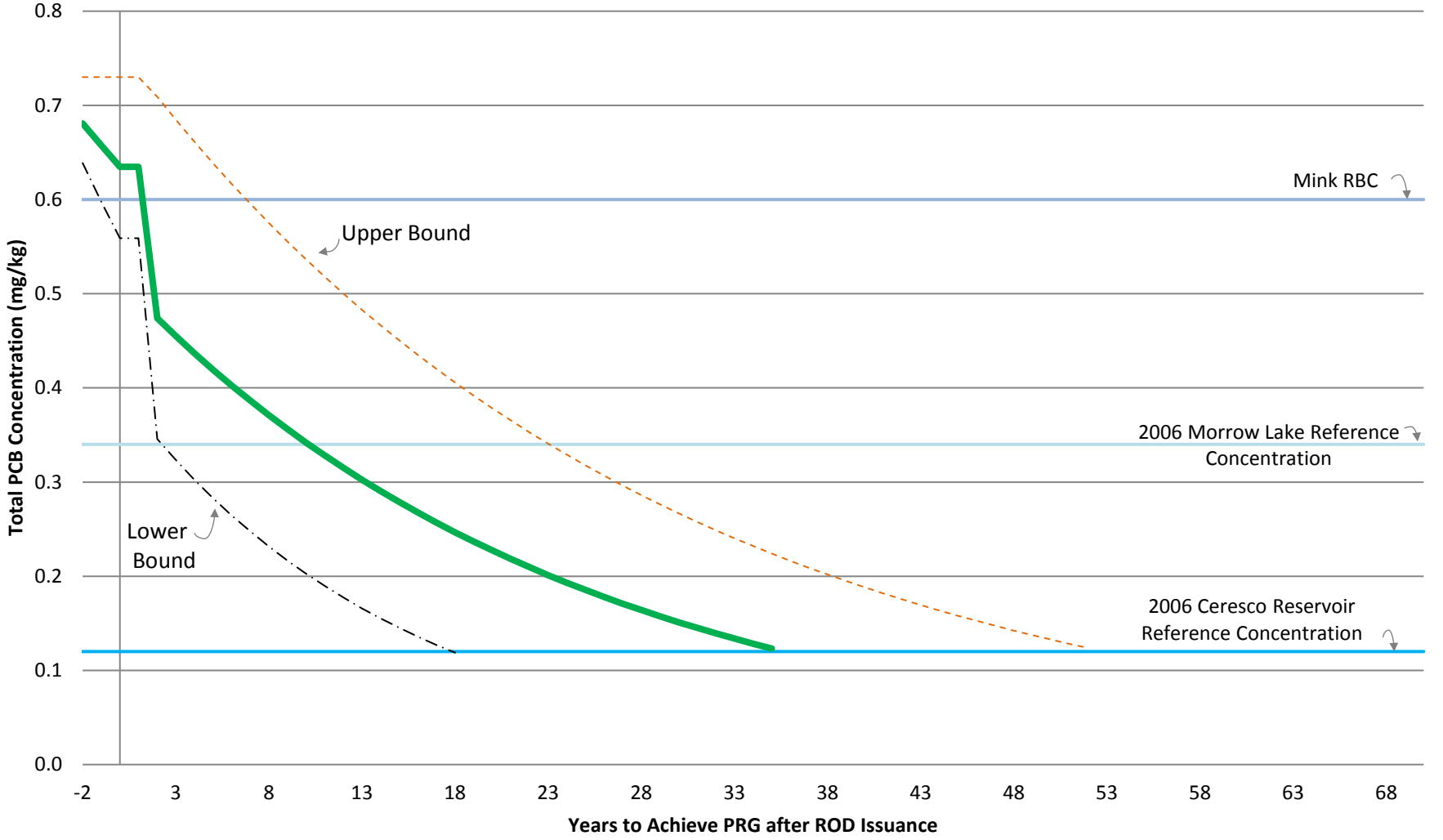
Mink RBC = 0.60 mg/kg
2006 Morrow Lake Reference Concentration = 0.34 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.12 mg/kg
Refer to Table I-2.1 for definition of segments

Figure I-2.1b
Fish Tissue Projections for S-2:
Smallmouth Bass Young of Year Whole Body in Dams Area



Mink RBC = 0.60 mg/kg
2006 Morrow Lake Reference Concentration = 0.34 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.12 mg/kg
Refer to Table I-2.1 for definition of segments

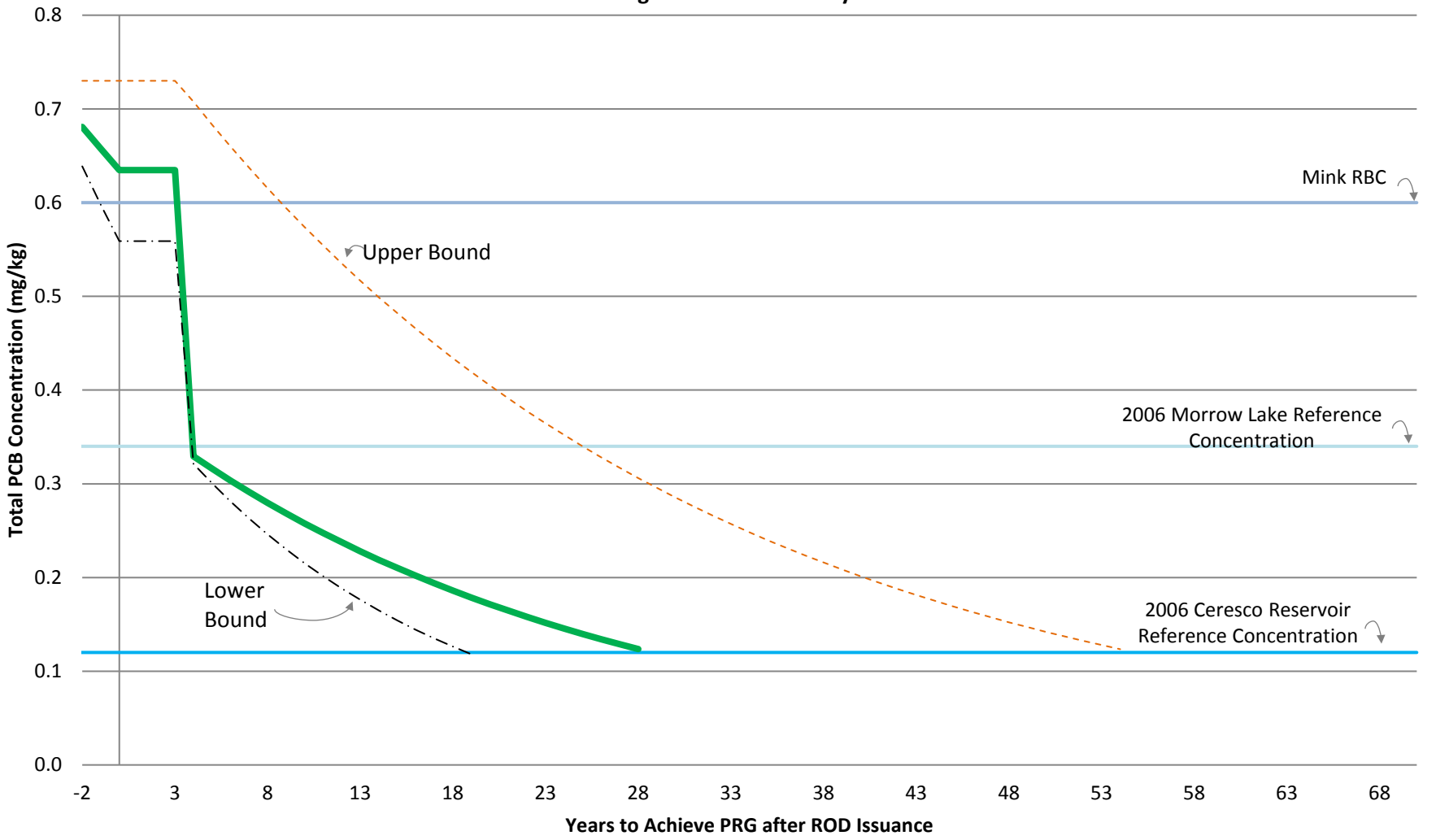
Figure I-2.2
Fish Tissue Projections for S-3:
Smallmouth Bass Young of Year Whole Body in Urban Area



Mink RBC = 0.60 mg/kg
2006 Morrow Lake Reference Concentration = 0.34 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.12 mg/kg
Refer to Table I-2.2 for definition of segments

- - - - - Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)
S-3: Section 2-4 Hotspots (Mid Approximation Step Down)
— · — · - Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

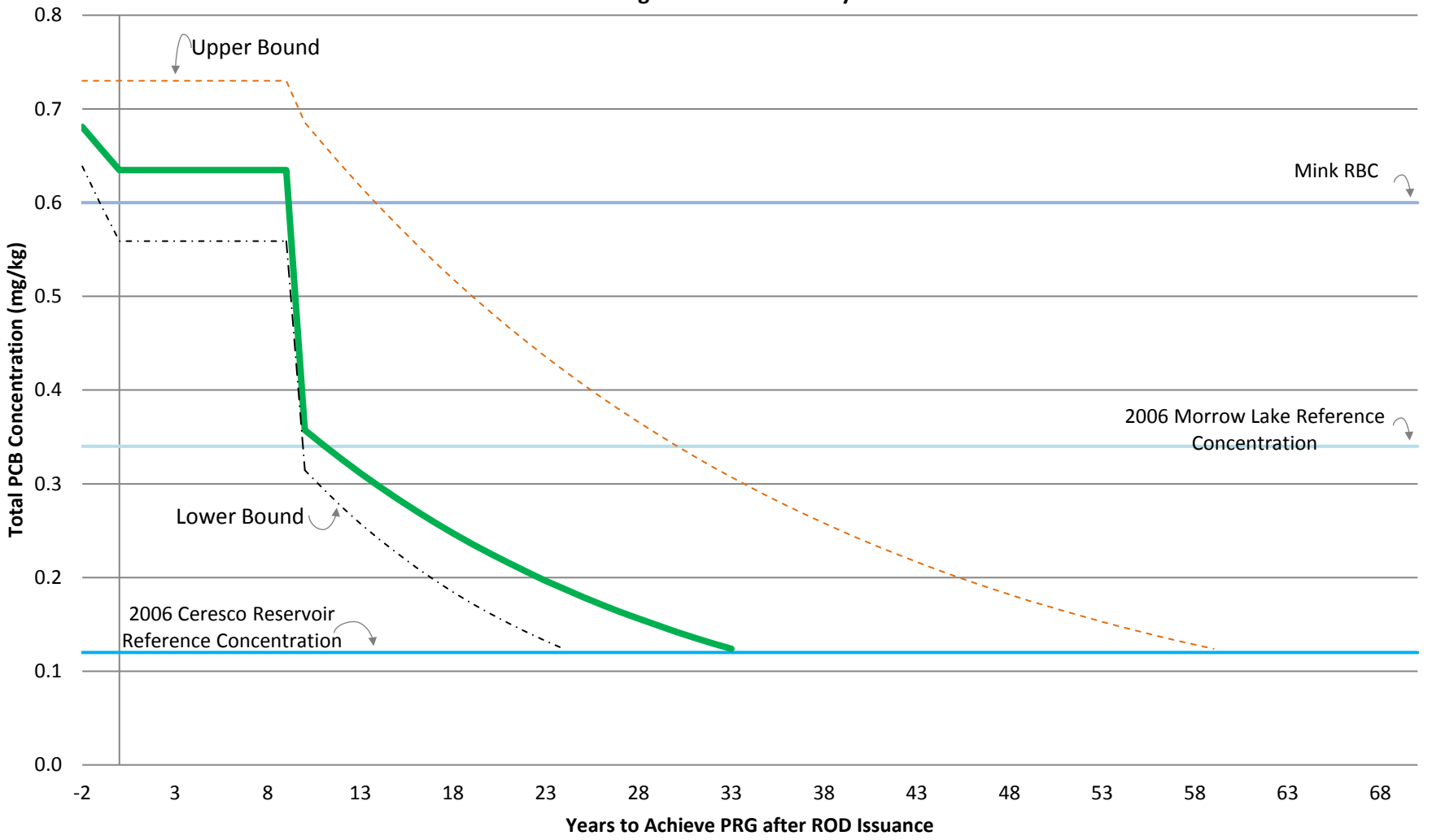
Figure I-2.3
Fish Tissue Projections for S-4:
Smallmouth Bass Young of Year Whole Body in Urban Area



Mink RBC = 0.60 mg/kg
2006 Morrow Lake Reference Concentration = 0.34 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.12 mg/kg
Refer to Table I-2.3 for definition of segments

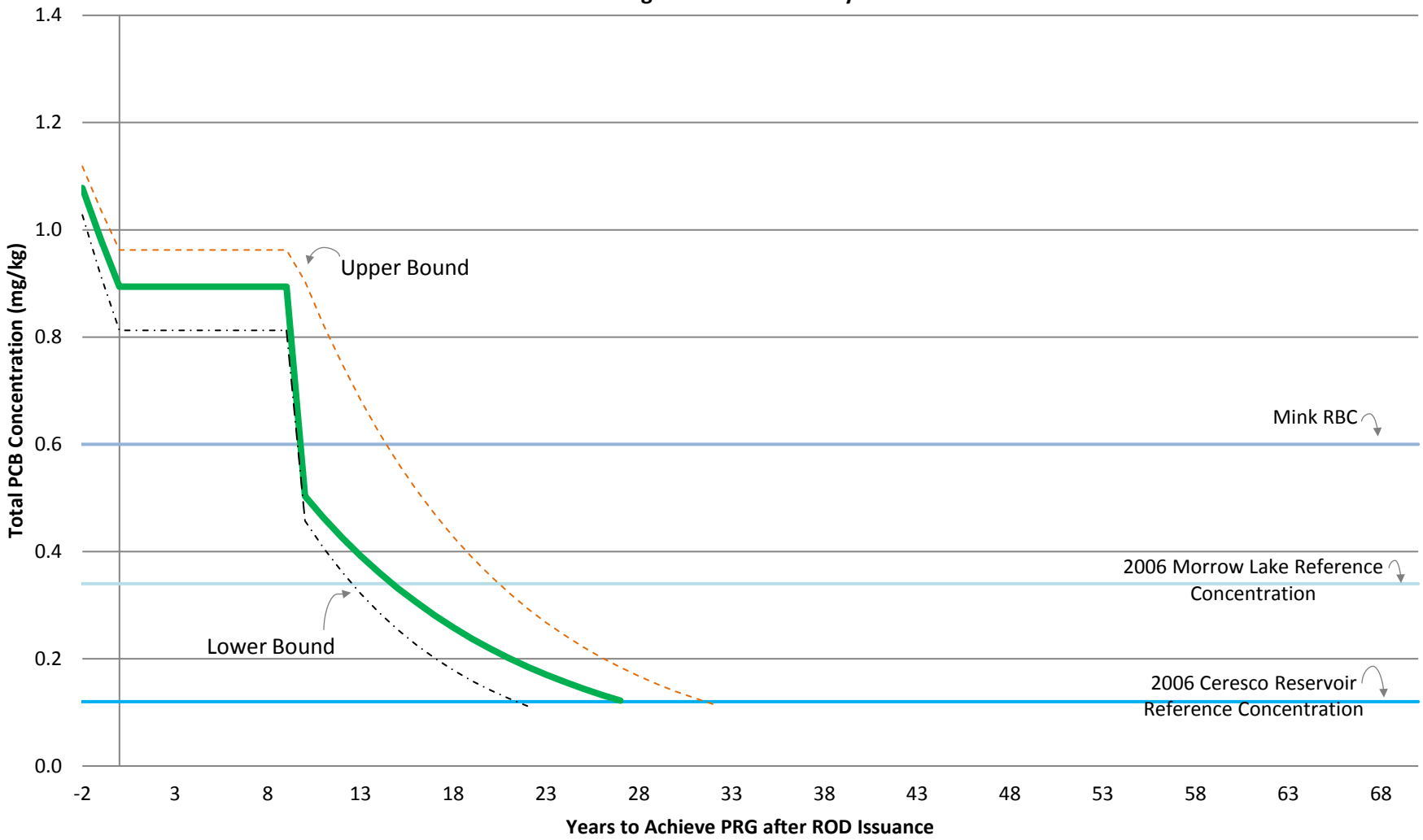
- - - - - Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)
——— S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)
—·—·- Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

Figure I-2.4a
Fish Tissue Projections for S-5:
Smallmouth Bass Young of Year Whole Body in Urban Area



Mink RBC = 0.60 mg/kg
2006 Morrow Lake Reference Concentration = 0.34 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.12 mg/kg
Refer to Table I-2.4 for definition of segments

Figure I-2.4b
Fish Tissue Projections for S-5:
Smallmouth Bass Young of Year Whole Body in Dams Area



Mink RBC = 0.60 mg/kg
2006 Morrow Lake Reference Concentration = 0.34 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.12 mg/kg
Refer to Table I-2.4 for definition of segments

Table I-3.1a Common Carp Fillet Equations

S-2 (Includes Urban and Dam)						
	Urban Area			Dams Area		
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
MNR	Urban 1 LCL	Urban 1	ABSA-03 UCL	ABSA-05 LCL	Dams	ABSA-05 UCL
Recovery	Urban 1 LCL	Urban 1	ABSA-03 UCL	ABSA-05 LCL	Dams	ABSA-05 UCL
S-3 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	Urban 1 LCL	Urban 1	ABSA-03 UCL	--	--	--
2 Year Step Down	0.1	LogLinear	LogLinear	--	--	--
Recovery	Urban 1	(power)	ABSA-03 UCL	--	--	--
S-4 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	Urban 1 LCL	Urban 1	ABSA-03 UCL	--	--	--
4 Year Step Down	0.1	LogLinear	LogLinear	--	--	--
Recovery	Urban 1	(power)	ABSA-03 UCL	--	--	--
S-5 (Includes Urban and Dam)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR	Urban 1 LCL	Urban 1	ABSA-03 UCL	ABSA-05 LCL	Dams	ABSA-05 UCL
10 Year Step Down	0.1	LogLinear	LogLinear	0.1	LogLinear	LogLinear
Recovery	Urban 1	(power)	ABSA-03 UCL	Dams	(power)	ABSA-05 UCL

Notes:
ABSA denotation refers to the fish regression equations for Aquatic Biota Sampling Areas (ABSA) presented in Appendix D
-- Not calculated

Prepared by/Date: LSV 11/07/13
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Revised by/Date: NSR 10/29/14
Checked by/Date: EFC 10/29/14

Table I-3.1b Common Carp Fillet Percentages

S-2 (Includes Urban and Dam)						
	Urban Area			Dams Area		
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
MNR (%)	0.58%	2.2%	6.1%	1.6%	2.8%	3.9%
Recovery (%)	0.58%	2.2%	6.1%	1.6%	2.8%	3.9%

Notes:
Percentages with no (explanation) calculated from a log-linear regression

S-3 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0.58%	2.2%	6.1%	--	--	--
2 Year Step Down (mg/kg)	0.11	1.1	1.3	--	--	--
Recovery (%)	2.2%	3.5% (power)	6.1%	--	--	--

Notes:
Used SWACs based on GIS and Arithmetic approaches for Remedial Reach (see Table 4-3 for SWAC values)
-- Not calculated
Percentages with no (explanation) calculated from a log-linear regression

S-4 (Includes Urban Only)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0.58%	2.2%	6.1%	--	--	--
4 Year Step Down (mg/kg)	0.12	2.0	1.5	--	--	--
Recovery (%)	2.2%	3.5% (power)	6.1%	--	--	--

Notes:
Used SWACs based on GIS and Arithmetic approaches for Remedial Reach (see Table 4-3 for SWAC values)
-- Not calculated
Percentages with no (explanation) calculated from a log-linear regression

S-5 (Includes Urban and Dam)						
	Upper Bound	Mid	Lower Bound	Upper Bound	Mid	Lower Bound
2 Year MNR (%)	0.58%	2.2%	6.1%	1.6%	2.8%	3.9%
10 Year Step Down (mg/kg)	0.24	1.9	1.5	0.19	1.5	1.4
Recovery (%)	2.2%	4.5% (power)	6.1%	2.8%	3.5% (power)	3.9%

Notes:
Used Area 1 Wide SWAC (see Section 4.7.2.1)
Percentages with no (explanation) calculated from a log-linear regression

Prepared by/Date: NHS 01/14/14
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Revised by/Date: NSR 10/29/14
Checked by/Date: EFC 10/29/14

Table I-3.2
Summary of Years From Initiation of Remediation to Achieve Common Carp Fillet Concentration Thresholds
Area 1, OU5 Kalamazoo River

	Fish Concentration Thresholds									
	2012 Morrow Lake Reference Concentration 0.29 mg/kg		2006 Ceresco Reservoir Reference Concentration 0.13 mg/kg		MDCH: 2 Meals Per Month 0.11 mg/kg		Human Health Fish Consumption RBC: High End Sport Angler (HQ =1) 0.072 mg/kg		Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) 0.042 mg/kg	
Remedial Alternative Scenarios	Urban	Dam	Urban	Dam	Urban	Dam	Urban	Dam	Urban	Dam
S-2 Lower Bound S-2: (MNR)	35	53	45	71	48	75	54	85	61	98
S-2: (MNR)	110	80	143	106	150	111	169	127	192	145
Upper Bound S-2: (MNR)	447	144	584	193	612	203	684	229	775	261
S-3 Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)	27	NC	37	NC	40	NC	46	NC	53	NC
S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	64	NC	86	NC	90	NC	103	NC	118	NC
Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	112	NC	145	NC	151	NC	170	NC	192	NC
S-4 Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)	28	NC	38	NC	44	NC	47	NC	54	NC
S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	54	NC	76	NC	80	NC	93	NC	108	NC
Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	113	NC	147	NC	153	NC	172	NC	194	NC
S-5 Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)	33	46	44	64	46	67	52	78	60	90
S-5: Area-wide Removal (Mid Approximation Step Down)	51	56	68	78	71	82	81	95	93	110
Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)	118	87	151	114	158	119	176	135	199	153

Notes:
NA = Not Achievable under this scenario
NC = Not Calculated
RBC = Risk-Based Concentration
MDCH = Michigan Department of Community Health
mg/kg = milligrams per kilogram

Prepared by/Date: NHS 11/14/13
Checked by/Date: NTG 01/11/14
Revised by/Date: NSR 10/29/14
Checked by/Date: EFC 10/29/14

Table I-3.3a
Calculation of Common Carp Tissue Projections for Remedial Alternative S-2
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042
Dams	3.3	0.29	0.13	0.11	0.072	0.042

S-2
0 years for remediation and step down

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-2 MNR	-0.00589	-0.0166	-0.0237	-0.0297	-0.0729	-0.0440

Upper Bound S-2: (MNR)

	Years to Reach:				
	0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	447	584	612	684	775
Dams	144	193	203	229	261

S-2: (MNR)

	Years to Reach:				
	0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	110	143	150	169	192
Dams	80	106	111	127	145

Lower Bound S-2: (MNR)

	Years to Reach:				
	0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	35	45	48	54	61
Dams	53	71	75	85	98

	Process	Upper Bound S-2: (MNR)		Process	S-2: (MNR)		Process	Lower Bound S-2: (MNR)	
Years[c]	Occurring	Urban	Dams	Occurring	Urban	Dams	Occurring	Urban	Dams
2011	Current	4.1	3.3	Current	4.1	3.3	Current	4.1	3.3
2012	MNR	4.1	3.2	MNR	4.0	3.2	MNR	3.8	3.2
0	MNR	4.1	3.2	MNR	3.9	3.1	MNR	3.5	3.0
1	MNR	4.0	3.1	MNR	3.8	3.0	MNR	3.3	2.9
2	MNR	4.0	3.1	MNR	3.7	2.9	MNR	3.1	2.8
3	MNR	4.0	3.0	MNR	3.6	2.8	MNR	2.8	2.6
4	MNR	4.0	3.0	MNR	3.6	2.8	MNR	2.6	2.5
5	MNR	3.9	2.9	MNR	3.5	2.7	MNR	2.5	2.4
6	MNR	3.9	2.9	MNR	3.4	2.6	MNR	2.3	2.3
7	MNR	3.9	2.8	MNR	3.3	2.5	MNR	2.1	2.2
8	MNR	3.9	2.8	MNR	3.2	2.5	MNR	2.0	2.1
9	MNR	3.8	2.7	MNR	3.2	2.4	MNR	1.8	2.0
10	MNR	3.8	2.7	MNR	3.1	2.3	MNR	1.7	1.9
11	MNR	3.8	2.7	MNR	3.0	2.2	MNR	1.6	1.9
12	MNR	3.8	2.6	MNR	2.9	2.2	MNR	1.5	1.8
13	MNR	3.8	2.6	MNR	2.9	2.1	MNR	1.4	1.7
14	MNR	3.7	2.5	MNR	2.8	2.1	MNR	1.3	1.6
15	MNR	3.7	2.5	MNR	2.7	2.0	MNR	1.2	1.6
16	MNR	3.7	2.4	MNR	2.7	1.9	MNR	1.1	1.5
17	MNR	3.7	2.4	MNR	2.6	1.9	MNR	1.0	1.4
18	MNR	3.6	2.4	MNR	2.6	1.8	MNR	0.95	1.4
19	MNR	3.6	2.3	MNR	2.5	1.8	MNR	0.89	1.3
20	MNR	3.6	2.3	MNR	2.4	1.7	MNR	0.82	1.3
21	MNR	3.6	2.3	MNR	2.4	1.7	MNR	0.77	1.2
22	MNR	3.6	2.2	MNR	2.3	1.6	MNR	0.71	1.1
23	MNR	3.5	2.2	MNR	2.3	1.6	MNR	0.66	1.1
24	MNR	3.5	2.1	MNR	2.2	1.5	MNR	0.62	1.1
25	MNR	3.5	2.1	MNR	2.2	1.5	MNR	0.57	1.0
26	MNR	3.5	2.1	MNR	2.1	1.4	MNR	0.53	0.96
27	MNR	3.5	2.0	MNR	2.1	1.4	MNR	0.49	0.92
28	MNR	3.4	2.0	MNR	2.0	1.4	MNR	0.46	0.88
29	MNR	3.4	2.0	MNR	2.0	1.3	MNR	0.43	0.84
30	MNR	3.4	1.9	MNR	1.9	1.3	MNR	0.40	0.81
31	MNR	3.4	1.9	MNR	1.9	1.2	MNR	0.37	0.77
32	MNR	3.4	1.9	MNR	1.8	1.2	MNR	0.34	0.74
33	MNR	3.3	1.8	MNR	1.8	1.2	MNR	0.32	0.71
34	MNR	3.3	1.8	MNR	1.7	1.1	MNR	0.30	0.68
35	MNR	3.3	1.8	MNR	1.7	1.1	MNR	0.28	0.65
36	MNR	3.3	1.8	MNR	1.7	1.1	MNR	0.26	0.62
37	MNR	3.3	1.7	MNR	1.6	1.0	MNR	0.24	0.59
38	MNR	3.2	1.7	MNR	1.6	1.0	MNR	0.22	0.57
39	MNR	3.2	1.7	MNR	1.6	0.98	MNR	0.21	0.54
40	MNR	3.2	1.6	MNR	1.5	0.95	MNR	0.19	0.52
41	MNR	3.2	1.6	MNR	1.5	0.92	MNR	0.18	0.50
42	MNR	3.2	1.6	MNR	1.4	0.89	MNR	0.17	0.48
43	MNR	3.1	1.6	MNR	1.4	0.87	MNR	0.15	0.46
44	MNR	3.1	1.5	MNR	1.4	0.84	MNR	0.14	0.44
45	MNR	3.1	1.5	MNR	1.3	0.82	MNR	0.13	0.42
46	MNR	3.1	1.5	MNR	1.3	0.79	MNR	0.12	0.40
47	MNR	3.1	1.5	MNR	1.3	0.77	MNR	0.12	0.38
48	MNR	3.1	1.4	MNR	1.3	0.75	MNR	0.11	0.37
49	MNR	3.0	1.4	MNR	1.2	0.72	MNR	0.10	0.35
50	MNR	3.0	1.4	MNR	1.2	0.70	MNR	0.092	0.34
51	MNR	3.0	1.4	MNR	1.2	0.68	MNR	0.086	0.32
52	MNR	3.0	1.3	MNR	1.1	0.66	MNR	0.080	0.31
53	MNR	3.0	1.3	MNR	1.1	0.64	MNR	0.074	0.29
54	MNR	2.9	1.3	MNR	1.1	0.62	MNR	0.069	0.28
55	MNR	2.9	1.3	MNR	1.1	0.61	MNR	0.064	0.27
56	MNR	2.9	1.3	MNR	1.0	0.59	MNR	0.060	0.26
57	MNR	2.9	1.2	MNR	1.0	0.57	MNR	0.056	0.25
58	MNR	2.9	1.2	MNR	0.99	0.55	MNR	0.052	0.24
59	MNR	2.9	1.2	MNR	0.97	0.54	MNR	0.048	0.23
60	MNR	2.8	1.2	MNR	0.95	0.52	MNR	0.045	0.22
61	MNR	2.8	1.2	MNR	0.92	0.51	MNR	0.041	0.21
62	MNR	2.8	1.1	MNR	0.90	0.49	MNR		0.20
63	MNR	2.8	1.1	MNR	0.88	0.48	MNR		0.19
64	MNR	2.8	1.1	MNR	0.86	0.46	MNR		0.18
65	MNR	2.8	1.1	MNR	0.84	0.45	MNR		0.17
66	MNR	2.7	1.1	MNR	0.82	0.44	MNR		0.17
67	MNR	2.7	1.1	MNR	0.80	0.42	MNR		0.16
68	MNR	2.7	1.0	MNR	0.78	0.41	MNR		0.15
69	MNR	2.7	1.0	MNR	0.76	0.40	MNR		0.15
70	MNR	2.7	1.0	MNR	0.75	0.39	MNR		0.14
71	MNR	2.7	0.98	MNR	0.73	0.38	MNR		0.13
72	MNR	2.7	0.97	MNR	0.71	0.37	MNR		0.13
73	MNR	2.6	0.95	MNR	0.70	0.36	MNR		0.12
74	MNR	2.6	0.94	MNR	0.68	0.34	MNR		0.12
75	MNR	2.6	0.92	MNR	0.66	0.33	MNR		0.11
76	MNR	2.6	0.91	MNR	0.65	0.32	MNR		0.11
77	MNR	2.6	0.89	MNR	0.63	0.32	MNR		0.10
78	MNR	2.6	0.88	MNR	0.62	0.31	MNR		0.10
79	MNR	2.5	0.86	MNR	0.60	0.30	MNR		0.094
80	MNR	2.5	0.85	MNR	0.59	0.29	MNR		0.090
81	MNR	2.5	0.83	MNR	0.58	0.28	MNR		0.086
82	MNR	2.5	0.82	MNR	0.56	0.27	MNR		0.082
83	MNR	2.5	0.81	MNR	0.55	0.26	MNR		0.079
84	MNR	2.5	0.79	MNR	0.54	0.26	MNR		0.075
85	MNR	2.5	0.78	MNR	0.52	0.25	MNR		0.072
86	MNR	2.4	0.77	MNR	0.51	0.24	MNR		0.069
87	MNR	2.4	0.75	MNR	0.50	0.23	MNR		0.066
88	MNR	2.4	0.74	MNR	0.49	0.23	MNR		0.063
89	MNR	2.4	0.73	MNR	0.48	0.22	MNR		0.060

Table I-3.3a
Calculation of Common Carp Tissue Projections for Remedial Alternative S-2
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042
Dams	3.3	0.29	0.13	0.11	0.072	0.042

S-2
0 years for remediation and step down

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-2 MNR	-0.00589	-0.0166	-0.0237	-0.0297	-0.0729	-0.0440

Upper Bound S-2: (MNR)

	Years to Reach:				
	0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	447	584	612	684	775
Dams	144	193	203	229	261

S-2: (MNR)

	Years to Reach:				
	0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	110	143	150	169	192
Dams	80	106	111	127	145

Lower Bound S-2: (MNR)

	Years to Reach:				
	0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	35	45	48	54	61
Dams	53	71	75	85	98

	Process	Upper Bound S-2: (MNR)		Process	S-2: (MNR)		Process	Lower Bound S-2: (MNR)	
Years[c]	Occurring	Urban	Dams	Occurring	Urban	Dams	Occurring	Urban	Dams
90	MNR	2.4	0.72	MNR	0.47	0.21	MNR		0.058
91	MNR	2.4	0.71	MNR	0.45	0.21	MNR		0.055
92	MNR	2.4	0.69	MNR	0.44	0.20	MNR		0.053
93	MNR	2.3	0.68	MNR	0.43	0.20	MNR		0.051
94	MNR	2.3	0.67	MNR	0.42	0.19	MNR		0.049
95	MNR	2.3	0.66	MNR	0.41	0.18	MNR		0.046
96	MNR	2.3	0.65	MNR	0.40	0.18	MNR		0.044
97	MNR	2.3	0.64	MNR	0.39	0.17	MNR		0.043
98	MNR	2.3	0.63	MNR	0.39	0.17	MNR		0.041
99	MNR	2.3	0.62	MNR	0.38	0.16			
100	MNR	2.2	0.61	MNR	0.37	0.16			
101	MNR	2.2	0.60	MNR	0.36	0.15			
102	MNR	2.2	0.59	MNR	0.35	0.15			
103	MNR	2.2	0.58	MNR	0.34	0.15			
104	MNR	2.2	0.57	MNR	0.33	0.14			
105	MNR	2.2	0.56	MNR	0.33	0.14			
106	MNR	2.2	0.55	MNR	0.32	0.13			
107	MNR	2.2	0.54	MNR	0.31	0.13			
108	MNR	2.1	0.53	MNR	0.30	0.13			
109	MNR	2.1	0.52	MNR	0.30	0.12			
110	MNR	2.1	0.52	MNR	0.29	0.12			
111	MNR	2.1	0.51	MNR	0.28	0.11			
112	MNR	2.1	0.50	MNR	0.28	0.11			
113	MNR	2.1	0.49	MNR	0.27	0.11			
114	MNR	2.1	0.48	MNR	0.26	0.11			
115	MNR	2.1	0.47	MNR	0.26	0.10			
116	MNR	2.0	0.47	MNR	0.25	0.10			
117	MNR	2.0	0.46	MNR	0.25	0.10			
118	MNR	2.0	0.45	MNR	0.24	0.093			
119	MNR	2.0	0.44	MNR	0.23	0.091			
120	MNR	2.0	0.44	MNR	0.23	0.088			
121	MNR	2.0	0.43	MNR	0.22	0.085			
122	MNR	2.0	0.42	MNR	0.22	0.083			
123	MNR	2.0	0.42	MNR	0.21	0.080			
124	MNR	2.0	0.41	MNR	0.21	0.078			
125	MNR	1.9	0.40	MNR	0.20	0.076			
126	MNR	1.9	0.39	MNR	0.20	0.074			
127	MNR	1.9	0.39	MNR	0.19	0.071			
128	MNR	1.9	0.38	MNR	0.19	0.069			
129	MNR	1.9	0.38	MNR	0.18	0.067			
130	MNR	1.9	0.37	MNR	0.18	0.065			
131	MNR	1.9	0.36	MNR	0.18	0.063			
132	MNR	1.9	0.36	MNR	0.17	0.062			
133	MNR	1.9	0.35	MNR	0.17	0.060			
134	MNR	1.8	0.35	MNR	0.16	0.058			
135	MNR	1.8	0.34	MNR	0.16	0.056			
136	MNR	1.8	0.33	MNR	0.16	0.055			
137	MNR	1.8	0.33	MNR	0.15	0.053			
138	MNR	1.8	0.32	MNR	0.15	0.051			
139	MNR	1.8	0.32	MNR	0.15	0.050			
140	MNR	1.8	0.31	MNR	0.14	0.048			
141	MNR	1.8	0.31	MNR	0.14	0.047			
142	MNR	1.8	0.30	MNR	0.14	0.046			
143	MNR	1.7	0.30	MNR	0.13	0.044			
144	MNR	1.7	0.29	MNR	0.13	0.043			
145	MNR	1.7	0.29	MNR	0.13	0.042			
146	MNR	1.7	0.28	MNR	0.12				
147	MNR	1.7	0.28	MNR	0.12				
148	MNR	1.7	0.27	MNR	0.12				
149	MNR	1.7	0.27	MNR	0.12				
150	MNR	1.7	0.27	MNR	0.11				

Notes:
(a) See Calculation Below
(b) Years calculated since remediation started, for S-2 this is at Year 0
(c) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-Based Concentration
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
MDCH = Michigan Department of Community Health

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

Table I-3.3b
Calculation of Common Carp Tissue Projections for Remedial Alternative S-3
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042

S-3
2 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.33
Post SWAC =	0.35	1.09	1.06

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-3 MNR	-0.00589	-0.0237	-0.0729
S-3 Recovery	-0.0237	3.5	-0.0729

Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	112	145	151	170	192

S-3: Section 2-4 Hotspots (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	64	86	90	103	118

Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	27	37	40	46	53

Years[c]	Process Occurring	Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	Process Occurring	S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	Process Occurring	Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)
2011	Current	4.1	Current	4.1	Current	4.1
2012	MNR	4.1	MNR	4.0	MNR	3.8
2013	MNR	4.1	MNR	3.9	MNR	3.5
2014/ ROD	MNR	4.0	MNR	3.8	MNR	3.3
RD 1	MNR	4.0	MNR	3.7	MNR	3.1
1	2 years for Removal	4.0	2 years for Removal Action	3.7	2 years for Removal Action	3.1
2	Action and Step Down	3.9	and Step Down	2.6	and Step Down	1.7
3	Recovery	3.8	Recovery	2.5	Recovery	1.6
4	Recovery	3.7	Recovery	2.4	Recovery	1.5
5	Recovery	3.6	Recovery	2.4	Recovery	1.4
6	Recovery	3.5	Recovery	2.3	Recovery	1.3
7	Recovery	3.5	Recovery	2.2	Recovery	1.2
8	Recovery	3.4	Recovery	2.1	Recovery	1.1
9	Recovery	3.3	Recovery	2.0	Recovery	1.0
10	Recovery	3.2	Recovery	2.0	Recovery	0.96
11	Recovery	3.1	Recovery	1.9	Recovery	0.89
12	Recovery	3.1	Recovery	1.8	Recovery	0.83
13	Recovery	3.0	Recovery	1.8	Recovery	0.77
14	Recovery	2.9	Recovery	1.7	Recovery	0.72
15	Recovery	2.9	Recovery	1.7	Recovery	0.67
16	Recovery	2.8	Recovery	1.6	Recovery	0.62
17	Recovery	2.7	Recovery	1.5	Recovery	0.58
18	Recovery	2.7	Recovery	1.5	Recovery	0.54
19	Recovery	2.6	Recovery	1.4	Recovery	0.50
20	Recovery	2.5	Recovery	1.4	Recovery	0.46
21	Recovery	2.5	Recovery	1.3	Recovery	0.43
22	Recovery	2.4	Recovery	1.3	Recovery	0.40
23	Recovery	2.4	Recovery	1.2	Recovery	0.37
24	Recovery	2.3	Recovery	1.2	Recovery	0.35
25	Recovery	2.3	Recovery	1.2	Recovery	0.32
26	Recovery	2.2	Recovery	1.1	Recovery	0.30
27	Recovery	2.2	Recovery	1.1	Recovery	0.28
28	Recovery	2.1	Recovery	1.0	Recovery	0.26
29	Recovery	2.1	Recovery	1.0	Recovery	0.24
30	Recovery	2.0	Recovery	0.97	Recovery	0.22
31	Recovery	2.0	Recovery	0.94	Recovery	0.21
32	Recovery	1.9	Recovery	0.90	Recovery	0.19
33	Recovery	1.9	Recovery	0.87	Recovery	0.18
34	Recovery	1.8	Recovery	0.84	Recovery	0.17
35	Recovery	1.8	Recovery	0.81	Recovery	0.16
36	Recovery	1.7	Recovery	0.78	Recovery	0.14
37	Recovery	1.7	Recovery	0.76	Recovery	0.13
38	Recovery	1.7	Recovery	0.73	Recovery	0.12
39	Recovery	1.6	Recovery	0.70	Recovery	0.12
40	Recovery	1.6	Recovery	0.68	Recovery	0.11
41	Recovery	1.5	Recovery	0.66	Recovery	0.10
42	Recovery	1.5	Recovery	0.63	Recovery	0.093
43	Recovery	1.5	Recovery	0.61	Recovery	0.087
44	Recovery	1.4	Recovery	0.59	Recovery	0.081
45	Recovery	1.4	Recovery	0.57	Recovery	0.075
46	Recovery	1.4	Recovery	0.55	Recovery	0.070
47	Recovery	1.3	Recovery	0.53	Recovery	0.065
48	Recovery	1.3	Recovery	0.51	Recovery	0.060
49	Recovery	1.3	Recovery	0.49	Recovery	0.056
50	Recovery	1.2	Recovery	0.48	Recovery	0.052
51	Recovery	1.2	Recovery	0.46	Recovery	0.048
52	Recovery	1.2	Recovery	0.44	Recovery	0.045
53	Recovery	1.2	Recovery	0.43	Recovery	0.042
54	Recovery	1.1	Recovery	0.41		
55	Recovery	1.1	Recovery	0.40		
56	Recovery	1.1	Recovery	0.38		
57	Recovery	1.1	Recovery	0.37		
58	Recovery	1.0	Recovery	0.36		
59	Recovery	1.01	Recovery	0.35		
60	Recovery	0.99	Recovery	0.33		
61	Recovery	0.96	Recovery	0.32		
62	Recovery	0.94	Recovery	0.31		
63	Recovery	0.92	Recovery	0.30		
64	Recovery	0.90	Recovery	0.29		
65	Recovery	0.88	Recovery	0.28		
66	Recovery	0.86	Recovery	0.27		
67	Recovery	0.84	Recovery	0.26		
68	Recovery	0.82	Recovery	0.25		
69	Recovery	0.80	Recovery	0.24		
70	Recovery	0.78	Recovery	0.23		
71	Recovery	0.76	Recovery	0.22		
72	Recovery	0.74	Recovery	0.22		
73	Recovery	0.73	Recovery	0.21		
74	Recovery	0.71	Recovery	0.20		
75	Recovery	0.69	Recovery	0.20		
76	Recovery	0.68	Recovery	0.19		
77	Recovery	0.66	Recovery	0.18		
78	Recovery	0.64	Recovery	0.18		
79	Recovery	0.63	Recovery	0.17		
80	Recovery	0.61	Recovery	0.16		
81	Recovery	0.60	Recovery	0.16		
82	Recovery	0.59	Recovery	0.15		
83	Recovery	0.57	Recovery	0.15		
84	Recovery	0.56	Recovery	0.14		
85	Recovery	0.55	Recovery	0.14		
86	Recovery	0.53	Recovery	0.13		
87	Recovery	0.52	Recovery	0.13		

Table I-3.3b
Calculation of Common Carp Tissue Projections for Remedial Alternative S-3
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042

S-3
2 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.33
Post SWAC =	0.35	1.09	1.06

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-3 MNR	-0.00589	-0.0237	-0.0729
S-3 Recovery	-0.0237	3.5	-0.0729

Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	112	145	151	170	192

S-3: Section 2-4 Hotspots (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	64	86	90	103	118

Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	27	37	40	46	53

Years[c]	Process Occurring	Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)	Process Occurring	S-3: Section 2-4 Hotspots (Mid Approximation Step Down)	Process Occurring	Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)
88	Recovery	0.51	Recovery	0.12		
89	Recovery	0.50	Recovery	0.12		
90	Recovery	0.49	Recovery	0.11		
91	Recovery	0.47	Recovery	0.11		
92	Recovery	0.46	Recovery	0.11		
93	Recovery	0.45	Recovery	0.10		
94	Recovery	0.44	Recovery	0.10		
95	Recovery	0.43	Recovery	0.10		
96	Recovery	0.42	Recovery	0.092		
97	Recovery	0.41	Recovery	0.089		
98	Recovery	0.40	Recovery	0.086		
99	Recovery	0.39	Recovery	0.083		
100	Recovery	0.38	Recovery	0.080		
101	Recovery	0.37	Recovery	0.077		
102	Recovery	0.37	Recovery	0.075		
103	Recovery	0.36	Recovery	0.072		
104	Recovery	0.35	Recovery	0.069		
105	Recovery	0.34	Recovery	0.067		
106	Recovery	0.33	Recovery	0.065		
107	Recovery	0.32	Recovery	0.062		
108	Recovery	0.32	Recovery	0.060		
109	Recovery	0.31	Recovery	0.058		
110	Recovery	0.30	Recovery	0.056		
111	Recovery	0.30	Recovery	0.054		
112	Recovery	0.29	Recovery	0.052		
113	Recovery	0.28	Recovery	0.050		
114	Recovery	0.28	Recovery	0.049		
115	Recovery	0.27	Recovery	0.047		
116	Recovery	0.26	Recovery	0.045		
117	Recovery	0.26	Recovery	0.044		
118	Recovery	0.25	Recovery	0.042		
119	Recovery	0.24				
120	Recovery	0.24				
121	Recovery	0.23				
122	Recovery	0.23				
123	Recovery	0.22				
124	Recovery	0.22				
125	Recovery	0.21				
126	Recovery	0.21				
127	Recovery	0.20				
128	Recovery	0.20				
129	Recovery	0.19				
130	Recovery	0.19				
131	Recovery	0.18				
132	Recovery	0.18				
133	Recovery	0.18				
134	Recovery	0.17				
135	Recovery	0.17				
136	Recovery	0.16				
137	Recovery	0.16				
138	Recovery	0.16				
139	Recovery	0.15				
140	Recovery	0.15				
141	Recovery	0.15				
142	Recovery	0.14				
143	Recovery	0.14				
144	Recovery	0.14				
145	Recovery	0.13				
146	Recovery	0.13				
147	Recovery	0.13				
148	Recovery	0.12				

Notes:
(a) See Calculation Below
(b) Years calculated since remediation started, for S-2 this is at Year 0
(c) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-Based Concentration
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
MDCH = Michigan Department of Community Health

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

Table I-3.3c
Calculation of Common Carp Tissue Projections for Remedial Alternative S-4
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042

S-4
4 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.23
Post SWAC =	0.34	0.60	0.90

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-4 MNR	-0.00589	-0.0237	-0.0729
S-4 Recovery	-0.0237	3.5	-0.0729

Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	113	147	153	172	194

S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	54	76	80	93	108

Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	28	38	44	47	54

Years[c]	Process Occurring	Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	Process Occurring	S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	Process Occurring	Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)
2011	Current	4.1	Current	4.1	Current	4.1
2012	MNR	4.1	MNR	4.0	MNR	3.8
2013	MNR	4.1	MNR	3.9	MNR	3.5
2014/ ROD	MNR	4.0	MNR	3.8	MNR	3.3
RD 1	MNR	4.0	MNR	3.7	MNR	3.1
1	4 years for Removal Action and Step Down	4.0	4 years for Removal Action and Step Down	3.7	4 years for Removal Action and Step Down	3.1
2		4.0		3.7		3.1
3		4.0		3.7		3.1
4		3.9		1.7		1.6
5	Recovery	3.8	Recovery	1.6	Recovery	1.5
6	Recovery	3.7	Recovery	1.6	Recovery	1.4
7	Recovery	3.6	Recovery	1.5	Recovery	1.3
8	Recovery	3.5	Recovery	1.5	Recovery	1.2
9	Recovery	3.4	Recovery	1.4	Recovery	1.1
10	Recovery	3.4	Recovery	1.4	Recovery	1.0
11	Recovery	3.3	Recovery	1.3	Recovery	0.95
12	Recovery	3.2	Recovery	1.3	Recovery	0.88
13	Recovery	3.1	Recovery	1.2	Recovery	0.82
14	Recovery	3.1	Recovery	1.2	Recovery	0.76
15	Recovery	3.0	Recovery	1.1	Recovery	0.71
16	Recovery	2.9	Recovery	1.1	Recovery	0.66
17	Recovery	2.9	Recovery	1.1	Recovery	0.61
18	Recovery	2.8	Recovery	1.0	Recovery	0.57
19	Recovery	2.7	Recovery	1.0	Recovery	0.53
20	Recovery	2.7	Recovery	0.96	Recovery	0.49
21	Recovery	2.6	Recovery	0.93	Recovery	0.46
22	Recovery	2.5	Recovery	0.90	Recovery	0.43
23	Recovery	2.5	Recovery	0.86	Recovery	0.40
24	Recovery	2.4	Recovery	0.83	Recovery	0.37
25	Recovery	2.4	Recovery	0.80	Recovery	0.34
26	Recovery	2.3	Recovery	0.78	Recovery	0.32
27	Recovery	2.3	Recovery	0.75	Recovery	0.30
28	Recovery	2.2	Recovery	0.72	Recovery	0.27
29	Recovery	2.1	Recovery	0.70	Recovery	0.26
30	Recovery	2.1	Recovery	0.67	Recovery	0.24
31	Recovery	2.0	Recovery	0.65	Recovery	0.22
32	Recovery	2.0	Recovery	0.63	Recovery	0.20
33	Recovery	2.0	Recovery	0.61	Recovery	0.19
34	Recovery	1.9	Recovery	0.58	Recovery	0.18
35	Recovery	1.9	Recovery	0.56	Recovery	0.16
36	Recovery	1.8	Recovery	0.54	Recovery	0.15
37	Recovery	1.8	Recovery	0.52	Recovery	0.14
38	Recovery	1.7	Recovery	0.51	Recovery	0.13
39	Recovery	1.7	Recovery	0.49	Recovery	0.12
40	Recovery	1.7	Recovery	0.47	Recovery	0.11
41	Recovery	1.6	Recovery	0.46	Recovery	0.11
42	Recovery	1.6	Recovery	0.44	Recovery	0.10
43	Recovery	1.5	Recovery	0.42	Recovery	0.092
44	Recovery	1.5	Recovery	0.41	Recovery	0.085
45	Recovery	1.5	Recovery	0.39	Recovery	0.079
46	Recovery	1.4	Recovery	0.38	Recovery	0.074
47	Recovery	1.4	Recovery	0.37	Recovery	0.069
48	Recovery	1.4	Recovery	0.35	Recovery	0.064
49	Recovery	1.3	Recovery	0.34	Recovery	0.059
50	Recovery	1.3	Recovery	0.33	Recovery	0.055
51	Recovery	1.3	Recovery	0.32	Recovery	0.051
52	Recovery	1.2	Recovery	0.31	Recovery	0.048
53	Recovery	1.2	Recovery	0.30	Recovery	0.044
54	Recovery	1.2	Recovery	0.29	Recovery	0.041
55	Recovery	1.2	Recovery	0.28		
56	Recovery	1.1	Recovery	0.27		
57	Recovery	1.1	Recovery	0.26		
58	Recovery	1.1	Recovery	0.25		
59	Recovery	1.1	Recovery	0.24		
60	Recovery	1.0	Recovery	0.23		
61	Recovery	1.01	Recovery	0.22		
62	Recovery	0.98	Recovery	0.22		
63	Recovery	0.96	Recovery	0.21		
64	Recovery	0.94	Recovery	0.20		
65	Recovery	0.92	Recovery	0.19		
66	Recovery	0.90	Recovery	0.19		
67	Recovery	0.87	Recovery	0.18		
68	Recovery	0.85	Recovery	0.17		
69	Recovery	0.83	Recovery	0.17		
70	Recovery	0.81	Recovery	0.16		
71	Recovery	0.80	Recovery	0.16		
72	Recovery	0.78	Recovery	0.15		
73	Recovery	0.76	Recovery	0.15		
74	Recovery	0.74	Recovery	0.14		
75	Recovery	0.72	Recovery	0.14		
76	Recovery	0.71	Recovery	0.13		
77	Recovery	0.69	Recovery	0.13		
78	Recovery	0.67	Recovery	0.12		
79	Recovery	0.66	Recovery	0.12		
80	Recovery	0.64	Recovery	0.11		
81	Recovery	0.63	Recovery	0.11		
82	Recovery	0.61	Recovery	0.11		
83	Recovery	0.60	Recovery	0.10		
84	Recovery	0.59	Recovery	0.098		
85	Recovery	0.57	Recovery	0.095		
86	Recovery	0.56	Recovery	0.092		
87	Recovery	0.55	Recovery	0.088		

Table I-3.3c
Calculation of Common Carp Tissue Projections for Remedial Alternative S-4
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042

S-4
4 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.49	1.76	2.23
Post SWAC =	0.34	0.60	0.90

	Urban LCL Slope	Urban Mid Slope	Urban UCL Slope
S-4 MNR	-0.00589	-0.0237	-0.0729
S-4 Recovery	-0.0237	3.5	-0.0729

Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	113	147	153	172	194

S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	54	76	80	93	108

Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	28	38	44	47	54

Years[c]	Process Occurring	Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)	Process Occurring	S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)	Process Occurring	Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)
88	Recovery	0.53	Recovery	0.085		
89	Recovery	0.52	Recovery	0.082		
90	Recovery	0.51	Recovery	0.079		
91	Recovery	0.50	Recovery	0.077		
92	Recovery	0.48	Recovery	0.074		
93	Recovery	0.47	Recovery	0.071		
94	Recovery	0.46	Recovery	0.069		
95	Recovery	0.45	Recovery	0.066		
96	Recovery	0.44	Recovery	0.064		
97	Recovery	0.43	Recovery	0.062		
98	Recovery	0.42	Recovery	0.060		
99	Recovery	0.41	Recovery	0.058		
100	Recovery	0.40	Recovery	0.056		
101	Recovery	0.39	Recovery	0.054		
102	Recovery	0.38	Recovery	0.052		
103	Recovery	0.37	Recovery	0.050		
104	Recovery	0.36	Recovery	0.048		
105	Recovery	0.36	Recovery	0.047		
106	Recovery	0.35	Recovery	0.045		
107	Recovery	0.34	Recovery	0.043		
108	Recovery	0.33	Recovery	0.042		
109	Recovery	0.32				
110	Recovery	0.32				
111	Recovery	0.31				
112	Recovery	0.30				
113	Recovery	0.29				
114	Recovery	0.29				
115	Recovery	0.28				
116	Recovery	0.27				
117	Recovery	0.27				
118	Recovery	0.26				
119	Recovery	0.26				
120	Recovery	0.25				
121	Recovery	0.24				
122	Recovery	0.24				
123	Recovery	0.23				
124	Recovery	0.23				
125	Recovery	0.22				
126	Recovery	0.22				
127	Recovery	0.21				
128	Recovery	0.21				
129	Recovery	0.20				
130	Recovery	0.20				
131	Recovery	0.19				
132	Recovery	0.19				
133	Recovery	0.18				
134	Recovery	0.18				
135	Recovery	0.18				
136	Recovery	0.17				
137	Recovery	0.17				
138	Recovery	0.16				
139	Recovery	0.16				
140	Recovery	0.16				
141	Recovery	0.15				
142	Recovery	0.15				
143	Recovery	0.14				
144	Recovery	0.14				
145	Recovery	0.14				
146	Recovery	0.14				
147	Recovery	0.13				
148	Recovery	0.13				

Notes:
(a) See Calculation Below
(b) Years calculated since remediation started, for S-2 this is at Year 0
(c) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-Based Concentration
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
MDCH = Michigan Department of Community Health

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

Table I-3.3d
Calculation of Common Carp Tissue Projections for Remedial Alternative S-5
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042
Dams	3.3	0.29	0.13	0.11	0.072	0.042

S-5
10 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.59	0.59	0.59
Post SWAC =	0.23	0.23	0.23

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-5 MNR	-0.00589	-0.0166	-0.0237	-0.0297	-0.0729	-0.0440
S-5 Recovery	-0.0237	-0.0297	4.5	3.5	-0.0729	-0.0440

Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	118	151	158	176	199
Dams	2	87	114	119	135	153

S-5: Area-wide Removal (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	51	68	71	81	93
Dams	2	56	78	82	95	110

Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg [a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	33	44	46	52	60
Dams	2	46	64	67	78	90

	Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)			S-5: Area-wide Removal (Mid Approximation Step Down)			Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)		
Years[c]	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams
2011	Current	4.1	3.3	Current	4.1	3.3	Current	4.1	3.3
2012	MNR	4.1	3.2	MNR	4.0	3.2	MNR	3.8	3.2
2013	MNR	4.1	3.2	MNR	3.9	3.1	MNR	3.5	3.0
2014/ ROD	MNR	4.0	3.1	MNR	3.8	3.0	MNR	3.3	2.9
RD 1	MNR	4.0	3.1	MNR	3.7	2.9	MNR	3.1	2.8
1		4.0	3.1		3.7	2.9		3.1	2.8
2		4.0	3.1		3.7	2.9		3.1	2.8
3		4.0	3.1		3.7	2.9		3.1	2.8
4		4.0	3.1		3.7	2.9		3.1	2.8
5	10 years for Removal Action and Step Down	4.0	3.1	10 years for Removal Action and Step Down	3.7	2.9	10 years for Removal Action and Step Down	3.1	2.8
6		4.0	3.1		3.7	2.9		3.1	2.8
7		4.0	3.1		3.7	2.9		3.1	2.8
8		4.0	3.1		3.7	2.9		3.1	2.8
9		4.0	3.1		3.7	2.9		3.1	2.8
10		3.8	2.9		1.9	1.5		1.5	1.4
11	Recovery	3.7	2.8	Recovery	1.8	1.4	Recovery	1.4	1.3
12	Recovery	3.6	2.7	Recovery	1.7	1.4	Recovery	1.3	1.3
13	Recovery	3.5	2.7	Recovery	1.6	1.3	Recovery	1.2	1.2
14	Recovery	3.4	2.6	Recovery	1.6	1.3	Recovery	1.2	1.2
15	Recovery	3.3	2.5	Recovery	1.5	1.2	Recovery	1.1	1.1
16	Recovery	3.3	2.4	Recovery	1.4	1.2	Recovery	0.99	1.1
17	Recovery	3.2	2.4	Recovery	1.4	1.1	Recovery	0.92	1.0
18	Recovery	3.1	2.3	Recovery	1.3	1.1	Recovery	0.86	1.0
19	Recovery	3.0	2.2	Recovery	1.2	1.1	Recovery	0.80	0.94
20	Recovery	3.0	2.2	Recovery	1.2	1.0	Recovery	0.74	0.90
21	Recovery	2.9	2.1	Recovery	1.1	1.0	Recovery	0.69	0.86
22	Recovery	2.8	2.0	Recovery	1.1	0.96	Recovery	0.64	0.82
23	Recovery	2.8	2.0	Recovery	1.0	0.93	Recovery	0.60	0.79
24	Recovery	2.7	1.9	Recovery	0.98	0.89	Recovery	0.55	0.75
25	Recovery	2.6	1.9	Recovery	0.94	0.86	Recovery	0.52	0.72
26	Recovery	2.6	1.8	Recovery	0.90	0.83	Recovery	0.48	0.69
27	Recovery	2.5	1.7	Recovery	0.86	0.80	Recovery	0.45	0.66
28	Recovery	2.5	1.7	Recovery	0.82	0.78	Recovery	0.41	0.63
29	Recovery	2.4	1.6	Recovery	0.78	0.75	Recovery	0.39	0.60
30	Recovery	2.3	1.6	Recovery	0.75	0.72	Recovery	0.36	0.58
31	Recovery	2.3	1.6	Recovery	0.71	0.70	Recovery	0.33	0.55
32	Recovery	2.2	1.5	Recovery	0.68	0.67	Recovery	0.31	0.53
33	Recovery	2.2	1.5	Recovery	0.65	0.65	Recovery	0.29	0.51
34	Recovery	2.1	1.4	Recovery	0.62	0.63	Recovery	0.27	0.48
35	Recovery	2.1	1.4	Recovery	0.59	0.60	Recovery	0.25	0.46
36	Recovery	2.0	1.3	Recovery	0.57	0.58	Recovery	0.23	0.44
37	Recovery	2.0	1.3	Recovery	0.54	0.56	Recovery	0.21	0.42
38	Recovery	1.9	1.3	Recovery	0.52	0.54	Recovery	0.20	0.41
39	Recovery	1.9	1.2	Recovery	0.49	0.52	Recovery	0.19	0.39
40	Recovery	1.8	1.19	Recovery	0.47	0.51	Recovery	0.17	0.37
41	Recovery	1.8	1.15	Recovery	0.45	0.49	Recovery	0.16	0.36
42	Recovery	1.8	1.12	Recovery	0.43	0.47	Recovery	0.15	0.34
43	Recovery	1.7	1.09	Recovery	0.41	0.45	Recovery	0.14	0.33
44	Recovery	1.7	1.06	Recovery	0.39	0.44	Recovery	0.13	0.31
45	Recovery	1.6	1.02	Recovery	0.37	0.42	Recovery	0.12	0.30
46	Recovery	1.6	0.99	Recovery	0.36	0.41	Recovery	0.11	0.29
47	Recovery	1.6	0.97	Recovery	0.34	0.39	Recovery	0.10	0.27
48	Recovery	1.5	0.94	Recovery	0.33	0.38	Recovery	0.10	0.26
49	Recovery	1.5	0.91	Recovery	0.31	0.37	Recovery	0.090	0.25
50	Recovery	1.5	0.88	Recovery	0.30	0.35	Recovery	0.083	0.24
51	Recovery	1.4	0.86	Recovery	0.28	0.34	Recovery	0.077	0.23
52	Recovery	1.4	0.83	Recovery	0.27	0.33	Recovery	0.072	0.22
53	Recovery	1.4	0.81	Recovery	0.26	0.32	Recovery	0.067	0.21
54	Recovery	1.3	0.78	Recovery	0.25	0.31	Recovery	0.062	0.20
55	Recovery	1.3	0.76	Recovery	0.24	0.30	Recovery	0.058	0.19
56	Recovery	1.3	0.74	Recovery	0.23	0.29	Recovery	0.054	0.18
57	Recovery	1.2	0.72	Recovery	0.22	0.28	Recovery	0.050	0.18
58	Recovery	1.2	0.70	Recovery	0.21	0.27	Recovery	0.046	0.17
59	Recovery	1.2	0.68	Recovery	0.20	0.26	Recovery	0.043	0.16
60	Recovery	1.2	0.66	Recovery	0.19	0.25	Recovery	0.040	0.15
61	Recovery	1.1	0.64	Recovery	0.18	0.24	Recovery		0.15
62	Recovery	1.1	0.62	Recovery	0.17	0.23	Recovery		0.14
63	Recovery	1.1	0.60	Recovery	0.16	0.22	Recovery		0.14
64	Recovery	1.0	0.58	Recovery	0.16	0.22	Recovery		0.13
65	Recovery	1.0	0.57	Recovery	0.15	0.21	Recovery		0.12
66	Recovery	1.0	0.55	Recovery	0.14	0.20	Recovery		0.12
67	Recovery	0.98	0.53	Recovery	0.14	0.19	Recovery		0.11
68	Recovery	0.95	0.52	Recovery	0.13	0.19	Recovery		0.11
69	Recovery	0.93	0.50	Recovery	0.12	0.18	Recovery		0.10
70	Recovery	0.91	0.49	Recovery	0.12	0.17	Recovery		0.10
71	Recovery	0.89	0.47	Recovery	0.11	0.17	Recovery		0.10
72	Recovery	0.87	0.46	Recovery	0.11	0.16	Recovery		0.091
73	Recovery	0.85	0.45	Recovery	0.10	0.16	Recovery		0.087
74	Recovery	0.83	0.43	Recovery	0.10	0.15	Recovery		0.083
75	Recovery	0.81	0.42	Recovery	0.094	0.15	Recovery		0.080
76	Recovery	0.79	0.41	Recovery	0.090	0.14	Recovery		0.076
77	Recovery	0.77	0.40	Recovery	0.086	0.14	Recovery		0.073
78	Recovery	0.75	0.38	Recovery	0.082	0.13	Recovery		0.070
79	Recovery	0.74	0.37	Recovery	0.078	0.13	Recovery		0.067
80	Recovery	0.72	0.36	Recovery	0.075	0.12	Recovery		0.064
81	Recovery	0.70	0.35	Recovery	0.071	0.12	Recovery		0.061
82	Recovery	0.68	0.34	Recovery	0.068	0.11	Recovery		0.059
83	Recovery	0.67	0.33	Recovery	0.065	0.11	Recovery		0.056
84	Recovery	0.65	0.32	Recovery	0.062	0.11	Recovery		0.054
85	Recovery	0.64	0.31	Recovery	0.059	0.10	Recovery		0.051
86	Recovery	0.62	0.30	Recovery	0.057	0.10	Recovery		0.049
87	Recovery	0.61	0.29	Recovery	0.054	0.095	Recovery		0.047

Table I-3.3d
Calculation of Common Carp Tissue Projections for Remedial Alternative S-5
Area 1, OU5 Kalamazoo River

	Current Concentration (Median of 2006 - 2011)	2012 Morrow Lake Reference Concentration	2006 Ceresco Reservoir Reference Concentration	MDCH: 2 Meals Per Month	Human Health Fish Consumption RBC: High End Sport Angler HQ = 1	Human Health Fish Consumption RBC: High End Sport Angler 10^{-5}
Urban	4.1	0.29	0.13	0.11	0.072	0.042
Dams	3.3	0.29	0.13	0.11	0.072	0.042

S-5
10 years for remediation and step down

	LCL	Mid	UCL
Pre SWAC =	0.59	0.59	0.59
Post SWAC =	0.23	0.23	0.23

	Urban LCL Slope	Dams LCL Slope	Urban Mid Slope	Dams Mid Slope	Urban UCL Slope	Dams UCL Slope
S-5 MNR	-0.00589	-0.0166	-0.0237	-0.0297	-0.0729	-0.0440
S-5 Recovery	-0.0237	-0.0297	4.5	3.5	-0.0729	-0.0440

Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	118	151	158	176	199
Dams	2	87	114	119	135	153

S-5: Area-wide Removal (Mid Approximation Step Down)

	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	51	68	71	81	93
Dams	2	56	78	82	95	110

Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

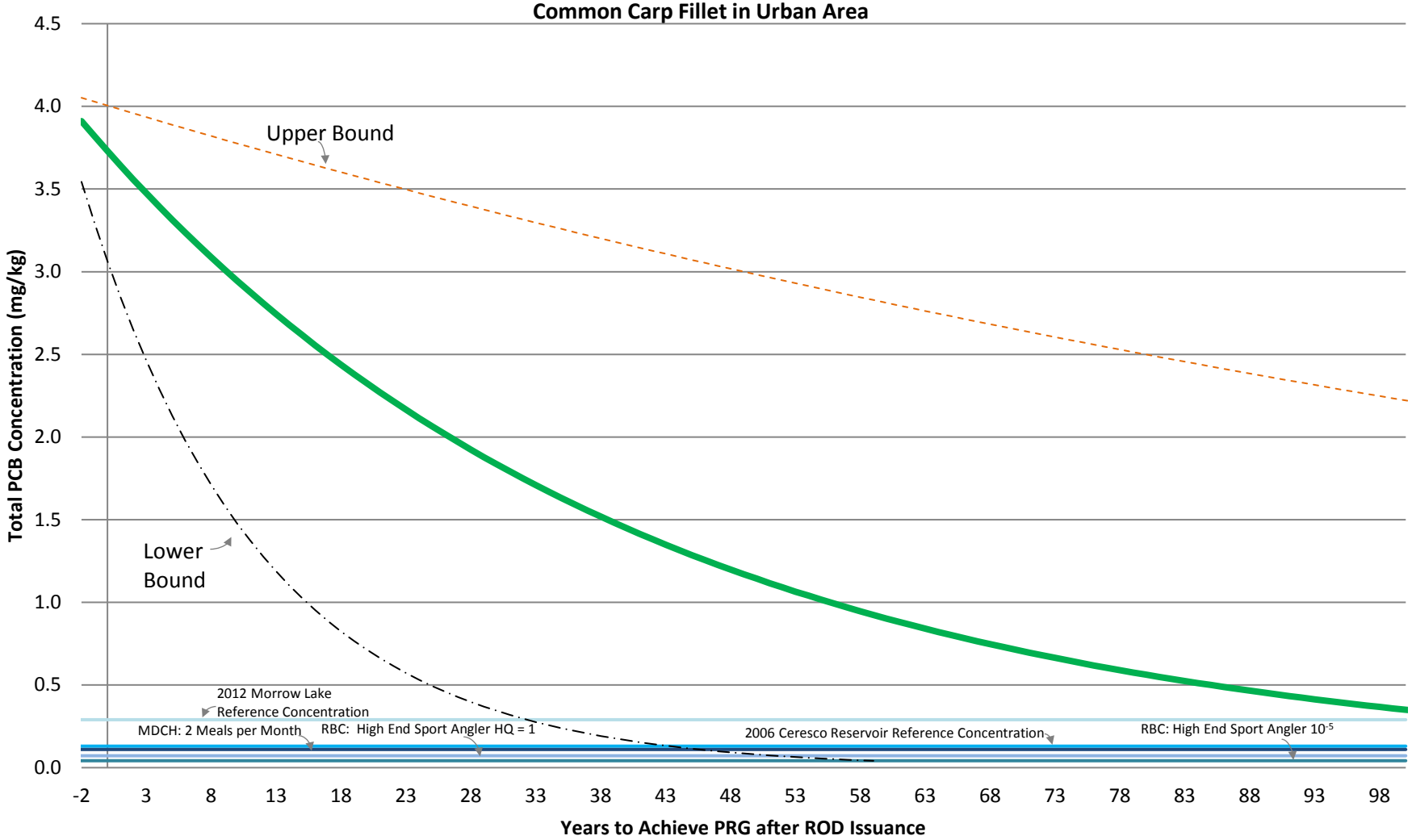
	Years of MNR	Years to Reach: 0.29 mg/kg[a,b]	0.13 mg/kg[a,b]	0.11 mg/kg[a,b]	0.072 mg/kg[a,b]	0.042 mg/kg[a,b]
Urban	2	33	44	46	52	60
Dams	2	46	64	67	78	90

	Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)			S-5: Area-wide Removal (Mid Approximation Step Down)			Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)		
Years[c]	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams	Process Occurring	Urban	Dams
88	Recovery	0.59	0.29	Recovery	0.052	0.091	Recovery		0.045
89	Recovery	0.58	0.28	Recovery	0.049	0.088	Recovery		0.043
90	Recovery	0.57	0.27	Recovery	0.047	0.085	Recovery		0.041
91	Recovery	0.55	0.26	Recovery	0.045	0.082			
92	Recovery	0.54	0.25	Recovery	0.043	0.079			
93	Recovery	0.53	0.25	Recovery	0.041	0.077			
94	Recovery	0.52	0.24	Recovery		0.074			
95	Recovery	0.50	0.23	Recovery		0.071			
96	Recovery	0.49	0.23	Recovery		0.069			
97	Recovery	0.48	0.22	Recovery		0.066			
98	Recovery	0.47	0.21	Recovery		0.064			
99	Recovery	0.46	0.21	Recovery		0.062			
100	Recovery	0.45	0.20	Recovery		0.060			
101	Recovery	0.44	0.19	Recovery		0.058			
102	Recovery	0.43	0.19	Recovery		0.056			
103	Recovery	0.42	0.18	Recovery		0.054			
104	Recovery	0.41	0.18	Recovery		0.052			
105	Recovery	0.40	0.17	Recovery		0.050			
106	Recovery	0.39	0.17	Recovery		0.048			
107	Recovery	0.38	0.16	Recovery		0.046			
108	Recovery	0.37	0.16	Recovery		0.045			
109	Recovery	0.36	0.15	Recovery		0.043			
110	Recovery	0.35	0.15	Recovery		0.042			
111	Recovery	0.34	0.14						
112	Recovery	0.34	0.14						
113	Recovery	0.33	0.14						
114	Recovery	0.32	0.13						
115	Recovery	0.31	0.13						
116	Recovery	0.31	0.12						
117	Recovery	0.30	0.12						
118	Recovery	0.29	0.12						
119	Recovery	0.29	0.11						
120	Recovery	0.28	0.11						
121	Recovery	0.27	0.11						
122	Recovery	0.27	0.10						
123	Recovery	0.26	0.10						
124	Recovery	0.25	0.098						
125	Recovery	0.25	0.095						
126	Recovery	0.24	0.092						
127	Recovery	0.24	0.090						
128	Recovery	0.23	0.087						
129	Recovery	0.23	0.084						
130	Recovery	0.22	0.082						
131	Recovery	0.21	0.080						
132	Recovery	0.21	0.077						
133	Recovery	0.20	0.075						
134	Recovery	0.20	0.073						
135	Recovery	0.20	0.071						
136	Recovery	0.19	0.069						
137	Recovery	0.19	0.067						
138	Recovery	0.18	0.065						
139	Recovery	0.18	0.063						
140	Recovery	0.17	0.061						
141	Recovery	0.17	0.059						
142	Recovery	0.17	0.057						
143	Recovery	0.16	0.056						
144	Recovery	0.16	0.054						
145	Recovery	0.15	0.052						
146	Recovery	0.15	0.051						
147	Recovery	0.15	0.049						
148	Recovery	0.14	0.048						

Notes:
(a) See Calculation Below
(b) Years calculated since remediation started, for S-2 this is at Year 0
(c) Years includes time for Record of Decision (ROD) issuance, Remedial Design (RD), and MNR occuring since last fish samples collected.
RBC = Risk-Based Concentration
MNR = Monitored Natural Recovery
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
MDCH = Michigan Department of Community Health

Prepared by/Date: NHS 11/15/13
Checked by/Date: NTG 01/11/14

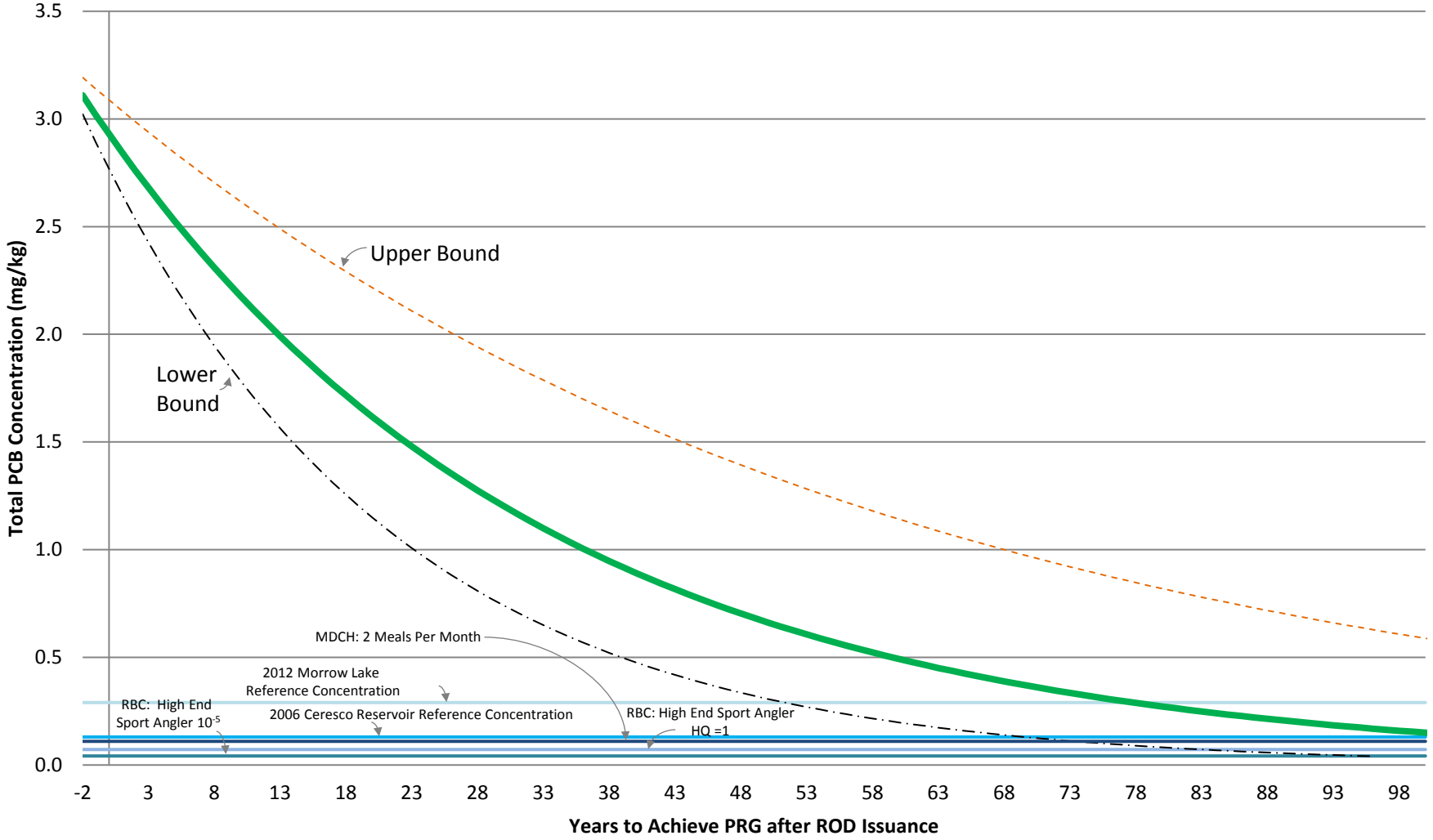
Figure I-3.1a
Fish Tissue Projections for S-2:
Common Carp Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.29 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.13 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler HQ =1 = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler 10^{-4} = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler 10^{-5} = 0.042 mg/kg
Refer to Table I-3.1 for definition of segments

Upper Bound S-2: (MNR)
S-2: (MNR)
Lower Bound S-2: (MNR)

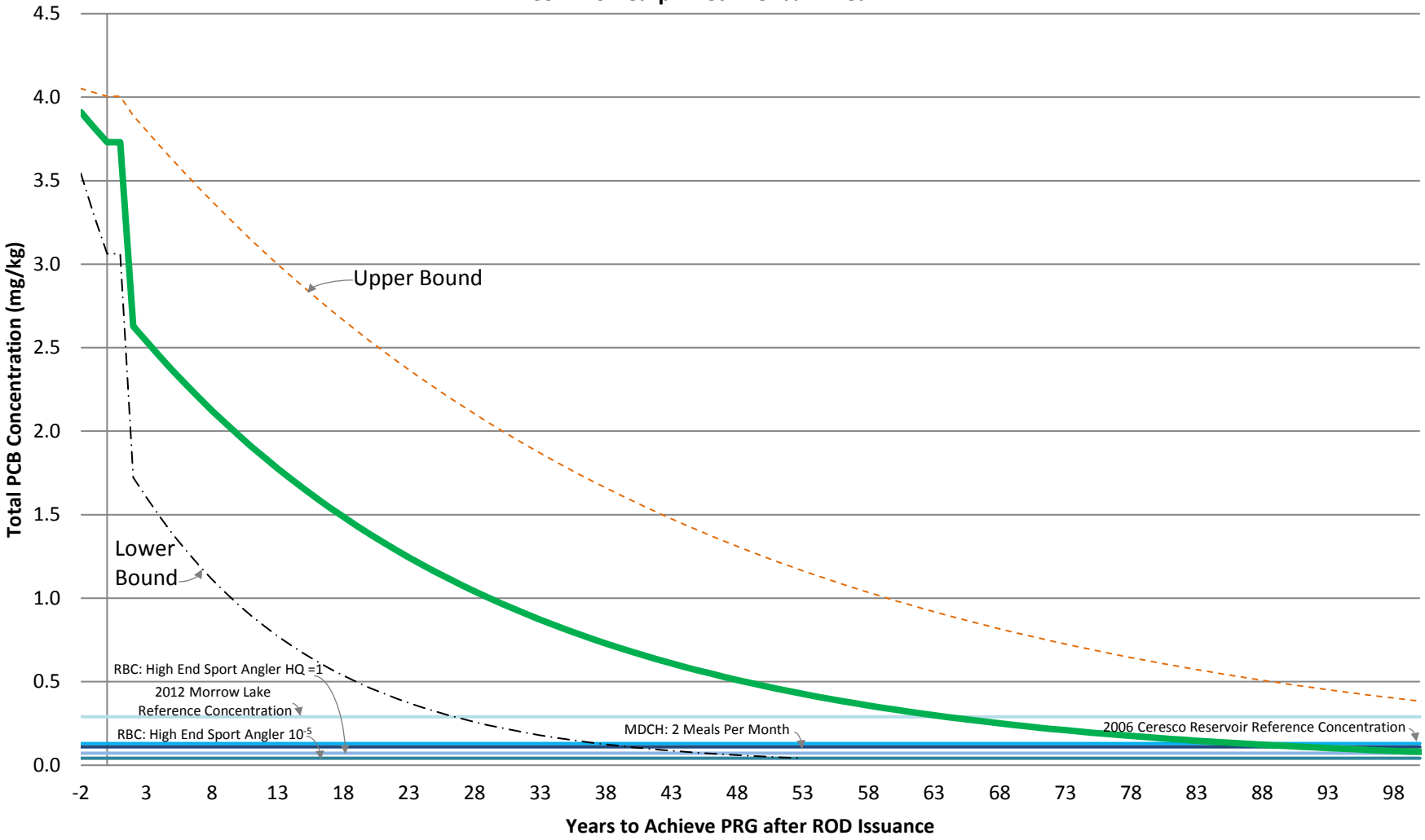
Figure I-3.1b
Fish Tissue Projections for S-2:
Common Carp Fillet in Dams Area



2012 Morrow Lake Reference Concentration = 0.29 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.13 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler HQ = 1 = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler 10^{-4} = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler 10^{-5} = 0.042 mg/kg
Refer to Table I-3.1 for definition of segments

- - - - - Upper Bound S-2: (MNR)
S-2: (MNR)
— · — · - Lower Bound S-2: (MNR)

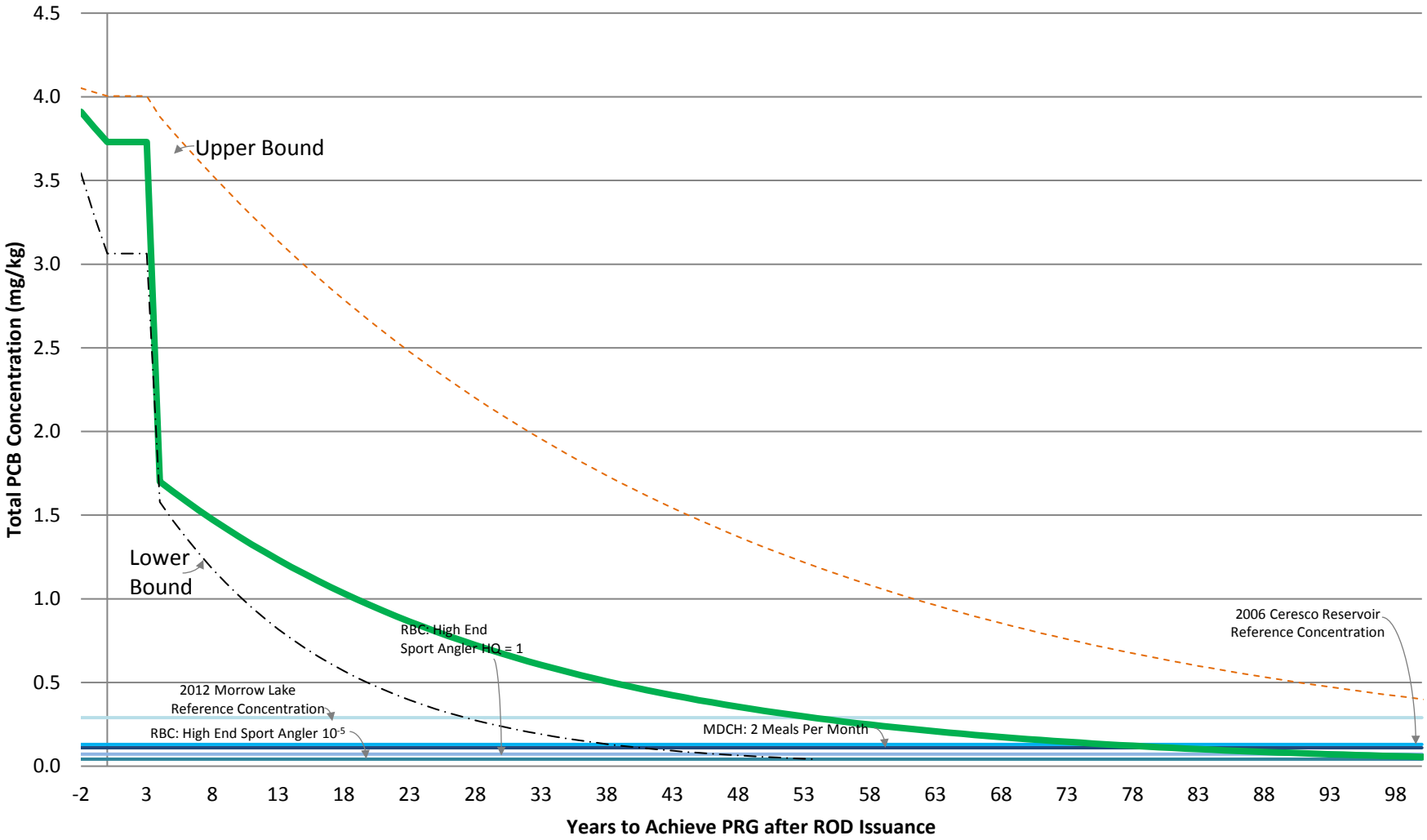
Figure I-3.2
Fish Tissue Projections for S-3:
Common Carp Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.29 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.13 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler HQ = 1 = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler 10^{-4} = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler 10^{-5} = 0.042 mg/kg
Refer to Table I-3.2 for definition of segments

- - - - Upper Bound S-3: Section 2-4 Hotspots (Upper Bound Step Down)
—— S-3: Section 2-4 Hotspots (Mid Approximation Step Down)
—·—·- Lower Bound S-3: Section 2-4 Hotspots (Lower Bound Step Down)

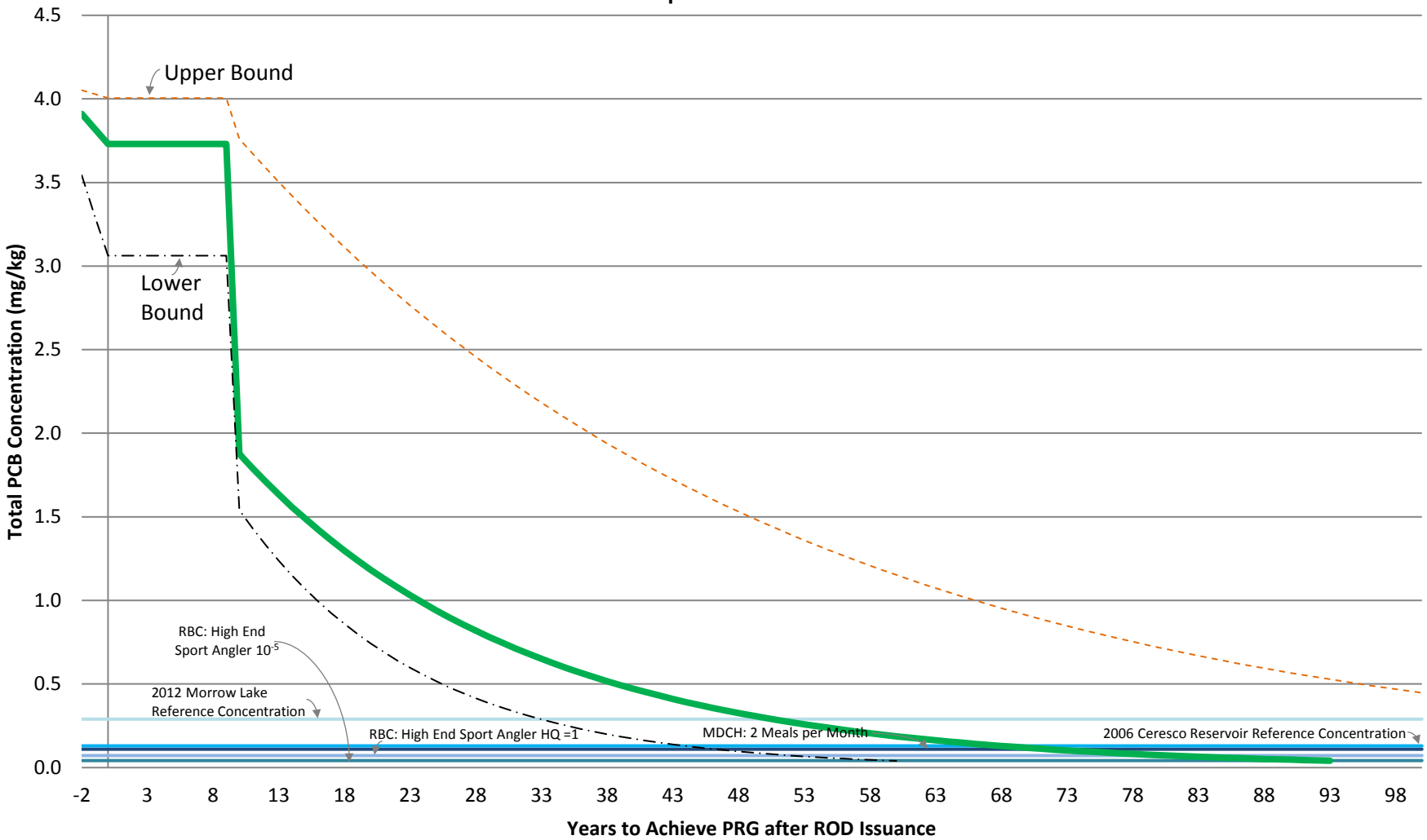
Figure I-3.3
Fish Tissue Projections for S-4:
Carp Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.29 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.13 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ =1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
Refer to Table I-3.3 for definition of segments

- - - - - Upper Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Upper Bound Step Down)
——— S-4: Section 2-4 Hotspots and Section 3 Edges (Mid Approximation Step Down)
—·—·- Lower Bound S-4: Section 2-4 Hotspots and Section 3 Edges (Lower Bound Step Down)

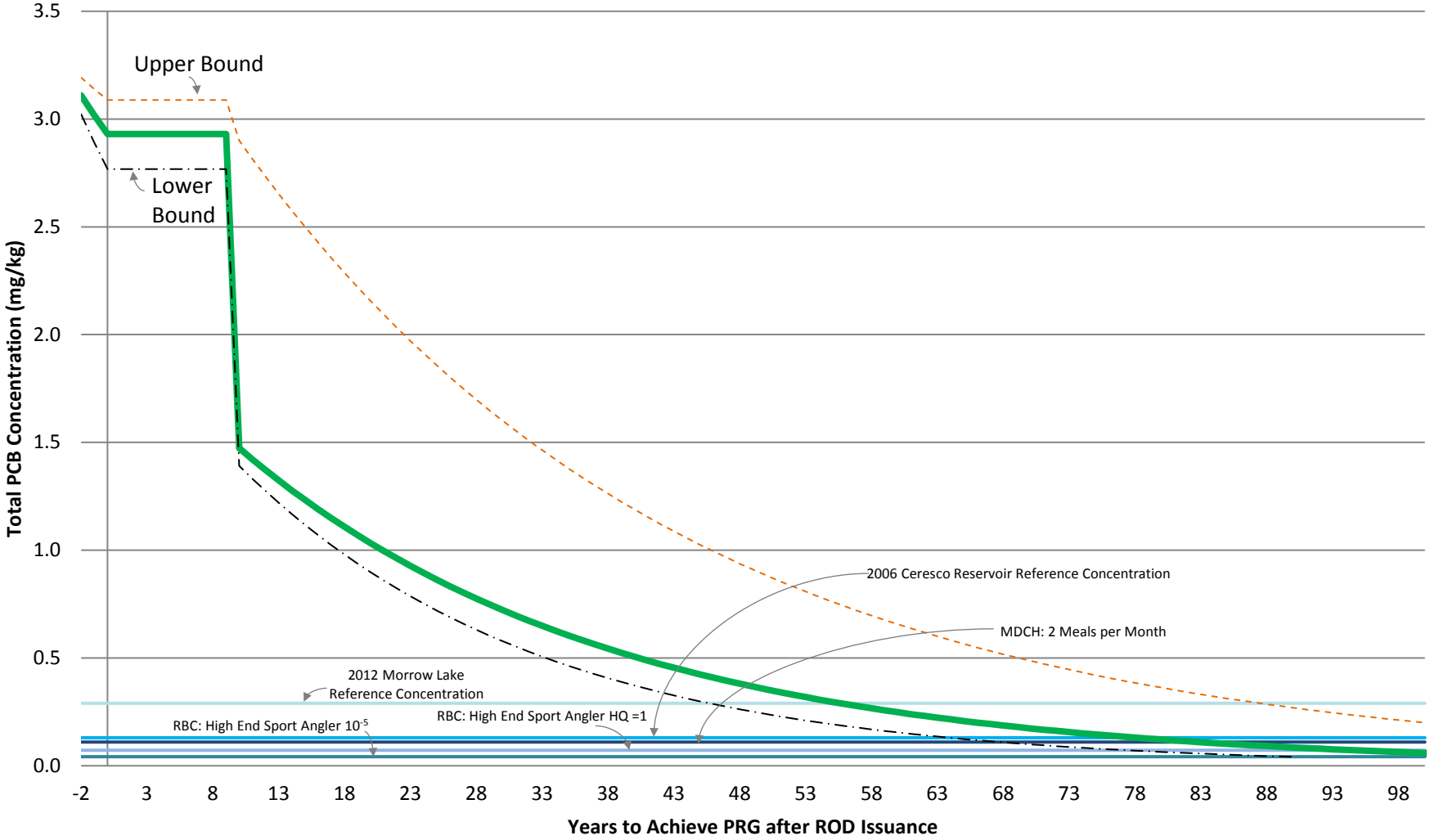
Figure I-3.4a
Fish Tissue Projections for S-5:
Common Carp Fillet in Urban Area



2012 Morrow Lake Reference Concentration = 0.29 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.13 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ =1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
Refer to Table I-3.4 for definition of segments

- - - - Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)
——— S-5: Area-wide Removal (Mid Approximation Step Down)
—·—·- Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)

Figure I-3.4b
Fish Tissue Projections for S-5:
Common Carp Fillet in Dams Area



2012 Morrow Lake Reference Concentration = 0.29 mg/kg
2006 Ceresco Reservoir Reference Concentration = 0.13 mg/kg
MDCH: 2 Meals Per Month = 0.11 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (HQ =1) = 0.072 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-4}) = 0.42 mg/kg
Human Health Fish Consumption RBC: High End Sport Angler (10^{-5}) = 0.042 mg/kg
Refer to Table I-3.4 for definition of segments

- - - - - Upper Bound S-5: Area-wide Removal (Upper Bound Step Down)
S-5: Area-wide Removal (Mid Approximation Step Down)
— · — · - Lower Bound S-5: Area-wide Removal (Lower Bound Step Down)