ECF-300FF5-20-0053
Revision 0

CALCULATION OF CONCENTRATION TRENDS, MEANS, AND CONFIDENCE LIMITS FOR CIS-1,2-DICHLOROETHENE, GROSS ALPHA, NITRATE, TRICHLOROETHENE, TRITIUM, AND URANIUM IN THE 300-FF-5 OPERABLE UNIT THROUGH CY 2019

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
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August 2020

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APPROVED
By Julia Raymer at 8:26 am, Aug 11, 2020

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ENVIRONMENTAL CALCULATION COVER PAGE

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Calculation of Concentration Trends, Means, and Confidence Limits for cis-1,2-Dichloroethene, Gross Alpha, Nitrate, Trichloroethene, Tritium, and Uranium in the 300-FF-5 Operable Unit through CY 2019

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Thank you,

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Terms

AWLN	automated water level network
CHPRC	CH2M HILL Plateau Remediation Company
COC	contaminant of concern
CRAN	Comprehensive R Archive Network
csv	comma separated value
CY	calendar year
EA	enhanced attenuation
ECF	environmental calculation file
HEIS	Hanford Environmental Information System
LCL	lower confidence limit
m amsl	meters above mean sea level (m amsl)
MDA	minimum detectable activity
MDL	method detection limit
MNA	monitored natural attenuation
OLS	ordinary least squares
OU	operable unit
ROD	record of decision
txt	text
UCL	upper confidence limit
USGS	U.S. Geological Survey

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1 Purpose

This environmental calculation file (ECF) presents estimates of concentration trends, yearly mean concentrations, and confidence limits for groundwater wells in the 300-FF-5 Operable Unit (OU) that are used for monitoring the monitored natural attenuation (MNA) remedy for *cis*-1,2-dichloroethene (*cis*-1,2-DCE), nitrate, trichloroethene (TCE), and tritium; and the enhanced attenuation (EA) remedy for uranium and gross alpha.

2 Background

The 300-FF-5 OU comprises groundwater contaminated by releases from facilities and waste sites associated with past operation of the 300 Area fuel fabrication facilities. The 300 Area record of decision (ROD) was issued in 2013 (EPA and DOE, 2013, *Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*). The ROD specifies EA, MNA, groundwater monitoring, and institutional controls to restrict groundwater use as the final 300-FF-5 OU remedial actions. The remedy is being implemented to address uranium, TCE, *cis*-1,2-DCE, gross alpha, nitrate, and tritium in 300-FF-5 OU groundwater. Performance monitoring of the remediation of these contaminants of concern (COCs) in the groundwater is a component of the EA and MNA remedies.

This document presents calculated concentration trends, annual mean concentrations, and associated lower confidence limits (LCLs) and upper confidence limits (UCLs) of the mean. These statistics were calculated using groundwater-concentration, groundwater-elevation, and river-stage data collected through the end of calendar year (CY) 2019.

3 Methodology

This chapter discusses the data and methods used for completing the calculations presented in this document.

3.1 Data Acquisition and Processing Prior to Trend Analysis

This section discusses the acquisition and processing of data before performing the calculations.

3.1.1 Data Acquisition

This section discusses the acquisition of data used in this analysis.

3.1.1.1 Chemistry Data

Groundwater chemistry data were downloaded from the Hanford Environmental Information System (HEIS) database, which is maintained by CH2M HILL Plateau Remediation Company (CHPRC), and exported into a Microsoft Access® database (named HEIS_CHEM_03052020.accdb). The data for this analysis were downloaded from the HEIS database on March 5, 2020. One table was downloaded from the HEIS database (HEIS_ADM_PNLGW_STD_RESULT_MV_2), which contains information on groundwater samples, including laboratory and review data qualifiers, sample medium, sample collection purpose, analytical method, and reporting limits. Table 1 presents the fields extracted from the HEIS database for use in calculations described in this document.

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Table 1. HEIS Database Fields for Chemistry Data

Field Extracted [a]	Definition
WELL_NAME	Location Identification
SAMP_DATE_TIME	Sampling Date
STD_CON_LONG_NAME	Analyte Name
STD_VALUE_RPTD	Reported Concentration
STD_ANAL_UNITS_RPTD	Units for Concentration Measurement
LAB_QUALIFIER	Laboratory Data Qualifier
REVIEW_QUALIFIER	Review Data Qualifier [b]
COLLECTION_PURPOSE	Primary Reason for Sample Collection
VALIDATION_QUALIFIER	Validation Qualifier

a. Field codes are defined in HNF-38155, *HEIS Sample, Result, and Sampling Site Data Dictionary*.

b. F = The result is undergoing further review; G = Record has been reviewed and determined to be correct, or the record has been corrected with laboratory confirmation or other supporting information; H = Laboratory holding time exceeded before the sample was analyzed; P = Potential problem. Collection/analysis circumstances makes value questionable; Q = Associated quality control sample is out of limits; R = Do not use. Further review indicates the result is not valid; Y = Result suspect. Review provided insufficient evidence to show result valid or invalid; Z = Miscellaneous circumstances exist. Additional information may be found in the RESULT_COMMENT field for this record.

HEIS = Hanford Environmental Information System

3.1.1.2 Water Level Data

Groundwater elevation data were downloaded from the HEIS database and exported into a Microsoft Access database (named HEIS_03052020.accdb). The data for this analysis were downloaded from the HEIS database on March 5, 2020. The table in the HEIS_03052020 database pertaining to manual water level measurements is titled HEIS_ADM_HYDRAULIC_HEAD_MV (Table 2). The data from this table are exported into a text file named qryManHEIS.txt, which contains data from the HEIS_ADM_HYDRAULIC_HEAD_MV table together with an additional field (“Type”) that identifies these data as manual water-level measurements (“MAN”).

Table 2. HEIS Database Fields for Manual Water Level Measurements

Field Extracted*	Definition
HEIS_ADM_HYDRAULIC_HEAD_MV	
WELL_NAME	Location Identification
HYD_DATE_TIME_PST	Measurement Date
HYD_HEAD_METERS_NAVD88	Depth to Water (m)
REVIEW_QUALIFIER	Measurement Qualifier

Table 2. HEIS Database Fields for Manual Water Level Measurements

Field Extracted*	Definition

*Field codes are defined in HNF-38155, *HEIS Sample, Result, and Sampling Site Data Dictionary*.

HEIS = Hanford Environmental Information System

Transducer data were obtained directly from CHPRC for the following wells: 399-1-10A, 399-1-12, 399-1-16A, 399-1-17A, 399-1-2, 399-1-21A, 399-1-7, 399-2-2, 399-2-32, 399-4-7, 399-8-1, and 399-8-5A. The data were obtained in several comma-separated value (csv) files and consist of water-level measurements obtained on a 15-minute interval.

3.1.1.3 River-Stage Data

Daily river-stage data for U.S. Geological Survey (USGS) Station 12472800, Columbia River below Priest Rapids Dam, Washington, were downloaded from the USGS National Water Information System (USGS 12472800, "Columbia River Below Priest Rapids Dam, WA"). Fifteen-minute river-stage elevation data for the 300 Area river gauge from February 6, 2013, to December 31, 2019, were obtained directly from CHPRC in several CSV files. Hourly river-stage elevation data for the 300 Area river gauge were obtained from the automated water level network (AWLN) database, which is maintained by CHPRC, and exported into a Microsoft Access database named AWLN_03052020.accdb (Table 3). The database maintains 300 Area river-gauge data from January 1, 2004, to February 1, 2013. The data for this analysis were downloaded on March 5, 2020. The data from this table are exported into a text file named qryAWLNAWLN.txt, which contains data from the dbo_v_AWLN_ProcessedData table together with an additional field ("Type") that identifies this data as transducer water level measurements ("XD").

Table 3. AWLN Database Fields

Field Extracted*	Definition
dbo_v_AWLN_ProcessedData	
WELL_NAME	Location Identification
PROCDATE	Measurement Date and Time
PROCWATERELEVATION	Transducer Reading

*Field codes are defined in HNF-38155, *HEIS Sample, Result, and Sampling Site Data Dictionary*.

AWLN = automated water level network.

A complete record for the 300 Area river gauge was compiled using the above three sources in order to have a continuous record from January 1, 1994 through December 31, 2019 (Table 4)[1]. Whenever possible, measured river-stage data were used in this analysis. River-stage data obtained using the method of convolution detailed in ECF-Hanford-13-0028, *Columbia River Stage Correlation for the Hanford Area*, were used when measured 300 Area river-stage data were not available. Figure 1 presents the final river-stage data set for the 300 Area river gauge in meters above mean sea level (m amsl).

[1] The 2017 AWLN database (downloaded on March 12, 2018) was used to fill in the missing or erroneous data present in the 2018 AWLN database.

Table 4. Data Sources for 300 Area River-Gauge Data

Date Range	Data Source
01/01/1994 to 12/31/2003	Convolution of Priest Rapids Dam measurements [a]
01/01/2004 to 05/19/2011	AWLN Database
05/20/2011 to 06/29/2011	Convolution of Priest Rapids Dam measurements [a,b]
06/30/2011 to 11/01/2011	AWLN Database
11/02/2011 to 12/11/2011	Convolution of Priest Rapids Dam measurements [a,b]
12/12/2011 to 06/25/2012	AWLN Database
06/26/2012	Convolution of Priest Rapids Dam measurements [a,b]
06/27/2012 to 06/28/2012	AWLN Database
06/29/2012 to 07/01/2012	Convolution of Priest Rapids Dam measurements [a,b]
07/02/2012 to 02/01/2013	AWLN Database
02/02/2013 to 02/05/2013	Convolution of Priest Rapids Dam measurements [a,b]
02/06/2013 to 07/26/2013	CHPRC csv files
07/27/2013 to 08/01/2013	Convolution of Priest Rapids Dam measurements [a,b]
08/02/2013 to 11/03/2016	CHPRC csv files
11/04/2016 to 11/09/2016	Convolution of Priest Rapids Dam measurements [a,b]
11/10/2016 to 06/05/2017	CHPRC csv files
06/06/2017 to 06/12/2017	Convolution of Priest Rapids Dam measurements [a,b]
06/13/2017 to 12/10/2017	CHPRC csv files
12/11/2017 to 12/17/2017	Convolution of Priest Rapids Dam measurements [a,b]
12/18/2017	CHPRC csv files
12/19/2017	Convolution of Priest Rapids Dam measurements [a,b]
12/20/2017 to 12/31/2019	CHPRC csv files

a. ECF-Hanford-13-0028, *Columbia River Stage Correlation for the Hanford Area*, Rev. 2

b. Data for this time period were missing from the AWLN database and CHPRC data files.

AWLN = automated water level network

CHPRC = CH2M HILL Plateau Remediation Company

csv = comma-separated value

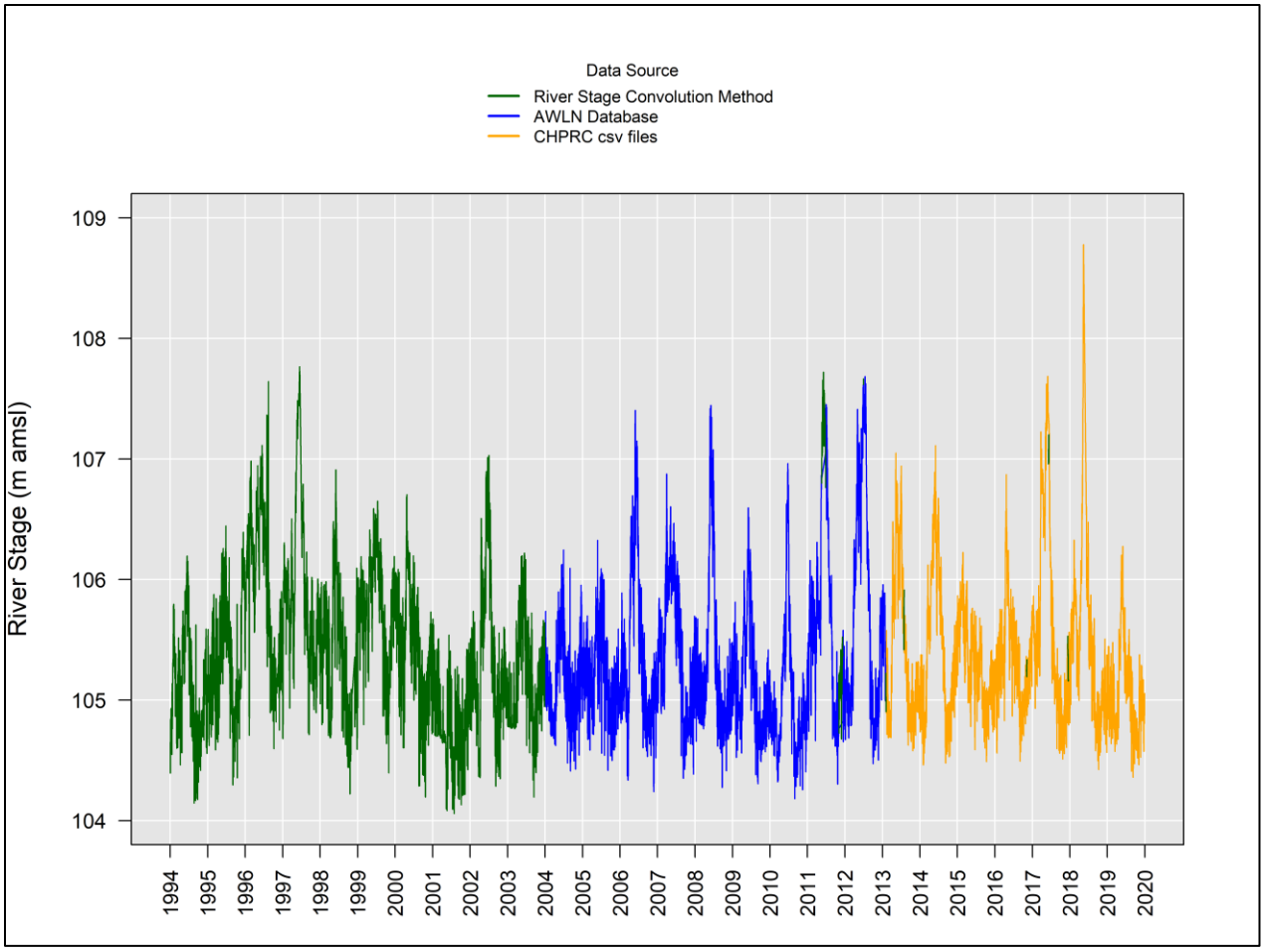

Figure 1. Compiled 300 Area River-Stage Data Set

3.1.1.4 Well Coordinates and Screen Data

Well coordinates and screen interval data were downloaded from the HEIS database on March 5, 2020, and exported into Microsoft Access databases (HEIS_03052020.accdb). The tables in the database pertaining to well coordinates and screen interval data are titled as follows:

- WELL_ADM_WELL_ATTRIBUTES_MV
- WELL_ADM_WELL_ELEVATION
- WELL_ADM_WELL_SCREEN

The table WELL_ADM_WELL_ATTRIBUTES_MV contains information on well location, OU, well type, well status, and well depth. The WELL_ADM_WELL_ELEVATION table contains the elevation of the manual water-level measurement reference point. The WELL_ADM_WELL_SCREEN table contains information on the screened interval of each well. Table 5 presents the fields extracted from the HEIS database.

Table 5. HEIS Database Fields for Well Coordinates and Screen Interval Data

Field Extracted [a]	Definition
WELL_ADM_WELL_ATTRIBUTES_MV	
WELL_NAME	Location Identification
WELL_ID	Secondary Identification
WELL_TYPE	Well Type
STATUS	Well Status
DRILL_DEPTH	Total Hole Depth (ft)
DEPTH_TO_BOTTOM	Total Well Depth (ft)
ZCOORDS	Well Elevation [b] (m amsl)
YCOORDS	Northing [c] (m)
XCOORDS	Easting [c] (m)
GW_AREA_OF_INTEREST	Operable Unit
WELL_ADM_WELL_ELEVATION	
WELL_ID	Secondary Identification
DISC_Z	Reference Point Elevation (m amsl)
WELL_ADM_WELL_SCREEN	
WELL_ID	Secondary Identification
SCREEN_DEPTH_TOP	Top of the Screen
SCREEN_DEPTH_BOTTOM	Bottom of the Screen
SCREEN_DEPTH_UNITS	Screen Interval Units (ft)

a. Field codes are defined in HNF-38155, *HEIS Sample, Result, and Sampling Site Data Dictionary*.
b. Elevations are reported in NAVD88, *North American Vertical Datum of 1988*.
c. Eastings and northings are reported in NAD83, *North American Datum of 1983*, State Plane Washington South.
m amsl = meters above mean sea level
HEIS = Hanford Environmental Information System

The data from these tables were exported into three text (txt) files: qryWellHWIS, which contains data from the WELL_ADM_WELL_ATTRIBUTES_MV table; qryElev_HWIS, which contains data from the WELL_ADM_WELL_ELEVATION table; and qryScreenHWIS, which contains data from the WELL_ADM_WELL_SCREEN table. For this analysis, data from the WELL_ADM_WELL_ATTRIBUTES_MV table were limited to data where the REVIEW_QUALIFIER field was null and data from the WELL_ADM_WELL_SCREEN table were limited to data where the SCREEN_DEPTH_UNITS field was “ft.”

3.1.2 Identifying Non-Detects

Non-detects in the chemistry data set were identified using the laboratory qualifier (LAB_QUALIFIER = U). The method detection limit (MDL) was substituted for concentration measurements with reported values of zero (i.e., for *cis*-1,2-DCE, nitrate, TCE, and uranium). The minimum detectable activity (MDA) was

substituted for activity measurements with reported values less than or equal to zero (i.e., for gross alpha and tritium). If the reported value was less than or equal to zero and an MDL or MDA was not provided, a value of 1 was substituted for concentration or activity. This substitution only occurred for one measured uranium sample and 31 measured tritium samples (Table 6). All estimated data (LAB_QUALIFIER = B or J) were treated as detected values.

Table 6. Samples with Reported Values Less than or Equal to Zero and No Reported MDL/MDA

Well Name	Sample Date	Analyte	Reported Value*	Measurement Unit
399-1-1	01/29/1986	Tritium	-110 U	pCi/L
399-1-1	10/15/1987	Tritium	-288 U	pCi/L
399-1-1	07/08/1988	Tritium	-114 U	pCi/L
399-1-11	02/05/1988	Tritium	-125 U	pCi/L
399-1-11	11/09/1988	Tritium	-89 U	pCi/L
399-1-12	02/11/1988	Tritium	-48.4 U	pCi/L
399-1-16B	11/28/1988	Tritium	-1.08 U	pCi/L
399-1-16B	10/04/1995	Tritium	-72.2 U	pCi/L
399-1-17A	07/07/1988	Tritium	-32.3 U	pCi/L
399-1-17A	11/09/1988	Tritium	-145 U	pCi/L
399-1-17A	05/14/1992	Tritium	-4.62 U	pCi/L
399-1-17A	08/31/1994	Tritium	-150 U	pCi/L
399-1-2	01/30/1986	Tritium	-50 U	pCi/L
399-1-2	04/23/1986	Tritium	-230 U	pCi/L
399-2-1	01/30/1986	Tritium	-210 U	pCi/L
399-2-1	10/15/1987	Tritium	-85.9 U	pCi/L
399-2-2	04/24/1986	Tritium	-320 U	pCi/L
399-2-2	08/22/1988	Tritium	-12.6 U	pCi/L
399-2-2	11/28/1988	Tritium	-43.1 U	pCi/L
399-3-6	12/27/1985	Uranium	-2.39 U	µg/L
399-3-6	01/30/1986	Tritium	-62 U	pCi/L
399-3-6	09/29/1994	Tritium	-12.4 U	pCi/L
399-3-9	04/24/1986	Tritium	-300 U	pCi/L

Table 6. Samples with Reported Values Less than or Equal to Zero and No Reported MDL/MDA

Well Name	Sample Date	Analyte	Reported Value*	Measurement Unit
399-4-11	08/11/1988	Tritium	-136 U	pCi/L
399-8-1	04/28/1986	Tritium	-360 U	pCi/L
399-8-1	04/02/1987	Tritium	-72.2 U	pCi/L
399-8-1	12/20/1991	Tritium	-219 U	pCi/L
399-8-1	12/20/1991	Tritium	-146 U	pCi/L
399-8-1	12/20/1991	Tritium	-134 U	pCi/L
399-8-5A	12/10/1991	Tritium	-5.93 UJ	pCi/L
399-8-5A	08/31/1993	Tritium	-395 U	pCi/L
399-8-5A	07/18/1994	Tritium	-67 U	pCi/L

*Qualifiers:

J = Estimated value; (1) constituent detected at a level less than the RDL or PQL and greater than or equal to the MDL, (2) estimated concentration for TICs.

U = Analyzed for but not detected above limiting criteria.

MDA = minimum detectable activity

MDL = method detection limit

PQL = practical quantitation limit

RDL = required detection limit

TIC = tentatively identified compound

3.1.3 Review Qualifiers

Chemistry data were removed from the data set prior to calculation based on their review qualifiers (Table 7), consistent with the manner in which review qualified data are handled for site-wide reporting (ECF-HANFORD-19-0010, *Calculation and Depiction of Groundwater Contamination for the Calendar Year 2018 Hanford Site Groundwater Monitoring Report*). Future analyses should evaluate removal of data based on review qualifiers on a case-by-case basis.

Table 7. Review Qualifiers for Data Removal

Review Qualifier	Definition
Y	Result is suspect. Review had insufficient evidence to show result valid or invalid.
R	Do not use. Further review indicates the result is not valid.
F	Result is undergoing further review.
Q	Associated quality control sample is out of limits.

3.1.4 Wells and Contaminants of Concern

The list of wells and COCs for this analysis was based on the data quality objectives report for the 300-FF-5 OU remedy implementation (Appendix A of DOE/RL-2014-42, *300-FF-5 Operable Unit Remedy Implementation Sampling and Analysis Plan*), as listed in Table 8.

Table 8. Wells and Contaminants of Concern

Well Name	Contaminants of Concern
399-1-1	Gross Alpha, Uranium
399-1-2	Gross Alpha, Uranium
399-1-7	Gross Alpha, Uranium
399-1-10A	Gross Alpha, Uranium
399-1-11	Gross Alpha, Uranium
399-1-12	Gross Alpha, Uranium
399-1-16A	Gross Alpha, Uranium
399-1-16B	*cis*-1,2-dichloroethene
399-1-17A	Gross Alpha, Uranium
399-1-21A	Gross Alpha, Uranium
399-1-55	Gross Alpha, Uranium
399-1-57	*cis*-1,2-dichloroethene
399-2-1	Gross Alpha, Uranium
399-2-2	Gross Alpha, Uranium
399-2-32	Gross Alpha, Uranium
399-3-6	Gross Alpha, Uranium

Table 8. Wells and Contaminants of Concern

Well Name	Contaminants of Concern
399-3-9	Gross Alpha, Uranium
399-3-12	Gross Alpha, Uranium
399-3-20	Gross Alpha, Uranium
399-4-1	Gross Alpha, Uranium
399-4-7	Gross Alpha, Uranium
399-4-10	Gross Alpha, Uranium
399-4-11	Gross Alpha, Uranium
399-4-12	Gross Alpha, Uranium
399-4-14	Trichloroethene
399-4-15	Gross Alpha, Uranium
399-6-3	Gross Alpha, Uranium
399-8-1	Gross Alpha, Uranium
399-8-5A	Gross Alpha, Uranium
699-12-2C	Nitrate, Tritium
699-13-0A	Tritium
699-13-1E	Nitrate, Tritium
699-13-2D	Nitrate, Tritium
699-13-3A	Nitrate, Tritium
699-S6-E3	Gross Alpha, Uranium
699-S6-E3B	Gross Alpha, Uranium
699-S6-E4B	Gross Alpha, Uranium
699-S6-E4E	Gross Alpha, Uranium
699-S6-E4K	Gross Alpha, Uranium
AT-3-7-M	Gross Alpha, Uranium

3.1.5 Time Period of Analysis

This analysis used data collected between January 1, 1994 (if available), and December 31, 2019. Multiple trend periods or shorter time spans were used for specific well/COC pairs that have been impacted by site

activities (Table 9). Only the last trend period was used to evaluate the trend, mean, and UCL/LCL for the purposes of assessing the progress of MNA/EA in this environmental calculation file.

Table 9. Trend Periods for Individual Well/COC Pairs

Well	COC	Time Period of Analysis	Basis
399-1-16A	Gross Alpha Uranium	01/01/1994 to 08/30/2018 09/01/2018 to 12/31/2019	In September 2018, a polyphosphate solution was injected in nearby upgradient wells.
399-1-17A	Gross Alpha Uranium	01/01/1994 to 11/01/2015 11/02/2015 to 08/30/2018 09/01/2018 to 12/31/2019	The arrival of the November 2015 polyphosphate injection impacted gross alpha and uranium concentrations. In September 2018, a polyphosphate solution was injected in nearby upgradient wells.
399-1-7	Gross Alpha Uranium	01/01/1994 to 11/01/2015 11/02/2015 to 08/30/2018 09/01/2018 to 12/31/2018	The arrival of the November 2015 polyphosphate injection impacted gross alpha and uranium concentrations. In September 2018, a polyphosphate solution was injected in nearby upgradient wells.
399-1-55	Gross Alpha Uranium	01/01/1994 to 11/01/2015 11/02/2015 to 08/30/2018 09/01/2018 to 12/31/2019	The arrival of the November 2015 polyphosphate injection impacted gross alpha and uranium concentrations. In September 2018, a polyphosphate solution was injected in nearby upgradient wells.
399-2-2	Gross Alpha Uranium	01/01/1994 to 08/30/2018 09/01/2018 to 12/31/2019	In September 2018, a polyphosphate solution was injected in nearby upgradient wells.
399-3-6[a]	Uranium	01/01/1994 to 06/30/2011 07/01/2011 to 12/31/2019	Plume migration
399-3-9	Uranium	01/01/2005 to 12/31/2019	Large gap in measurements which impacts trend analysis (no measurements between 1995 and 2004).
399-4-1[a]	Uranium	01/01/1994 to 06/30/2011 07/01/2011 to 12/31/2019	Plume migration
399-4-7	Uranium	01/01/1997 to 12/31/2019	Low concentrations from 1994 to 1996 created a large influence on the trend and caused the trend to capture recent data inadequately
399-4-10	Uranium	01/01/2000 to 12/31/2019	Low concentrations in 1994 and 1995 created a large influence on the trend and caused the trend to capture recent data inadequately. There were no data between 1996 and 2000.
399-4-14	Trichloroethene	01/01/2012 to 12/31/2019	High river-stage event in 2011
399-8-1	Gross Alpha Uranium	01/01/2011 to 12/31/2019	Impact of dust-control water prior to 2011

Table 9. Trend Periods for Individual Well/COC Pairs

Well	COC	Time Period of Analysis	Basis
399-8-5A	Gross Alpha Uranium	01/01/2011 to 12/31/2019	Impact of dust-control water prior to 2011
699-12-2C	Tritium	07/01/2008 to 12/31/2019	Impact of tritium gas release from buried radiological solid waste at the 618-11 Burial Ground
699-12-2D	Nitrate	01/01/2002 to 12/31/2016 01/01/2017 to 12/31/2019	Possible decrease in water-table below the Hanford formation.
699-12-2D	Tritium	07/01/2007 to 12/31/2016 01/01/2017 to 12/31/2019	Possible decrease in water-table below the Hanford formation.
699-13-0A	Nitrate	01/01/1995 to 12/31/2016 01/01/2017 to 12/31/2019	Possible decrease in water-table below the Hanford formation.
699-13-0A	Tritium	01/01/2009 to 12/31/2016 01/01/2017 to 12/31/2019	Impact of tritium gas release from buried radiological solid waste at the 618-11 Burial Ground. Possible decrease in water-table below the Hanford formation in 2017-2019.
699-13-1E	Tritium	01/01/2009 to 12/31/2019	Impact of tritium gas release from buried radiological solid waste at the 618-11 Burial Ground
699-13-2D	Tritium	07/01/2007 to 12/31/2019	Impact of tritium gas release from buried radiological solid waste at the 618-11 Burial Ground
699-13-3A	Nitrate	01/01/2000 to 12/31/2019	Low concentrations in 1995 created a large influence on the trend and caused the trend to capture recent data inadequately
699-13-3A	Tritium	01/01/2007 to 12/31/2019	Impact of tritium gas release from buried radiological solid waste at the 618-11 Burial Ground
699-S6-E4B[b]	Gross Alpha Uranium	01/01/2007 to 01/01/2011 01/01/2012 to 12/31/2019	Impact of dust control water from 2003–2005 and in 2011
699-S6-E4E[b]	Gross Alpha Uranium	01/01/2007 to 12/31/2011 01/01/2012 to 12/31/2019	Impact of dust control water from 2003–2005 and in 2011
699-S6-E4K[b]	Gross Alpha Uranium	01/01/2007 to 12/31/2011 01/01/2012 to 12/31/2019	Impact of dust control water from 2003–2005 and in 2011

a. Appendix B of ECF-300FF5-16-0130, *Calculation of Concentration Trends, Means, and Confidence Limits for cis-1,2-Dichloroethene, Gross Alpha, Nitrate, Trichloroethene, Tritium, and Uranium in the 300-FF-5 Operable Unit through CY 2015*.

Table 9. Trend Periods for Individual Well/COC Pairs

Well	COC	Time Period of Analysis	Basis

b. Appendix B of ECF-300FF5-15-0017, *Calculation of Concentration Trends, Means, and Confidence Limits for cis-1,2-Dichloroethene, Gross Alpha, Nitrate, Trichloroethene, Tritium, and Uranium in the 300-FF-5 Operable Unit*.

COC = contaminant of concern

The stage of the Columbia River was unusually high during 2011 and during this time concentrations of TCE were substantially different at several wells in the 300 Area, notably wells 399-3-12, 399-4-7, and 399-4-9 (ECF-300FF5-15-0017, *Calculation of Concentration Trends, Means, and Confidence Limits for cis-1,2-Dichloroethene, Gross Alpha, Nitrate, Trichloroethene, Tritium, and Uranium in the 300-FF-5 Operable Unit*.). This singular, particularly high river-stage event did not appear to impact the overall TCE trend at these wells because they had sufficiently long-term datasets (from 1994 to 2015) which constrained the calculated trends. At well 399-4-14, data were collected only after 2007; consequently, the high river-stage event exerts a strong influence on the overall trend at this location. As a result of accommodating this high river-stage event, a trend analysis based on data from 2007 to the present predicts an increasing trend which is inconsistent with the most recent data (collected in late 2016 through 2019), during which time concentrations are consistently at or below 2 µg/L. Therefore, the time period of analysis for well 399-4-14 was constrained to data collected after the 2011 high river-stage event (Table 9).

3.1.6 Outliers

The data set was not formally tested for outliers. All available data, with the exception of those removed based on their review qualifiers (see Section 3.1.3), were used unless otherwise noted (Table 10).

Table 10. Data Outliers Removed from Analysis

Well	COC	Sample Date	Concentration	Basis
399-1-10A	Uranium	12/19/2002	235 B µg/L	Impacted by excavations at the 618-5 Burial Ground
399-1-10A	Uranium	03/21/2003	178 µg/L	Impacted by excavations at the 618-5 Burial Ground
399-1-10A	Uranium	05/30/2003	71.6 µg/L	Impacted by excavations at the 618-5 Burial Ground
399-1-10A	Uranium	07/14/2003	131 B µg/L	Impacted by excavations at the 618-5 Burial Ground
399-1-10A	Uranium	08/18/2003	119 µg/L	Impacted by excavations at the 618-5 Burial Ground
399-1-10A	Uranium	09/16/2003	99.2 B µg/L	Impacted by excavations at the 618-5 Burial Ground

Table 10. Data Outliers Removed from Analysis

Well	COC	Sample Date	Concentration	Basis
399-2-1	Uranium	06/10/2011	0.135 µg/L	Two orders of magnitude lower than all other measured concentrations at this location

COC = contaminant of concern

3.1.7 Daily Averaging and Linear Interpolation

A daily average was calculated for river-stage, water-level, and chemistry data possessing multiple measurements on the same day. When all measurements on the same day were non-detect, the highest detection limit was used for the daily value. For daily duplicates where only one of the samples was non-detect, the detected value, or average of the detected values if more than one detected value was present, was used for the daily value. Linear interpolation in time was used to fill in small gaps that were present in the river-stage data set.

3.2 Trend Analysis

A censored regression (Tobit) model was used to estimate the parameters (the basis for use of the Tobit censored regression method is detailed in SGW-58883, *Methodology for the Calculation of Concentration Trends, Means, and Confidence Limits for Performance and Attainment Monitoring*). The Tobit model estimates linear relationships when there are left-censored data (non-detects are left-censored data) in the dependent variable. When all data are quantified, the Tobit model yields the same parameter estimates as ordinary least squares (OLS) regression. The standard errors of the parameter estimates that it produces tend to be slightly smaller than the OLS standard errors; this difference in standard errors diminishes as the amount of data increases. The Tobit regression model allows for the inclusion of multiple covariates, such as time and river-stage, to explain the observed water-levels or concentrations. A brief summary of the trend analysis methodology is provided below and a more detailed description is provided in subsequent subsections.

The trend analysis methodology accounts for a time lag between observed changes in the river-stage and observed changes in water levels or concentrations in a well. Lag times were determined for each well based on a correlation between water-level and river-stage (see Section 3.2.1). If no correlation was found between water-level and river-stage, the river-stage was not used a covariate for the chemistry trends. Trends were tested for statistical significance and yearly means and both LCLs and UCLs of the mean were calculated from the trends.

The trend analysis methodology presented herein relies solely on the observed empirical data. This methodology provides one line of evidence to assess remedy performance and it does not account for or replace other lines of evidence that could be used to assess remedy performance, such as historical plume migration patterns, groundwater flow, and contaminant fate and transport models.

3.2.1 Tobit Regression Model

Groundwater elevation and concentration data (which in the context of this document refers to both concentration and activity unless otherwise noted) were compared to river stage to determine if groundwater elevation and concentrations showed a relationship to river stage: if a relationship existed, the lag time between observed changes in river stage and observed groundwater elevation or

concentration changes in the well was estimated. The relationship between groundwater elevation or chemistry and river stage was defined in Equations 3.1a and 3.1b, respectively, as follows (SGW-58883 provides more detail on the basis for this calculation):

$$WL = \alpha_w - \beta_w t + \beta_{1w} x_t \quad \textbf{(Eq. 3.1a)}$$

$$ln(C_i) = \alpha_c - \beta_c t + \beta_{1c} x_t \quad \textbf{(Eq. 3.1b)}$$

where:

WL	=	a fitted groundwater level elevation (m amsl)
C_i	=	a fitted concentration or activity [milligrams per liter (mg/L), micrograms per liter (µg/L), or picoCuries per liter (pCi/L)] for analyte *i*
t	=	the time [day]
x_t	=	the observed river stage, lagged in time, at time *t* (see below) (m amsl)
α, β, and β_1	=	parameters corresponding to the equation intercept, date coefficient, and river-stage coefficient, respectively; they are assumed to be constant and are estimated using regression. Subscript *w* corresponds to the water-level regression and subscript *c* corresponds to the chemistry regression.

If, after examining the relationship between measured water level in the well and river stage, it was determined that no relationship existed (Section 3.2.2), the river-stage covariate was removed, and Equation 3.1b reduced to a simple regression over time, shown in Equation 3.2:

$$ln(C_i) = \alpha_C - \beta_c t \quad \textbf{(Eq. 3.2)}$$

The lag time (in days) between observed water level or chemistry concentrations and observed river stage was determined using cross correlation. Cross correlation is a measure of the similarity of two signals as a function of the time lag between the two signals. The cross correlation function is defined as a set of correlations between timeseries *X* and *Y* and is defined as:

$$\rho_{XY}(h) = \frac{E[(X_{h+t} - \mu_X)(Y_t - \mu_Y)]}{\sigma_X \sigma_Y} \quad \textbf{(Eq. 3.3)}$$

where:

$\rho_{XY}(h)$	=	the cross correlation coefficient for lag time *h*
E	=	the expected value
X_{h+t}	=	the value of time series *X* at time *h+t*
Y_t	=	the value of time series *Y* at time *t*
μ_x	=	the mean of time series *X*
μ_Y	=	the mean of time series *Y*
σ_x	=	the standard deviation of time series *X*
σ_Y	=	the standard deviation of time series *Y*.

The optimized lag time is determined by the maximum of the smoothed relationship between the cross correlation coefficient and lag time. Only positive lag times were allowed, meaning that *X* (water level or

chemistry timeseries) lags *Y* (river stage timeseries). Plots of the cross correlation coefficients vs. lag time and the comparison of water level to river stage are included in Appendix A.

The predictive power of the Tobit regression model is affected by the number and the frequency of water quality samples. When samples are collected infrequently (annual sampling frequency or less), it is difficult to determine a correlation between measured concentrations and changes in river stage because any number of lag times can result in similar cross correlation coefficients. When sampling is infrequent and samples are not always collected at the same time of year, trends can be difficult to assess with any certainty because distinctions between concentration changes due to river stage and concentration changes due to an overall trend are not clear. Specific trend analyses impacted by infrequent sampling are discussed in Chapter 7.

3.2.2 Evaluation of River Stage as Covariate

Tobit regression analysis was performed on measured water levels to determine if the river stage should be used as a covariate in the chemistry trends. River stage was considered to be an appropriate covariate if: (1) the p-value of the river stage coefficient in the Tobit regression model was less than 0.05, and/or; (2) the distance from the river was less than 1,500 m, based on a qualitative evaluation of the water-level time-series plots. Plots of the correlation of water level and river stage are presented in Appendix A. Table 11 lists wells where water level and river stage was not used as a covariate in the Tobit regression model.

Table 11. Wells Where River Stage Was Not Used as Covariate

Well	Basis	Distance to River (m)	Correlation with River Stage (p-value)
699-12-2C	No observed correlation between water level and river stage	5,526	0.36
699-13-0A	No observed correlation between water level and river stage	4,675	0.39
699-13-1E	No observed correlation between water level and river stage	5,173	0.012
699-13-2D	No observed correlation between water level and river stage	5,519	0.96
699-13-3A	No observed correlation between water level and river stage	1,630	0.98
699-S6-E3	Insufficient data to evaluate relationship (n < 8)	3,568	N/A
699-S6-E3B	Insufficient data to evaluate relationship (n < 8)	3,637	N/A
699-S6-E4B	No observed correlation between water level and river stage	3,438	0.86
699-S6-E4E	No observed correlation between water level and river stage	3,518	0.10
699-S6-E4K	No observed correlation between water level and river stage	3,689	0.38

N/A = not applicable

3.2.3 Chemistry Dataset Lag Times

As noted above, the predictive power of the Tobit regression model is affected by the number and the frequency of water quality samples; it can also be affected by the number and frequency of water level measurements. In the 300 Area, water levels are measured more frequently than chemistry data. Consequently, lag times determined by cross correlation of water levels and river stage are more reliable than lag times determined using chemistry data alone. When water level data were available for a well, the lag time determined from cross correlation of water level and river stage data was used as the lag time for the chemistry regression analysis. Well 399-4-12 and aquifer tube AT-3-7-M had no water level data, but these locations are only 153 m and 5 m, respectively, from the river, and therefore a 0 day lag time was assumed.

3.2.4 Determination of Sufficient Data for Trend Analysis

Trends over time were evaluated for each well/COC pair that possessed a minimum of 6 samples and less than 50% (i.e., half) reported non-detects. Well/COC pairs where trend analysis was not performed are listed in Table 12.

Table 12. Wells with Insufficient Data for Trend Analysis

Well	Analyte	Trend Period	Number of Observations	Percent Non-detects
399-1-7	Gross Alpha	09/01/2018 to 12/31/2019	3	0%
399-1-16A	Gross Alpha	09/01/2018 to 12/31/2019	1	0%
399-1-17A	Gross alpha	09/01/2018 to 12/31/2019	3	0%
399-1-55	Gross alpha	09/01/2018 to 12/31/2019	0	N/A
399-2-2	Gross Alpha	09/01/2018 to 12/31/2019	3	0%
699-13-2D	Nitrate	01/01/2017 to 12/31/2019	2	0%
699-13-2D	Tritium	01/01/2017 to 12/31/2019	4	0%
699-13-3A	Nitrate	01/01/2017 to 12/31/2019	3	0%
699-13-3A	Tritium	01/01/2017 to 12/31/2019	4	0%
699-S6-E3	Gross alpha	08/17/2018 to 12/31/2019	5	0%
699-S6-E3B	Gross alpha	No available data	0	N/A
699-S6-E3B	Uranium	11/17/2019 to 12/31/2019	1	0%

N/A = not applicable

3.2.5 Evaluation of Overall Trend Significance

The significance of the overall trend was first evaluated using the log-likelihood ratio test. The log-likelihood ratio test is a statistical test that compares the goodness of fit between two models: the null

model (a model where there is no relationship between the dependent variable and the covariates) and an alternative model (the Tobit regression model). The log-likelihood ratio statistic is defined as:

$$LRT = 2(logL_A) - 2(logL_{NULL}) \quad \textbf{(Eq. 3.4)}$$

where:

LRT	=	the log-likelihood ratio statistic
$logL_A$	=	the log-likelihood of the alternative model
$logL_{NULL}$	=	the log-likelihood of the null model.

The null probability distribution of the log-likelihood ratio statistic is approximated by the chi-square distribution with degrees of freedom equal to the number of additional covariates used in the alternative model. The significance of the alternative is assessed by comparing the p-value (determined from the chi-square distribution) to the level of significance (α), in this case 0.05[2]. When the p-value is less than α, the alternative model is statistically significant. The significance of the trend with respect to time is then assessed by comparing the p-value of the date coefficient to the same α level. When the p-value of the date coefficient is less than α, the time trend is significant.

3.3 Yearly Mean and Upper and Lower Confidence Limit Concentrations

Fitted concentrations were determined by lagging the river stage based on the optimized lag time and applying the Tobit regression described in Section 3.2.1. Yearly mean concentrations (C_{mean}) were estimated from the fitted concentrations in Equation 3.5 as follows:

$$ln\big(C_{mean}(t_0, t_1)\big) = \frac{1}{t_1 - t_0}\int_{t_0}^{t_1}\big(\alpha - \beta t + \beta_1 x(t-h)\big)dt \quad \textbf{(Eq. 3.5)}$$

where:

C_{mean}	=	the yearly geometric mean concentration
t_0	=	the first day (start) of the year
t_1	=	the last day (end) of the year
x	=	the covariate (river stage) lagged by the lag time h.

UCLs and LCLs were calculated by first determining the mean river stage for the year. Next, the calculated concentration for the year (C_{mean}) was determined based on the yearly mean river stage and the Tobit model regression. The UCL and LCL were then calculated as shown in Equations 3.6a and 3.6b:

$$UCL = exp^{\left(\ln(C_{mean}) - (t_{df,\alpha/2})(\sigma)\right)} \quad \textbf{(Eq. 3.6a)}$$

$$LCL = exp^{\left(\ln(C_{mean}) + (t_{df,\alpha/2})(\sigma)\right)} \quad \textbf{(Eq. 3.6b)}$$

where:

[2] The level of significance of 0.05 represents a 5% probability of rejecting the null hypothesis (in this case, the null hypothesis is that the trend is significant) when it is true.

C_{mean} = the calculated yearly mean concentration based on the yearly mean river stage (mg/L, µg/L, or pCi/L)

$t_{df,\alpha}$ = the lower 100 percent – α quantile of Student's *t* distribution with *df* degrees of freedom

α = the significance level based on a confidence limit of 95 percent (0.05)

df = the number of data points minus the number of covariates

σ = estimate of the standard deviation of the concentration calculated using the yearly mean river stage and the variance-covariance matrix of the regression coefficients.

4 Assumptions and Inputs

The following is a summary of assumptions made in this analysis:

- The MDL and MDA are independent of concentration and activity.
- Concentrations observed at a well are affected by the same activities at the site for the selected time periods over which calculations of the 2019 mean and LCL/UCL are made (see Section 3.1.5). This observation includes the well/COC pairs listed in Table 9, because start (and end) dates for the regression analyses were chosen to occur when listed site activities are believed to not appreciably affect these wells.

The results presented in this environmental calculation file are based on the application of statistical methods to sample data sets of varying size, degree of censoring, and historical coverage, among other factors. Estimates presented herein rely solely on calculated statistical trends and observed data and are not based on future-projected plume migration patterns, groundwater modeling, or contaminant transport parameters. Assessments made on the basis of these calculations should be interpreted in light of the number of sample results, the level of censoring (i.e., number of non-detect results), the historical period for which data are available, and the historical period over which the Tobit regression was applied.

5 Software Applications

Calculations were performed using the public domain computing platform R (version 3.1.3 [published March 9, 2015]). The R platform provides data manipulation, calculation, and graphical display capabilities to support data analysis (Venables et al., 2015, *An Introduction to R Notes on R: A Programming Environment for Data Analysis and Graphics*). The platform is freely available to the public and can be compiled and run on a variety of media. The base installation of R contains statistical and plotting functions. Many more functions are available for download through the Comprehensive R Archive Network (CRAN). The R routines described previously were independently checked and verified by evaluation of sample datasets as part of the preparation of this calculation.

Several R packages used for this analysis were downloaded from CRAN and are listed in Table 13.

In addition to the CRAN packages listed in Table 13, several functions specific to the calculations performed in this document were incorporated into a user-defined R package called "sspaTrendAnalysis."

The calculations were performed with the following series of R scripts:

- 01_ImportData.R
- 02_TobitAnalysis_Initial.R
- 03_WL_TobitSummaryPlots.R
- 04_Chemistry_TobitSummaryPlots_Initial.R
- 05_TobitAnalysis_Final.R
- 06_Chemistry_TobitSummaryPlots_Initial.R
- 07_TobitRegressionPlots.R
- 08_UCLPlots.R

Table 13. R Packages Used for Calculations

R Package	Package Description	Version
bdsmatrix	Routines for Block Diagonal Symmetric Matrices	1.3-2
censReg*	Censored Regression (Tobit) Models	0.5-20
chron	Chronological Objects that Can Handle Dates and Times	2.3-47
data.table	Extension of data.frame	1.9.4
Formula	Extended Model Formulas	1.2-1
glmmML	Generalized Linear Models with Clustering	1.0
magrittr	A Forward-Pipe Operator for R	1.5
maxLik	Maximum Likelihood Estimation	1.2-4
miscTools	Miscellaneous Tools and Utilities	0.6-16
plm	Linear Models for Panel Data	1.4-0
plyr	Tools for Splitting, Applying, and Combining Data	1.8.3
Rcpp	Seamless R and C++ Integration	0.12.0
reshape2	Restructure and Aggregate Data	1.4.1
sandwich	Robust Covariance Matrix Estimators	2.3-3
stringi	Character String Processing Facilities	0.5-5
stringr	Make It Easier to Work with Strings	1.0.0
zoo	S3 Infrastructure for Regular and Irregular Time Series (Z's Ordered Observations)	1.7-12

*Modified to allow for multiple detection limits.

6 Calculation

The following input files were used in the implementation of this analysis:

- *qryChemHeis1.txt* and *qryChemHeis2.txt*: Concentration data from the HEIS database
- *qryAWLNAWLN.txt*: Transducer data from the AWLN database
- *qry_SSPAWL.txt*: Water level data received from CHPRC
- *qryManHEIS.txt*: Water level data (manual) from the HEIS database
- *300Gauge_03052020.RData*: River stage determined using convolution method
- *WellList_04062020.csv*: Well/COC pairs, use of river stage as a covariate, and analysis starting date
- *DIST.RData*: Table of well distances from the Columbia River
- *SCREEN.RData*: Well screen interval data
- *WELL.RData*: List of well location information including operable unit, well status, and well coordinates
- *BASE.RData*: shapefiles for mapping

The calculations were performed with a series of R scripts (listed in Chapter 5 of this document). The first script (*01_ImportData.R*) imports the concentration, river stage, and well/COC pairs data, subsets the data by COC/well pairs, removes data based on review qualifiers, identifies non-detects, sets the date range for analysis (post January 1, 1994), computes the daily average concentration when necessary, and correlates concentration and river-stage data based on date. This script exports an R data file with a data table containing the merged (by date) concentration and river-stage data. The second script (*02_TobitAnalysis_Initial.R*) calculates trends based on Tobit regression model for the initial evaluation of trends for both water levels and chemistry. The script *03_WL_TobitSummaryPlots.R* script produces plots for evaluating the correlation of water levels and river stage (Appendix A). The script *04_Chemistry_TobitSummaryPlots_Initial.R* produces plots for evaluating the correlation of chemistry and river stage prior to any lag time adjustments based on the cross correlation of water levels and river stage. The script *05_TobitAnalysis_Final.R* calculates chemistry trends based on Tobit regression model by adjusting lag times based on cross correlation of water levels and river stage, and script *06_Chemistry_TobitSummaryPlots_Initial.R* produces plots for evaluating the correlation of chemistry and river stage using the lag times determined with cross correlation of water levels and river stage (Appendix A). The script *07_TobitRegressionPlots.R* produces figures depicting the Tobit trend analysis results. The script *08_UCLPlots.R* calculates yearly mean concentrations and the LCL/UCL of this mean and produces figures depicting these quantities together with the underlying data.

7 Results

Outputs of the calculations are presented in a series of figures that are compiled in Appendix B of this document. Examples are presented in each of the following subsections to illustrate the key features of the various figures and tables that are used to present the outputs of the calculations.

In general, datasets for *cis*-1,2-DCE, nitrate, tritium, TCE, and uranium have sufficient sampling frequency to evaluate trends. Sampling frequencies for gross alpha, however, are infrequent and sporadic

which for the time being results in trends that are less certain: this will change over time, as a larger number of samples is obtained.

7.1 Tobit Model Regression Results

Figure 2 shows example results of the calculations obtained from the Tobit regression analysis for uranium at well 399-1-16A.

The header of the plot presents the approximate distance of the well from the Columbia River, the number of trend analysis periods, and a table displaying the estimated lag time, p-value of the trend based on the log-likelihood ratio test (after applying the appropriate lag time), the p-value of the River Stage coefficient (if applicable), the p-value of the Date coefficient, the number of measured water level and chemistry data (number of observations) and the percent non-detects.

The plot in the upper left corner is a map displaying the location of the well.

The plot in the upper right corner displays the legend for the plots that follow.

The first plot of this figure shows a time series of the river stage (right y-axis) and the measured water level (left y-axis) (when available). On the far left of the plot is the well screen interval. The second plot of this figure shows a time series of the river stage and of the observed uranium concentrations. Measurements that are below the MDL for uranium (non-detects) are highlighted in red triangles. In the example in Figure 2, there are no non-detects present. The third plot of this figure displays a time series of the fitted uranium concentrations (calculated concentrations) and measured uranium concentrations (observed concentrations). The fitted concentrations were determined for each day after lagging the river-stage data by the optimized lag time (in this case, 1 day), fitting the Tobit model, and using Equation 3.1. The Tobit parameter estimates are displayed below the plot.

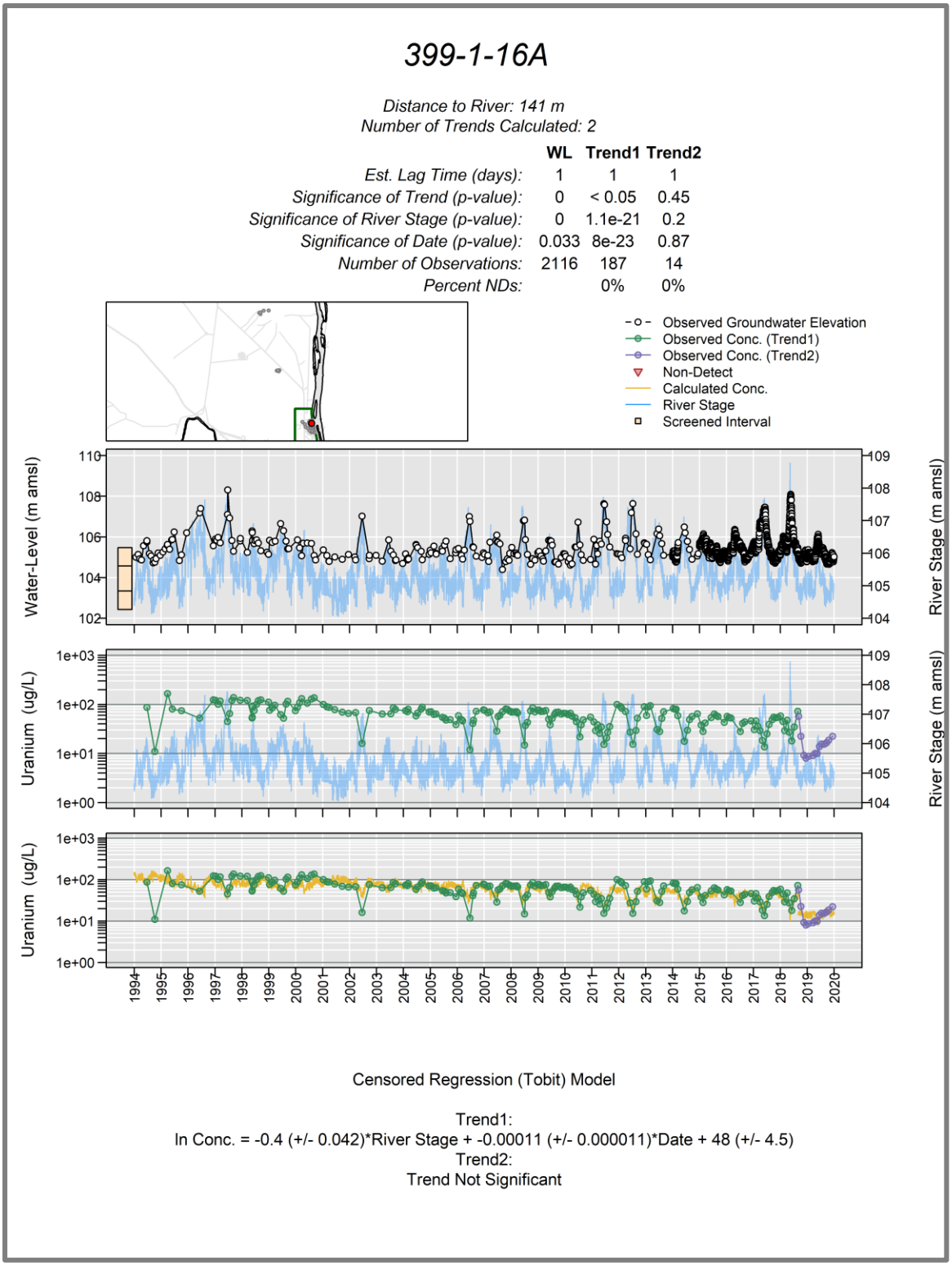

Figure 2. Censored Regression (Tobit) Model Results for Uranium in Well 399-1-16A

7.2 Yearly Mean Concentration and Upper and Lower Confidence Limit Results

Figure 3 shows the results from the yearly mean concentration, UCL, and LCL calculations for uranium in well 399-1-16A.

The header of the plot presents the approximate distance of the well from the Columbia River, the number of trend analysis periods, and a table displaying the estimated lag time, p-value of the trend based on the log-likelihood ratio test (after applying the appropriate lag time), the p-value of the River Stage coefficient (if applicable), the p-value of the Date coefficient, the number of measured water level and chemistry data (number of observations) and the percent non-detects.

The plot in the upper left corner is a map displaying the location of the well.

The plot in the upper right corner displays the legend for the plots that follow.

The plot displays a time series of uranium concentration for both the fitted (calculated concentration) and measured data (observed concentration). The fitted concentrations were determined after lagging the river-stage data by the optimized lag time (in this case, 1 day) and using Equation 3.1. Measurements that are below the MDL for uranium (non-detects) are highlighted in red triangles. In the example presented in Figure 3, there are no non-detects present. The UCLs and LCLs are displayed with dashed light blue lines and the window between the UCL and LCL (the confidence interval) is highlighted in light blue.
The fitted yearly mean concentration is displayed with a solid dark blue line. The target cleanup level is represented with a dashed black line (in the case of uranium the target cleanup level is 30 µg/L).
The censored regression used to determine the calculated concentration and yearly mean and UCL/LCL is presented below the graph along with the summary statistics that are based on the trend through 2019.

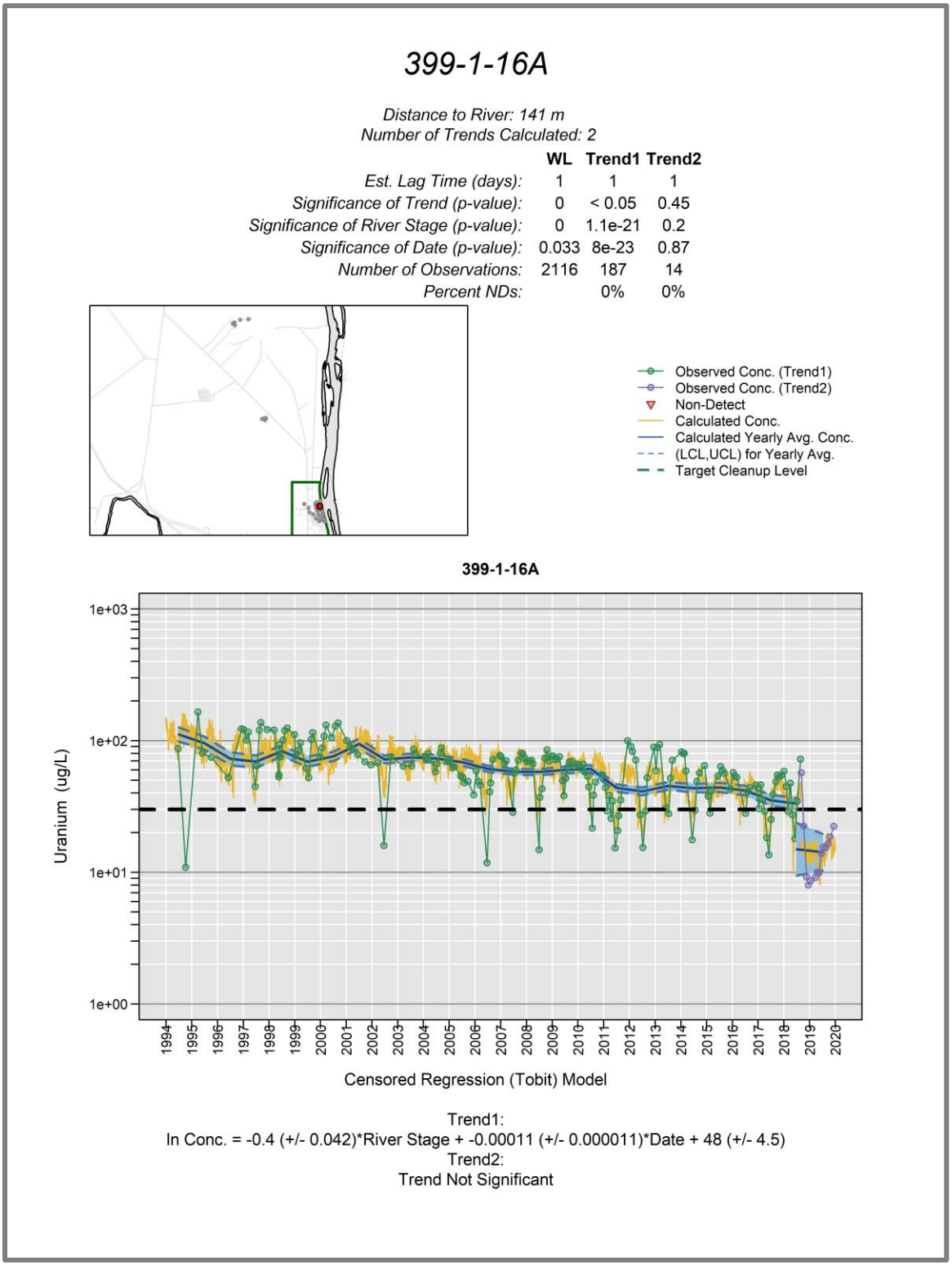

Figure 3. Yearly Mean Concentration and Upper/Lower Confidence Limit Results for Uranium in Well 399-1-16A

7.3 Summary of Results

Tables 14 through 19 present the results of the analyses.

Table 14. Calculated Concentration Mean, UCL, and Trend Results for *cis*-1,2-Dichloroethene

Well Name	Cleanup Level (µg/L)	2019		Trend Significant	Trend Direction
		Mean* (µg/L)	UCL* (µg/L)		
399-1-16B	16	173	182	Yes	Increasing
399-1-57	16	61.6	86.9	No	N/A

*Yearly mean and UCL of the mean calculated based on the fitted trend.

N/A = not applicable

UCL = upper confidence limit

Table 15. Calculated Concentration Mean, UCL, and Trend Results for Gross Alpha

Well Name	Cleanup Level (pCi/L)	2019		Trend Significant	Trend Direction
		Mean [a] (pCi/L)	UCL [a] (pCi/L)		
399-1-1	15	15.4	21.0	Yes	Decreasing
399-1-2 [b]	15	10.3	22.3	Yes	Increasing
399-1-7 [c]	15	N/A	N/A	N/A	N/A
399-1-10A	15	9.37	13.5	Yes	Decreasing
399-1-11 [b]	15	4.09	6.84	Yes	Decreasing
399-1-12 [b]	15	6.71	9.84	Yes	Decreasing
399-1-16A [c]	15	N/A	N/A	N/A	N/A
399-1-17A [c]	15	N/A	N/A	N/A	N/A
399-1-21A [b]	15	10.3	24.2	No	N/A
399-1-55 [b, c]	15	N/A	N/A	N/A	N/A
399-2-1	15	31.9	40.3	Yes	Decreasing
399-2-2 [c]	15	N/A	N/A	N/A	N/A
399-2-32	15	13.0	19.6	Yes	Decreasing
399-3-6	15	17.1	23.5	No	N/A
399-3-9	15	43.2	59.8	No	N/A

Table 15. Calculated Concentration Mean, UCL, and Trend Results for Gross Alpha

Well Name	Cleanup Level (pCi/L)	2019		Trend Significant	Trend Direction
		Mean [a] (pCi/L)	UCL [a] (pCi/L)		
399-3-12	15	15.7	20.4	Yes	Increasing
399-3-20 [b]	15	23.2	41.1	No	N/A
399-4-1	15	15.2	23.7	Yes	Increasing
399-4-7	15	31.9	48.5	No	N/A
399-4-10	15	27.7	39.2	Yes	Decreasing
399-4-11	15	6.95	11.5	No	N/A
399-4-12	15	20.0	37.7	Yes	Increasing
399-4-15 [b]	15	1.00	19.6	No	N/A
399-6-3	15	13.4	20.3	Yes	Increasing
399-8-1	15	28.5	50.5	No	N/A
399-8-5A	15	14.9	58.1	No	N/A
699-S6-E3 [c]	15	N/A	N/A	N/A	N/A
699-S6-E3B [c]	15	N/A	N/A	N/A	N/A
699-S6-E4B	15	4.56	5.99	No	N/A
699-S6-E4E	15	11.2	14.9	Yes	Increasing
699-S6-E4K	15	7.44	12.2	Yes	Increasing
AT-3-7-M	15	12.0	35.0	No	N/A

a. Yearly mean and UCL of the mean calculated based on the fitted trend.

b. There were no data collected for this well and analyte in 2019.

c. Insufficient data for trend analysis.

N/A = not applicable

UCL = upper confidence limit

Table 16. Calculated Concentration Mean, UCL, and Trend Results for Nitrate

Well Name	Cleanup Level (mg/L)	2019		Trend Significant	Trend Direction
		Mean [a] (mg/L)	UCL [a] (mg/L)		
699-12-2C	45	54.4	68.3	No	N/A
699-13-1E	45	47.6	51.0	No	N/A
699-13-2D[b]	45	N/A	N/A	N/A	N/A
699-13-3A[b]	45	N/A	N/A	N/A	N/A

a. Yearly mean and UCL of the mean calculated based on the fitted trend.

b. Insufficient data for trend analysis.

N/A = not applicable

UCL = upper confidence limit

Table 17. Calculated Concentration Mean, UCL, and Trend Results for TCE

Well Name	Cleanup Level (µg/L)	2019		Trend Significant	Trend Direction
		Mean* (µg/L)	UCL* (µg/L)		
399-4-14	4	1.05	1.23	Yes	Decreasing

*Yearly mean and UCL of the mean calculated based on the fitted trend.

N/A = not applicable

UCL = upper confidence limit

Table 18. Calculated Concentration Mean, UCL, and Trend Results for Tritium

Well Name	Cleanup Level (pCi/L)	2019		Trend Significant	Trend Direction
		Mean [a] (pCi/L)	UCL [a] (pCi/L)		
699-12-2C	20,000	12,100	13,700	Yes	Decreasing
699-13-0A	20,000	32,300	39,600	Yes	Decreasing
699-13-1E	20,000	65,000	72,800	Yes	Decreasing
699-13-2D [b]	20,000	N/A	N/A	N/A	N/A
699-13-3A [b]	20,000	N/A	N/A	N/A	N/A

a. Yearly mean and UCL of the mean calculated based on the fitted trend.

b. Insufficient data for trend analysis.

N/A = not applicable

UCL = upper confidence limit

Table 19. Calculated Concentration Mean, UCL, and Trend Results for Uranium

Well Name	Cleanup Level (µg/L)	2019		Trend Significant	Trend Direction
		Mean [a] (µg/L)	UCL [a] (µg/L)		
399-1-1	30	35.2	44.3	Yes	Decreasing
399-1-2	30	9.21	11.3	No	N/A
399-1-7	30	30.9	36.0	Yes	Decreasing
399-1-10A	30	19.7	21.8	Yes	Decreasing
399-1-11	30	7.46	9.69	Yes	Decreasing
399-1-12	30	15.8	18.0	Yes	Decreasing
399-1-16A	30	14.2	19.6	No	N/A
399-1-17A	30	17.6	33.1	No	N/A
399-1-21A	30	25.9	33.8	No	N/A
399-1-55	30	110	139	Yes	Decreasing
399-2-1	30	64.2	80.4	Yes	Decreasing
399-2-2	30	12.5	19.6	No	N/A
399-2-32	30	20.8	28.2	Yes	Decreasing
399-3-6	30	25.6	34.7	No	N/A
399-3-9	30	103	126	No	N/A
399-3-12	30	23.7	29.2	No	N/A
399-3-20	30	42.8	57.4	Yes	Decreasing
399-4-1	30	22.2	30.8	No	N/A
399-4-7	30	47.6	55.8	Yes	Decreasing
399-4-10	30	70.6	82.7	Yes	Decreasing
399-4-11	30	25.3	30.1	No	N/A
399-4-12	30	25.4	29.3	No	N/A
399-4-15	30	16.7	31.8	Yes	Decreasing
399-6-3	30	18.6	29.7	No	N/A
399-8-1	30	33.7	49.6	No	N/A
399-8-5A	30	39.9	66.1	Yes	Decreasing

Table 19. Calculated Concentration Mean, UCL, and Trend Results for Uranium

Well Name	Cleanup Level (µg/L)	2019		Trend Significant	Trend Direction
		Mean [a] (µg/L)	UCL [a] (µg/L)		
699-S6-E3	30	7.55	9.47	Yes	Decreasing
699-S6-E3B [b]	30	N/A	N/A	N/A	N/A
699-S6-E4B	30	6.20	6.78	No	N/A
699-S6-E4E	30	22.3	23.9	Yes	Increasing
699-S6-E4K	30	11.8	13.1	Yes	Increasing
AT-3-7-M	30	18.1	29.2	No	N/A

a. Yearly mean and UCL of the mean calculated based on the fitted trend.

b. Insufficient data for trend analysis

N/A = not applicable

UCL = upper confidence limit

8 References

DOE/RL-2014-42, 2015, *300-FF-5 Operable Unit Remedy Implementation Sampling and Analysis Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0079669H.

ECF-300FF5-15-0017, 2015, *Calculation of Concentration Trends, Means, and Confidence Limits for cis-1,2-Dichloroethene, Gross Alpha, Nitrate, Trichloroethene, Tritium, and Uranium in the 300-FF-5 Operable Unit*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0079510H.

ECF-300FF5-16-0130, 2016, *Calculation of Concentration Trends, Means, and Confidence Limits for cis-1,2-Dichloroethene, Gross Alpha, Nitrate, Trichloroethene, Tritium, and Uranium in the 300-FF-5 Operable Unit through CY 2015*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0074255H.

ECF-Hanford-13-0028, 2018, *Columbia River Stage Correlation for the Hanford Area*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=AR-01127.

ECF-HANFORD-19-0010, 2019, *Calculation and Depiction of Groundwater Contamination for the Calendar Year 2018 Hanford Site Groundwater Monitoring Report*, Rev. 0, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland, Washington, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03099.

EPA and DOE, 2013, *Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland, Washington, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0087180.

HNF-38155, 2011, *HEIS Sample, Result, and Sampling Site Data Dictionary*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0082589H.

NAD83, 1991, *North American Datum of 1983*, as revised, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland. Available at: https://www.ngs.noaa.gov/datums/horizontal/north-american-datum-1983.shtml.

NAVD88, 1988, *North American Vertical Datum of 1988*, as revised, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland. Available at: https://www.ngs.noaa.gov/datums/vertical/north-american-vertical-datum-1988.shtml.

SGW-58883, 2015, *Methodology for the Calculation of Concentration Trends, Means, and Confidence Limits for Performance and Attainment Monitoring*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0079695H.

USGS 12472800, 2018, "Columbia River Below Priest Rapids Dam, WA," *USGS Real-Time Water Data for the Nation*, U.S. Geological Survey, Reston, Virginia. Accessed March 15. Available at: http://waterdata.usgs.gov/usa/nwis/uv?site_no=12472800.

Venables, W.N., D.M. Smith, and the R Core Team, 2015, *An Introduction to R; Notes on R: A Programming Environment for Data Analysis and Graphics*, Version 3.1.3.

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Appendix A

Plots of Water Level and River Stage Correlation

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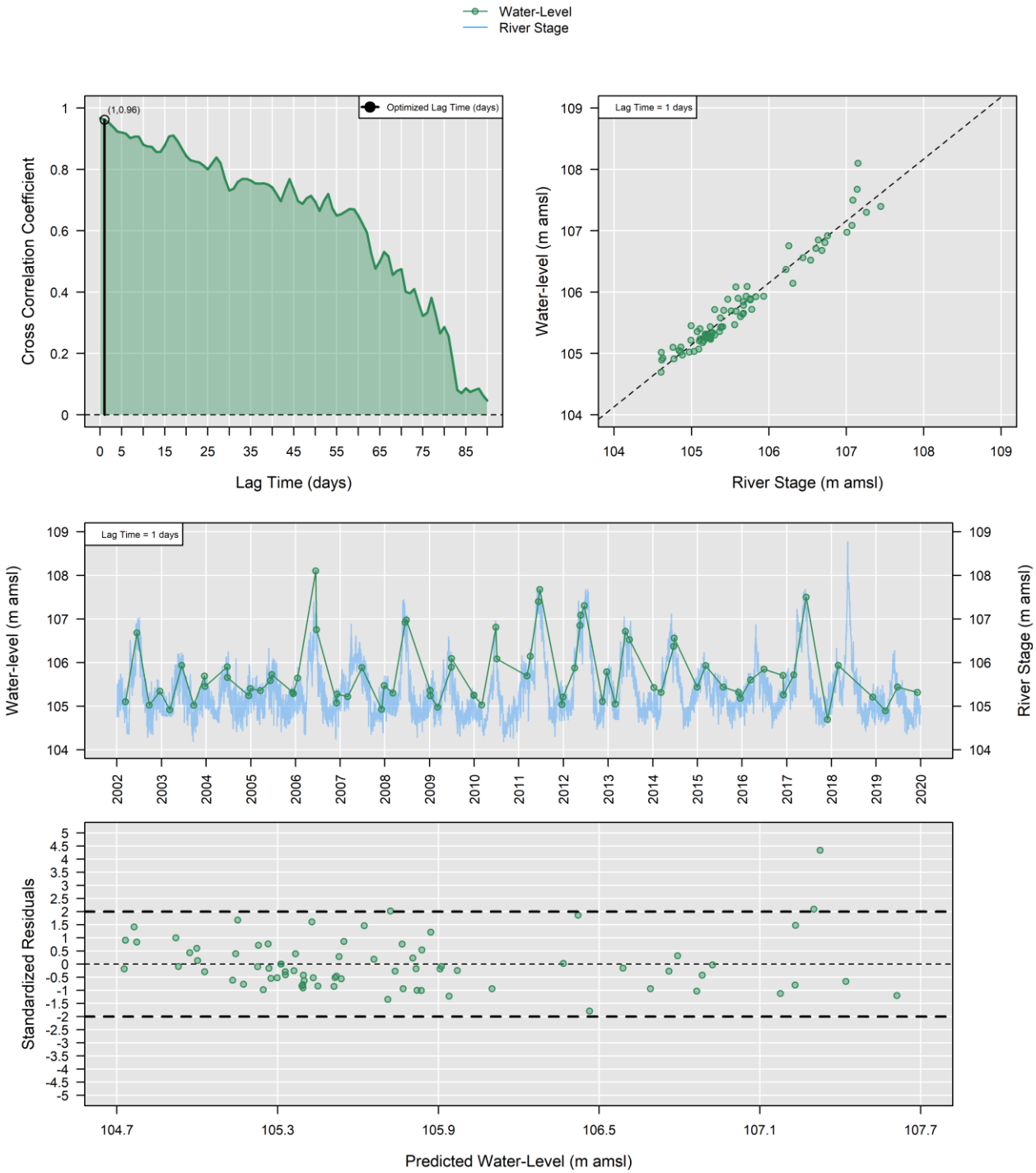
Water-Level and River Stage Correlations Plots

Appendix A presents a series of plots used to evaluate the relationship between water-level in a well and river stage. The header of the plot presents the well name, the p-value of the river stage coefficient in the Tobit Regression Model, the distance to the river and the determination of the significance of the correlation between water-level and river stage.

The upper left-hand plot presents the cross-correlation coefficient for each lag time. The optimized lag time is highlighted with a black circle and the optimized lag time and cross-correlation coefficient is shown in parentheses. The upper-right hand plot shows the correlation between water-level and river stage for the optimized lag time. The center plot shows a timeseries of the water-level and river stage. In this plot, the water-level data have been lagged by the optimized lag time. The final plot is a timeseries of the regression residuals for the water-level Tobit Regression Model.

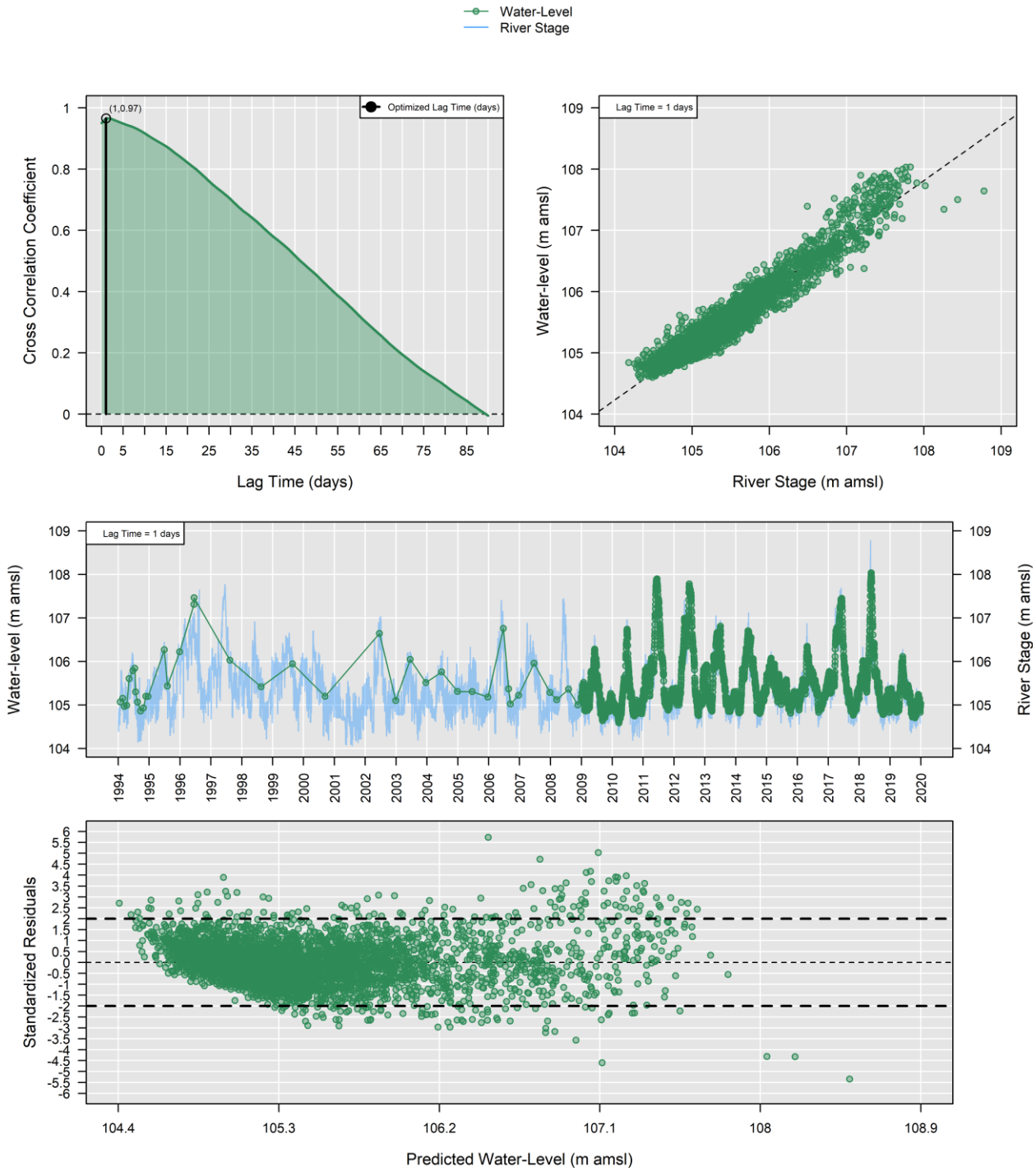
399-1-1

Significance of River Stage (p-value): 3.6e-47
Distance to River: 76 m
Correlation with River Stage significant



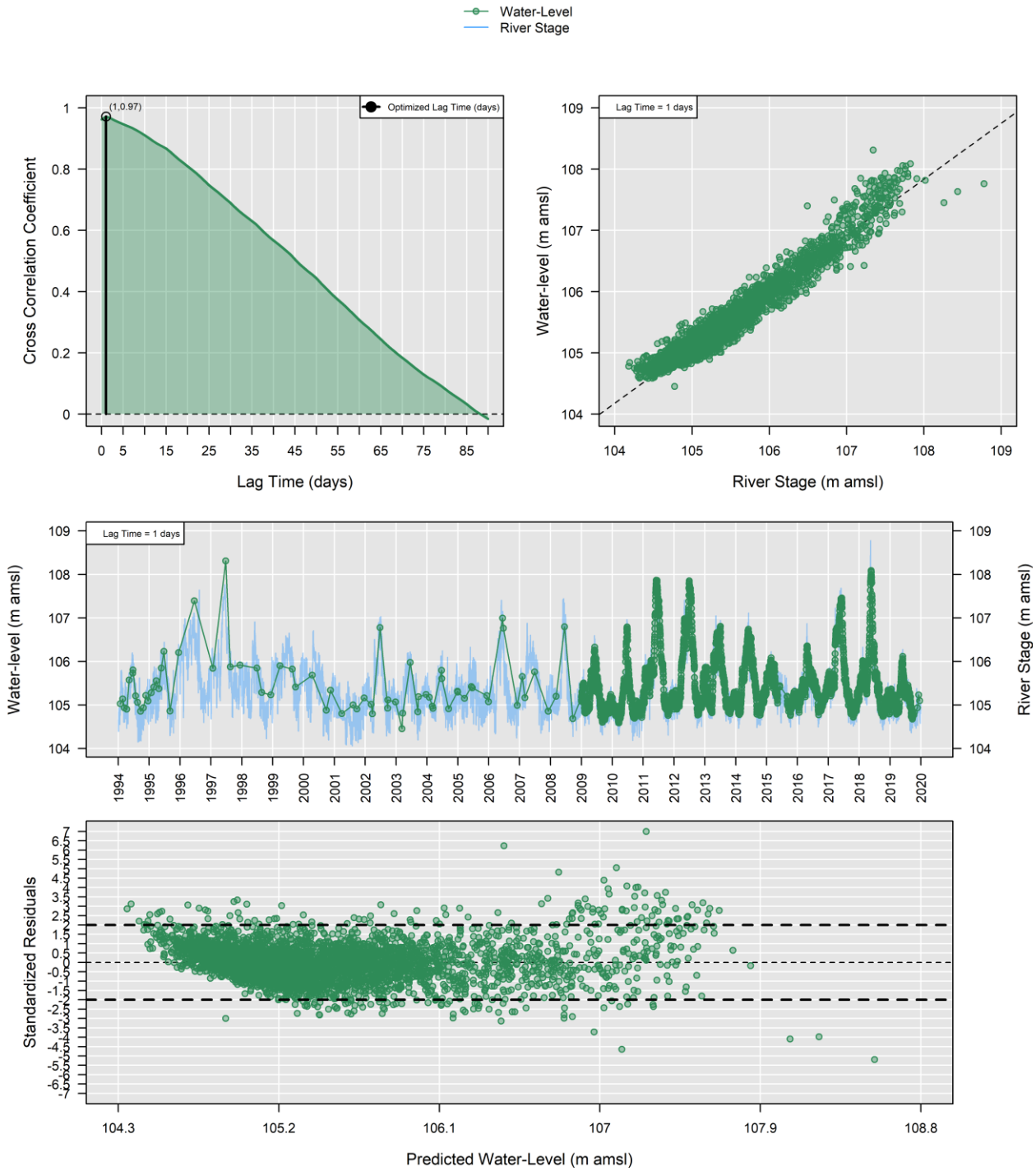
399-1-2

Significance of River Stage (p-value): 0
Distance to River: 386 m
Correlation with River Stage significant



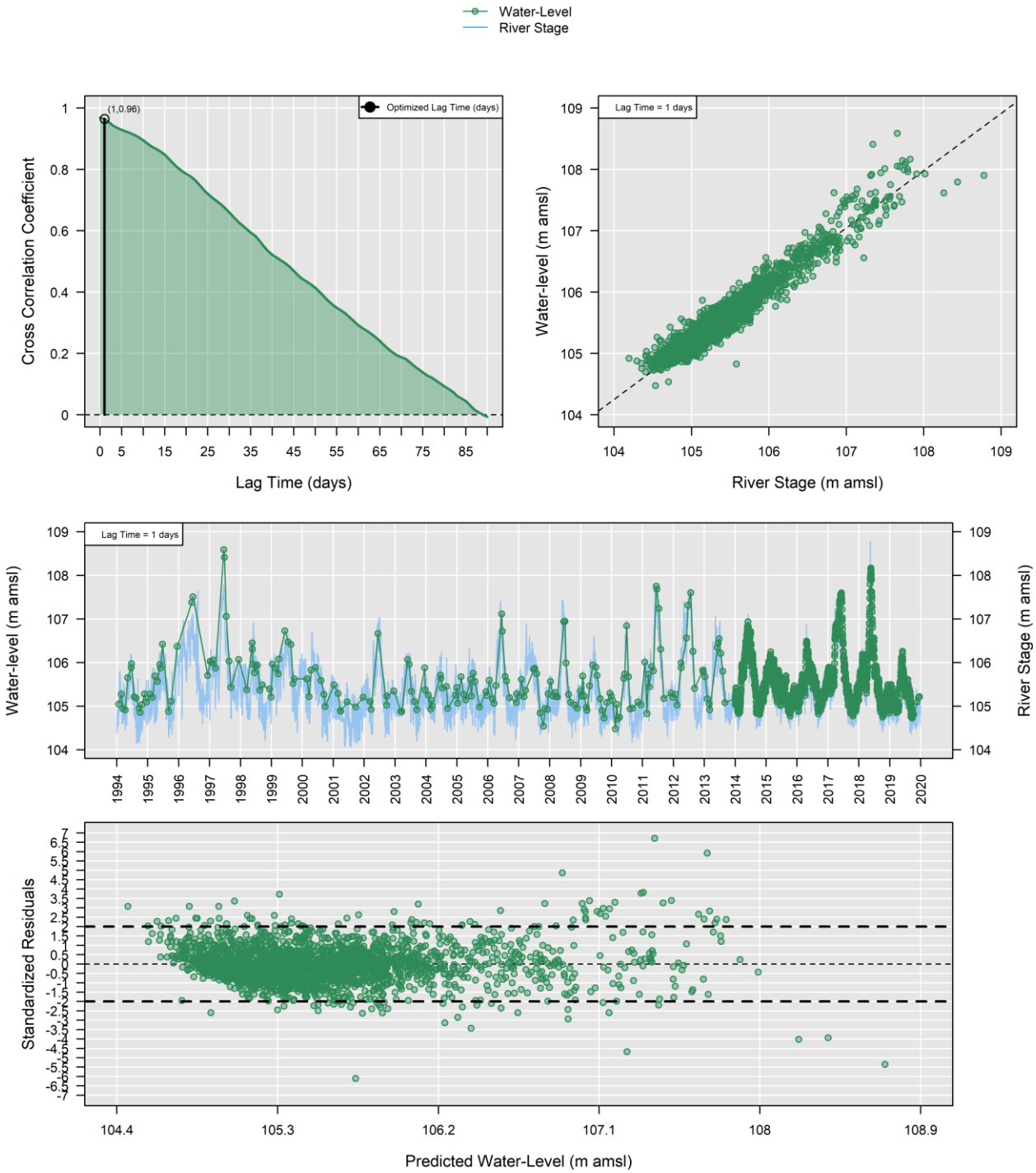
399-1-7

Significance of River Stage (p-value): 0
Distance to River: 209 m
Correlation with River Stage significant



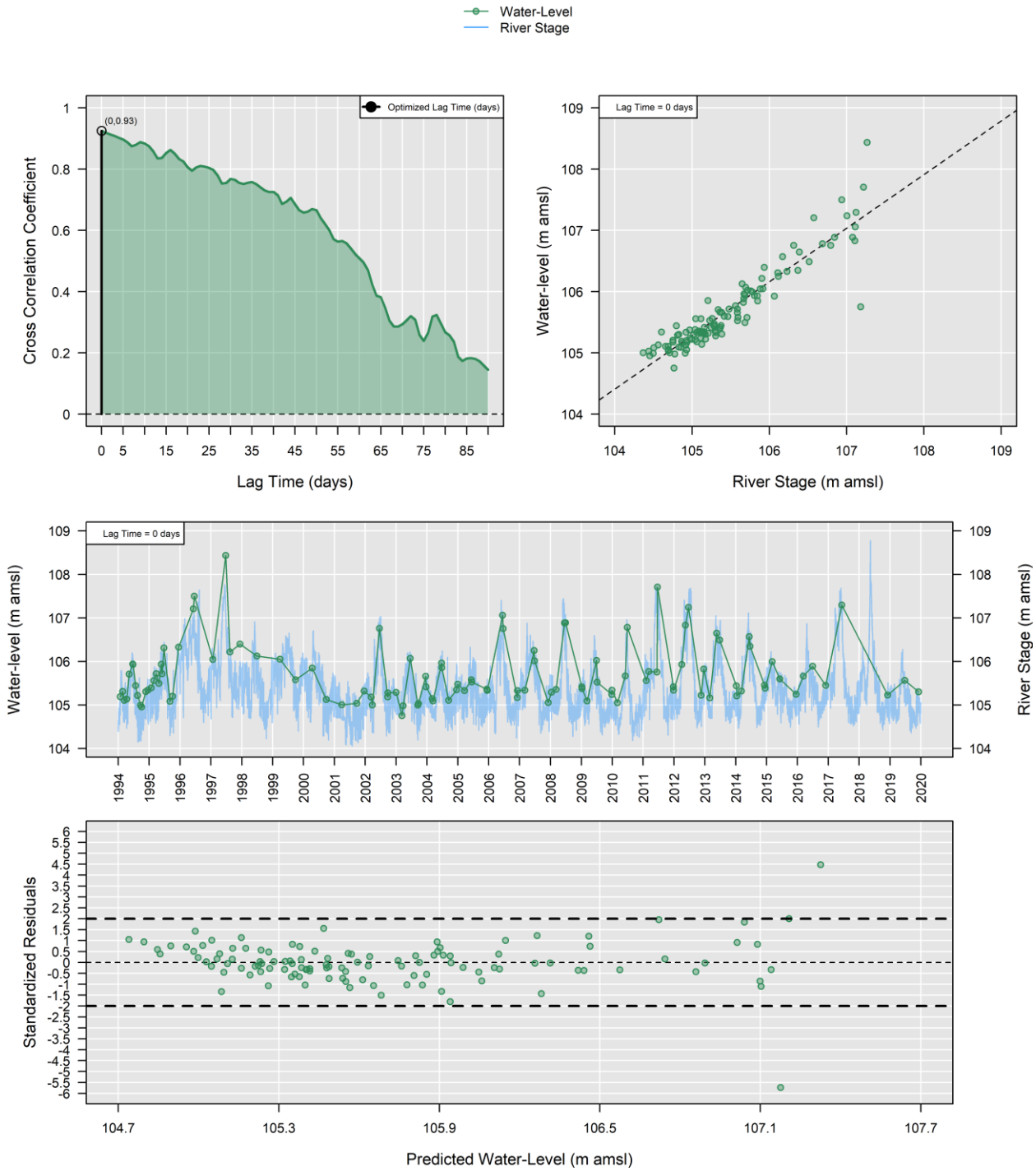
399-1-10A

Significance of River Stage (p-value): 0
Distance to River: 70 m
Correlation with River Stage significant



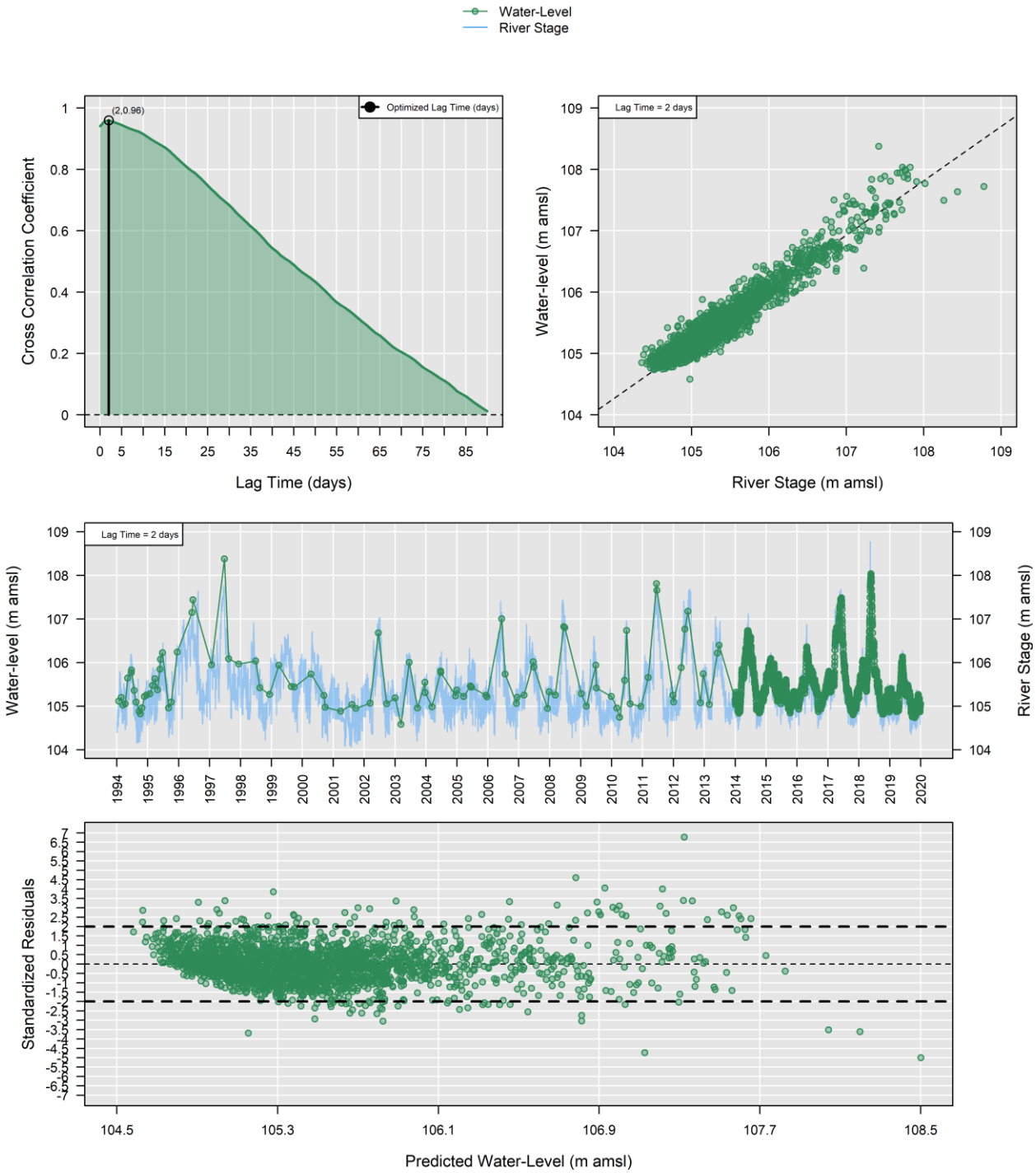
399-1-11

Significance of River Stage (p-value): 1.1e-50
Distance to River: 314 m
Correlation with River Stage significant



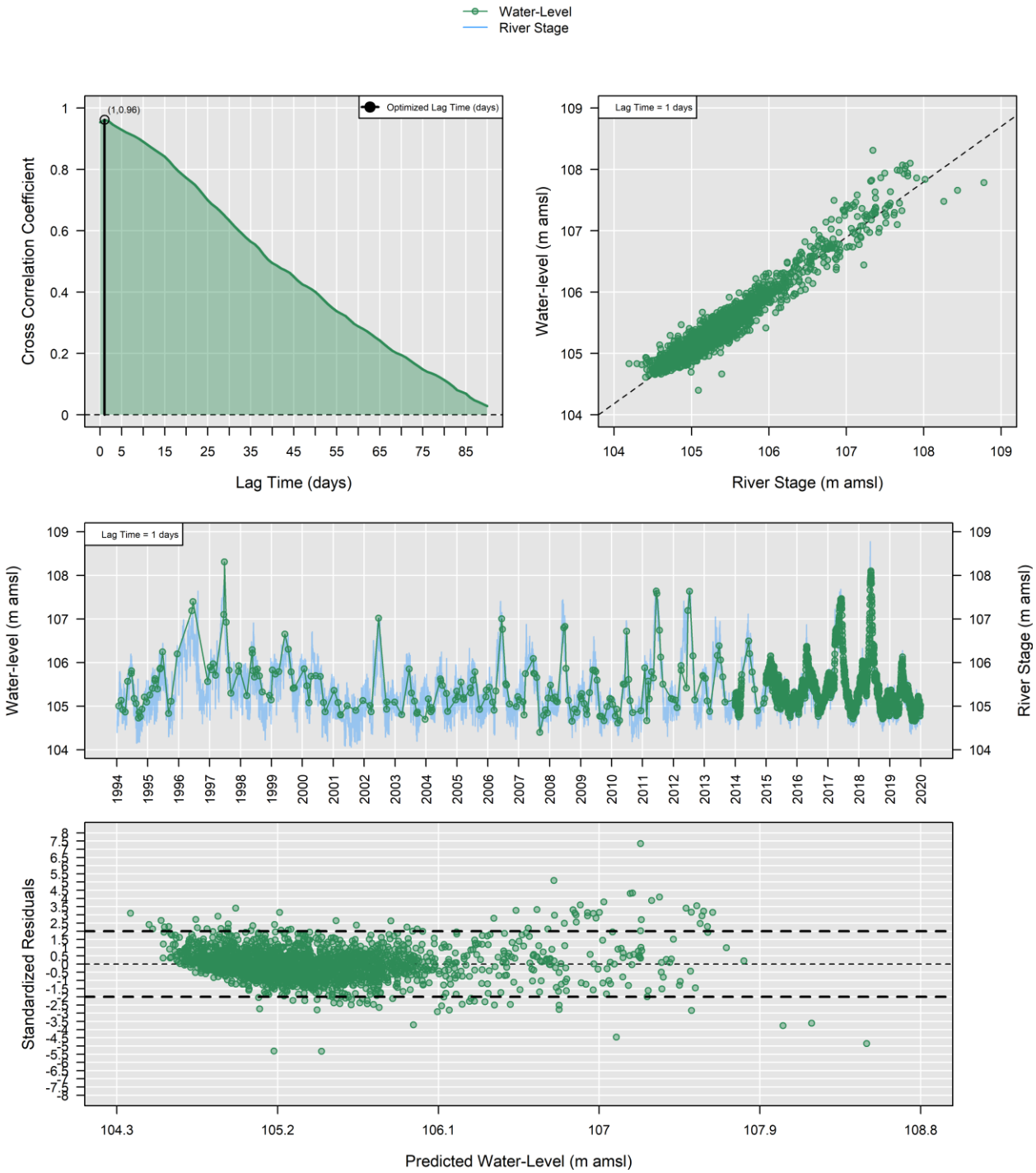
399-1-12

Significance of River Stage (p-value): 0
Distance to River: 398 m
Correlation with River Stage significant



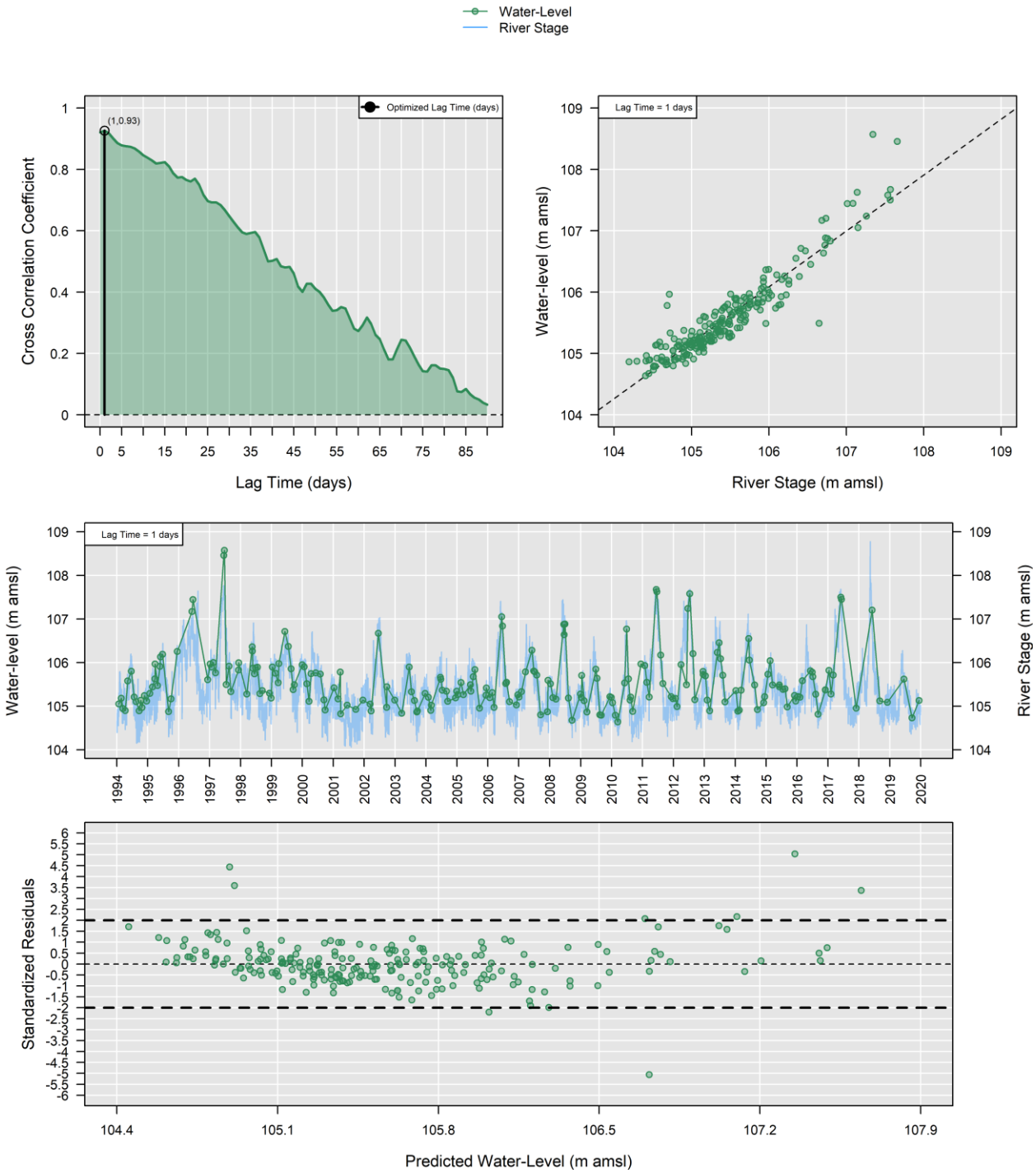
399-1-16A

Significance of River Stage (p-value): 0
Distance to River: 141 m
Correlation with River Stage significant



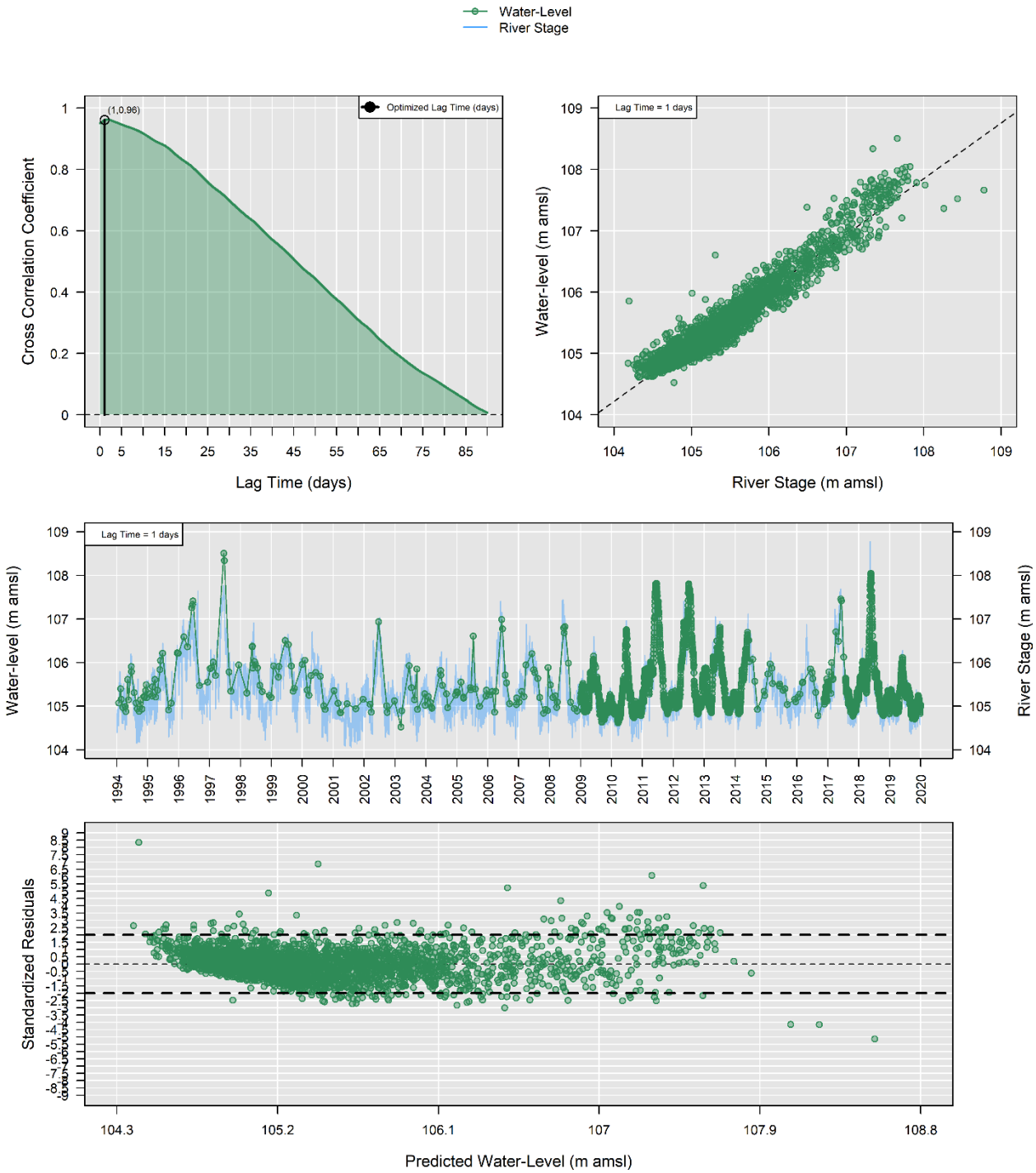
399-1-16B

Significance of River Stage (p-value): 1.3e-99
Distance to River: 135 m
Correlation with River Stage significant



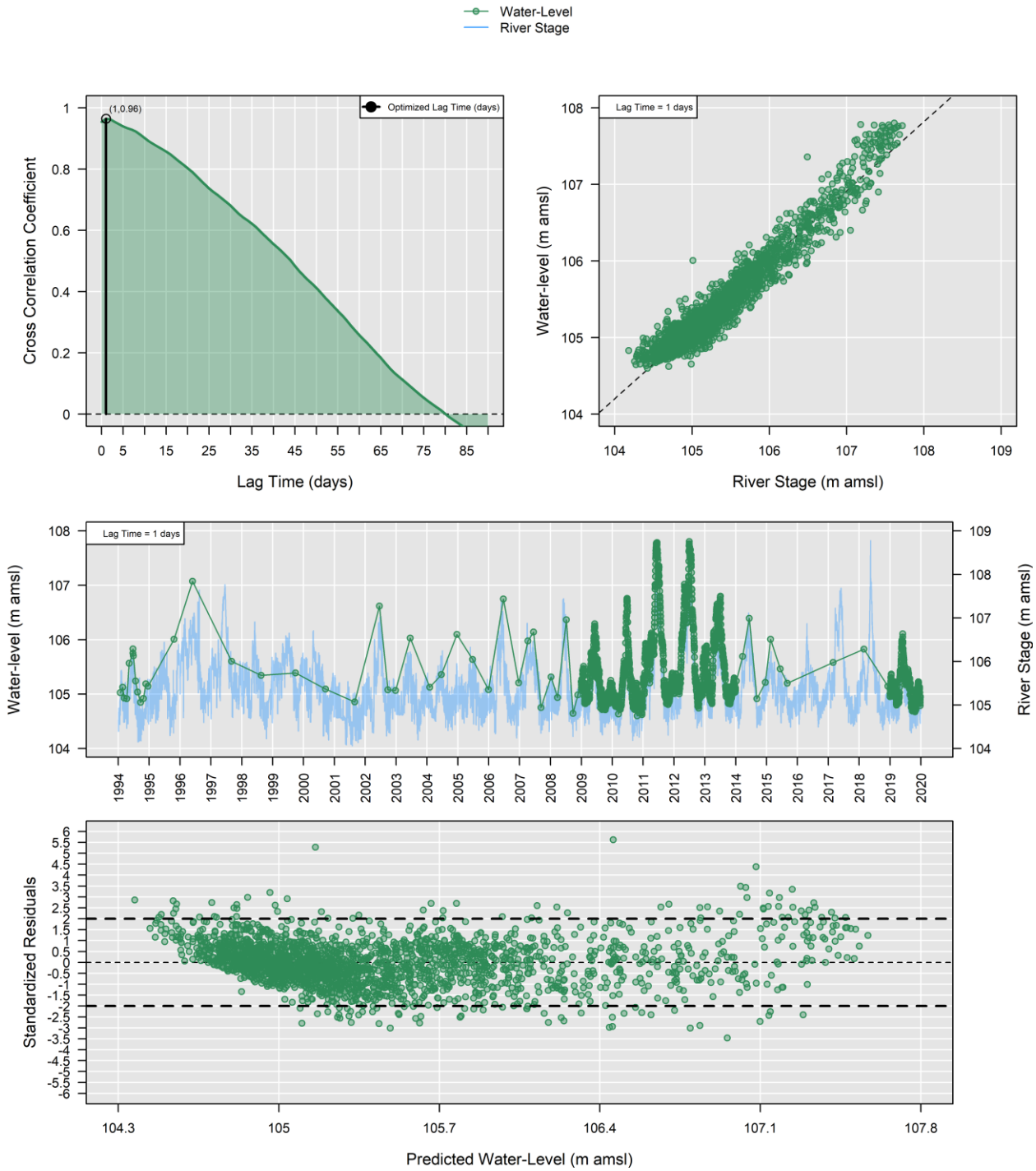
399-1-17A

Significance of River Stage (p-value): 0
Distance to River: 344 m
Correlation with River Stage significant



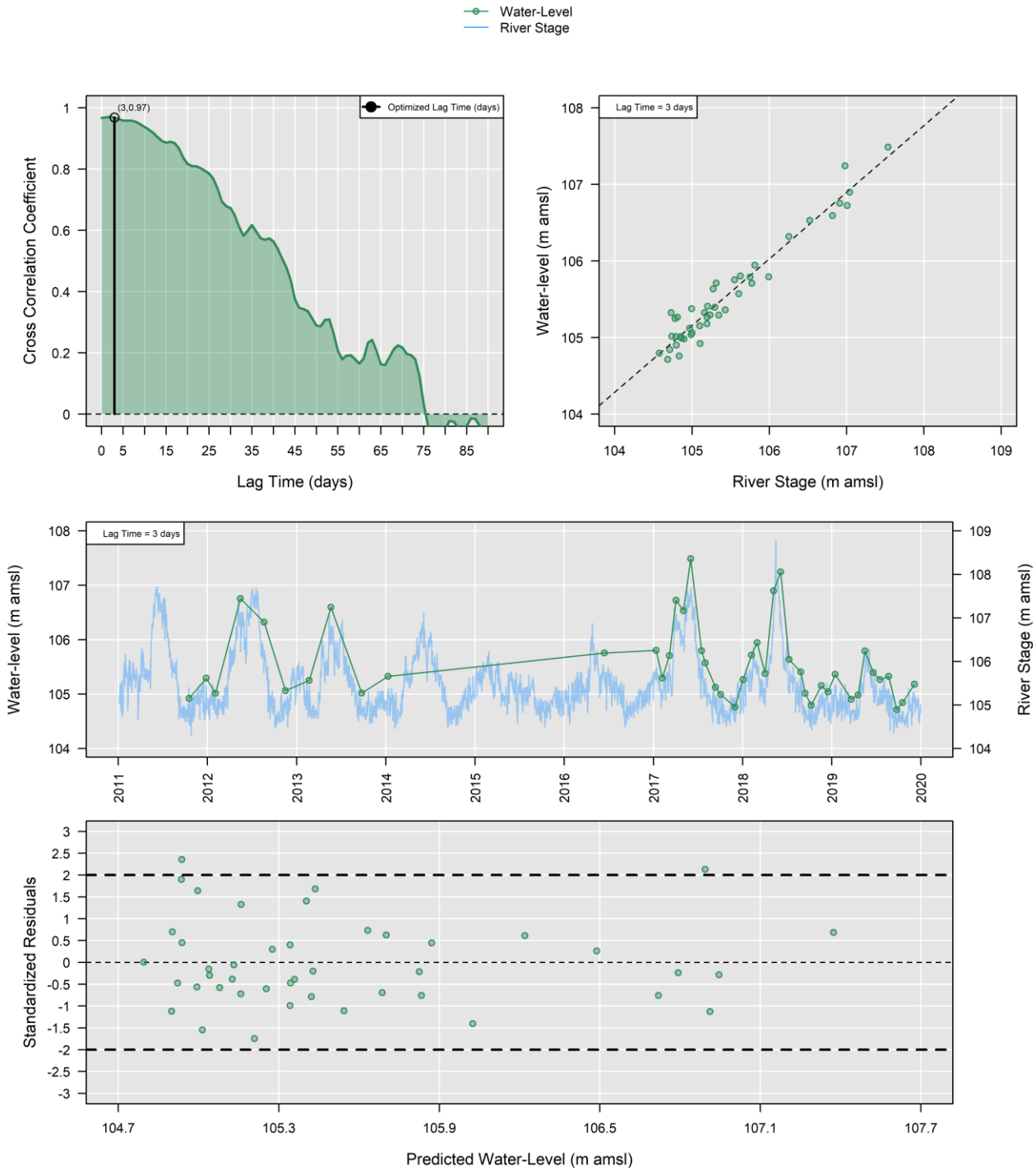
399-1-21A

Significance of River Stage (p-value): 0
Distance to River: 340 m
Correlation with River Stage significant



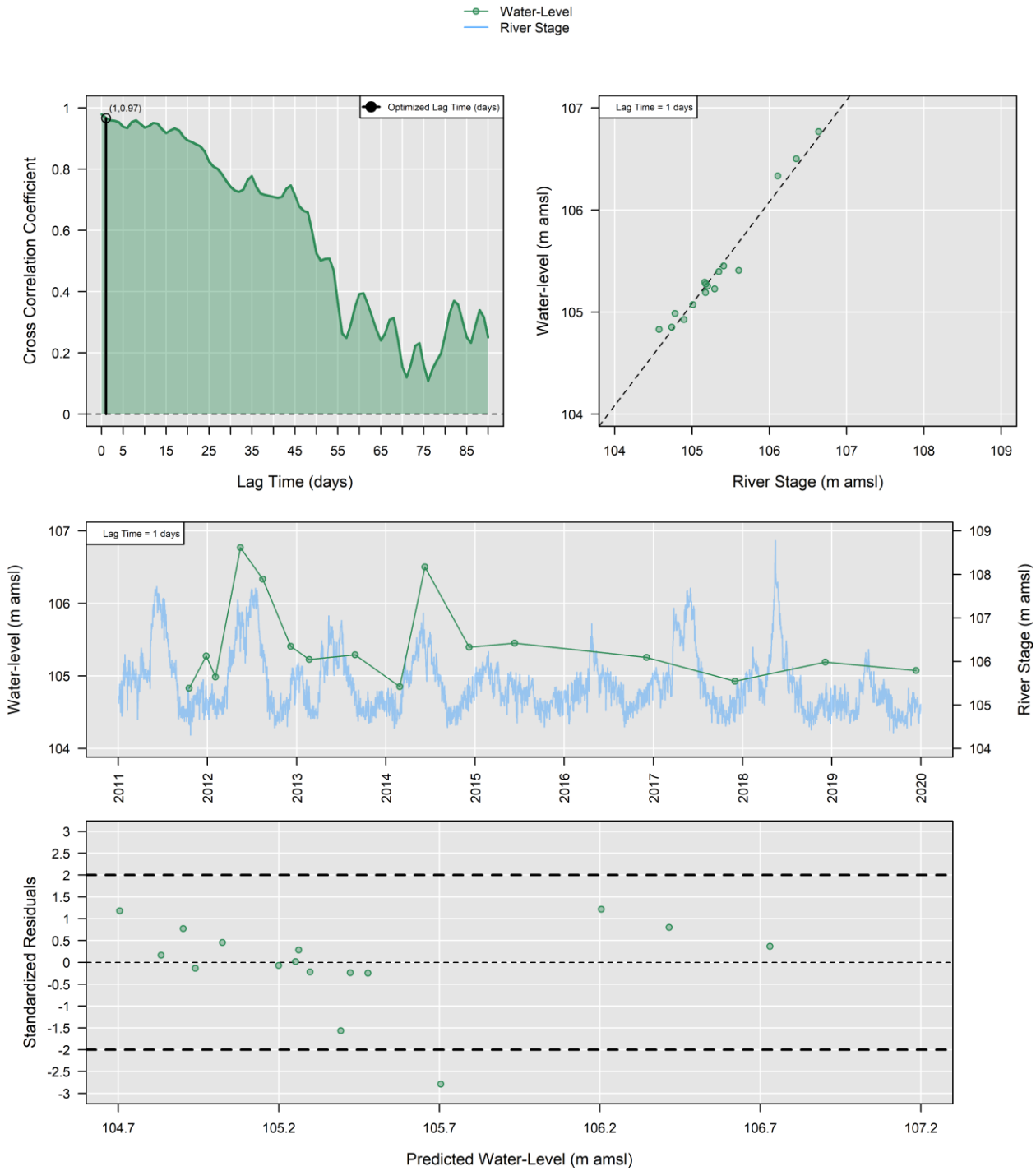
399-1-55

Significance of River Stage (p-value): 4.4e-27
Distance to River: 295 m
Correlation with River Stage significant



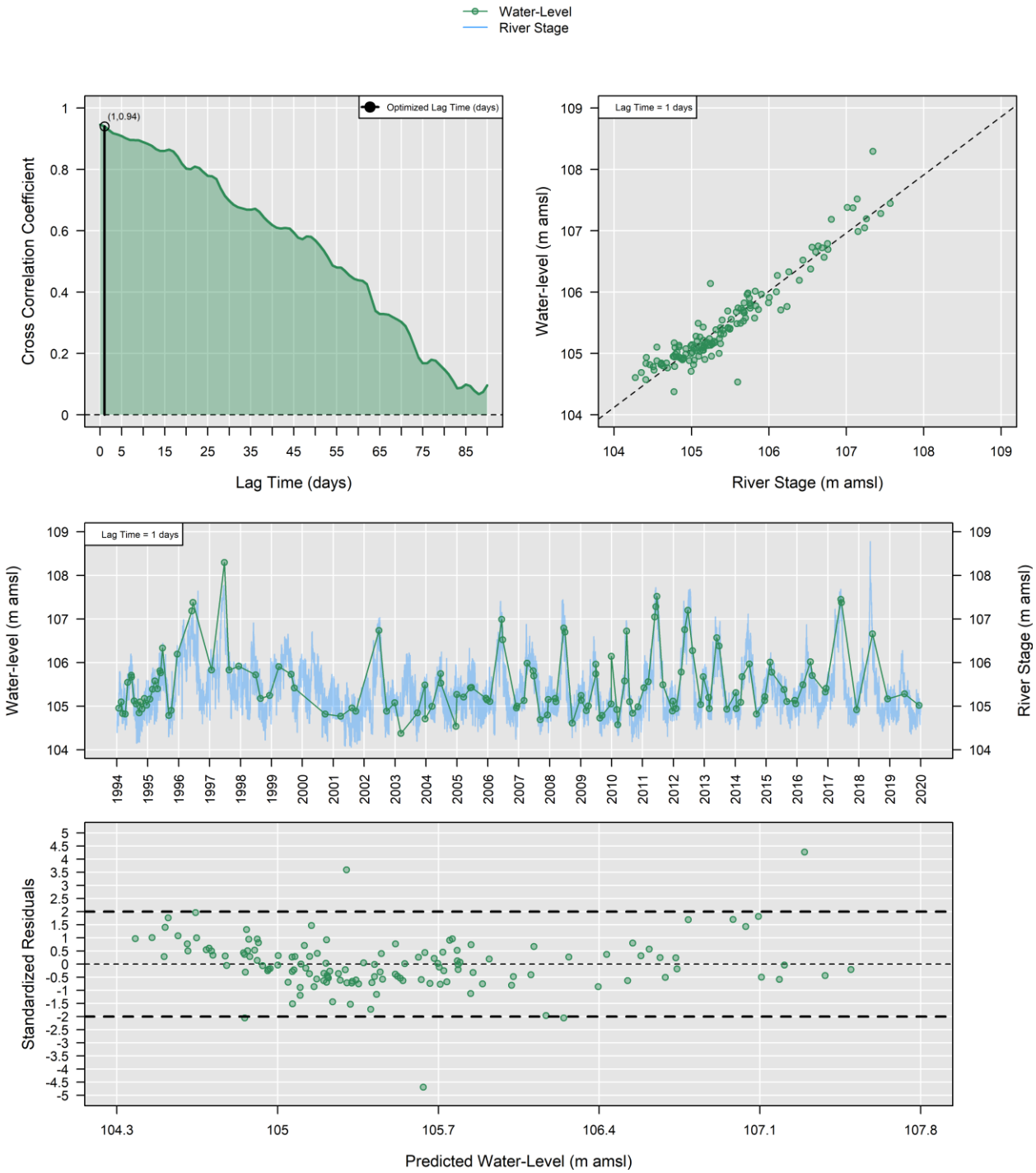
399-1-57

Significance of River Stage (p-value): 7.5e-11
Distance to River: 86 m
Correlation with River Stage significant



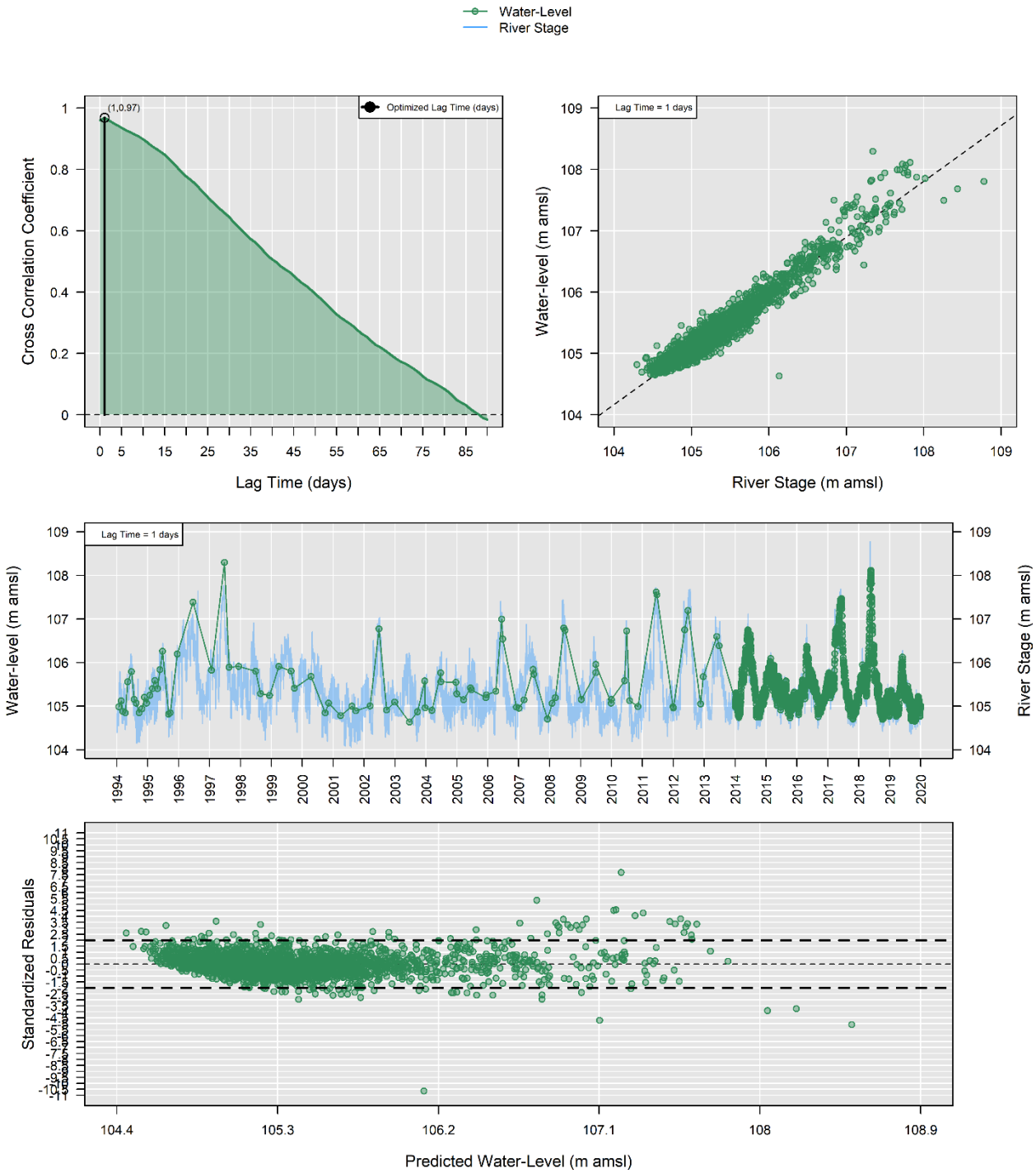
399-2-1

Significance of River Stage (p-value): 9.4e-69
Distance to River: 57 m
Correlation with River Stage significant



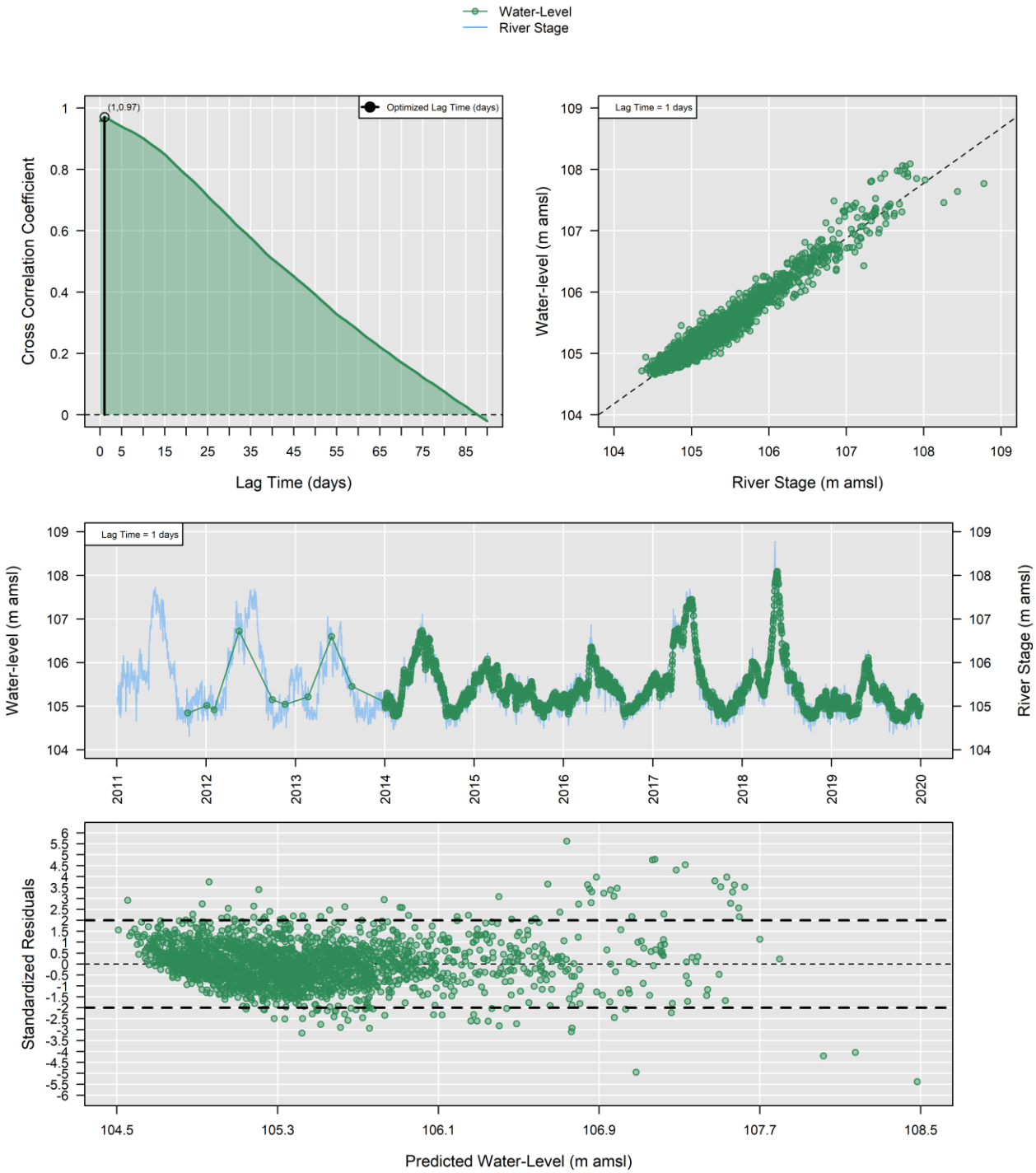
399-2-2

Significance of River Stage (p-value): 0
Distance to River: 98 m
Correlation with River Stage significant



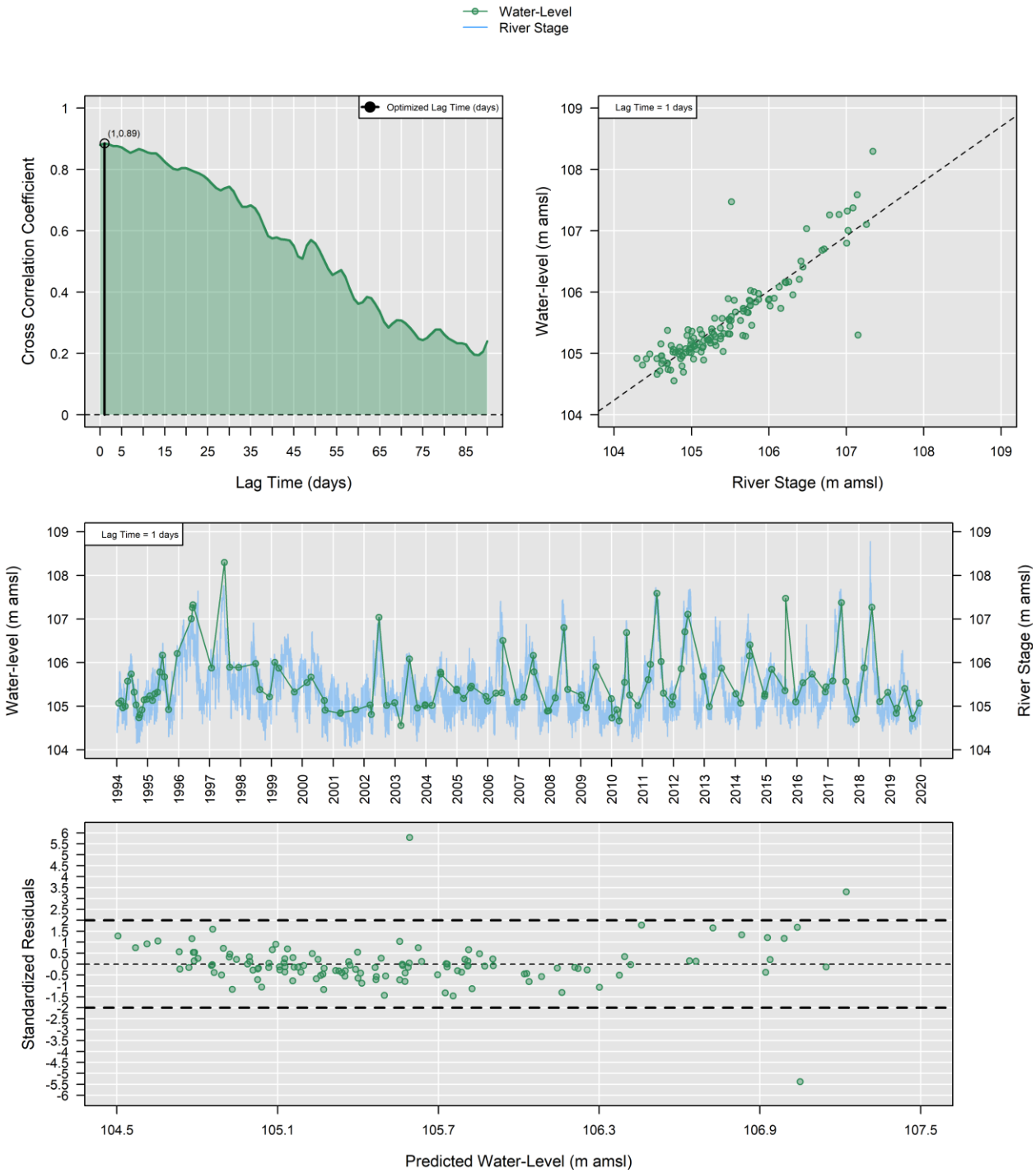
399-2-32

Significance of River Stage (p-value): 0
Distance to River: 217 m
Correlation with River Stage significant



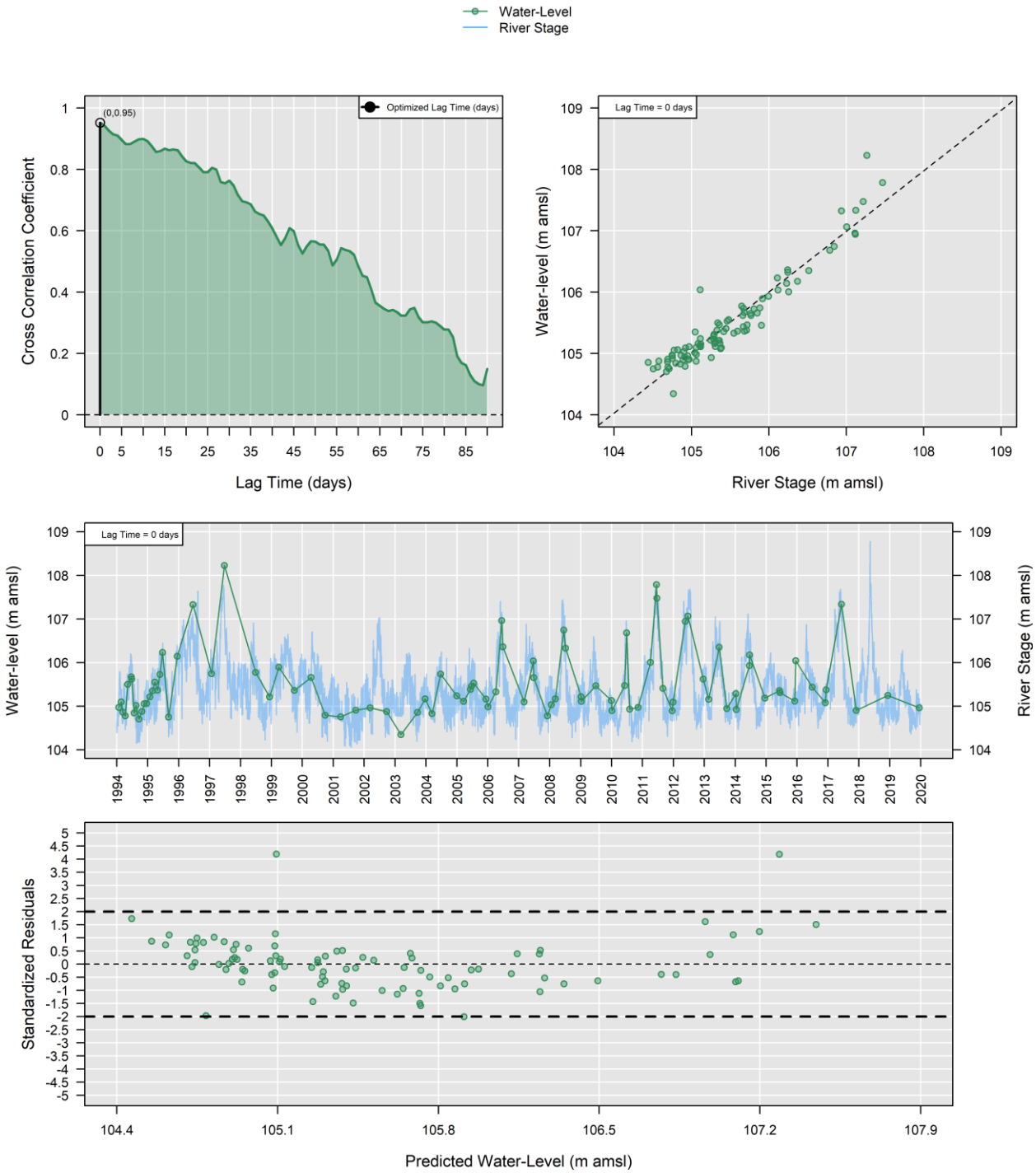
399-3-6

Significance of River Stage (p-value): 7.9e-44
Distance to River: 623 m
Correlation with River Stage significant



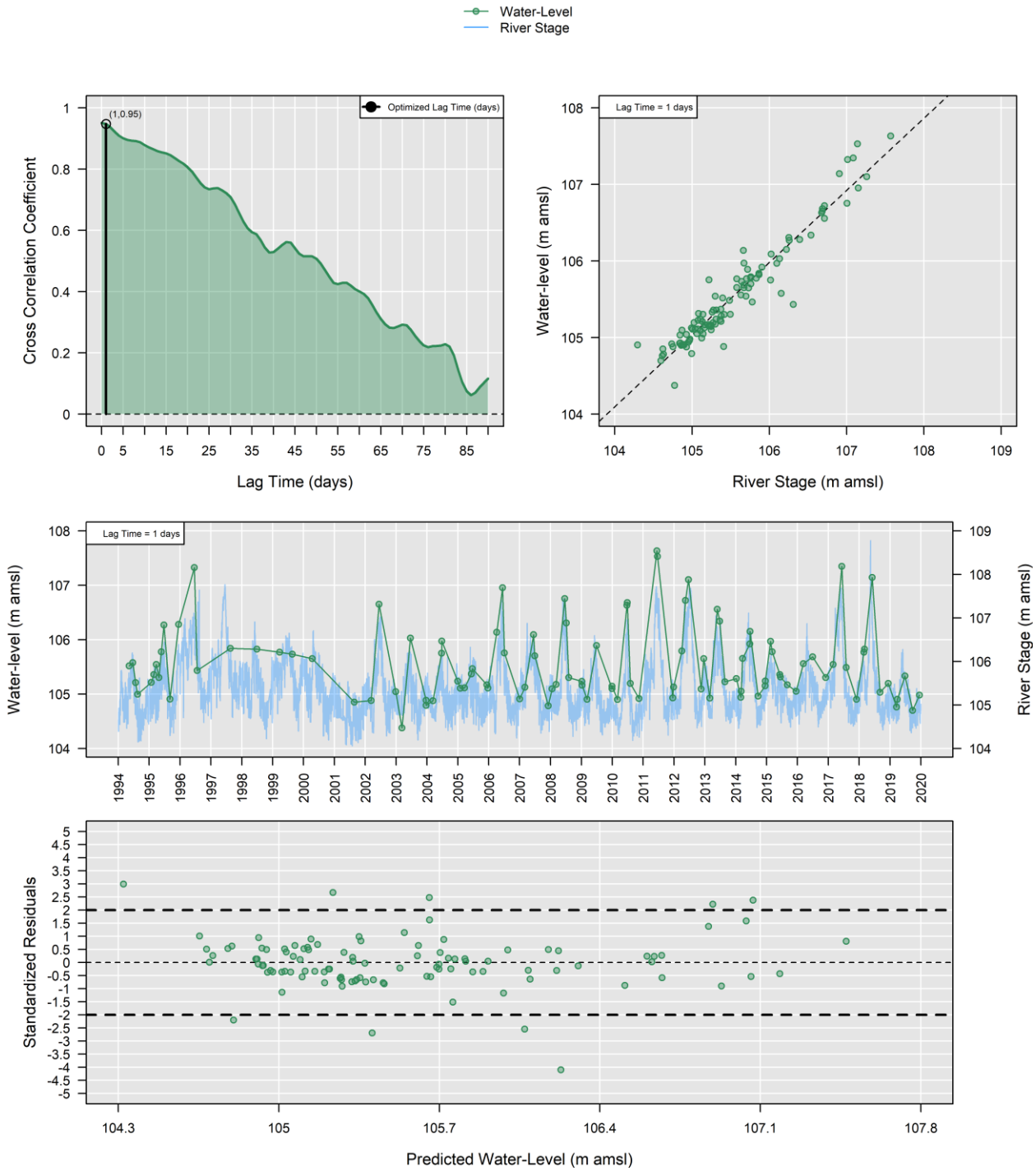
399-3-9

Significance of River Stage (p-value): 6.4e-49
Distance to River: 68 m
Correlation with River Stage significant



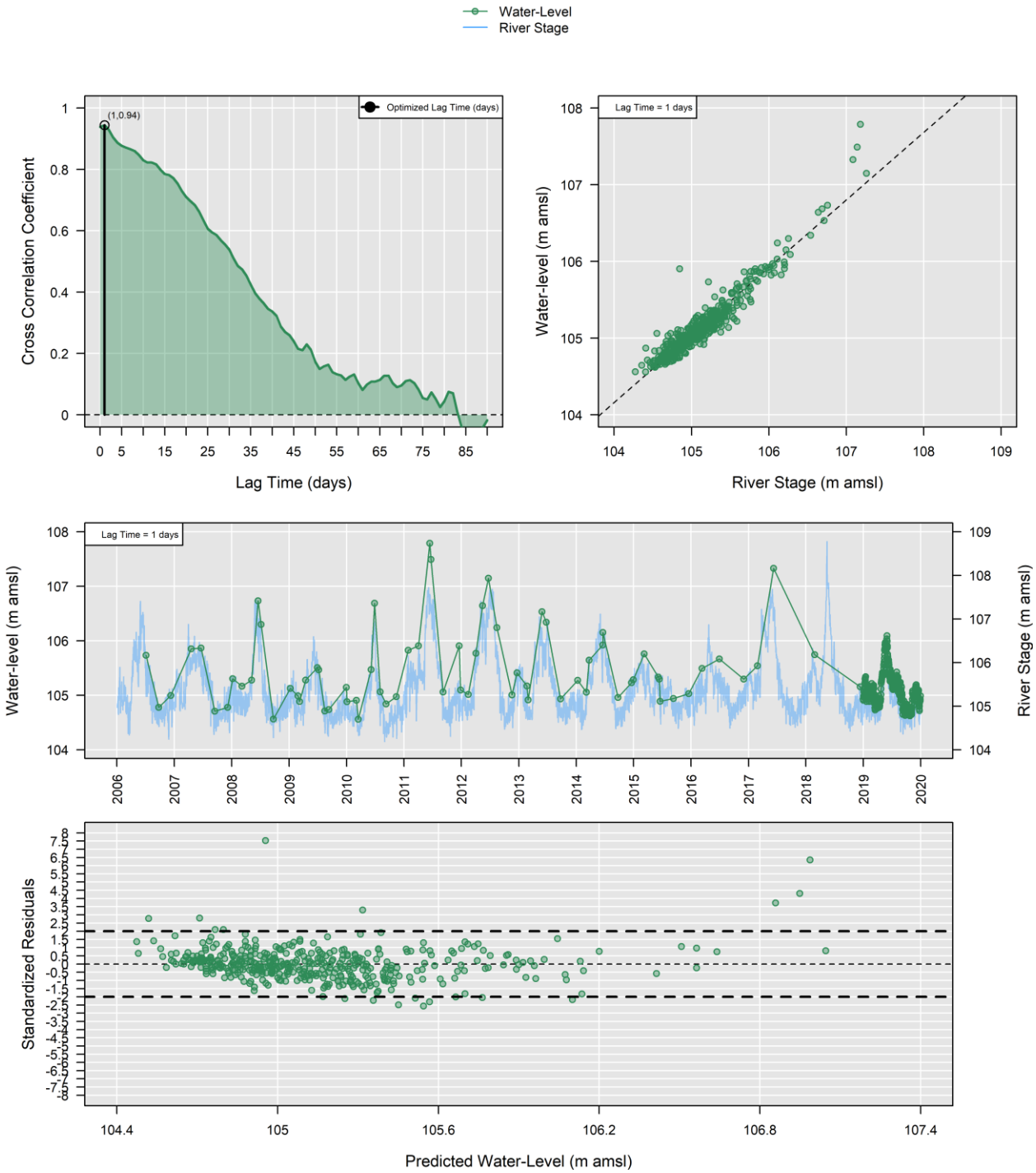
399-3-12

Significance of River Stage (p-value): 3.4e-58
Distance to River: 344 m
Correlation with River Stage significant



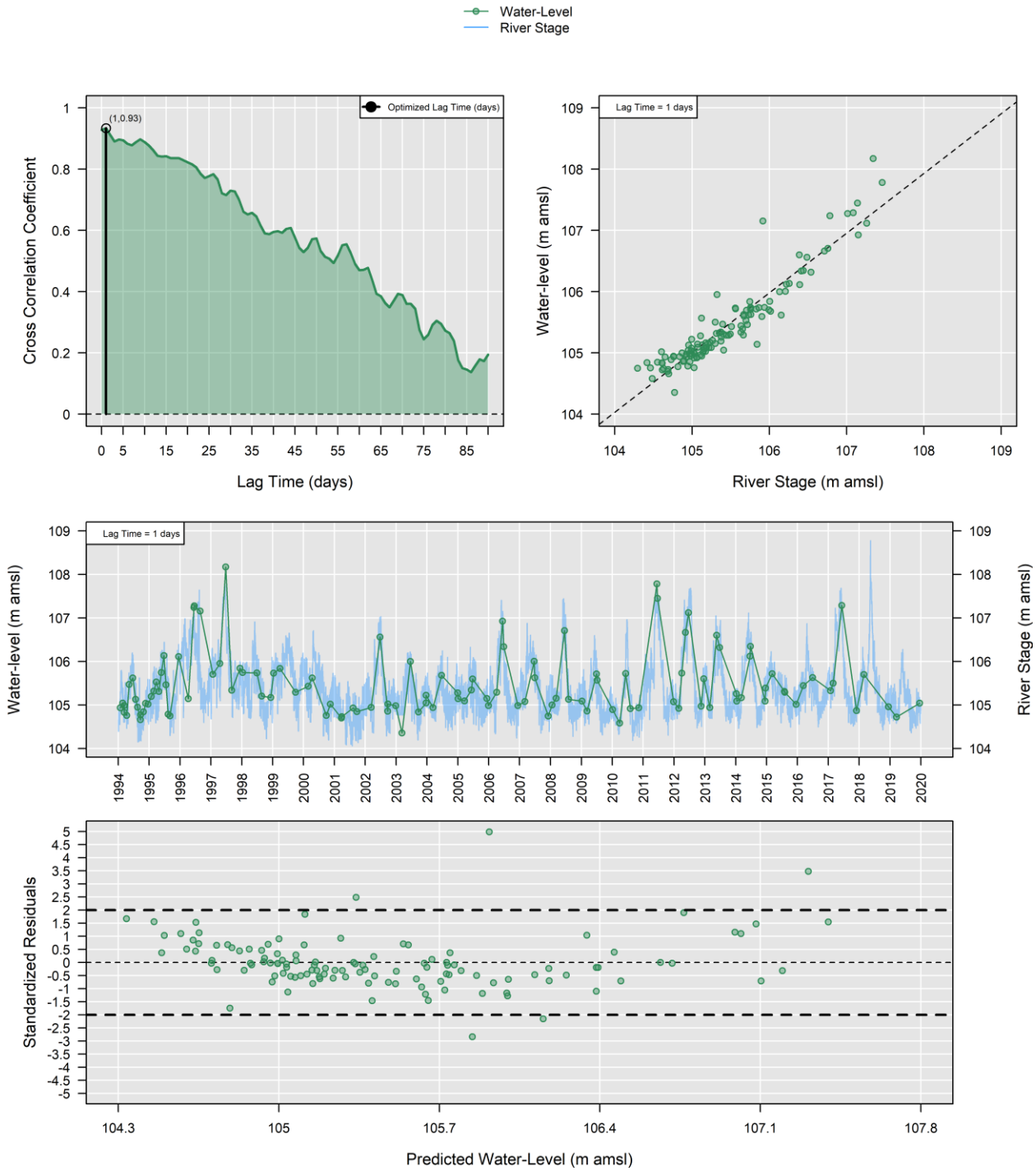
399-3-20

Significance of River Stage (p-value): 1.8e-222
Distance to River: 210 m
Correlation with River Stage significant



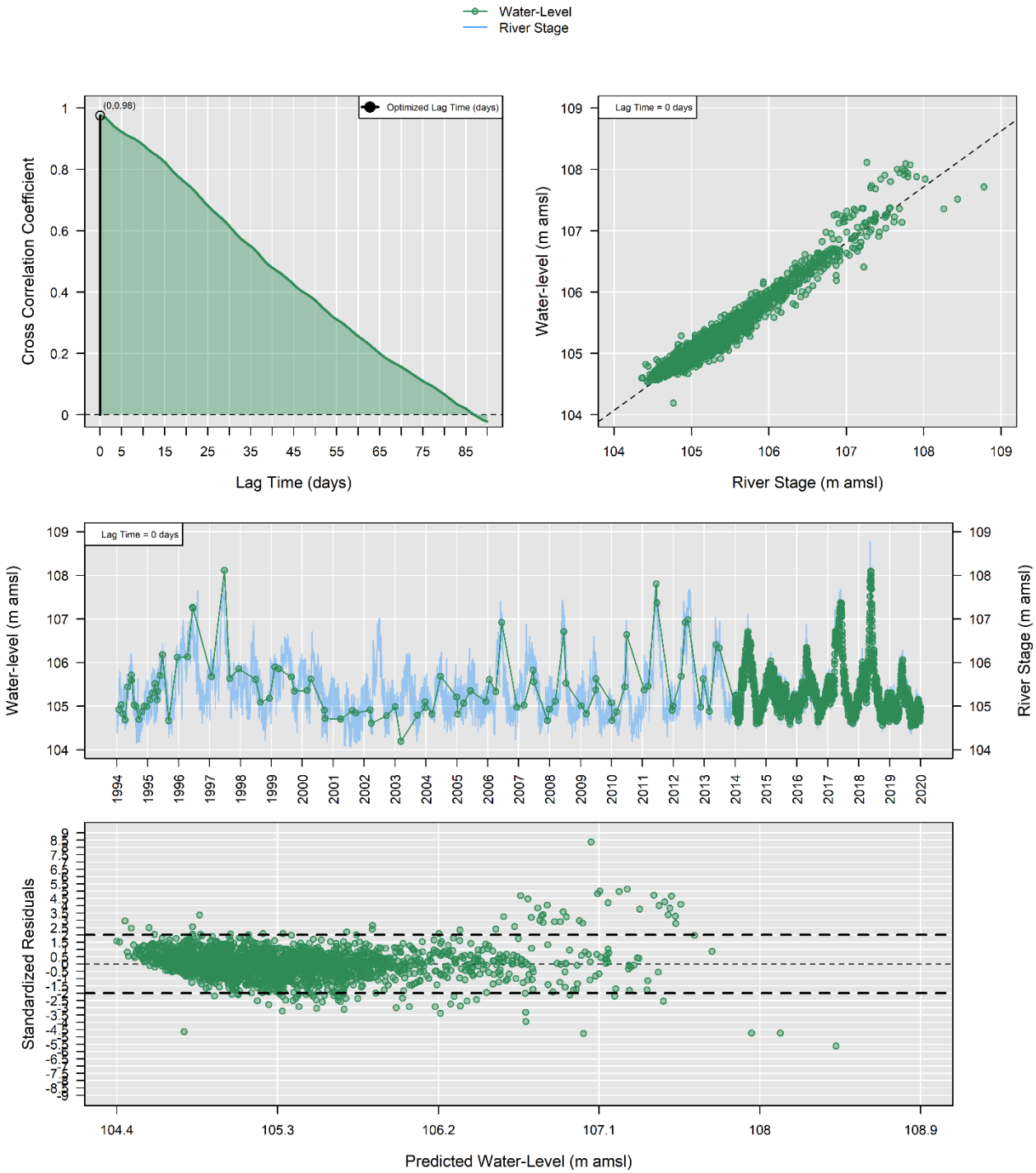
399-4-1

Significance of River Stage (p-value): 9.2e-57
Distance to River: 381 m
Correlation with River Stage significant



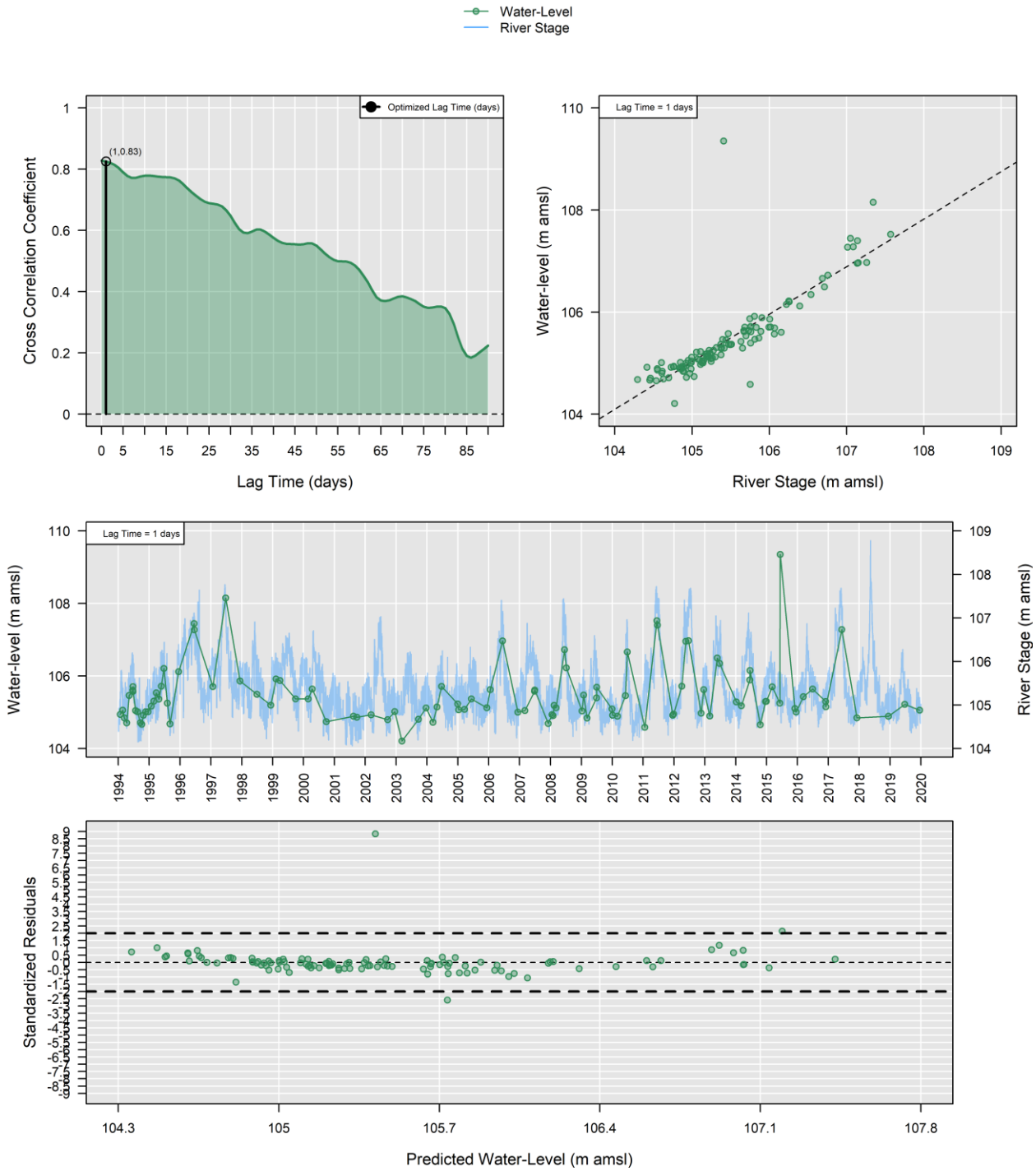
399-4-7

Significance of River Stage (p-value): 0
Distance to River: 72 m
Correlation with River Stage significant



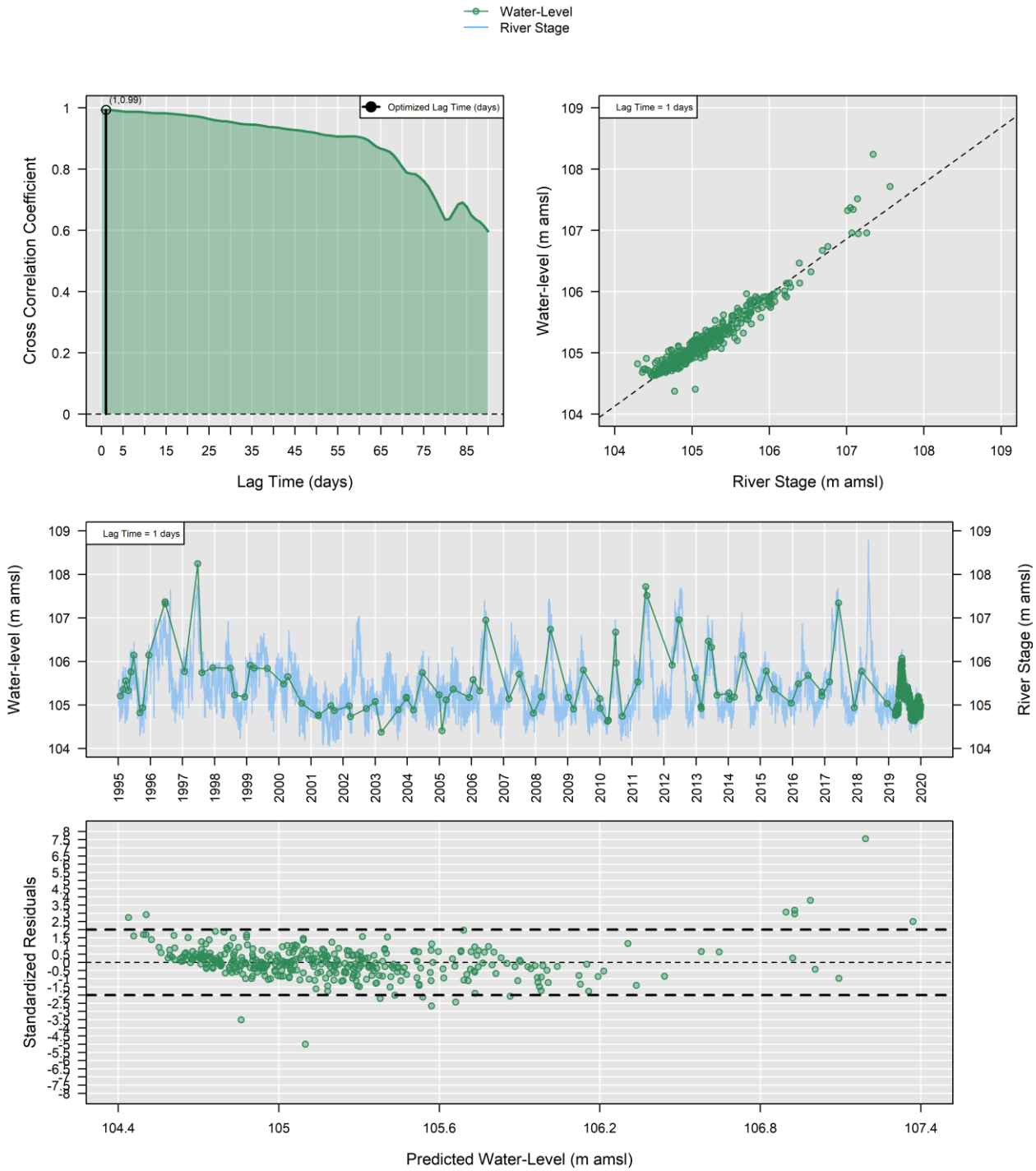
399-4-10

Significance of River Stage (p-value): 8.1e-30
Distance to River: 69 m
Correlation with River Stage significant



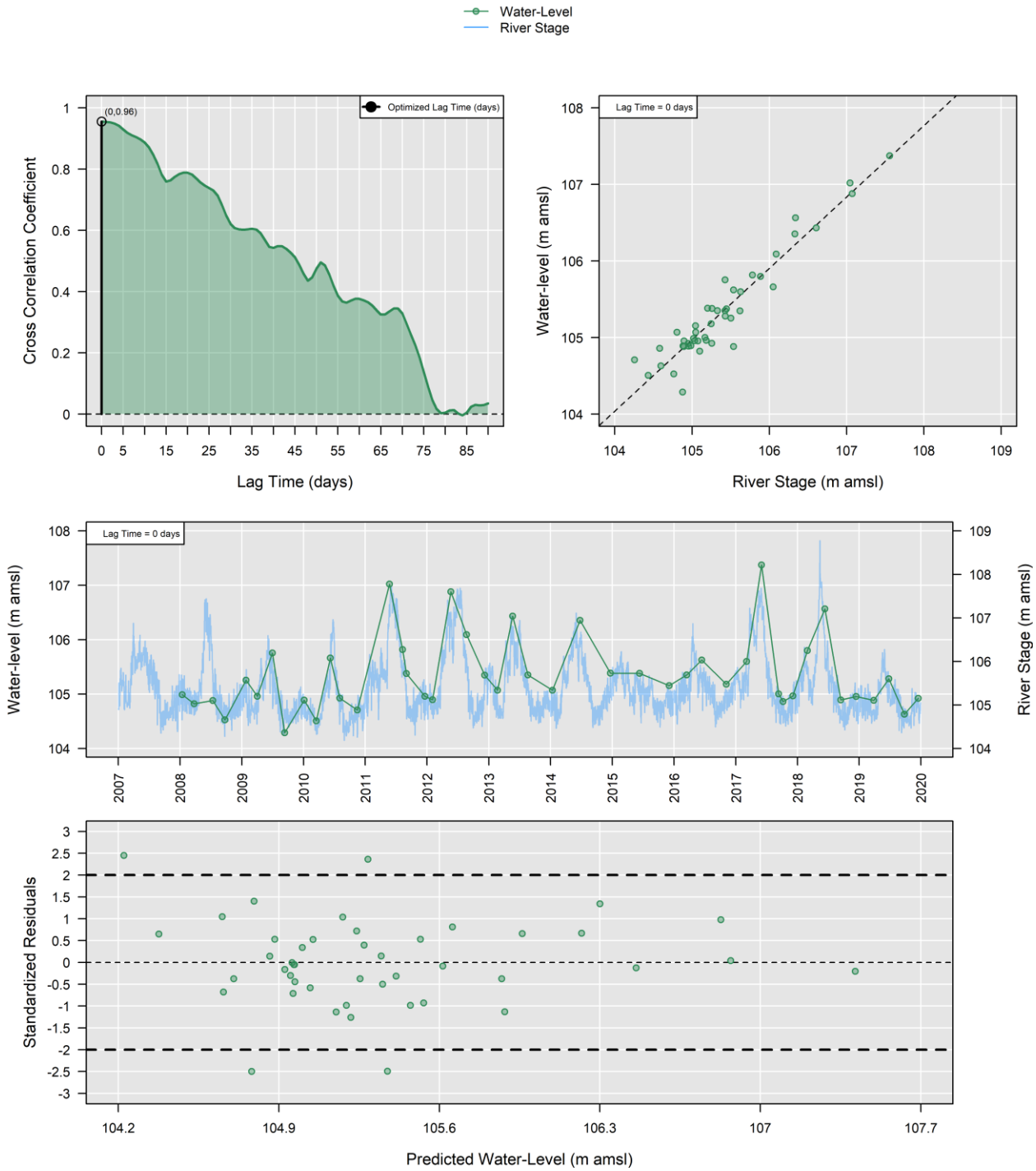
399-4-11

Significance of River Stage (p-value): 1.1e-206
Distance to River: 522 m
Correlation with River Stage significant



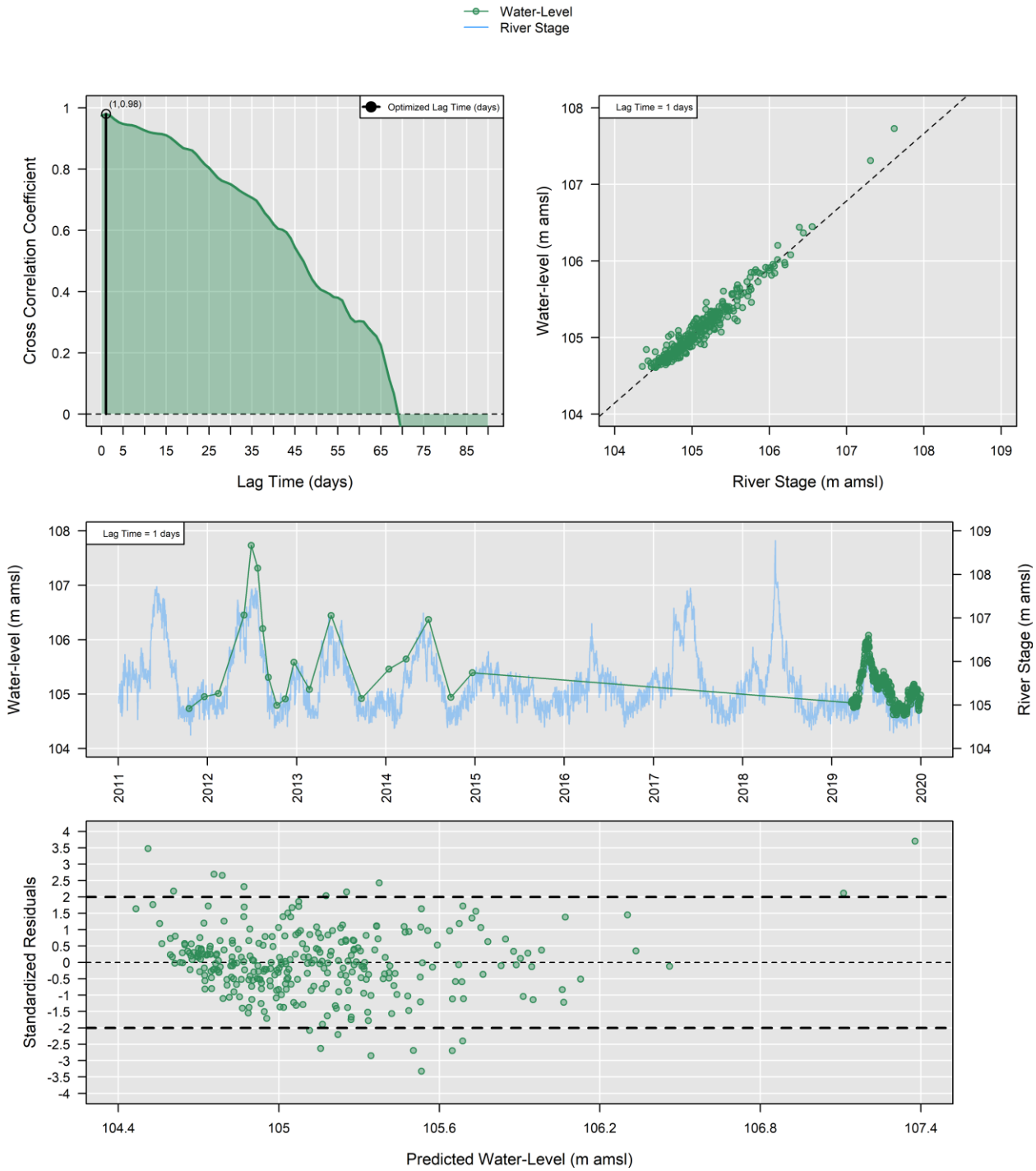
399-4-14

Significance of River Stage (p-value): 3.1e-24
Distance to River: 247 m
Correlation with River Stage significant



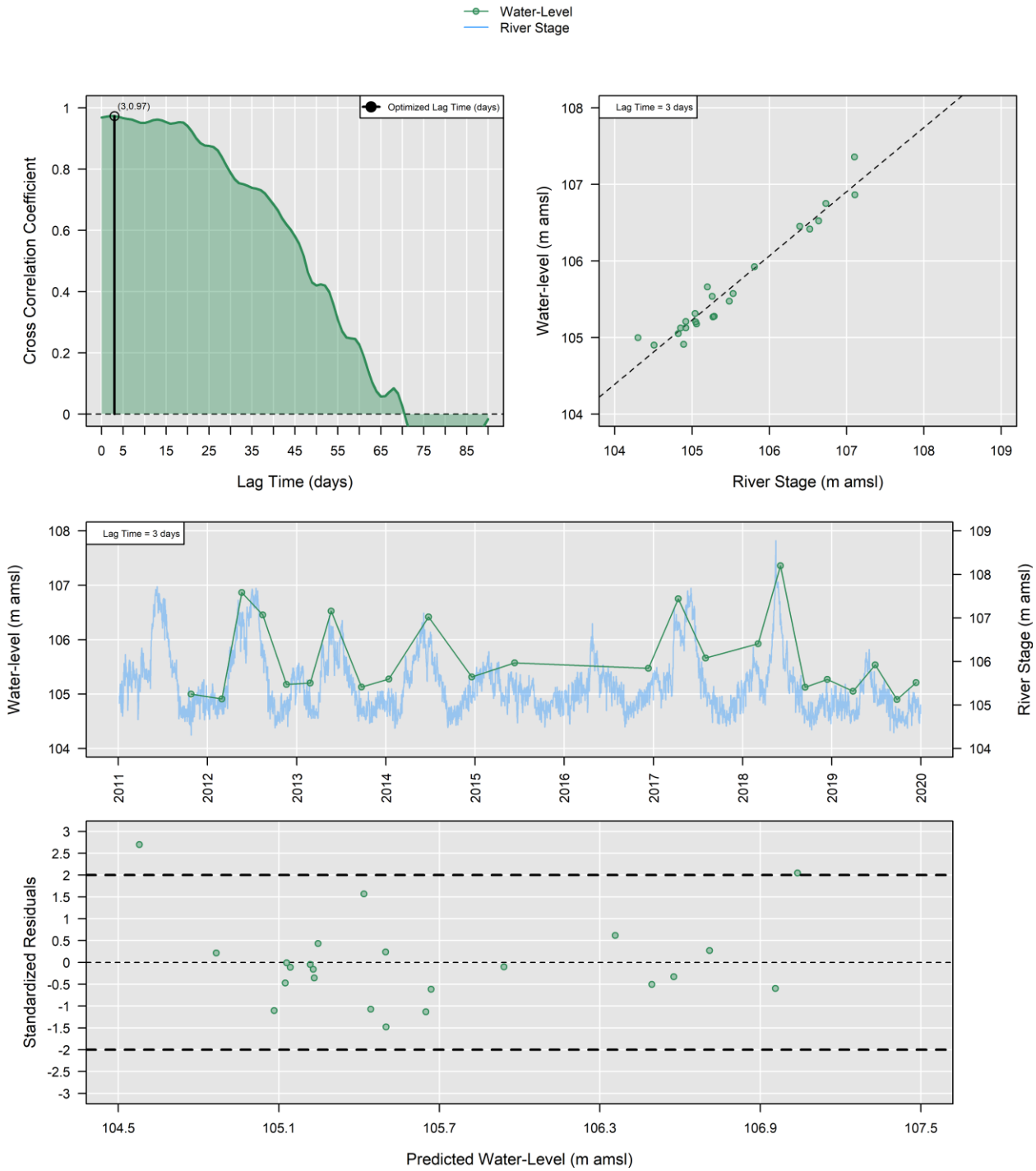
399-4-15

Significance of River Stage (p-value): 3.6e-184
Distance to River: 278 m
Correlation with River Stage significant



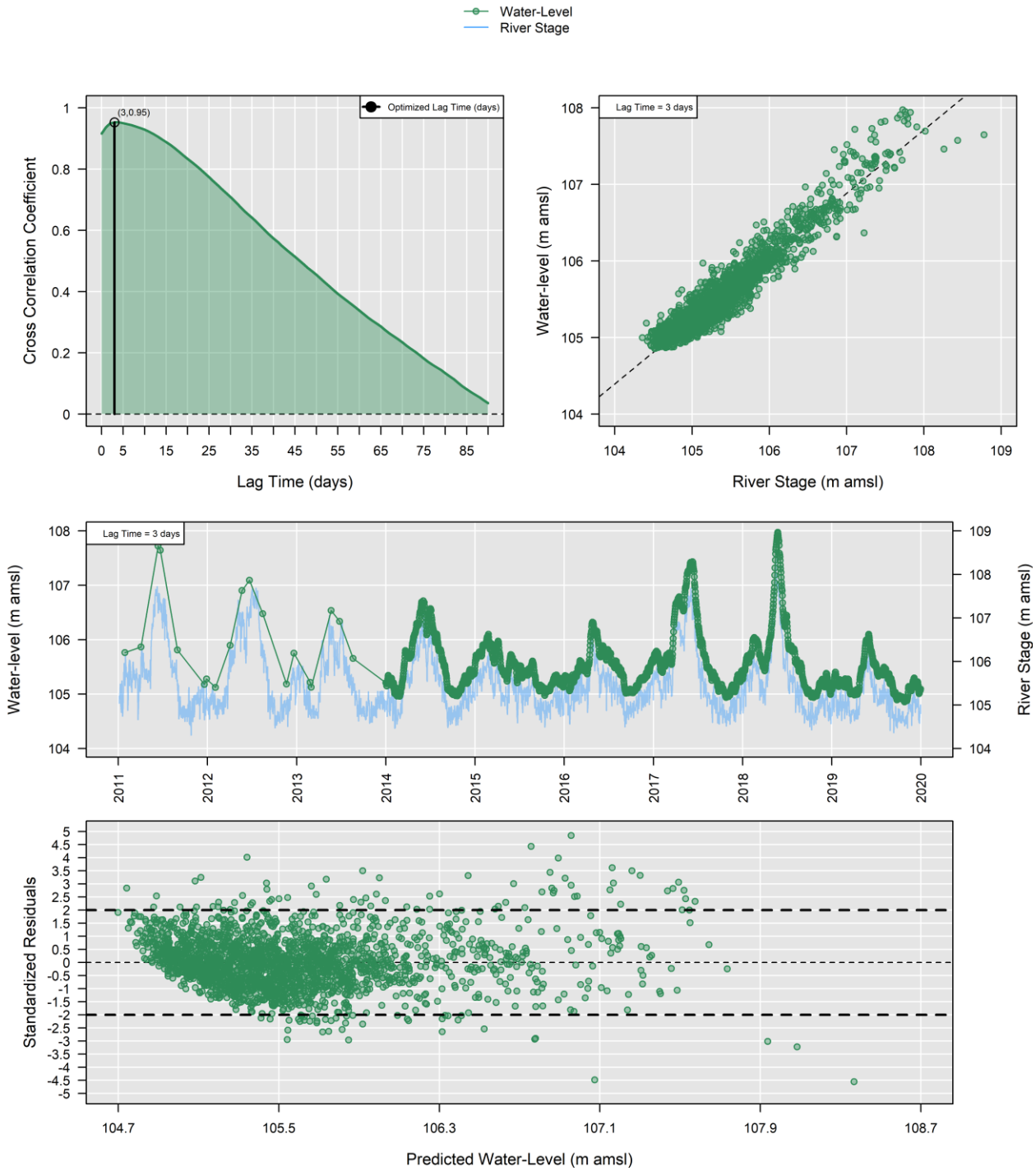
399-6-3

Significance of River Stage (p-value): 1.2e-14
Distance to River: 819 m
Correlation with River Stage significant



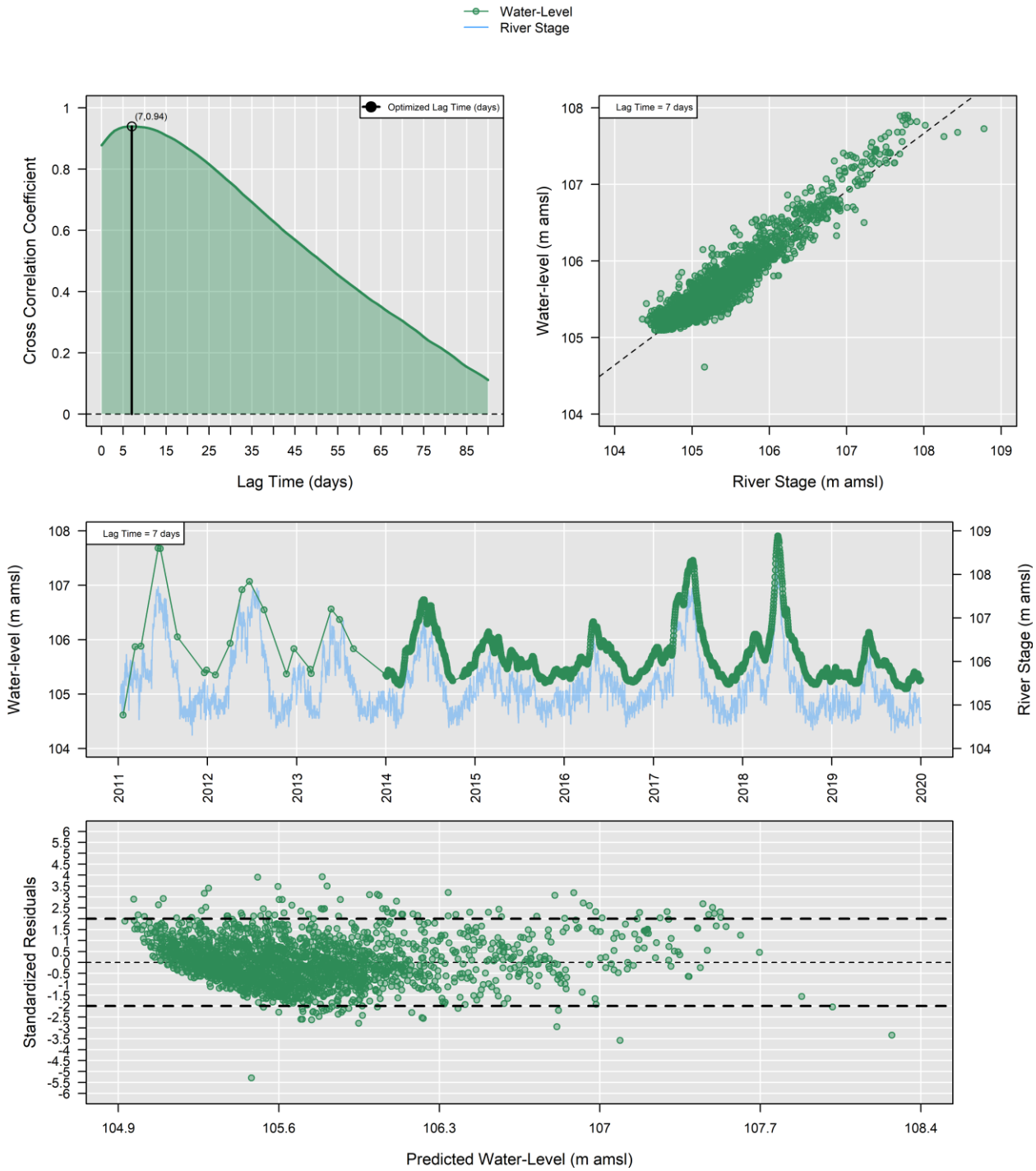
399-8-1

Significance of River Stage (p-value): 0
Distance to River: 832 m
Correlation with River Stage significant



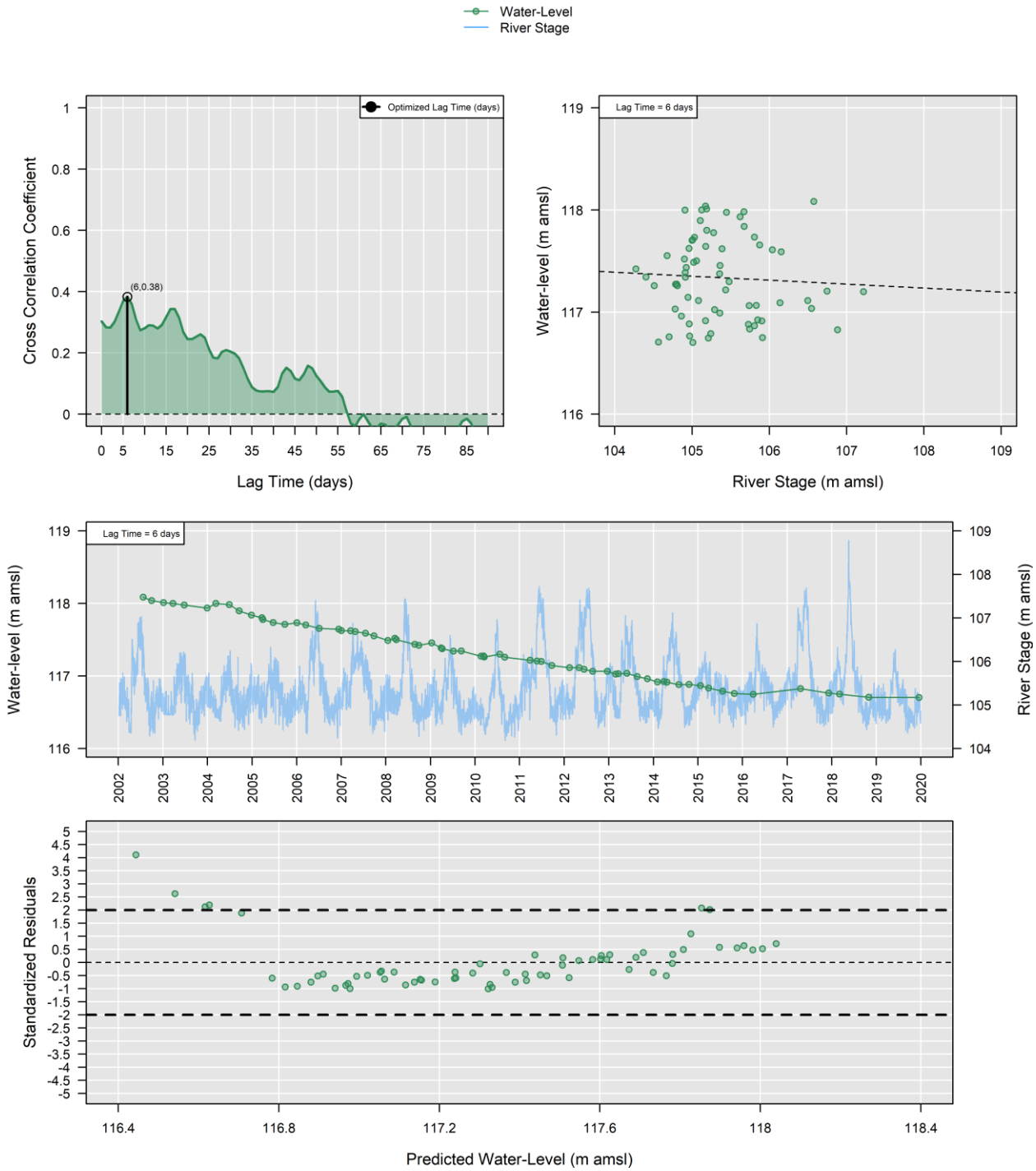
399-8-5A

Significance of River Stage (p-value): 0
Distance to River: 1046 m
Correlation with River Stage significant



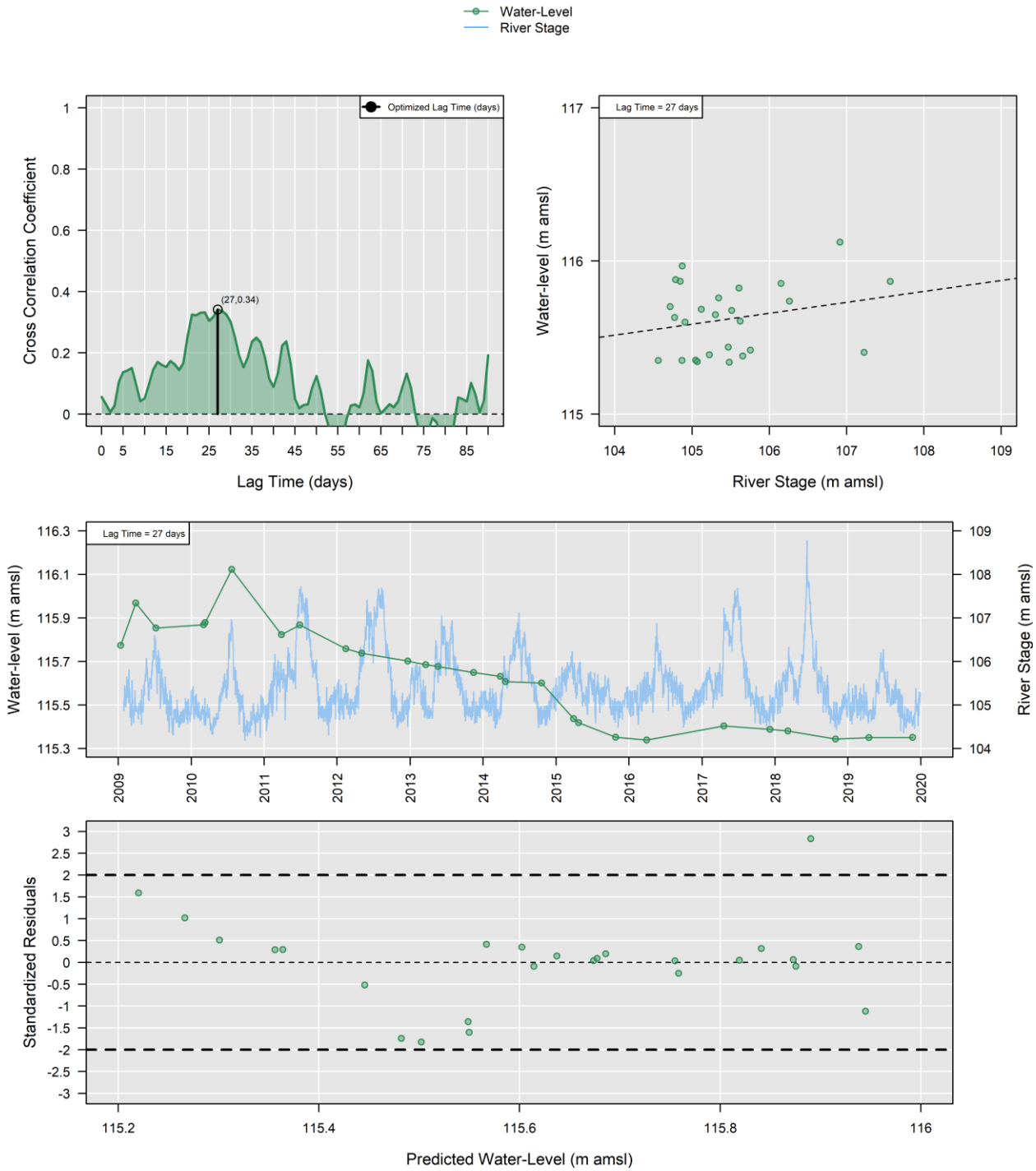
699-12-2C

Significance of River Stage (p-value): 0.36
Distance to River: 5526 m
Correlation with River Stage not significant



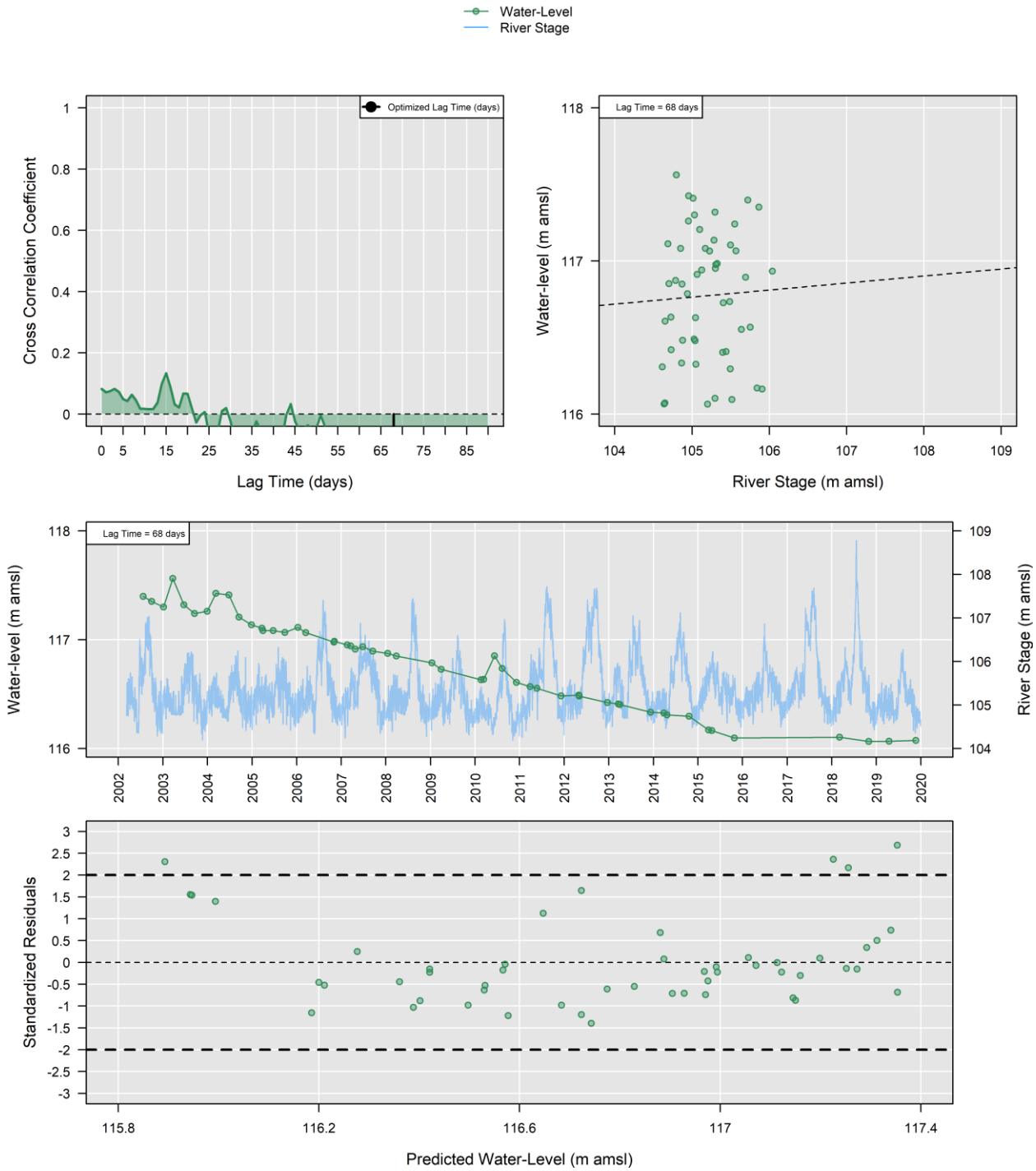
699-13-0A

Significance of River Stage (p-value): 0.39
Distance to River: 4675 m
Correlation with River Stage not significant



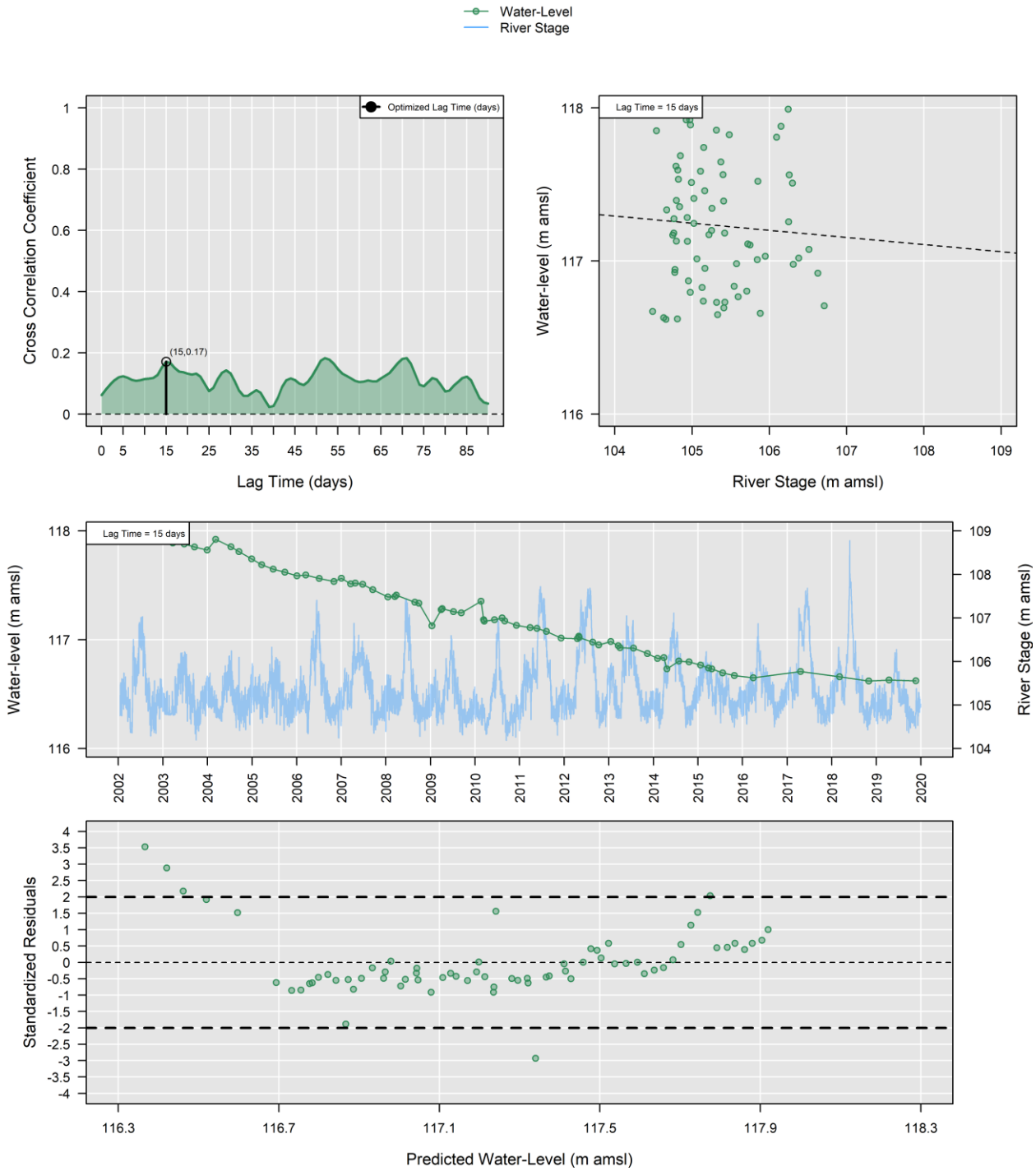
699-13-1E

Significance of River Stage (p-value): 0.012
Distance to River: 5173 m
Correlation with River Stage not significant



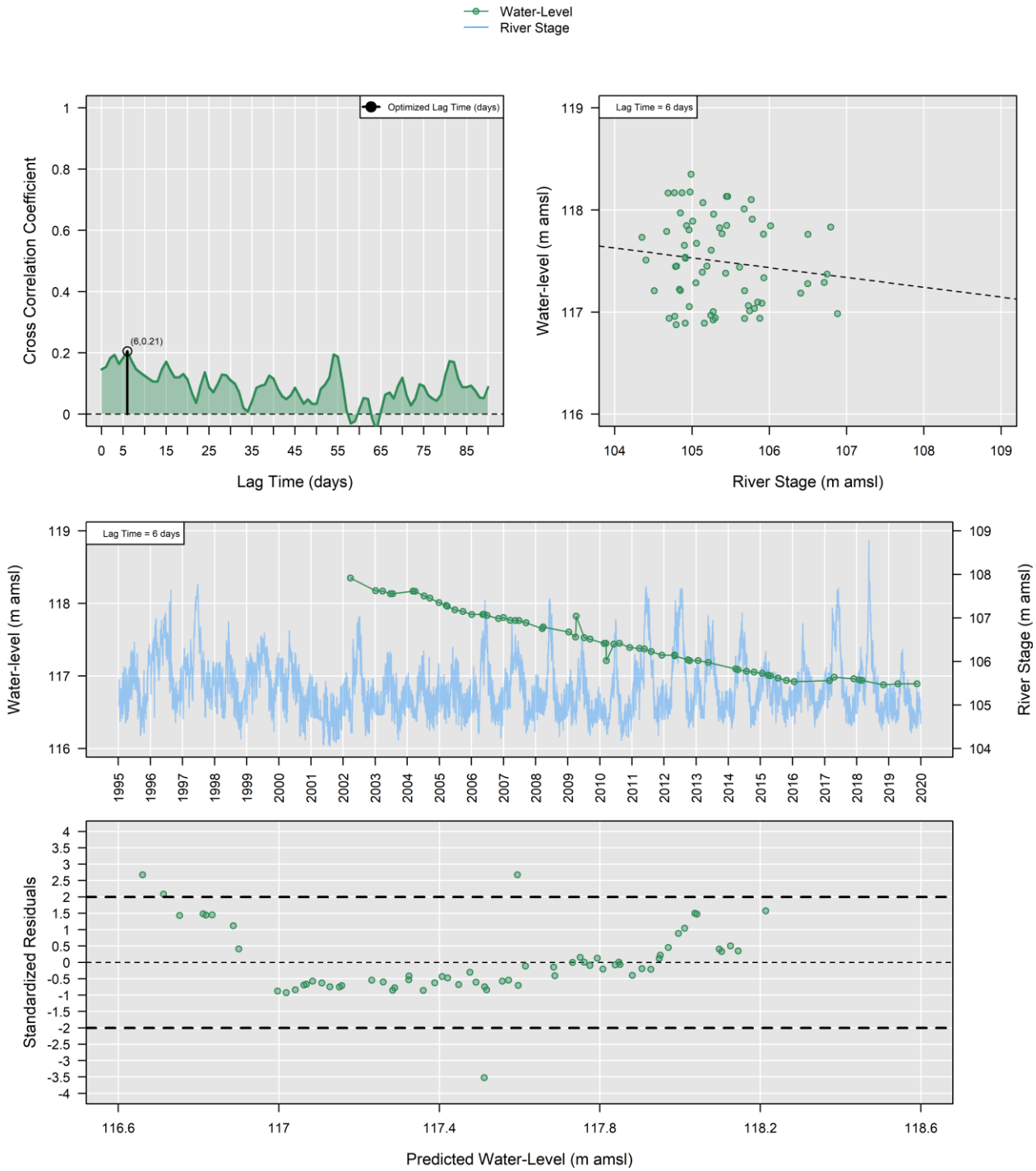
699-13-2D

Significance of River Stage (p-value): 0.96
Distance to River: 5519 m
Correlation with River Stage not significant



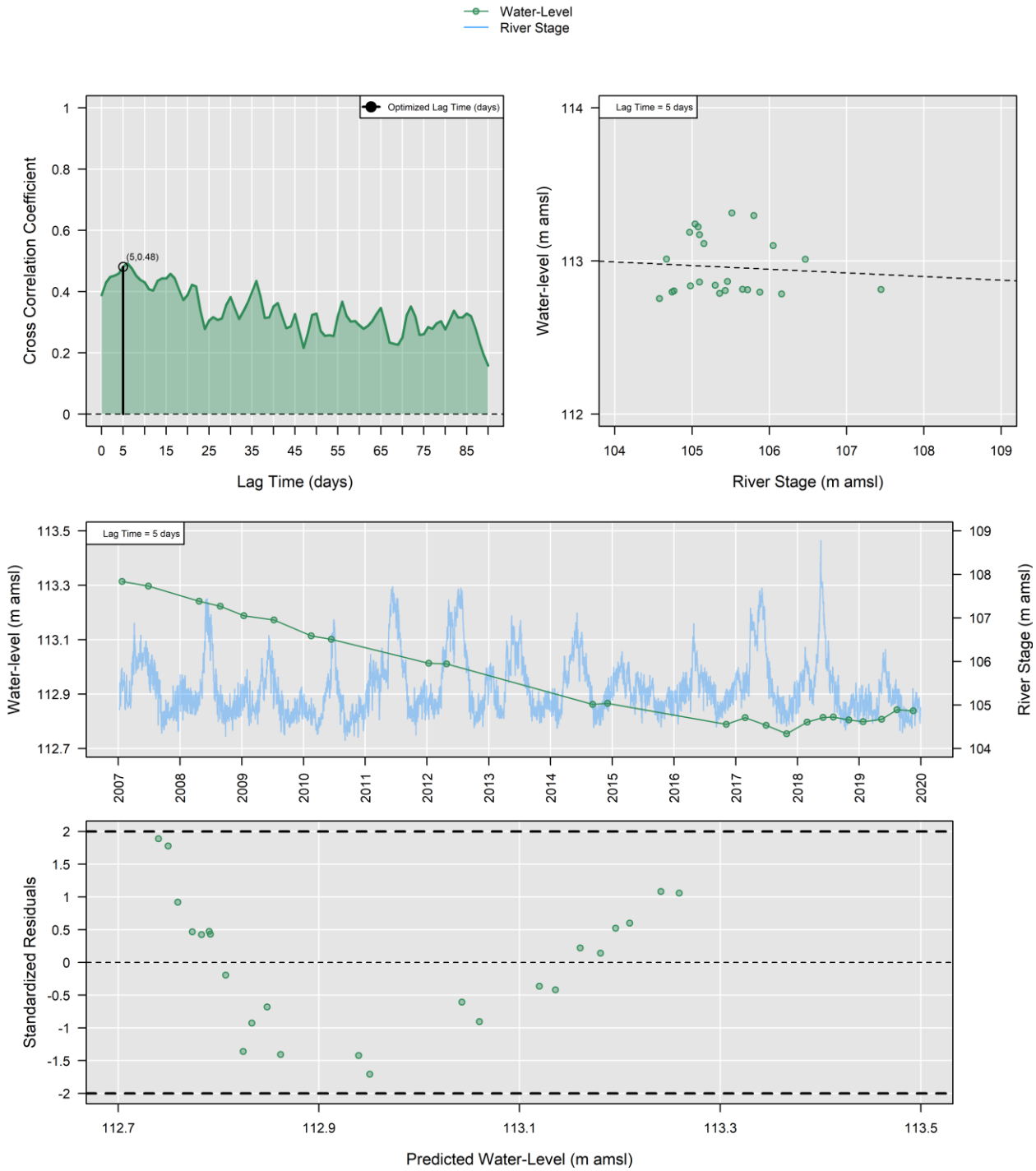
699-13-3A

Significance of River Stage (p-value): 0.98
Distance to River: 5630 m
Correlation with River Stage not significant



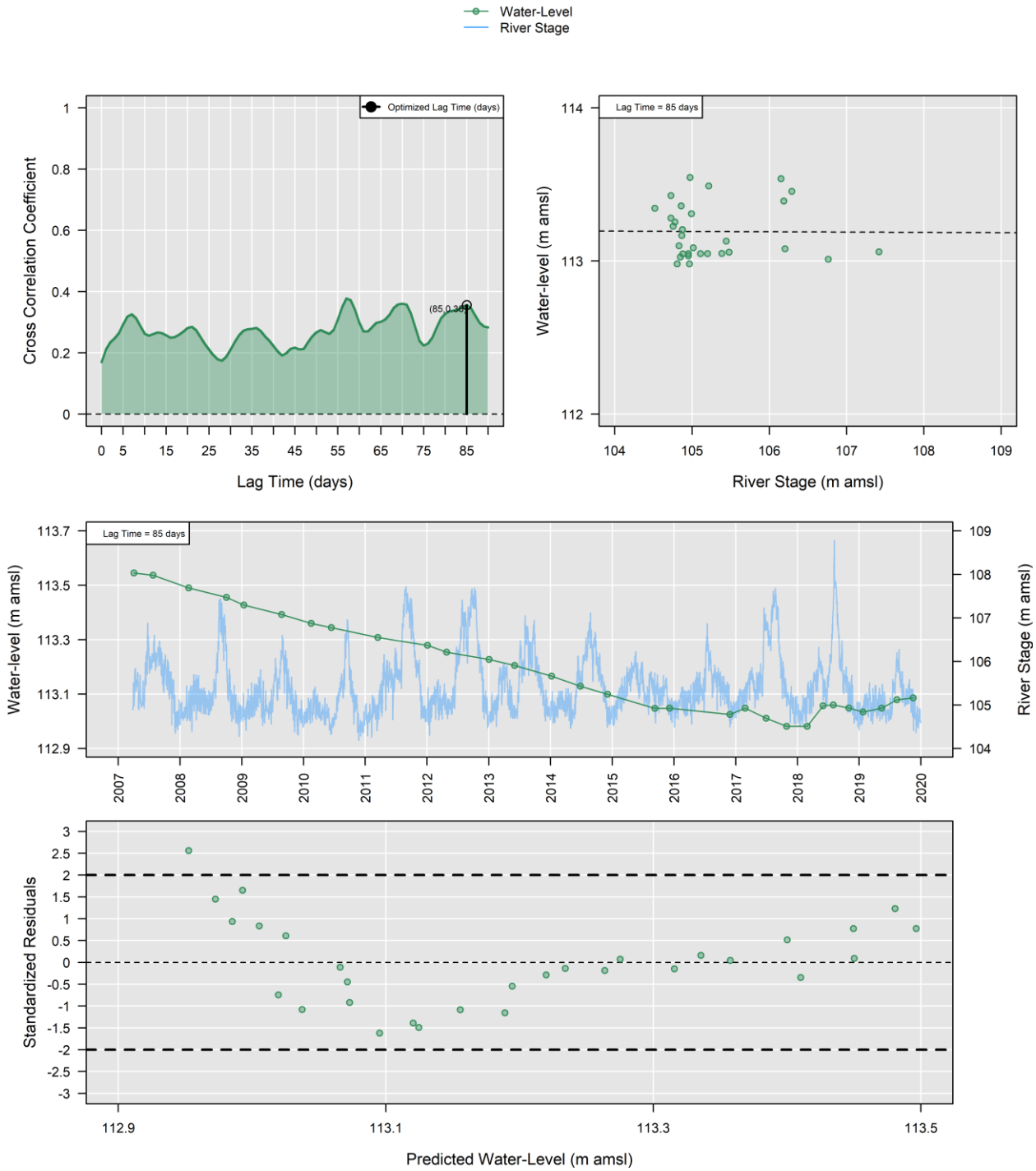
699-S6-E4B

Significance of River Stage (p-value): 0.86
Distance to River: 3438 m
Correlation with River Stage not significant



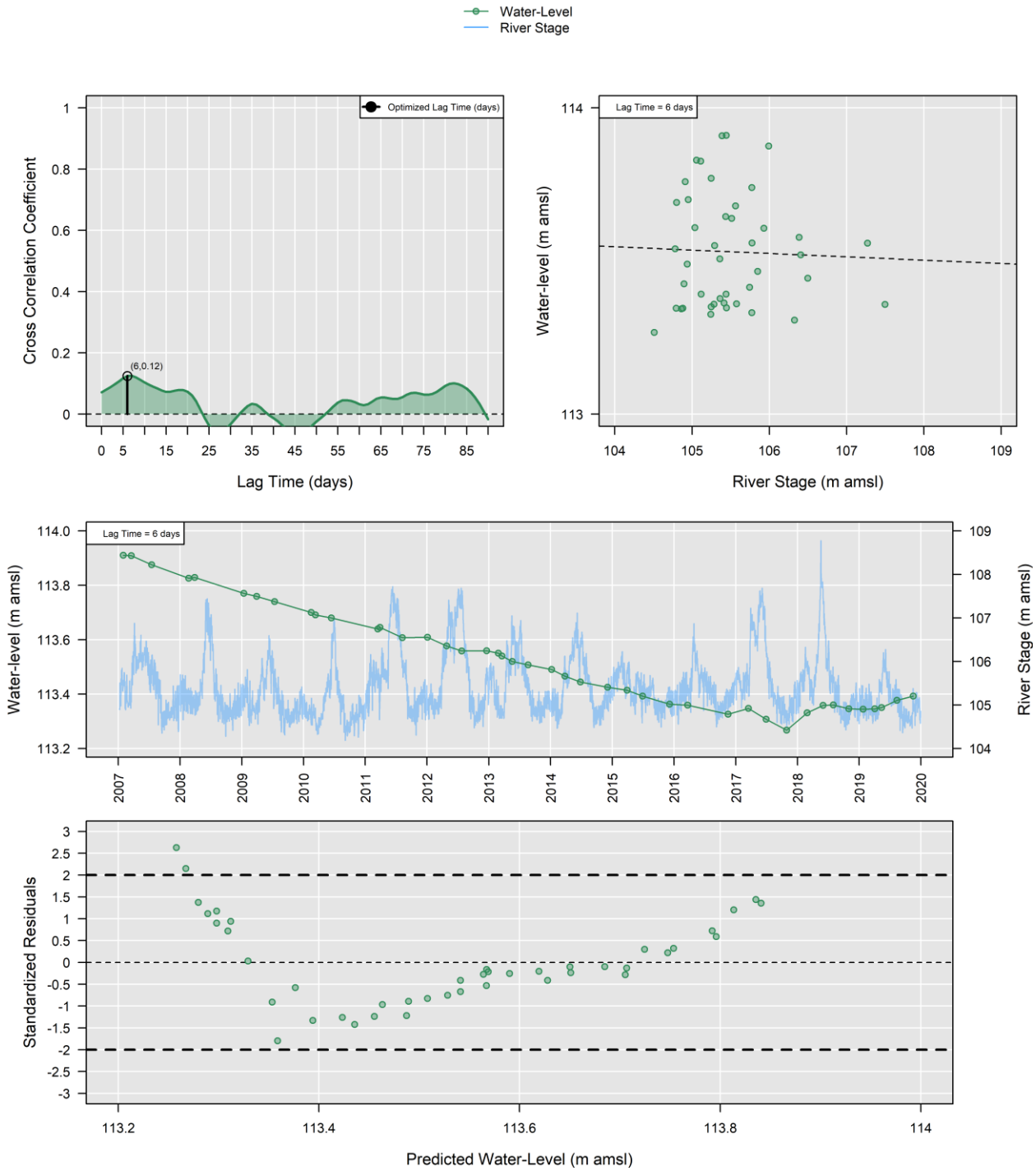
699-S6-E4E

Significance of River Stage (p-value): 0.1
Distance to River: 3518 m
Correlation with River Stage not significant



699-S6-E4K

Significance of River Stage (p-value): 0.38
Distance to River: 3689 m
Correlation with River Stage not significant



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Appendix B

Plots of Results for Well-Analyte Pairs

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Tritium B-120

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Well-Analyte Pairs Plots

Appendix B presents a series of plots showing the results from the Tobit Regression Model. There are two (2) sets of plots in this appendix: (1) Tobit Regression Results, and (2) Yearly Mean, UCL, and LCL Results. An explanation of the key components of each set of plots is presented below.

Tobit Regression Results

The header of the plot presents the approximate distance of the well from the Columbia River, the number of trend analysis periods, and a table displaying the estimated lag time, p-value of the trend based on the log-likelihood ratio test (after applying the appropriate lag time), the p-value of the River Stage coefficient (if applicable), the p-value of the Date coefficient, the number of measured water level and chemistry data (number of observations) and the percent non-detects.

The plot in the upper left corner is a map displaying the location of the well.

The plot in the upper right corner displays the legend for the plots that follow.

The first plot of this figure shows a time series of the river stage (right y-axis) and the measured water level (left y-axis) (when available). On the far left of the plot is the well screen interval. The second plot of this figure shows a time series of the river stage and of the observed uranium concentrations. Measurements that are below the MDL for uranium (non-detects) are highlighted in red triangles. The third plot of this figure displays a time series of the fitted uranium concentrations (calculated concentrations) and measured uranium concentrations (observed concentrations). The fitted concentrations were determined for each day after lagging the river stage data by the optimized lag time fitting the Tobit model, and using Equation 3.1. The Tobit parameter estimates are displayed below the plot.

Yearly Mean, UCL, and LCL Results

The header of the plot presents the approximate distance of the well from the Columbia River, the number of trend analysis periods, and a table displaying the estimated lag time, p-value of the trend based on the log-likelihood ratio test (after applying the appropriate lag time), the p-value of the River Stage coefficient (if applicable), the p-value of the Date coefficient, the number of measured water level and chemistry data (number of observations) and the percent non-detects.

The plot in the upper left corner is a map displaying the location of the well.

The plot in the upper right corner displays the legend for the plots that follow.

The plot displays a time series of uranium concentration for both the fitted (calculated concentration) and measured data (observed concentration). The fitted concentrations were determined after lagging the river-stage data by the optimized lag time and using Equation 3.1. Measurements that are below the MDL for uranium (non-detects) are highlighted in red triangles. The UCLs and LCLs are displayed with dashed light blue lines and the window between the UCL and LCL (the confidence interval) is highlighted in light blue. The fitted yearly mean is displayed with a solid dark blue line. The target cleanup level is represented with a dashed black line. The censored regression used to determine the calculated concentration and yearly mean and UCL/LCL is presented below the graph along with the summary statistics that are based on the trend through 2019.

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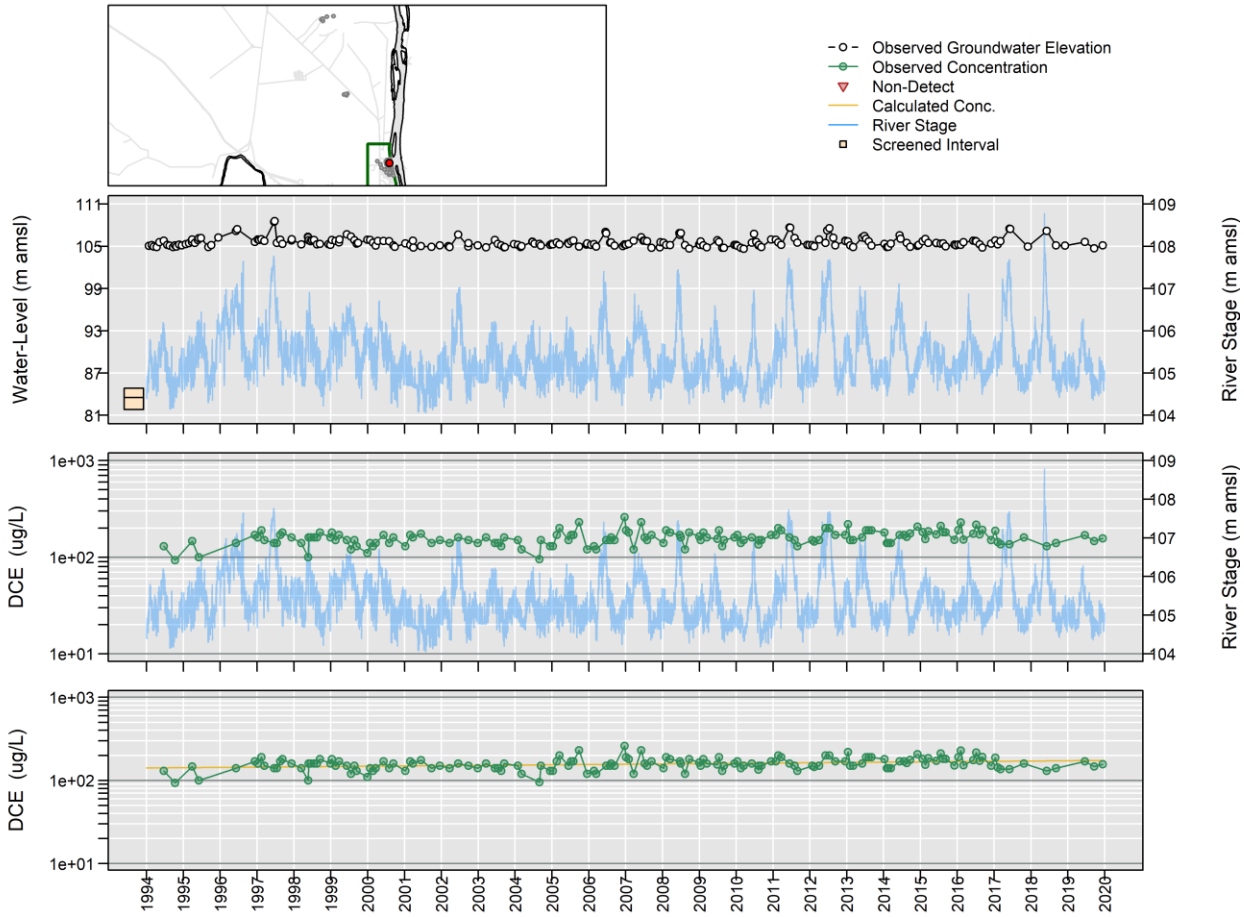
Tobit Regression Results

cis-1,2-Dichloroethene (cis-1,2-DCE)

399-1-16B

Distance to River: 135 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.00021
Significance of River Stage (p-value):	1.3e-99	0.99
Significance of Date (p-value):	0.035	2.5e-05
Number of Observations:	225	157
Percent NDs:		0%



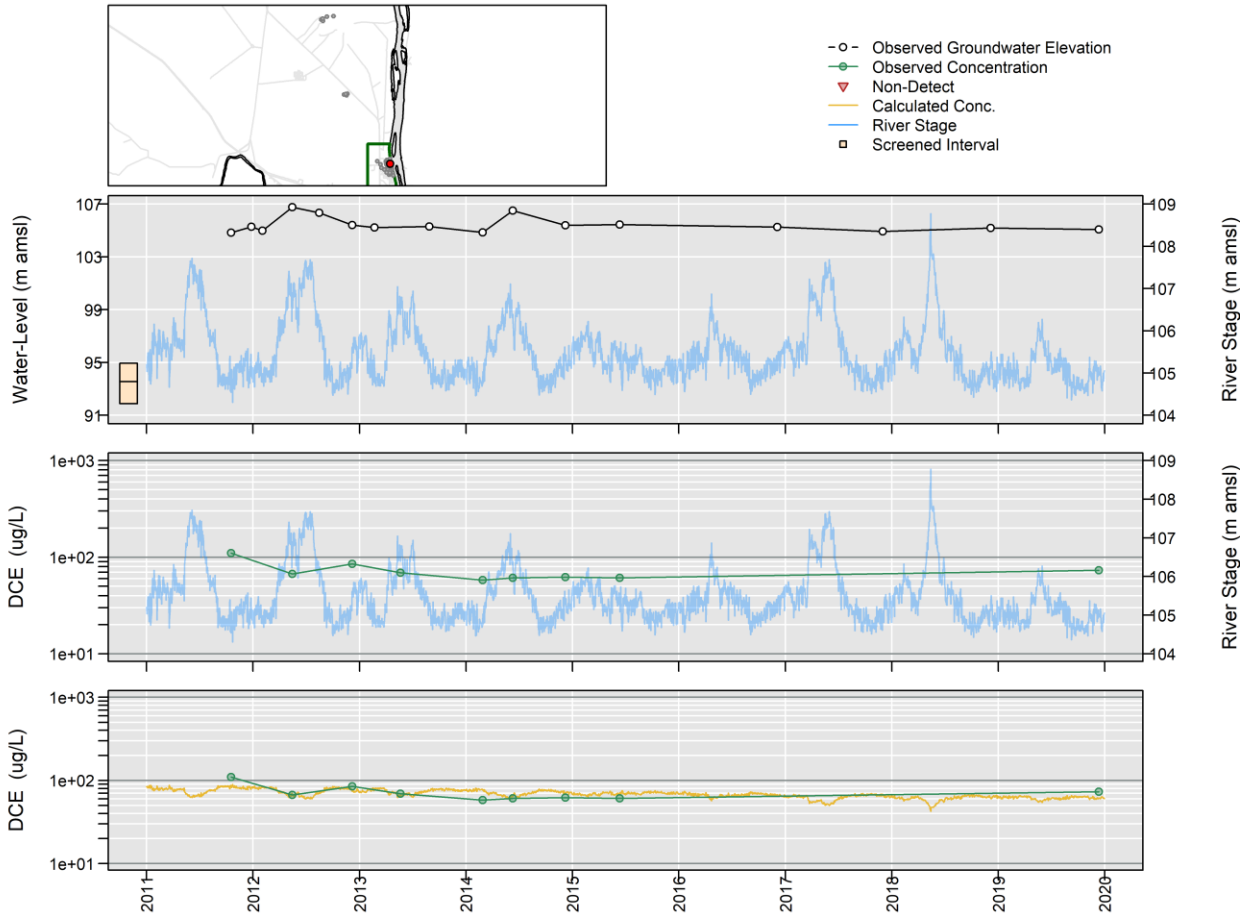
Censored Regression (Tobit) Model

ln Conc. = -0.00026 (+/- 0.019)*River Stage + 0.000022 (+/- 0.0000052)*Date + 4.8 (+/- 2.1)

399-1-57

Distance to River: 86 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	1.2e-12	0.21
Significance of River Stage (p-value):	7.5e-11	0.13
Significance of Date (p-value):	0.27	0.13
Number of Observations:	16	9
Percent NDs:		0%



Censored Regression (Tobit) Model

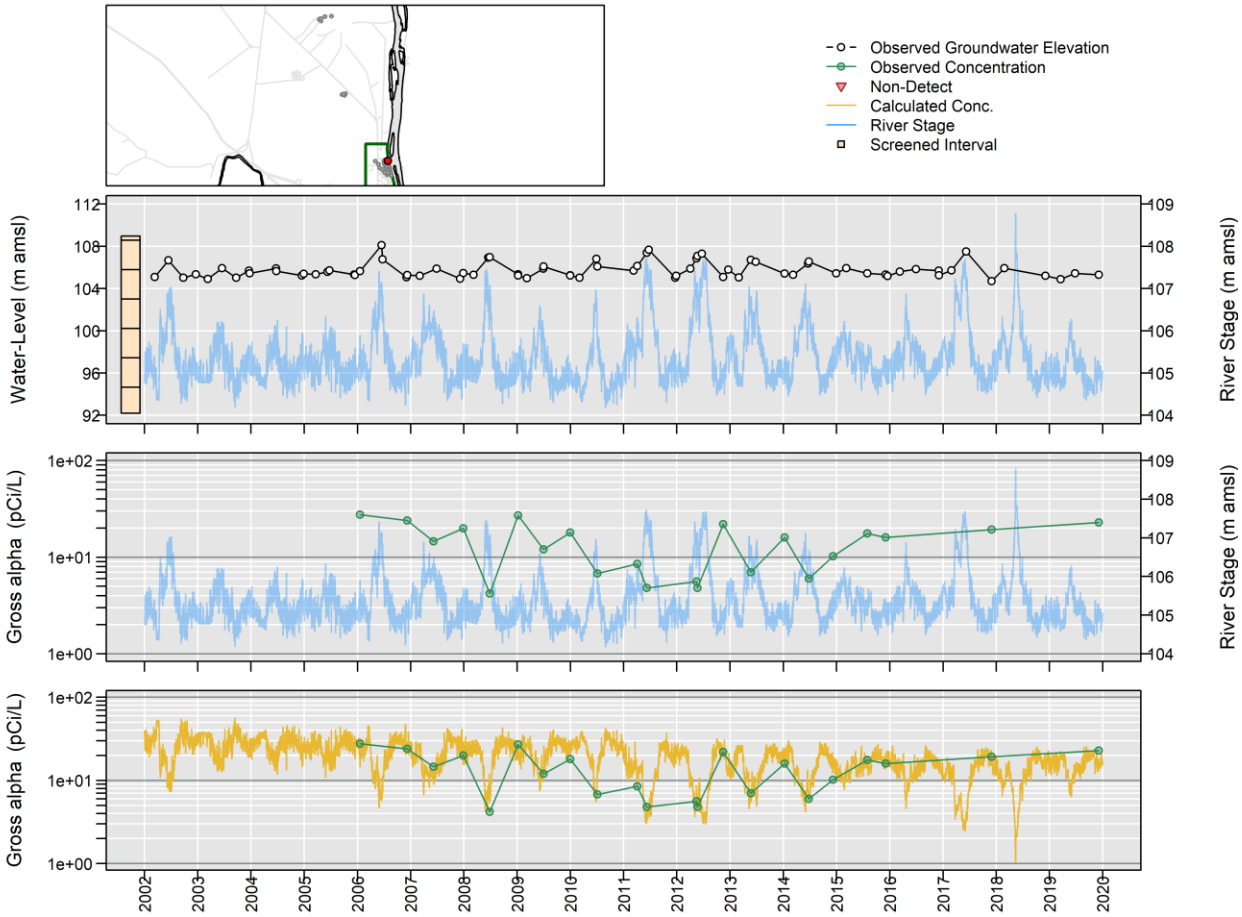
Trend Not Significant

Gross Alpha

399-1-1

Distance to River: 76 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	6.6e-08
Significance of River Stage (p-value):	3.6e-47	1.9e-18
Significance of Date (p-value):	0.59	0.019
Number of Observations:	76	22
Percent NDs:		0%



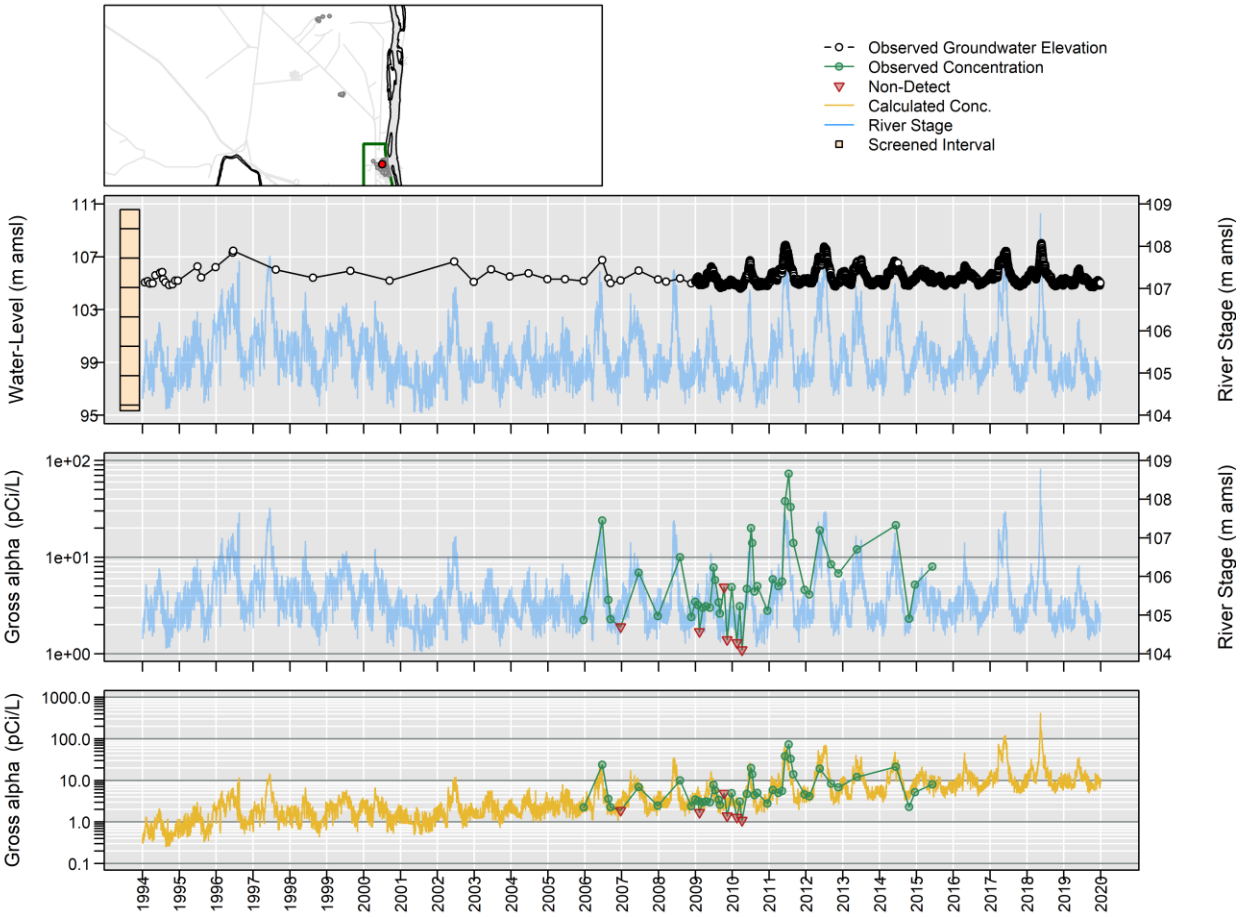
Censored Regression (Tobit) Model

ln Conc. = -0.74 (+/- 0.084)*River Stage + -0.00011 (+/- 0.000048)*Date + 82 (+/- 9.1)

399-1-2

Distance to River: 386 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	1.1e-10
Significance of River Stage (p-value):	0	1.6e-15
Significance of Date (p-value):	2.7e-05	0.0066
Number of Observations:	4042	48
Percent NDs:		12%



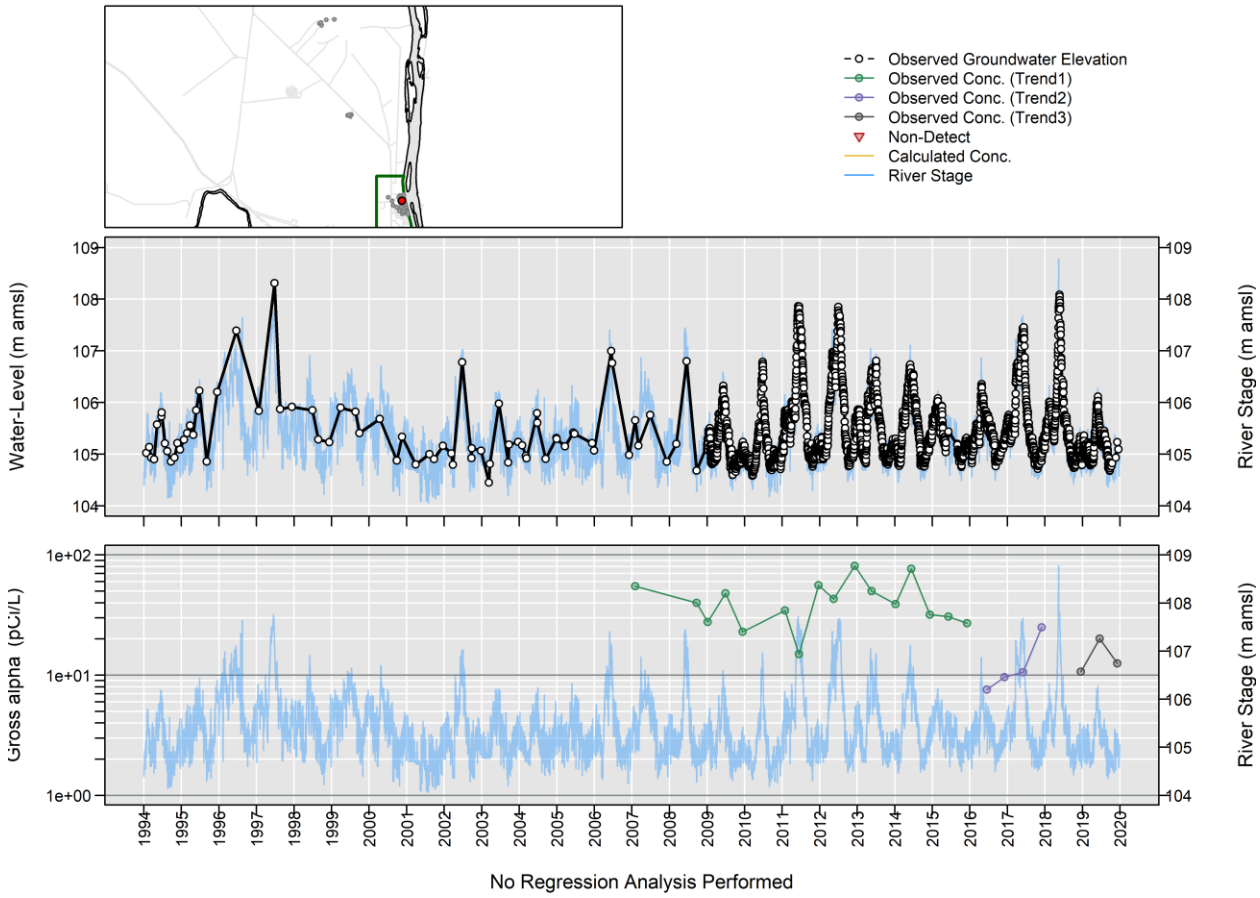
Censored Regression (Tobit) Model

ln Conc. = 1 (+/- 0.13)*River Stage + 0.0003 (+/- 0.00011)*Date + -110 (+/- 14)

399-1-7

Distance to River: 209 m
Number of Trends Calculated: 3

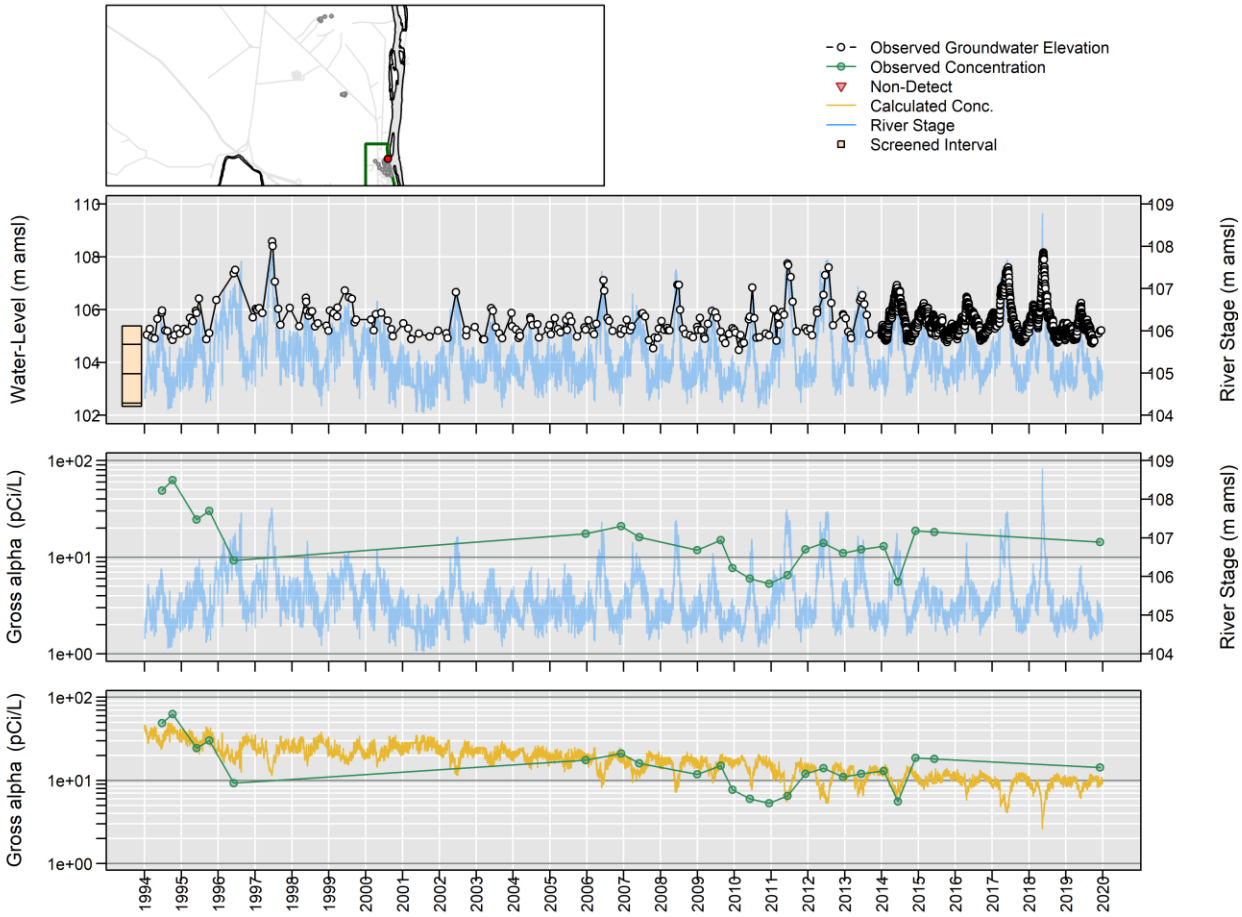
	WL	Trend1	Trend2	Trend3
Est. Lag Time (days):	1	1	NA	NA
Significance of Trend (p-value):	0	0.93	NA	NA
Significance of River Stage (p-value):	0	0.72	NA	NA
Significance of Date (p-value):	0.018	0.93	NA	NA
Number of Observations:	3890	16	4	3
Percent NDs:		0%	0%	0%



399-1-10A

Distance to River: 70 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.00023
Significance of River Stage (p-value):	0	0.0057
Significance of Date (p-value):	0.0015	1.3e-05
Number of Observations:	2304	23
Percent NDs:		0%



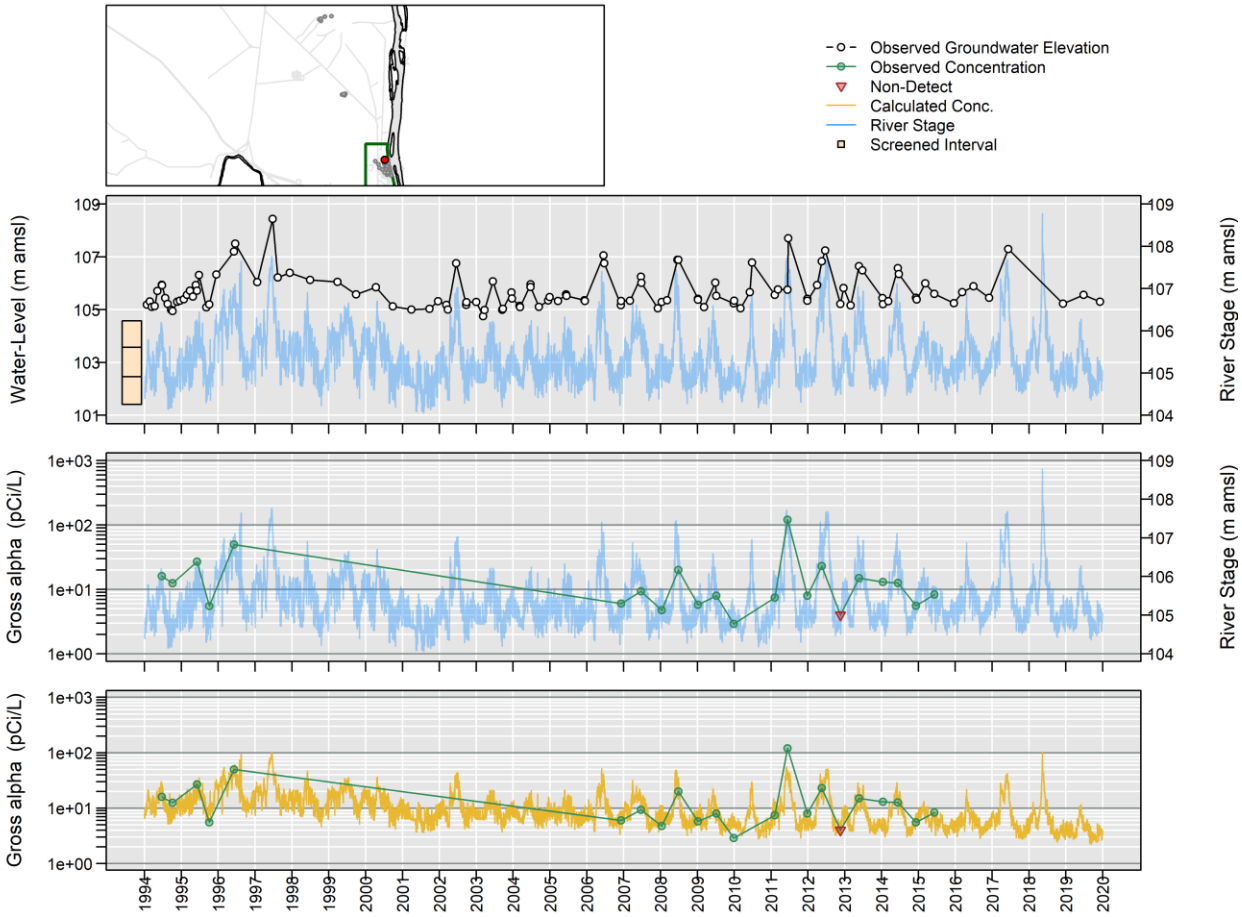
Censored Regression (Tobit) Model

ln Conc. = -0.36 (+/- 0.13)*River Stage + -0.00015 (+/- 0.000034)*Date + 43 (+/- 14)

399-1-11

Distance to River: 314 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0	1.4e-05
Significance of River Stage (p-value):	1.1e-50	2.6e-09
Significance of Date (p-value):	0.089	0.01
Number of Observations:	116	22
Percent NDs:		5%



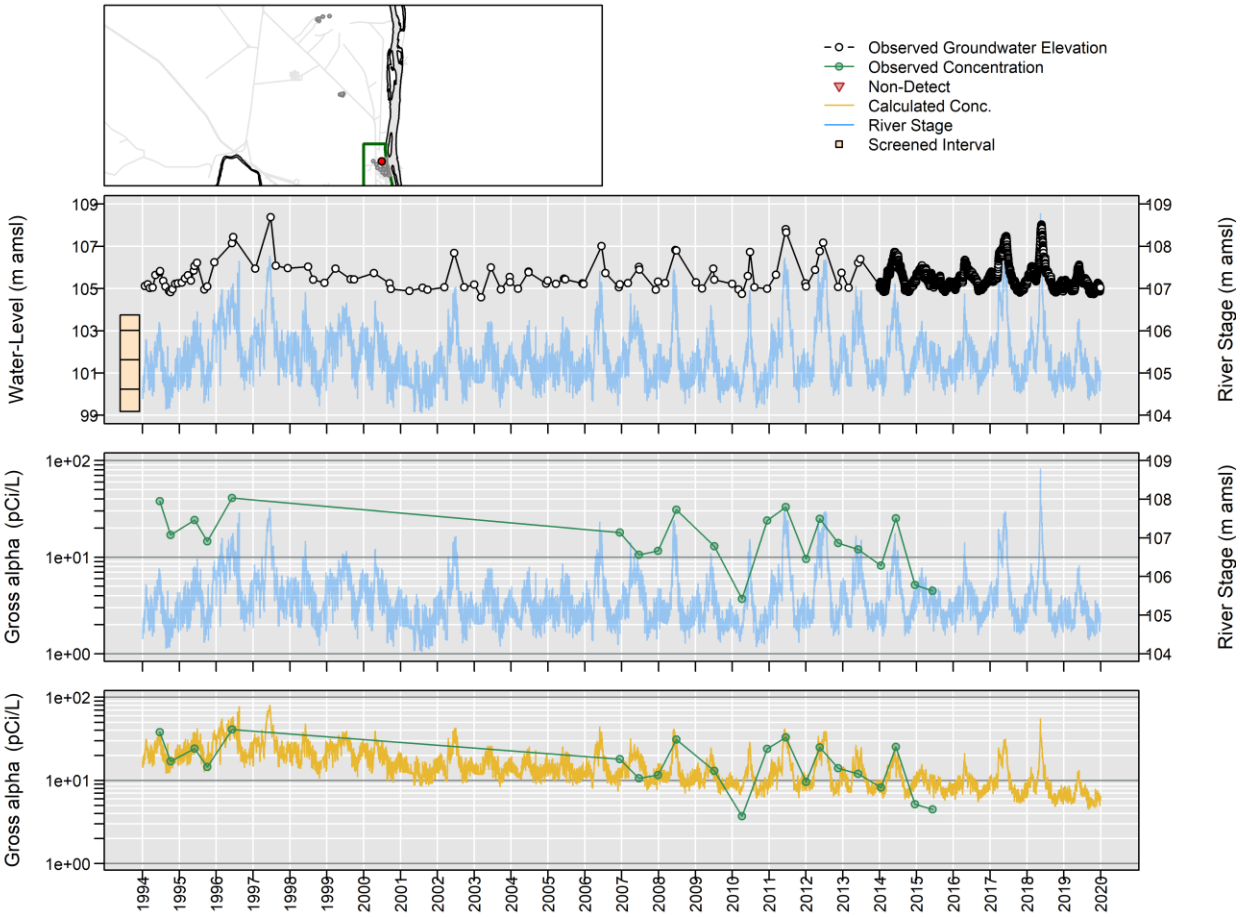
Censored Regression (Tobit) Model

ln Conc. = 0.85 (+/- 0.14)*River Stage + -0.00011 (+/- 0.000044)*Date + -86 (+/- 15)

399-1-12

Distance to River: 398 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	2	2
Significance of Trend (p-value):	0	3.1e-05
Significance of River Stage (p-value):	0	1.9e-06
Significance of Date (p-value):	0.16	3e-04
Number of Observations:	2288	21
Percent NDs:		0%



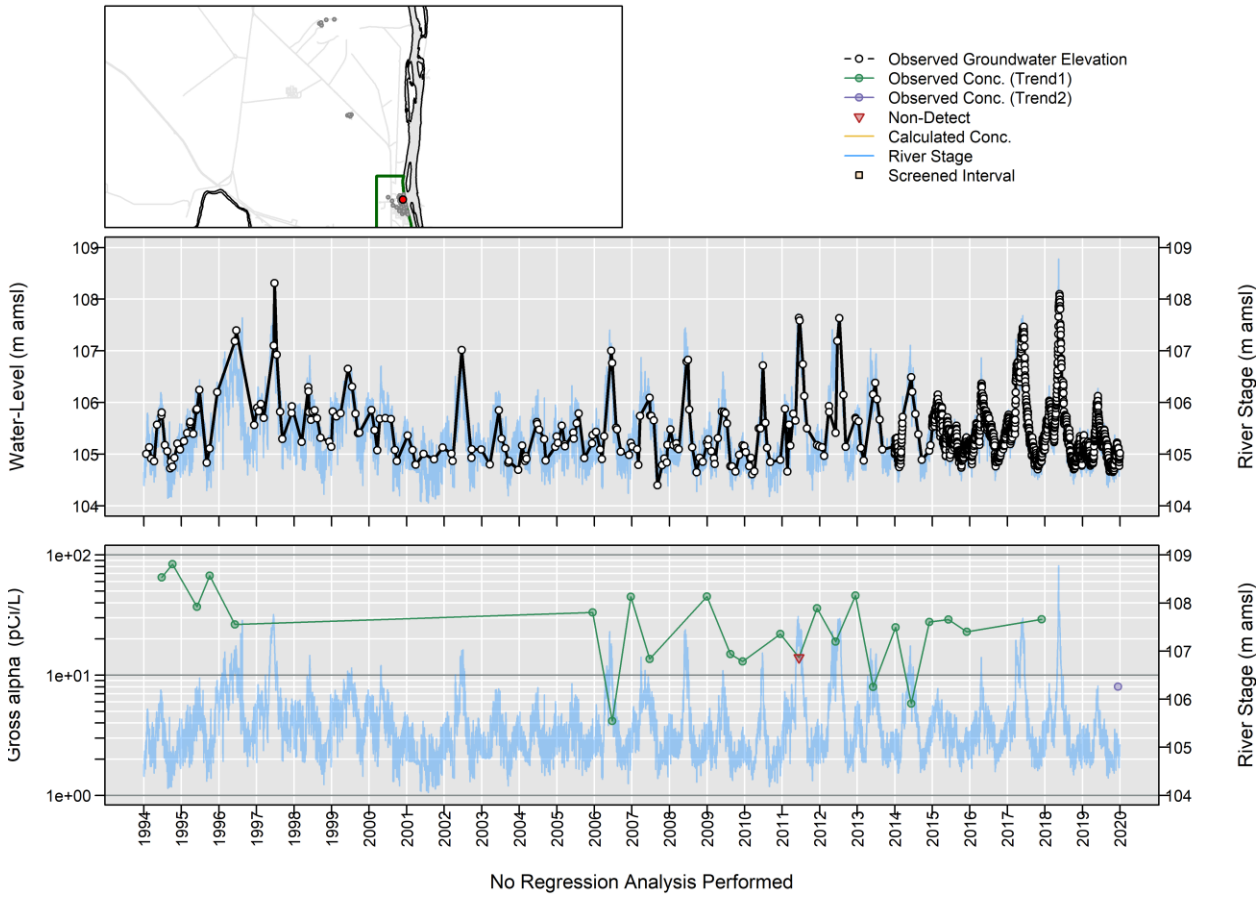
Censored Regression (Tobit) Model

ln Conc. = 0.55 (+/- 0.12)*River Stage + -0.00012 (+/- 0.000034)*Date + -54 (+/- 12)

399-1-16A

Distance to River: 141 m
Number of Trends Calculated: 2

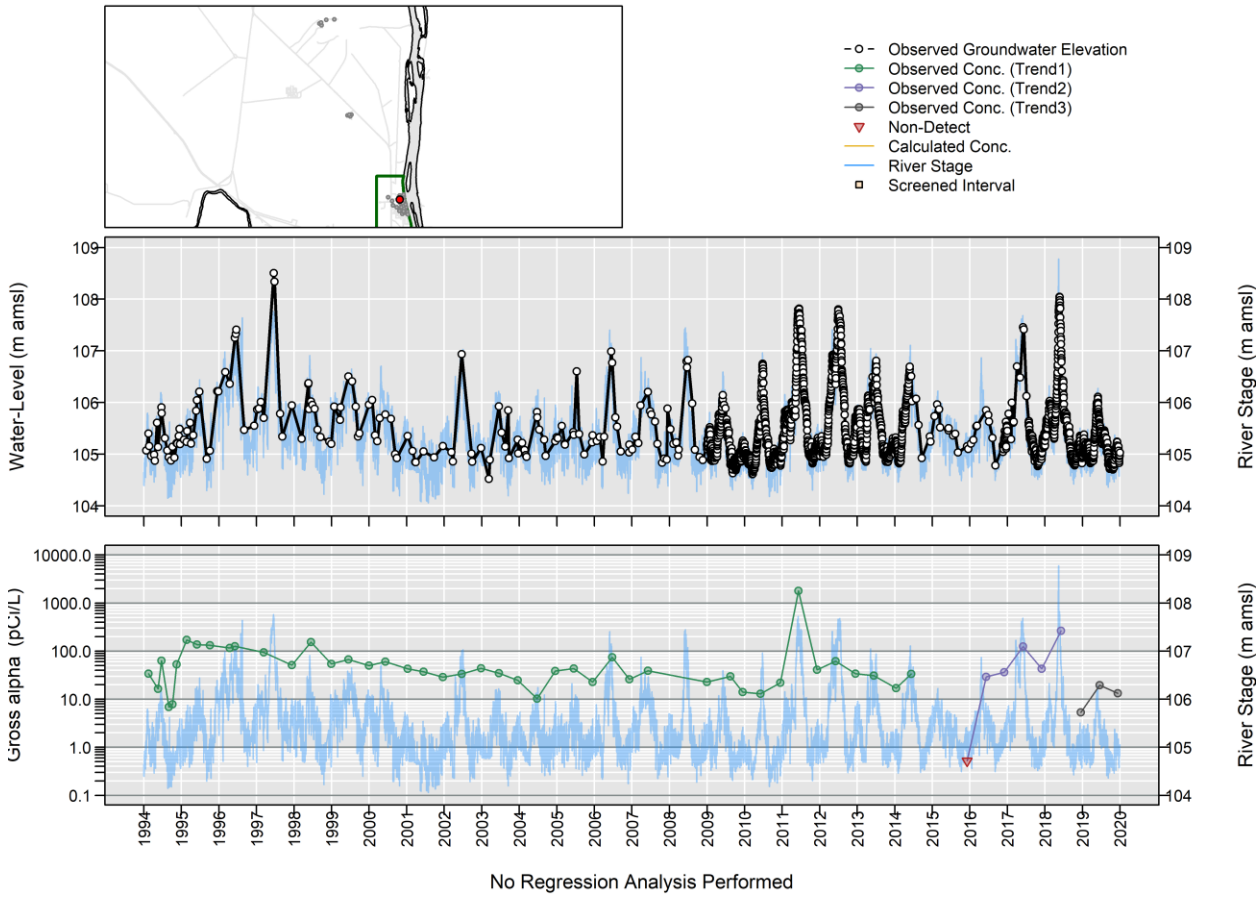
	WL	Trend1	Trend2
Est. Lag Time (days):	1	1	NA
Significance of Trend (p-value):	0	8.5e-05	NA
Significance of River Stage (p-value):	0	9.7e-05	NA
Significance of Date (p-value):	0.033	0.00025	NA
Number of Observations:	2116	24	1
Percent NDs:		4%	0%



399-1-17A

Distance to River: 344 m
Number of Trends Calculated: 3

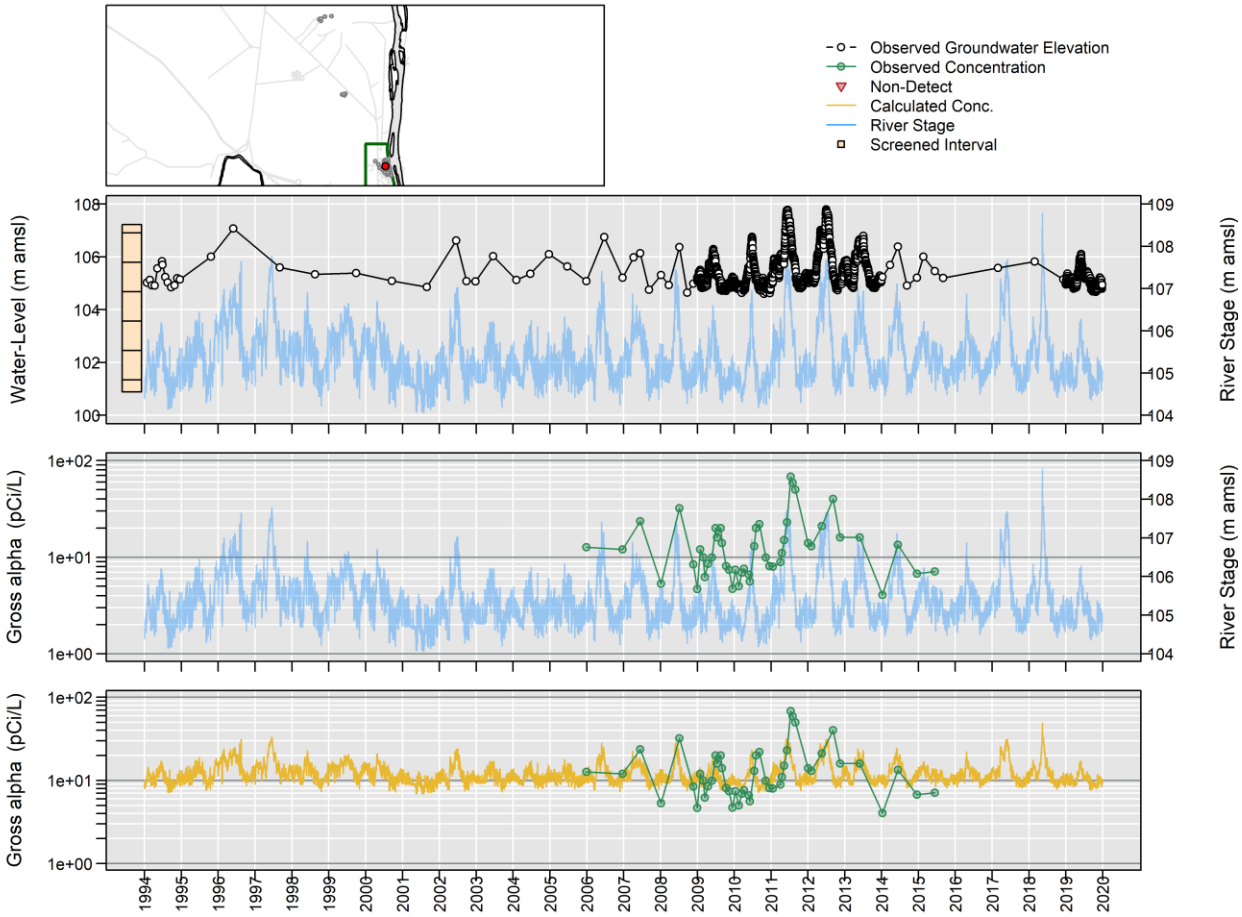
	WL	Trend1	Trend2	Trend3
Est. Lag Time (days):	1	1	1	NA
Significance of Trend (p-value):	0	1e-04	0.012	NA
Significance of River Stage (p-value):	0	3.7e-06	0.072	NA
Significance of Date (p-value):	9.8e-05	0.11	0.0028	NA
Number of Observations:	3037	44	6	3
Percent NDs:		0%	17%	0%



399-1-21A

Distance to River: 340 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.0073
Significance of River Stage (p-value):	0	0.0011
Significance of Date (p-value):	0.0044	0.98
Number of Observations:	2216	48
Percent NDs:		0%



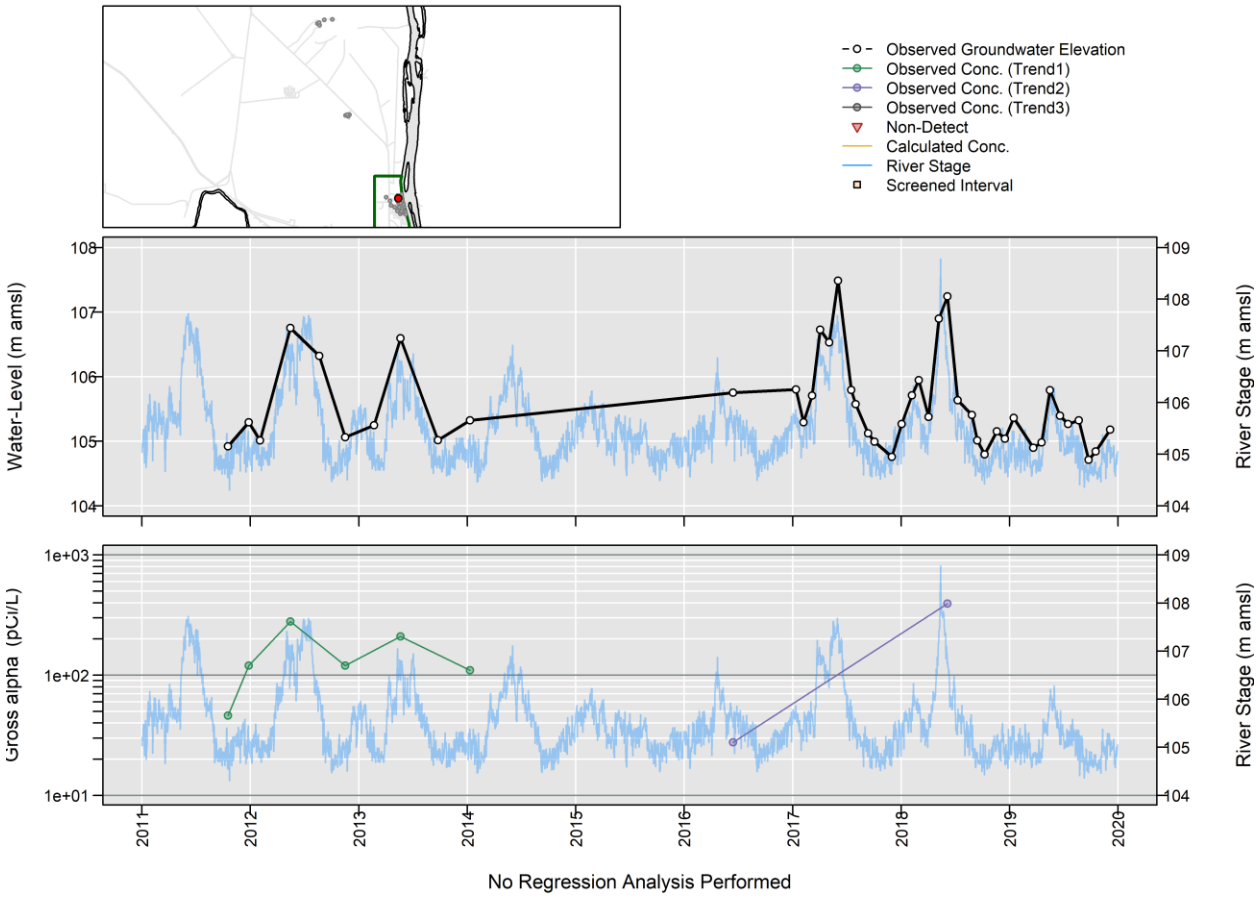
Censored Regression (Tobit) Model

Trend Not Significant

399-1-55

Distance to River: 295 m
Number of Trends Calculated: 3

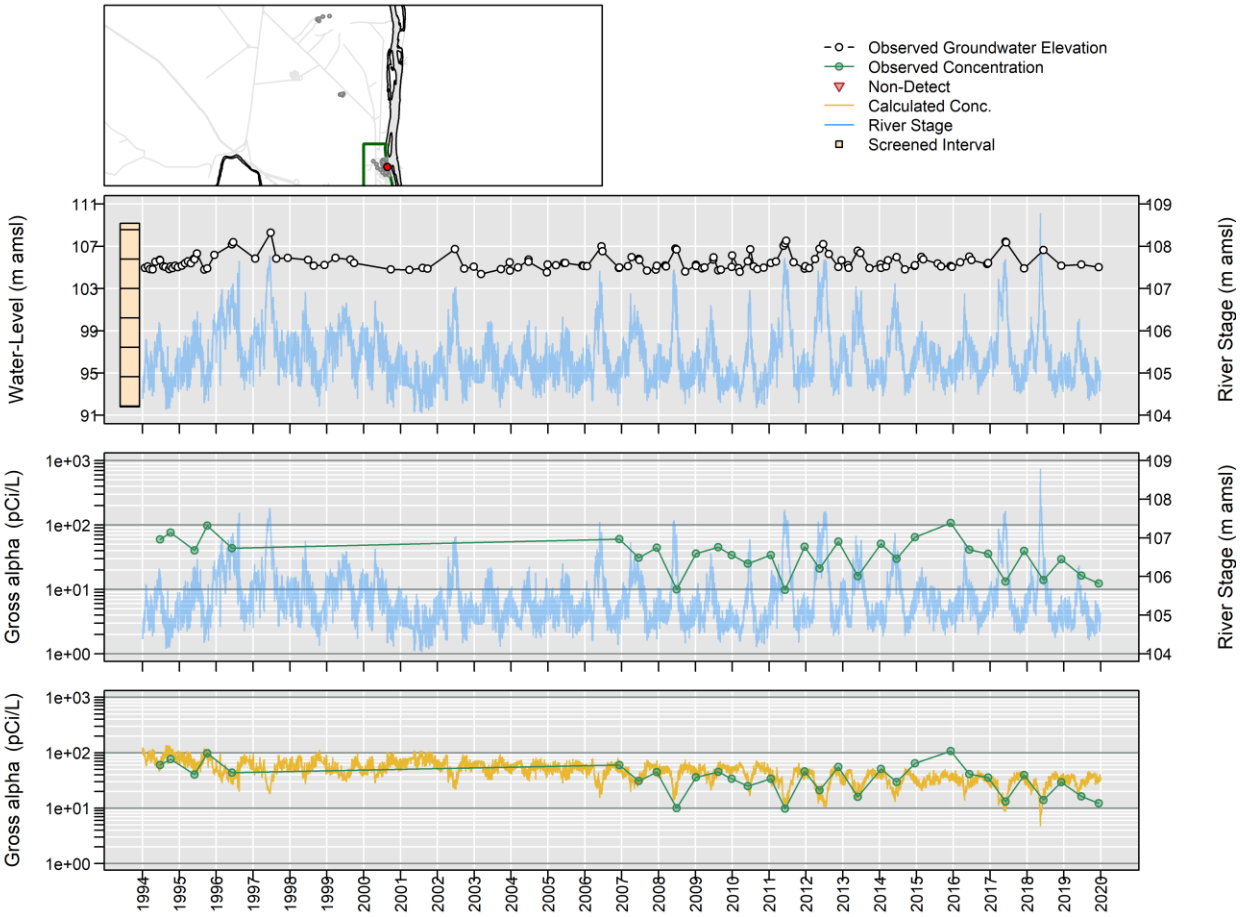
	WL	Trend1	Trend2	Trend3
Est. Lag Time (days):	3	3	NA	NA
Significance of Trend (p-value):	0	0.02	NA	NA
Significance of River Stage (p-value):	4.4e-27	2e-04	NA	NA
Significance of Date (p-value):	0.51	0.25	NA	NA
Number of Observations:	44	6	2	0
Percent NDs:		0%	0%	NaN%



399-2-1

Distance to River: 57 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	1.1e-07
Significance of River Stage (p-value):	9.4e-69	3.7e-10
Significance of Date (p-value):	0.82	1.3e-05
Number of Observations:	137	31
Percent NDs:		0%



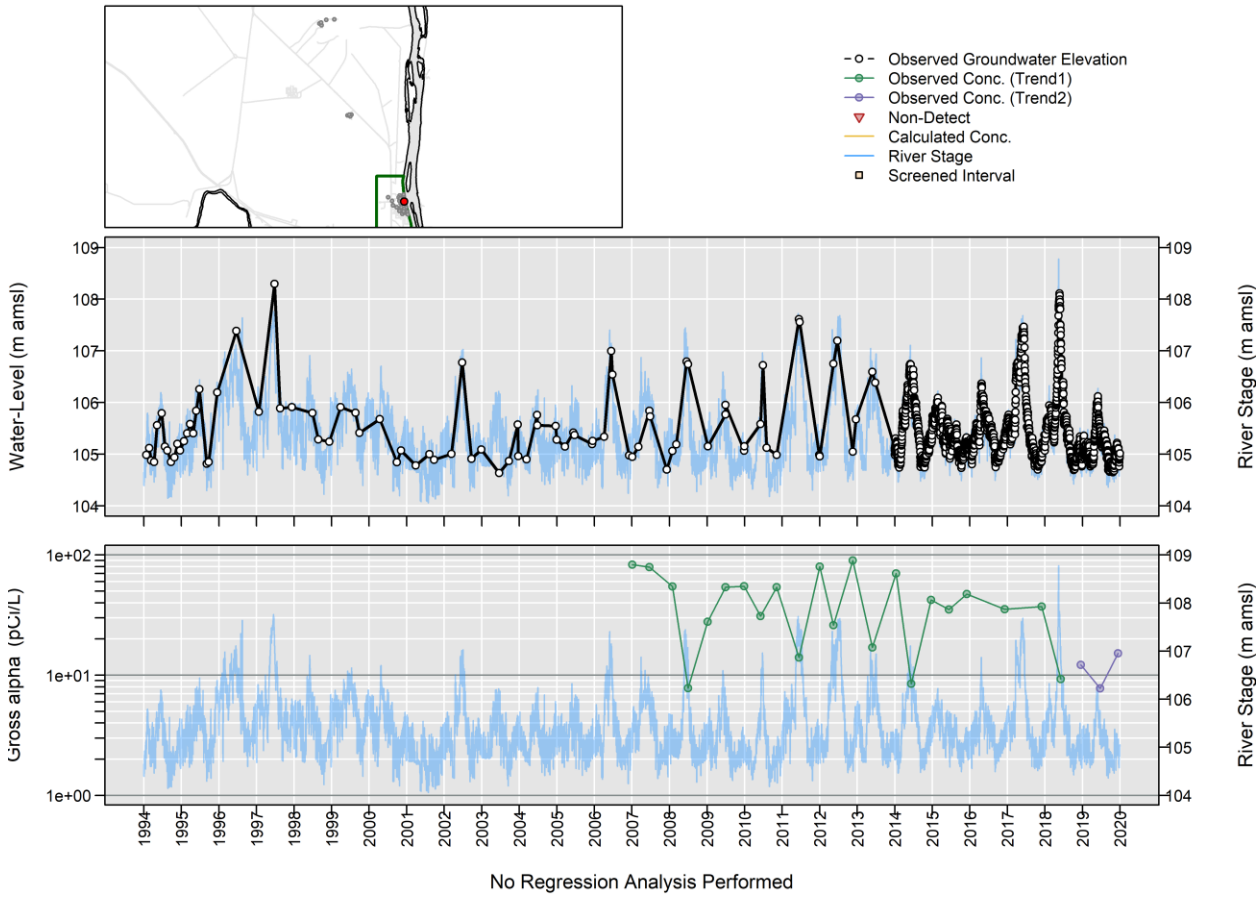
Censored Regression (Tobit) Model

ln Conc. = -0.52 (+/- 0.083)*River Stage + -0.00011 (+/- 0.000024)*Date + 60 (+/- 8.8)

399-2-2

Distance to River: 98 m
Number of Trends Calculated: 2

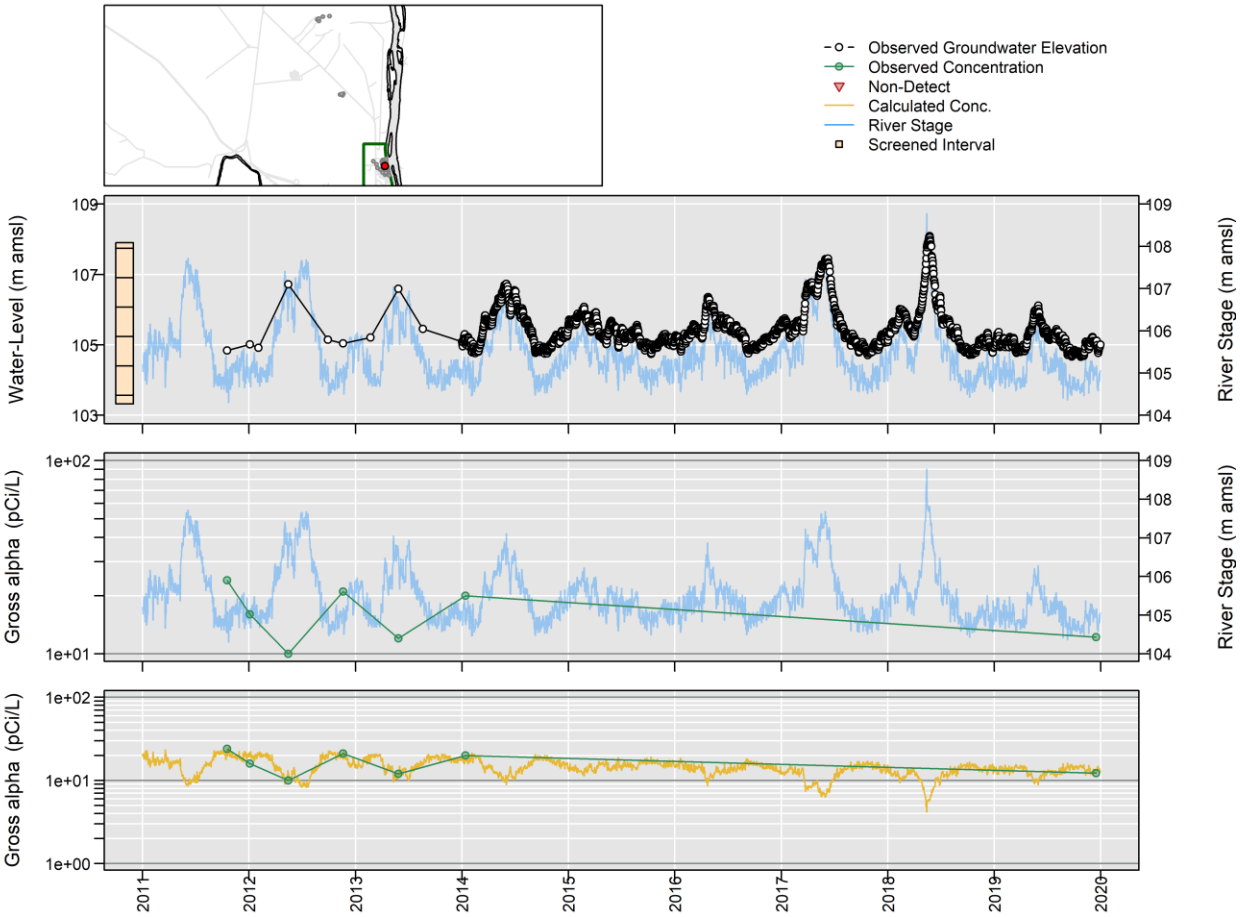
	WL	Trend1	Trend2
Est. Lag Time (days):	1	1	NA
Significance of Trend (p-value):	0	1.8e-06	NA
Significance of River Stage (p-value):	0	1.1e-11	NA
Significance of Date (p-value):	0.36	0.074	NA
Number of Observations:	2231	22	3
Percent NDs:		0%	0%



399-2-32

Distance to River: 217 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.0043
Significance of River Stage (p-value):	0	2.1e-06
Significance of Date (p-value):	0.24	0.0079
Number of Observations:	2200	7
Percent NDs:		0%



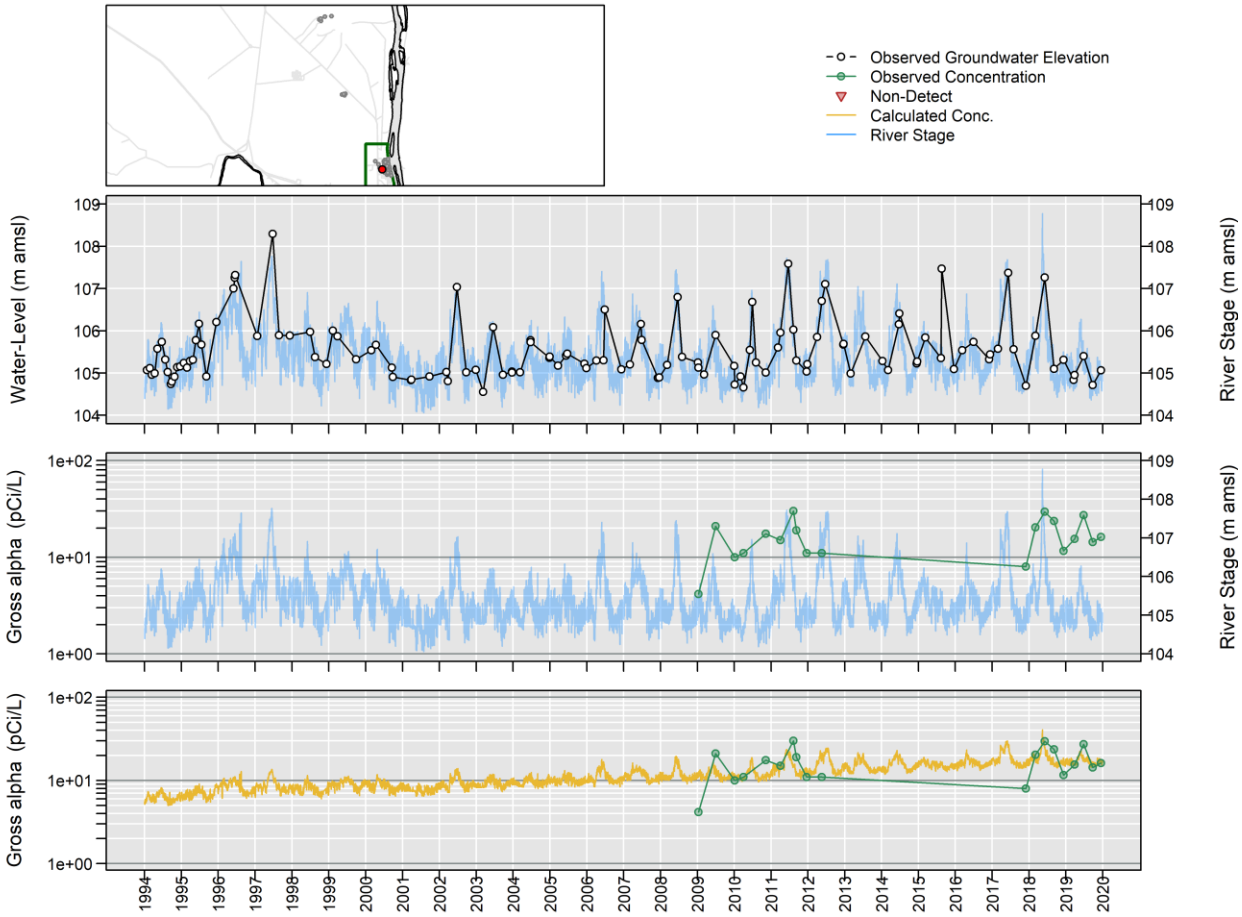
Censored Regression (Tobit) Model

ln Conc. = -0.32 (+/- 0.068)*River Stage + -0.00015 (+/- 0.000056)*Date + 39 (+/- 7.4)

399-3-6

Distance to River: 623 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.076
Significance of River Stage (p-value):	7.9e-44	0.072
Significance of Date (p-value):	0.99	0.083
Number of Observations:	127	19
Percent NDs:		0%



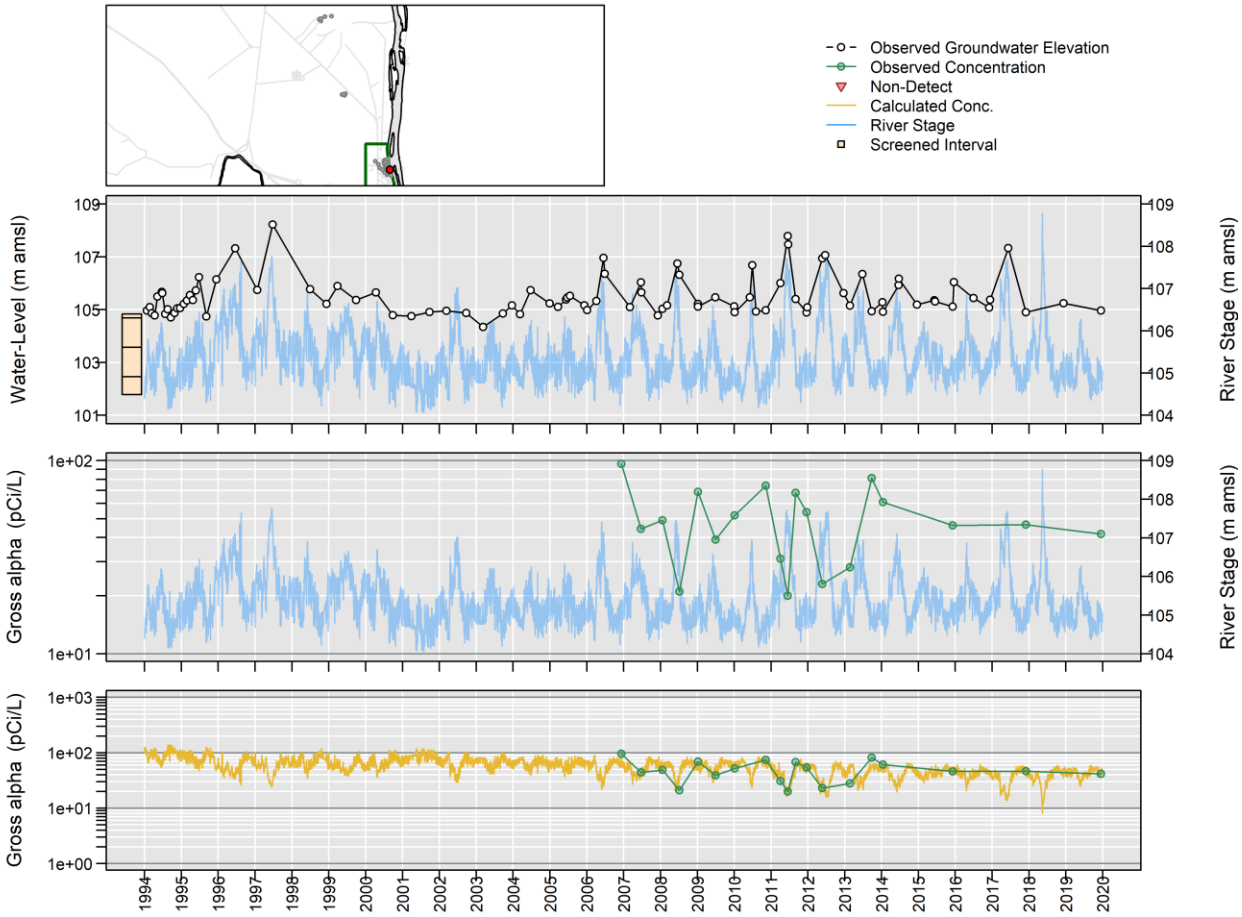
Censored Regression (Tobit) Model

Trend Not Significant

399-3-9

Distance to River: 68 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0	5.8e-05
Significance of River Stage (p-value):	6.4e-49	6.2e-09
Significance of Date (p-value):	0.35	0.1
Number of Observations:	94	19
Percent NDs:		0%



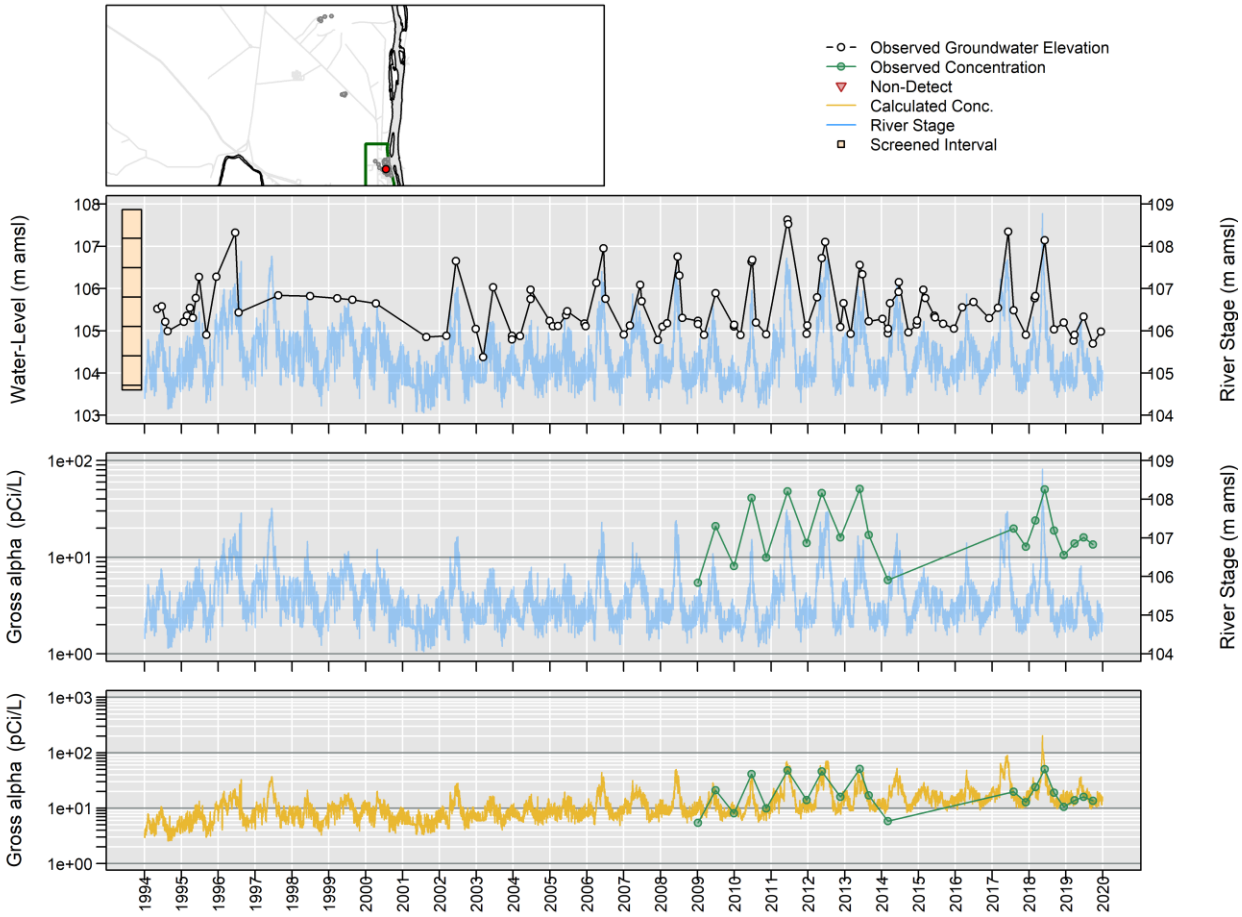
Censored Regression (Tobit) Model

Trend Not Significant

399-3-12

Distance to River: 344 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	8.4e-07
Significance of River Stage (p-value):	3.4e-58	2.1e-14
Significance of Date (p-value):	0.16	0.021
Number of Observations:	106	21
Percent NDs:		0%



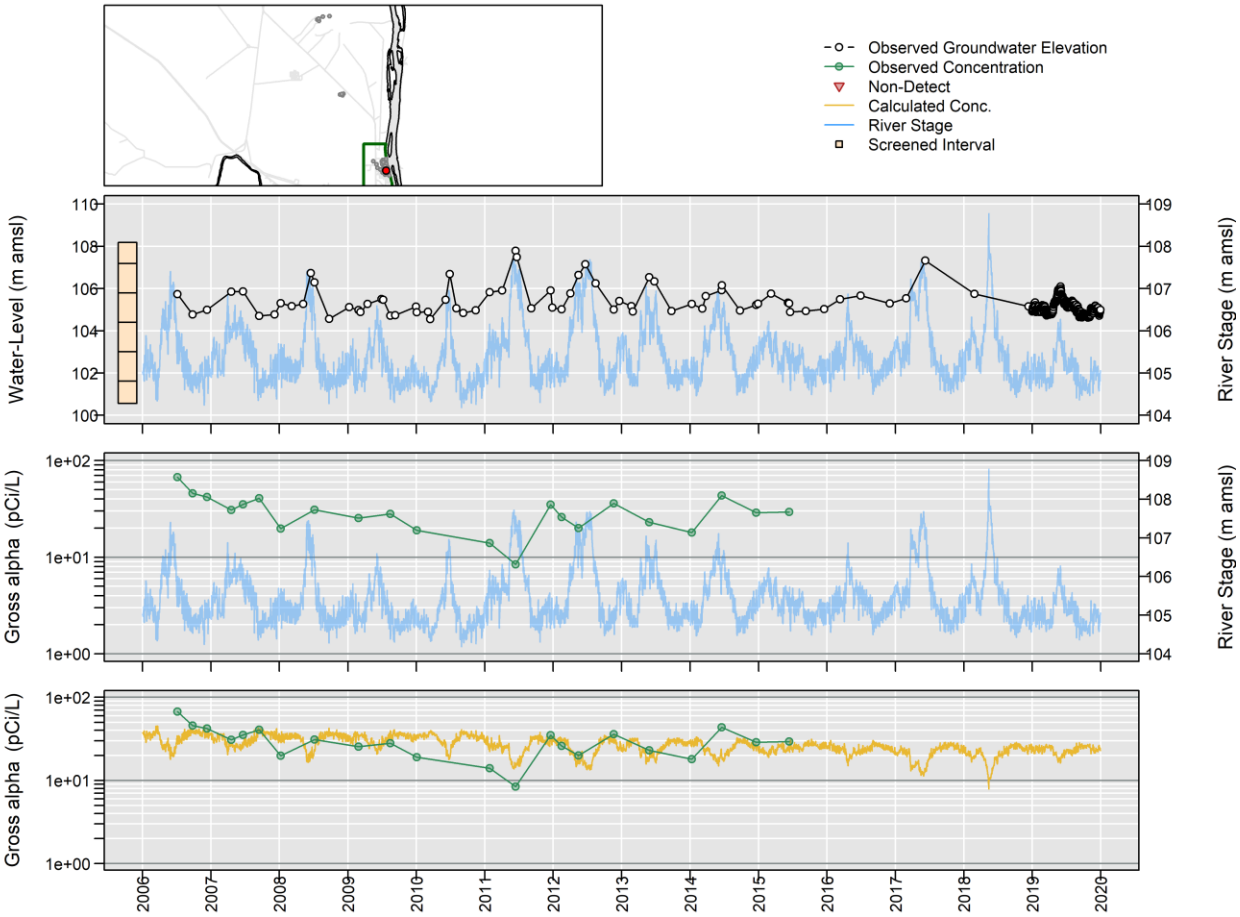
Censored Regression (Tobit) Model

ln Conc. = 0.7 (+/- 0.092)*River Stage + 0.00013 (+/- 0.000056)*Date + -73 (+/- 10)

399-3-20

Distance to River: 210 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.011
Significance of River Stage (p-value):	1.8e-222	0.006
Significance of Date (p-value):	0.00049	0.21
Number of Observations:	435	22
Percent NDs:		0%



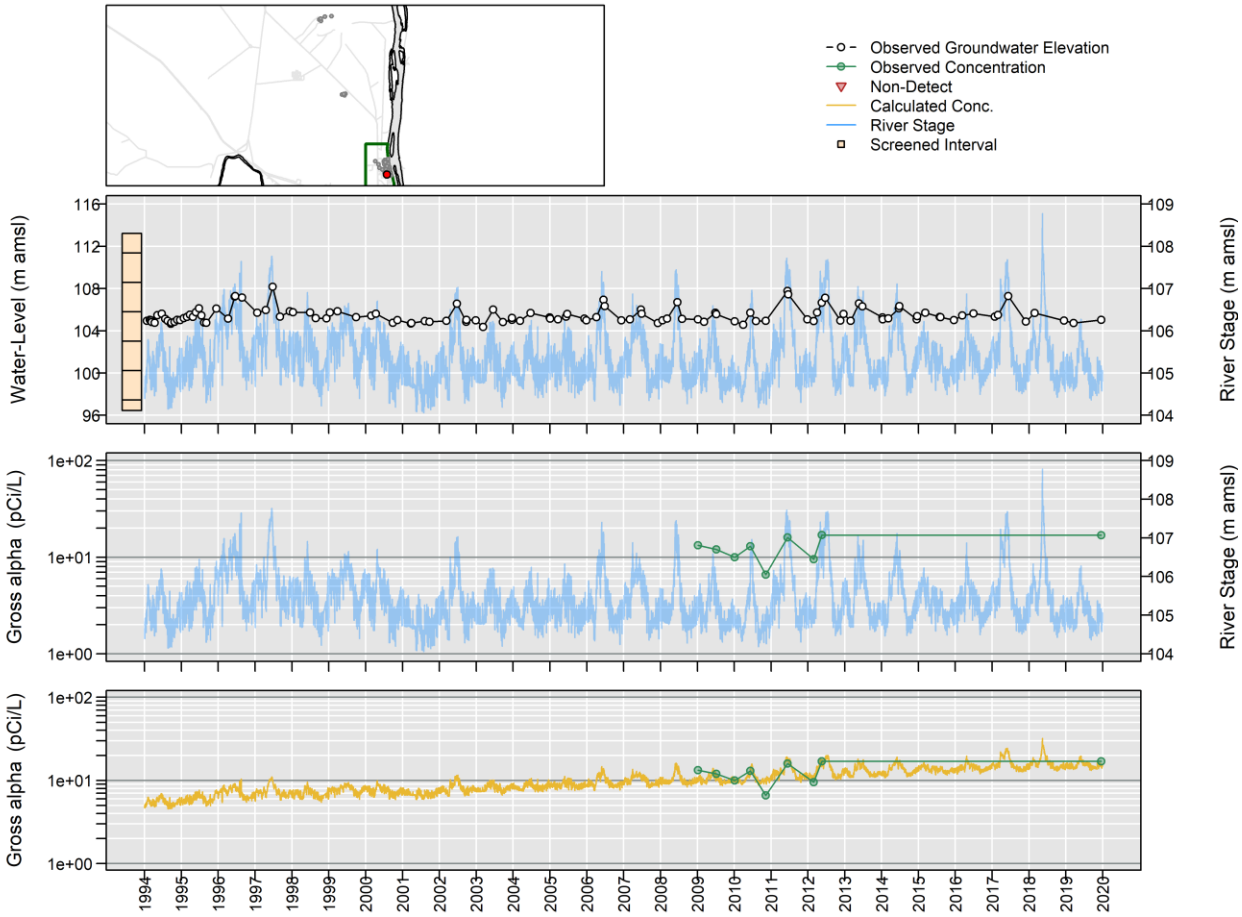
Censored Regression (Tobit) Model

Trend Not Significant

399-4-1

Distance to River: 381 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.018
Significance of River Stage (p-value):	9.2e-57	0.0022
Significance of Date (p-value):	0.48	0.045
Number of Observations:	121	9
Percent NDs:		0%



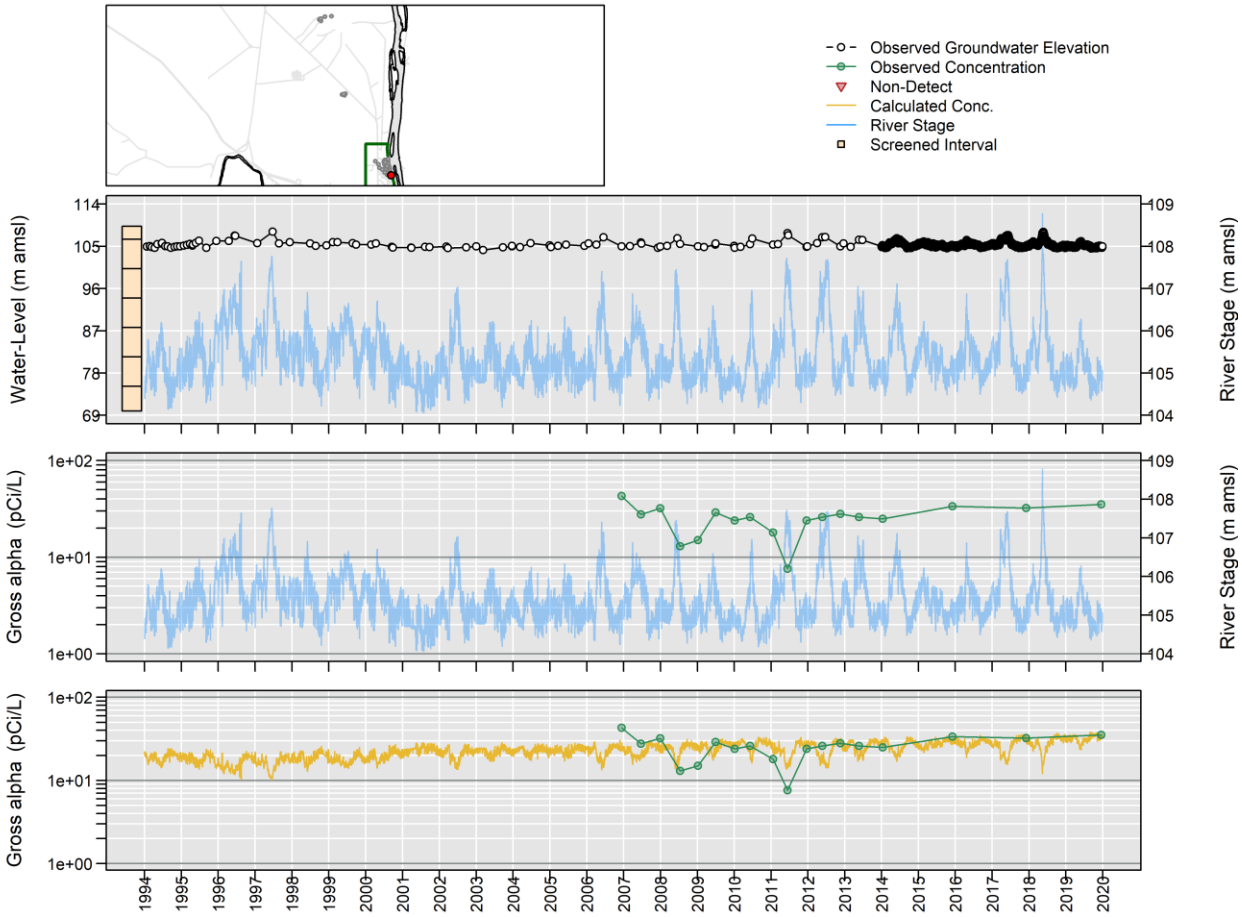
Censored Regression (Tobit) Model

ln Conc. = 0.21 (+/- 0.07)*River Stage + 0.00011 (+/- 0.000056)*Date + -22 (+/- 7.4)

399-4-7

Distance to River: 72 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0	0.039
Significance of River Stage (p-value):	0	0.011
Significance of Date (p-value):	0.59	0.36
Number of Observations:	2286	18
Percent NDs:		0%



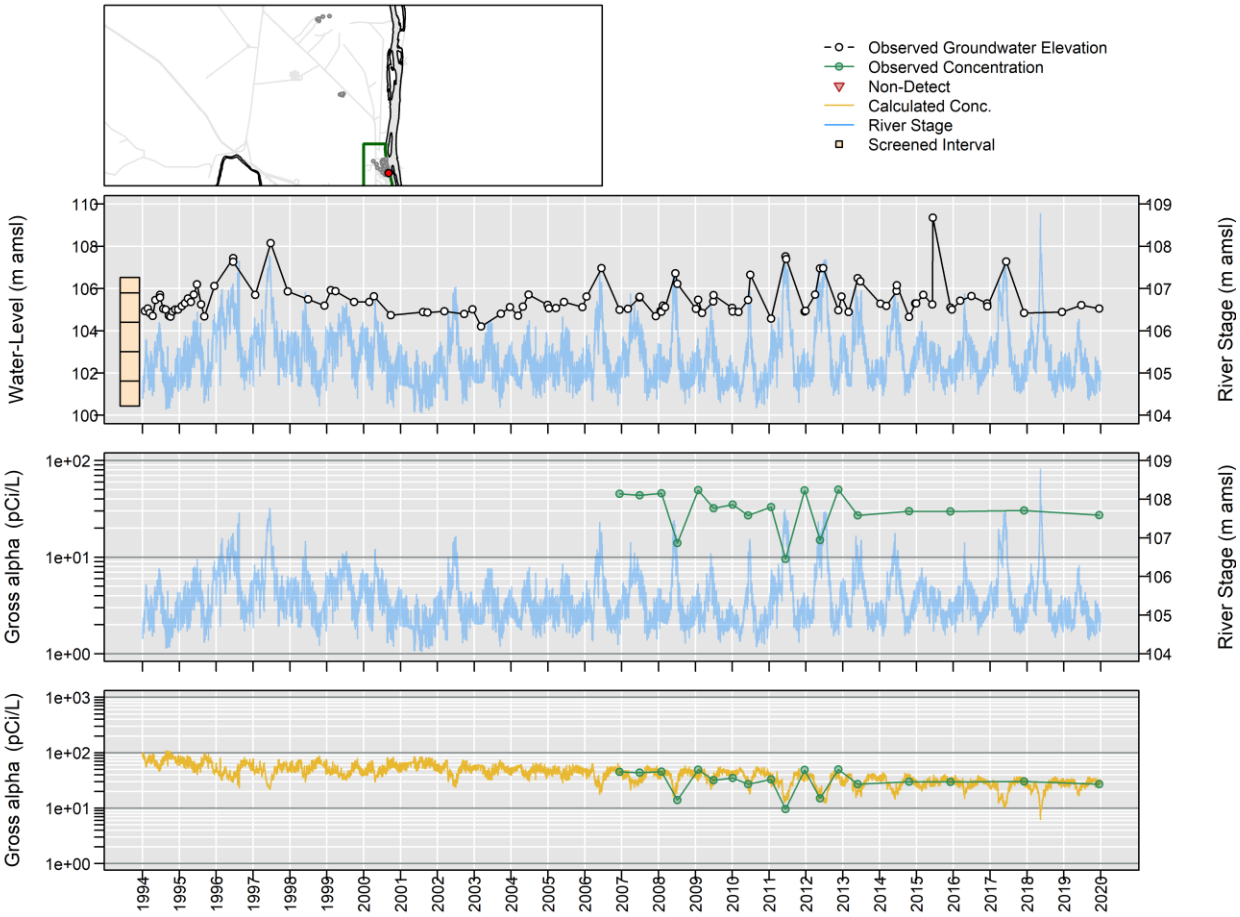
Censored Regression (Tobit) Model

Trend Not Significant

399-4-10

Distance to River: 69 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.00021
Significance of River Stage (p-value):	8.1e-30	2.3e-07
Significance of Date (p-value):	0.8	0.042
Number of Observations:	110	18
Percent NDs:		0%



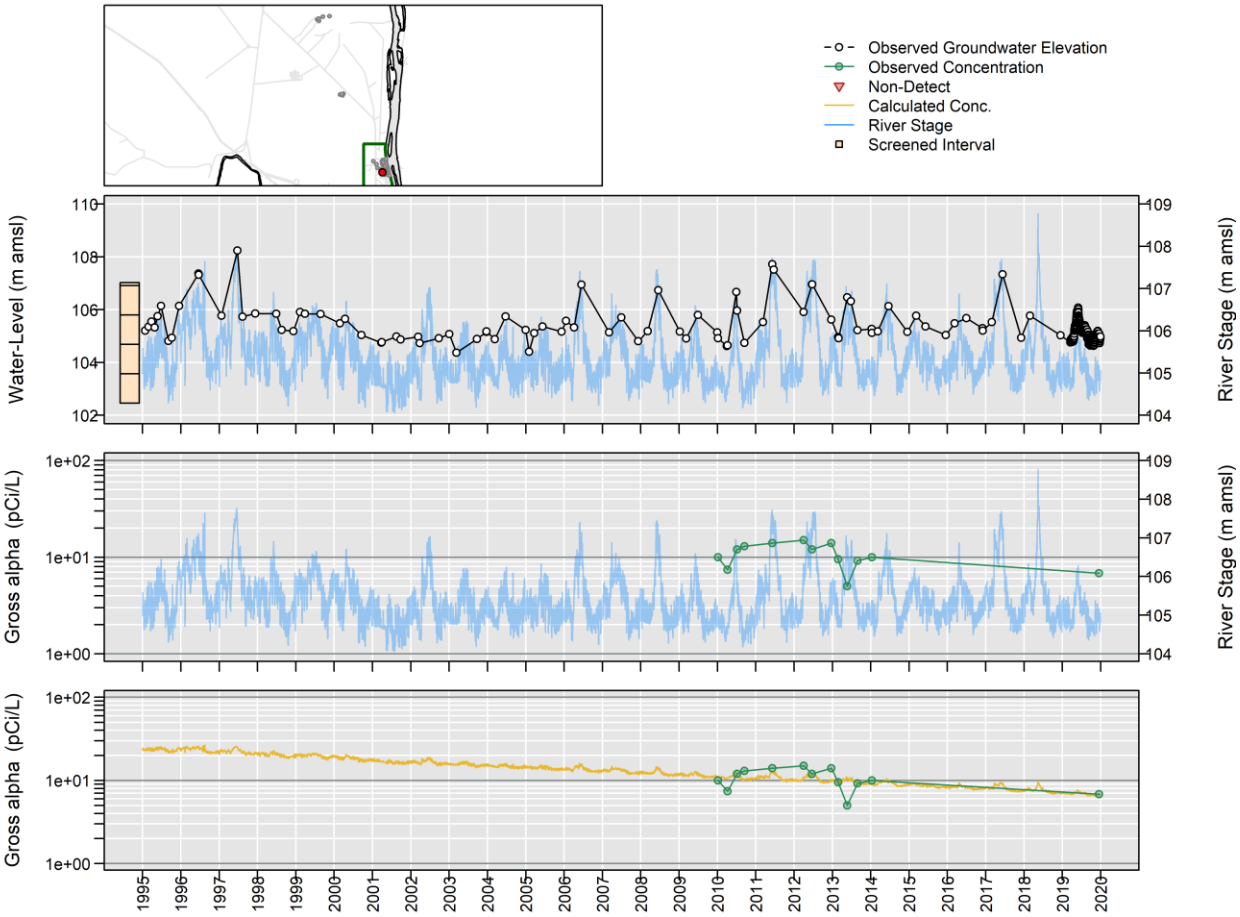
Censored Regression (Tobit) Model

ln Conc. = -0.41 (+/- 0.08)*River Stage + -0.00011 (+/- 0.000053)*Date + 49 (+/- 8.6)

399-4-11

Distance to River: 522 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.19
Significance of River Stage (p-value):	1.1e-206	0.32
Significance of Date (p-value):	0.17	0.1
Number of Observations:	378	13
Percent NDs:		0%



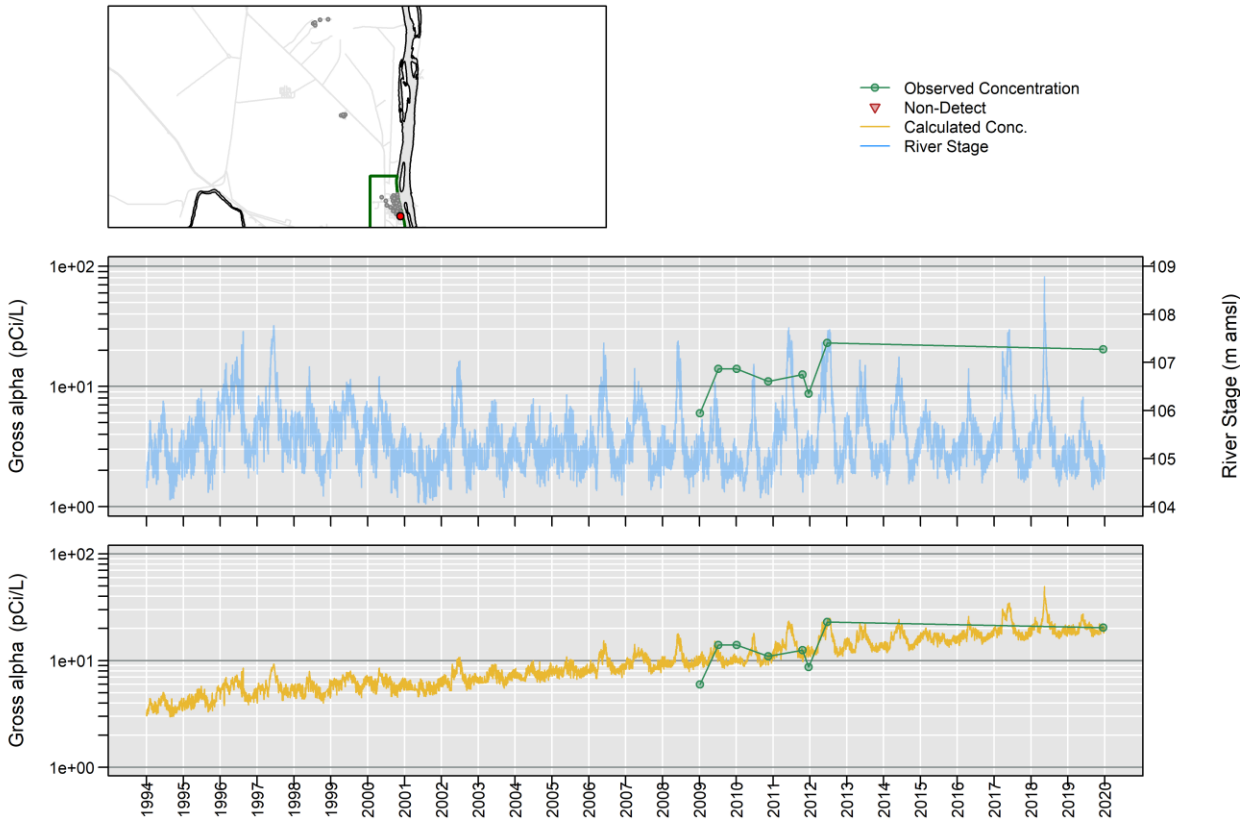
Censored Regression (Tobit) Model

Trend Not Significant

399-4-12

Distance to River: 153 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.021
Significance of River Stage (p-value):	0.014
Significance of Date (p-value):	0.015
Number of Observations:	8
Percent NDs:	0%



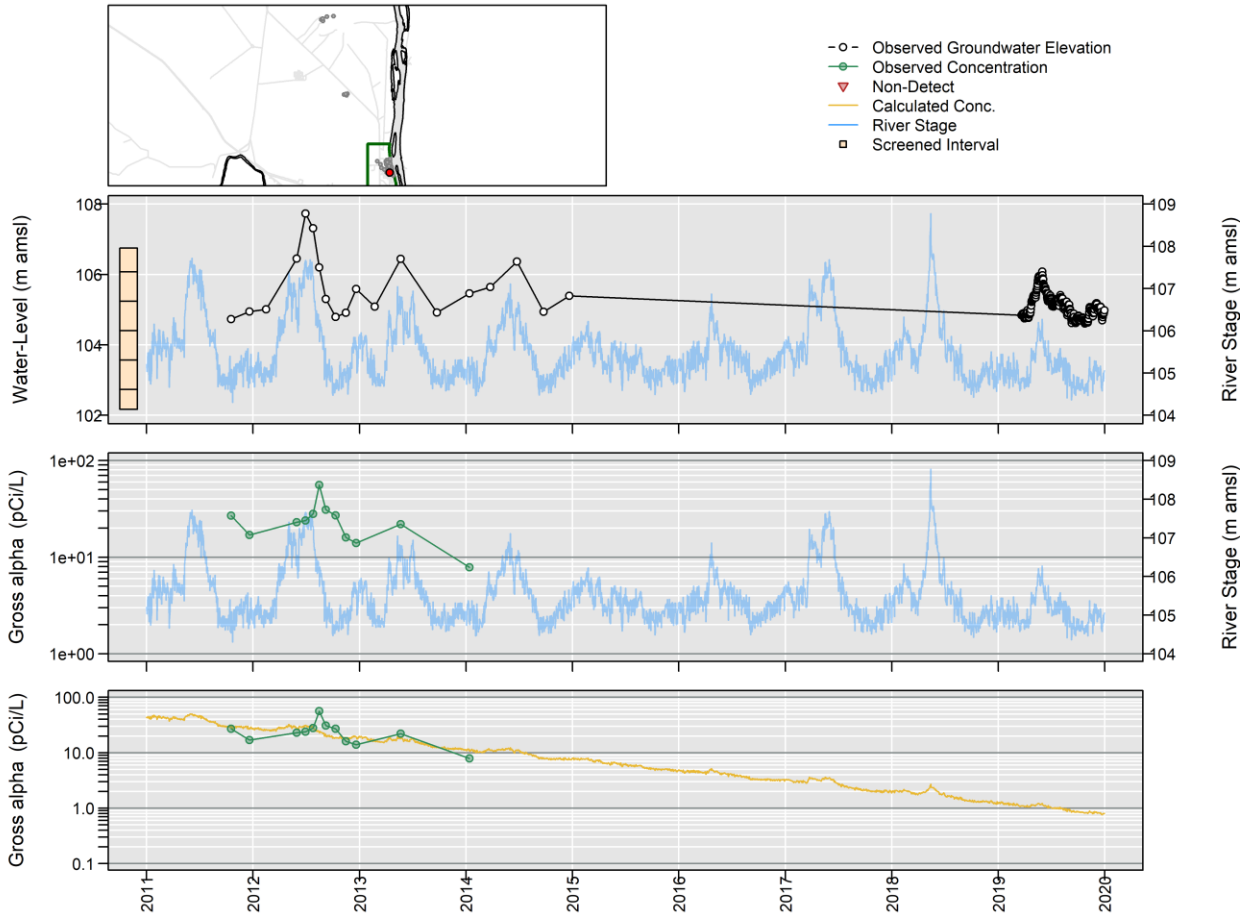
Censored Regression (Tobit) Model

ln Conc. = 0.26 (+/- 0.11)*River Stage + 0.00018 (+/- 0.000075)*Date + -28 (+/- 11)

399-4-15

Distance to River: 278 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.069
Significance of River Stage (p-value):	3.6e-184	0.22
Significance of Date (p-value):	0.00042	0.019
Number of Observations:	304	12
Percent NDs:		0%



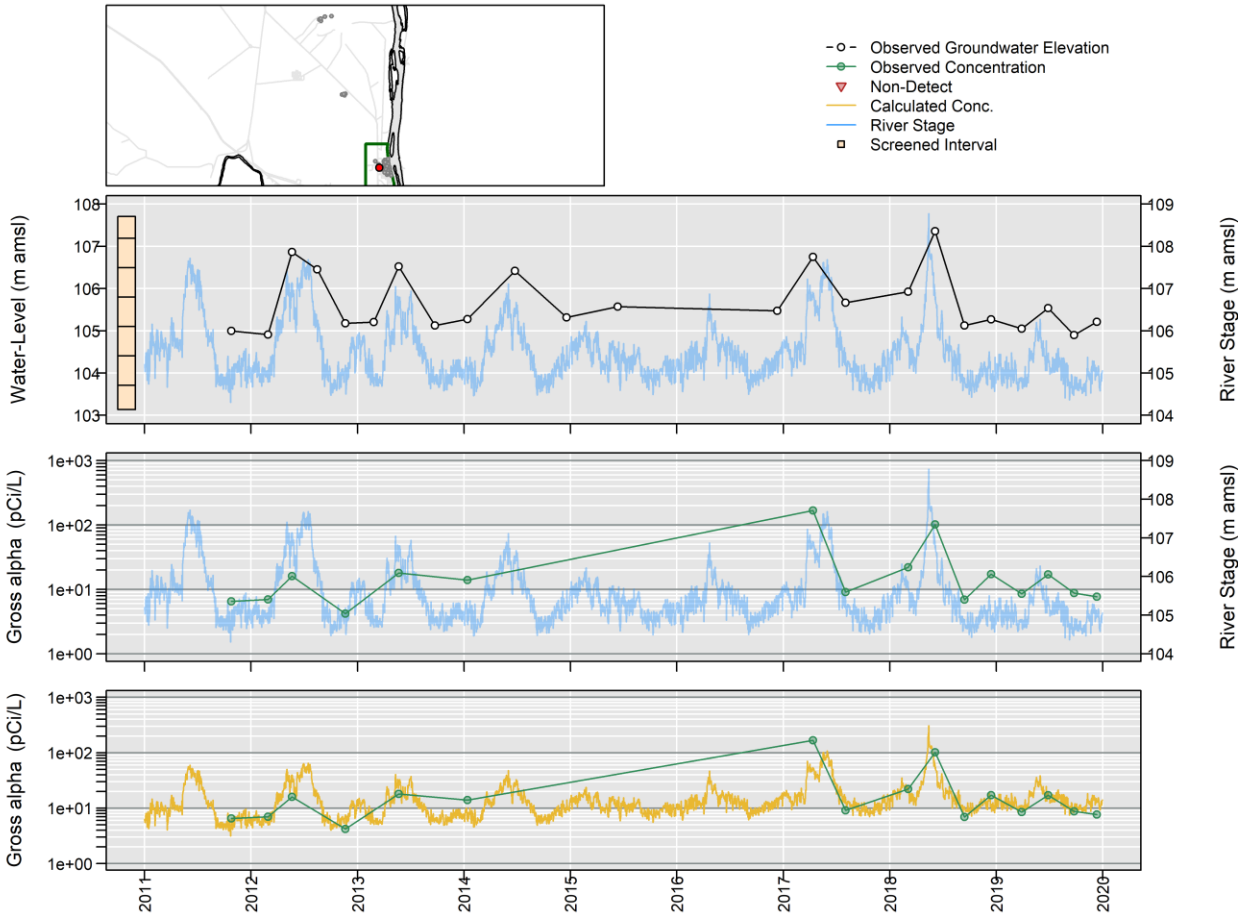
Censored Regression (Tobit) Model

Trend Not Significant

399-6-3

Distance to River: 819 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	3	3
Significance of Trend (p-value):	6.7e-16	6.5e-05
Significance of River Stage (p-value):	1.2e-14	3.8e-09
Significance of Date (p-value):	0.26	0.018
Number of Observations:	23	16
Percent NDs:		0%



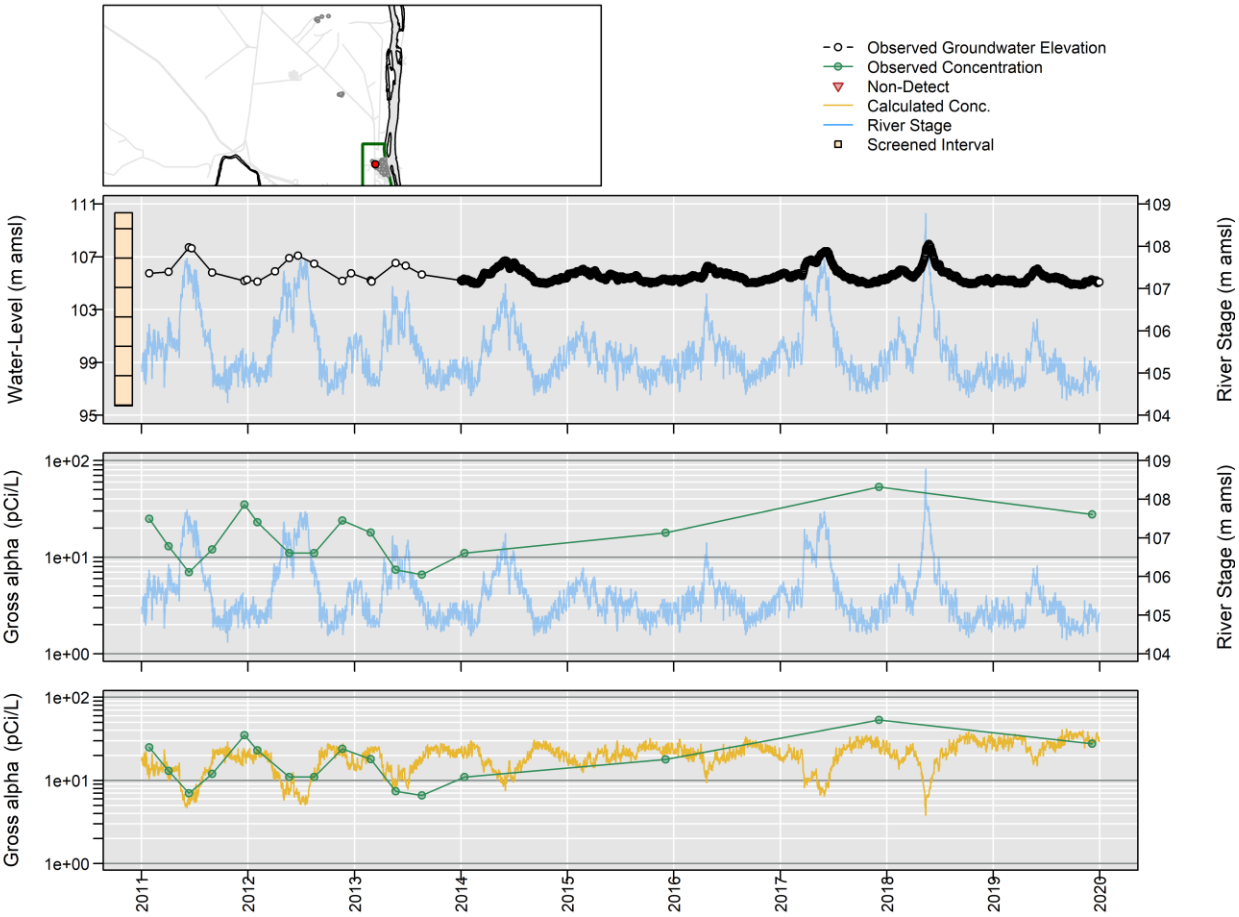
Censored Regression (Tobit) Model

ln Conc. = 0.88 (+/- 0.15)*River Stage + 0.00028 (+/- 0.00012)*Date + -94 (+/- 16)

399-8-1

Distance to River: 832 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	3	3
Significance of Trend (p-value):	0	0.0013
Significance of River Stage (p-value):	0	0.00015
Significance of Date (p-value):	0.11	0.24
Number of Observations:	2210	16
Percent NDs:		0%



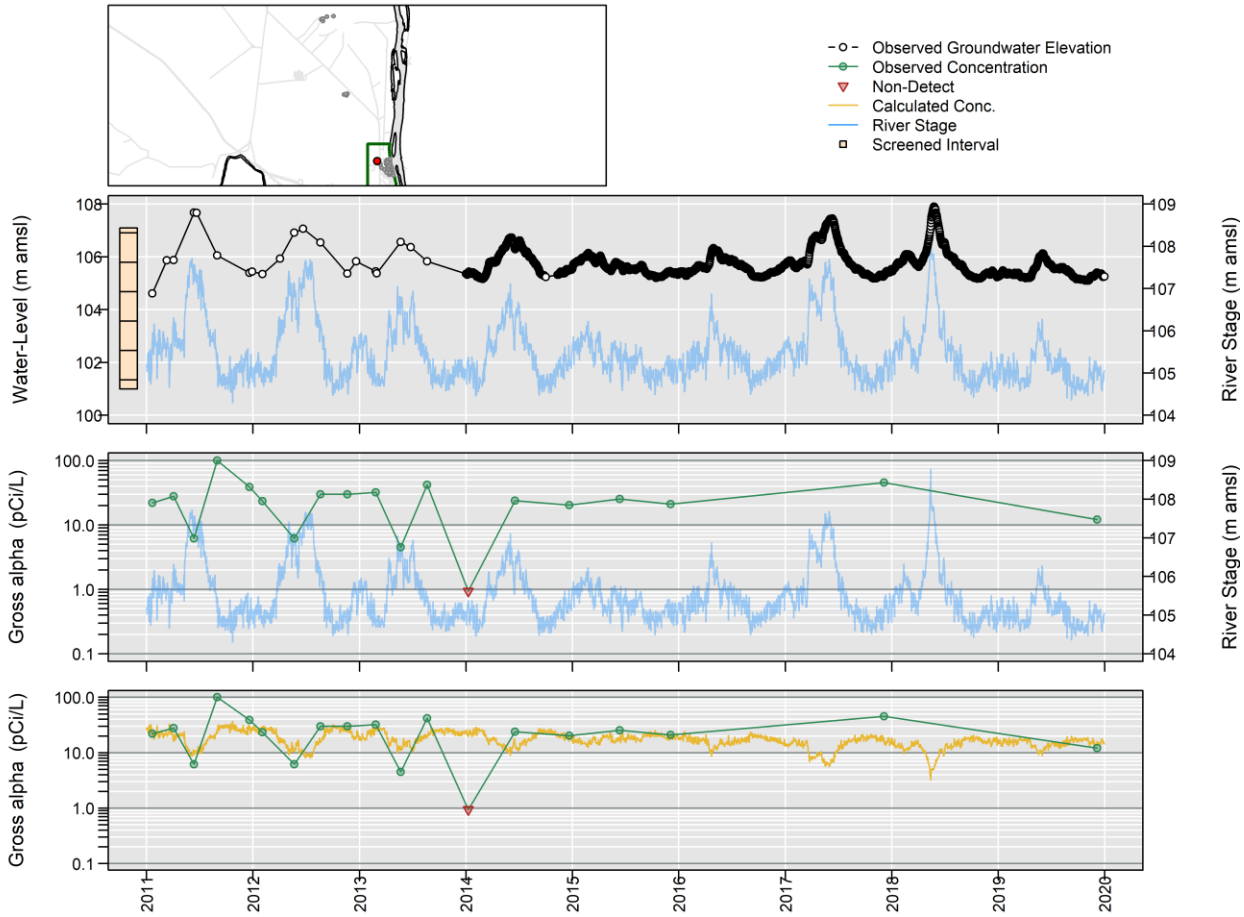
Censored Regression (Tobit) Model

Trend Not Significant

399-8-5A

Distance to River: 1046 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	7	7
Significance of Trend (p-value):	0	0.41
Significance of River Stage (p-value):	0	0.18
Significance of Date (p-value):	0.0011	0.49
Number of Observations:	2172	19
Percent NDs:		5%



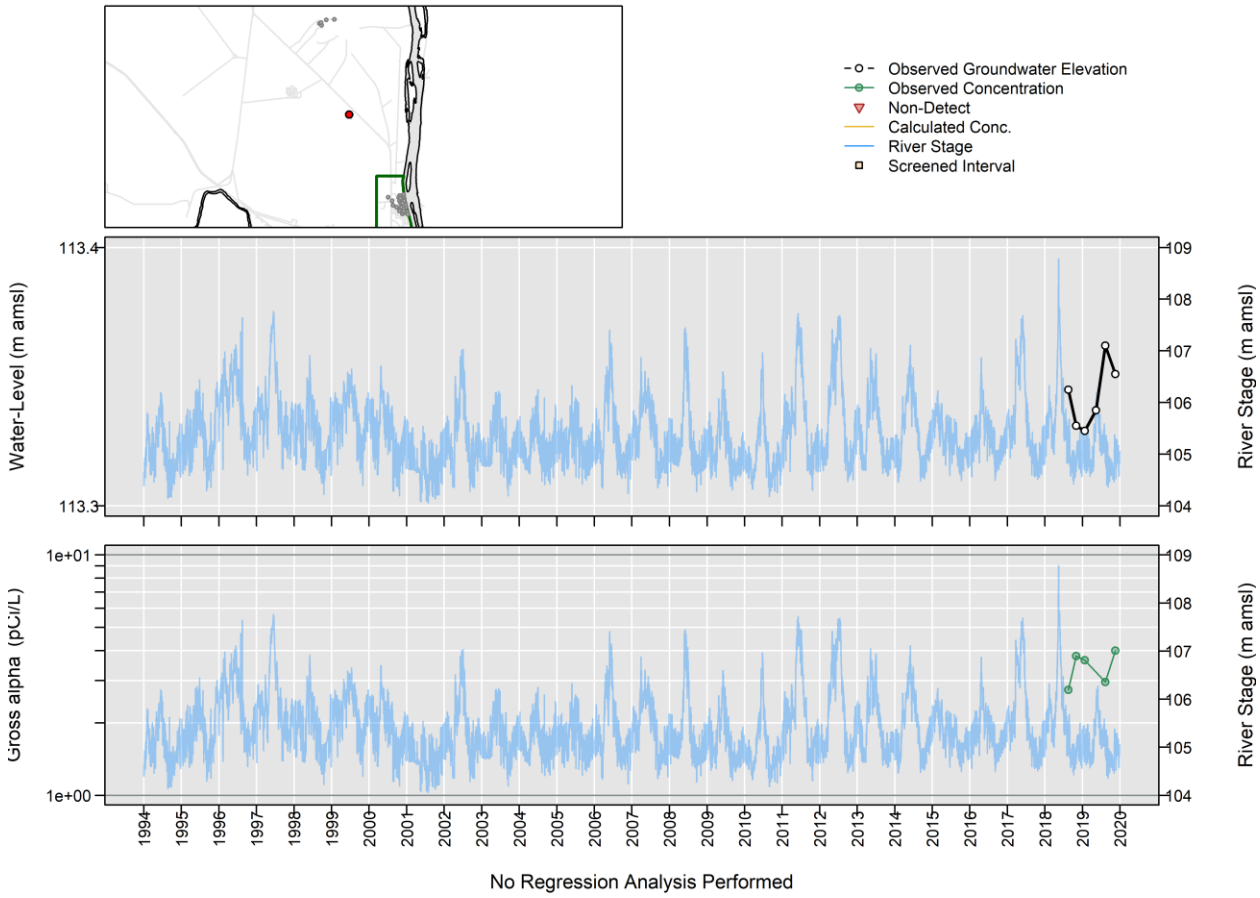
Censored Regression (Tobit) Model

Trend Not Significant

699-S6-E3

Distance to River: 3568 m
Number of Trends Calculated: 1

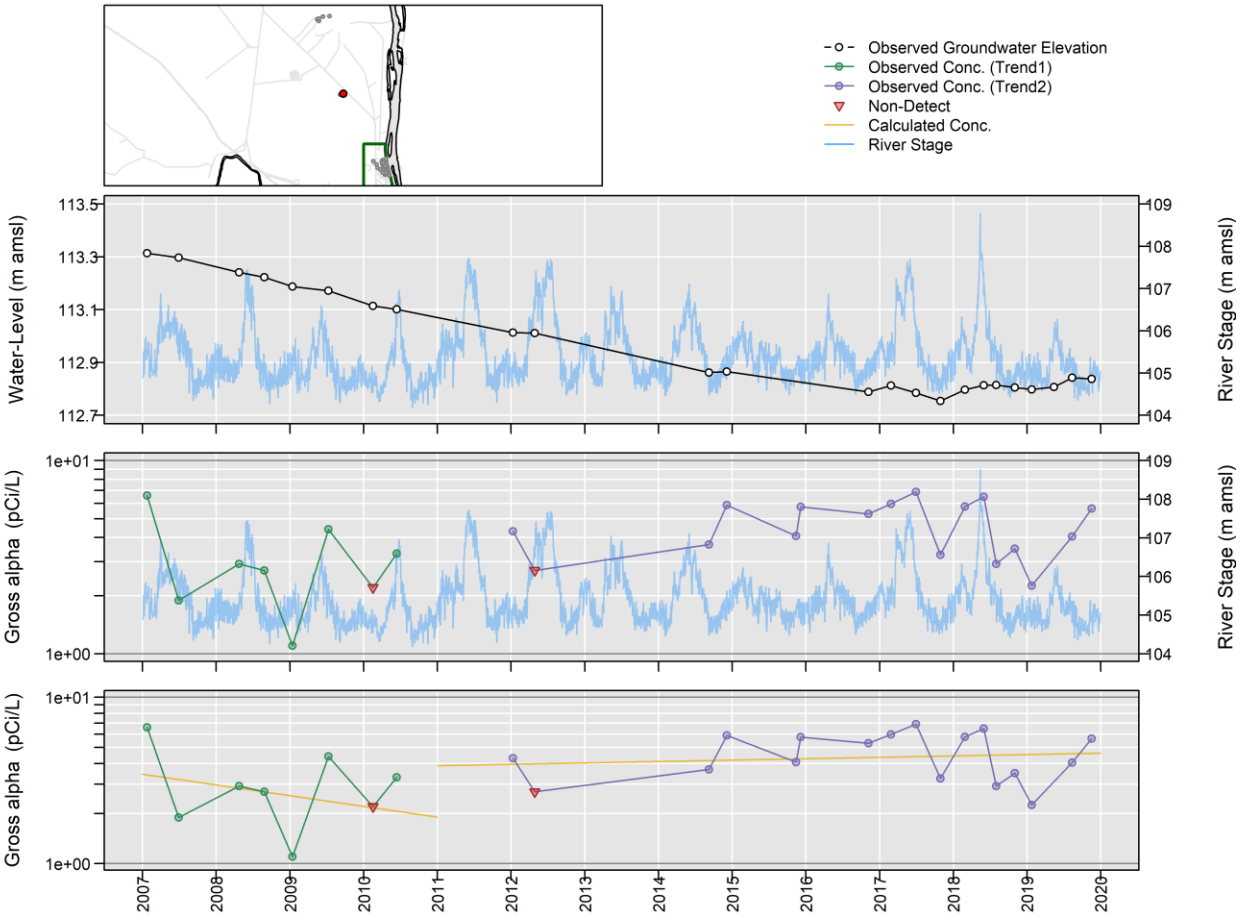
	WL	Conc
Est. Lag Time (days):	NA	No Covariate
Significance of Trend (p-value):	NA	NA
Significance of Date (p-value):	NA	NA
Number of Observations:	6	5
Percent NDs:		0%



699-S6-E4B

Distance to River: 3438 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	5	No Covariate	No RS
Significance of Trend (p-value):	2.3e-14	0.4	0.61
Significance of Date (p-value):	0.86	0.4	0.61
Number of Observations:	24	8	17
Percent NDs:		12%	6%



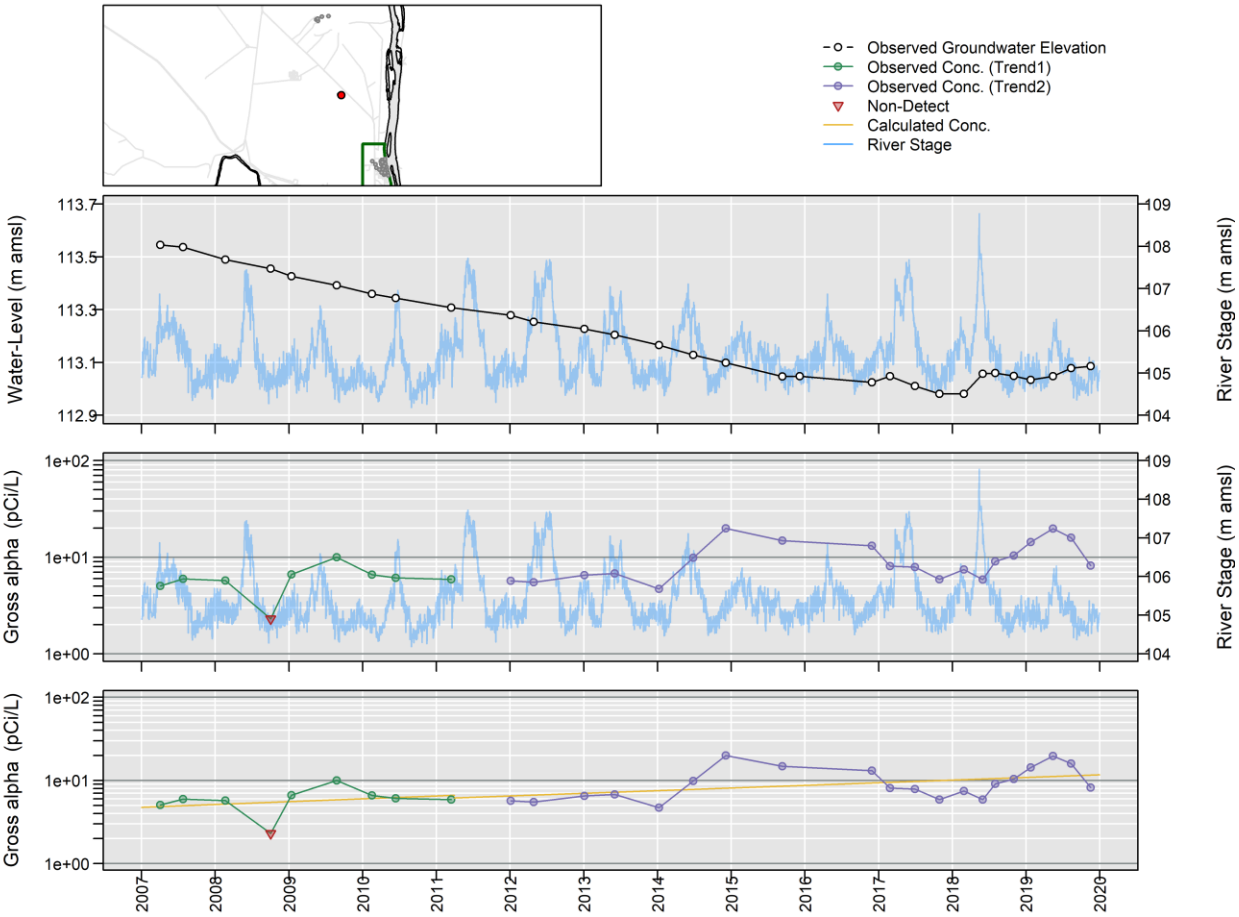
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

699-S6-E4E

Distance to River: 3518 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	85	No Covariate	No RS
Significance of Trend (p-value):	1.1e-16	0.46	0.043
Significance of Date (p-value):	0.1	0.45	0.033
Number of Observations:	30	9	20
Percent NDs:		11%	0%



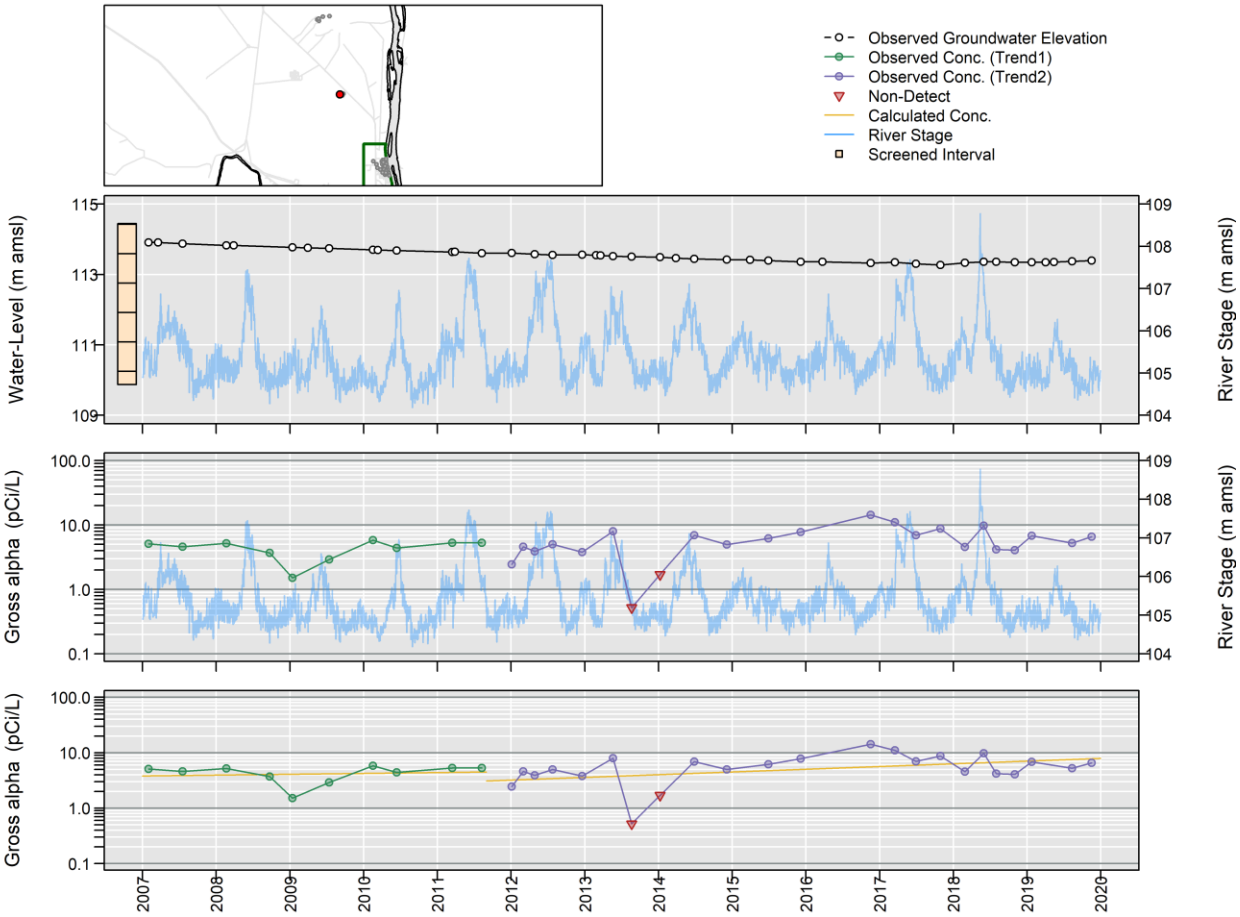
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.0002 (+/- 0.000094)*Date + -1.2 (+/- 1.6)

699-S6-E4K

Distance to River: 3689 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	6	No Covariate	No RS
Significance of Trend (p-value):	0	0.68	0.043
Significance of Date (p-value):	0.38	0.68	0.035
Number of Observations:	43	10	23
Percent NDs:		0%	9%



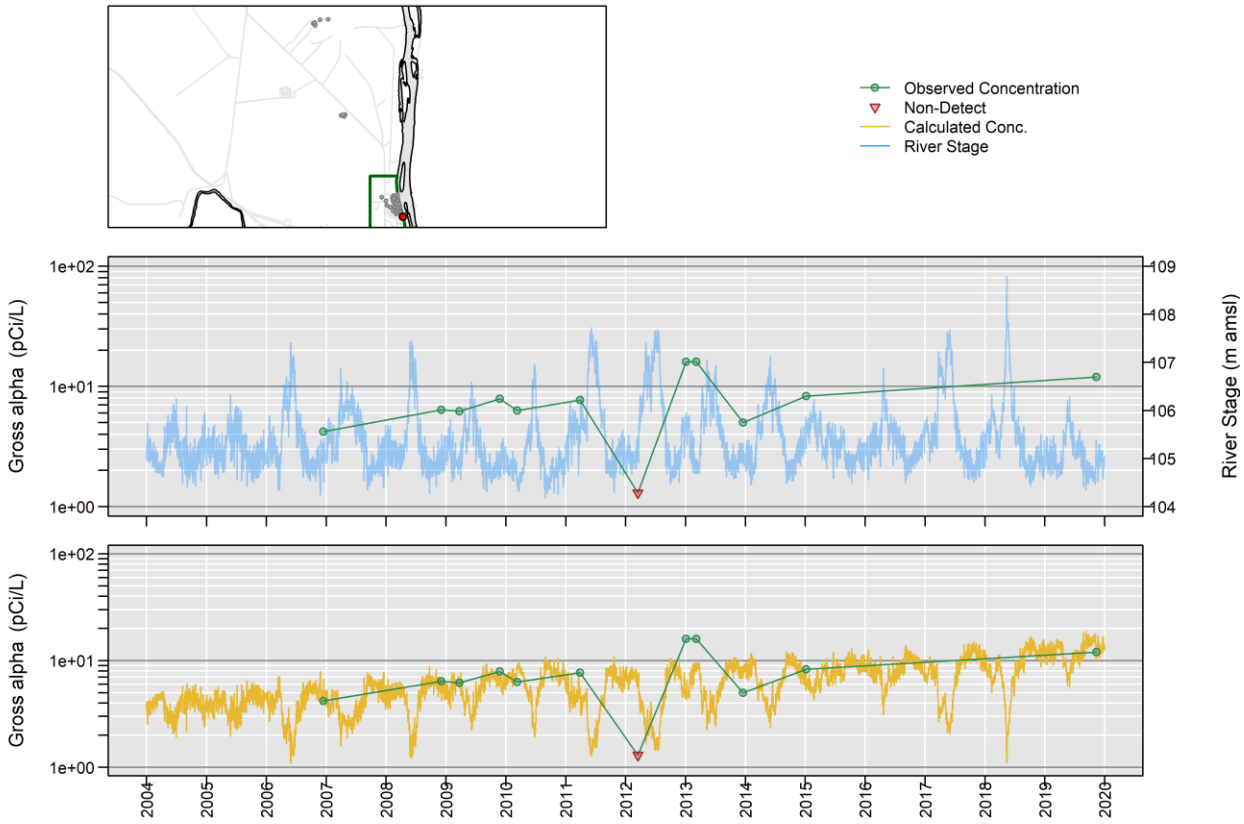
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.00031 (+/- 0.00015)*Date + -3.6 (+/- 2.5)

AT-3-7-M

Distance to River: 5 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.33
Significance of River Stage (p-value):	0.32
Significance of Date (p-value):	0.19
Number of Observations:	12
Percent NDs:	8%



Censored Regression (Tobit) Model

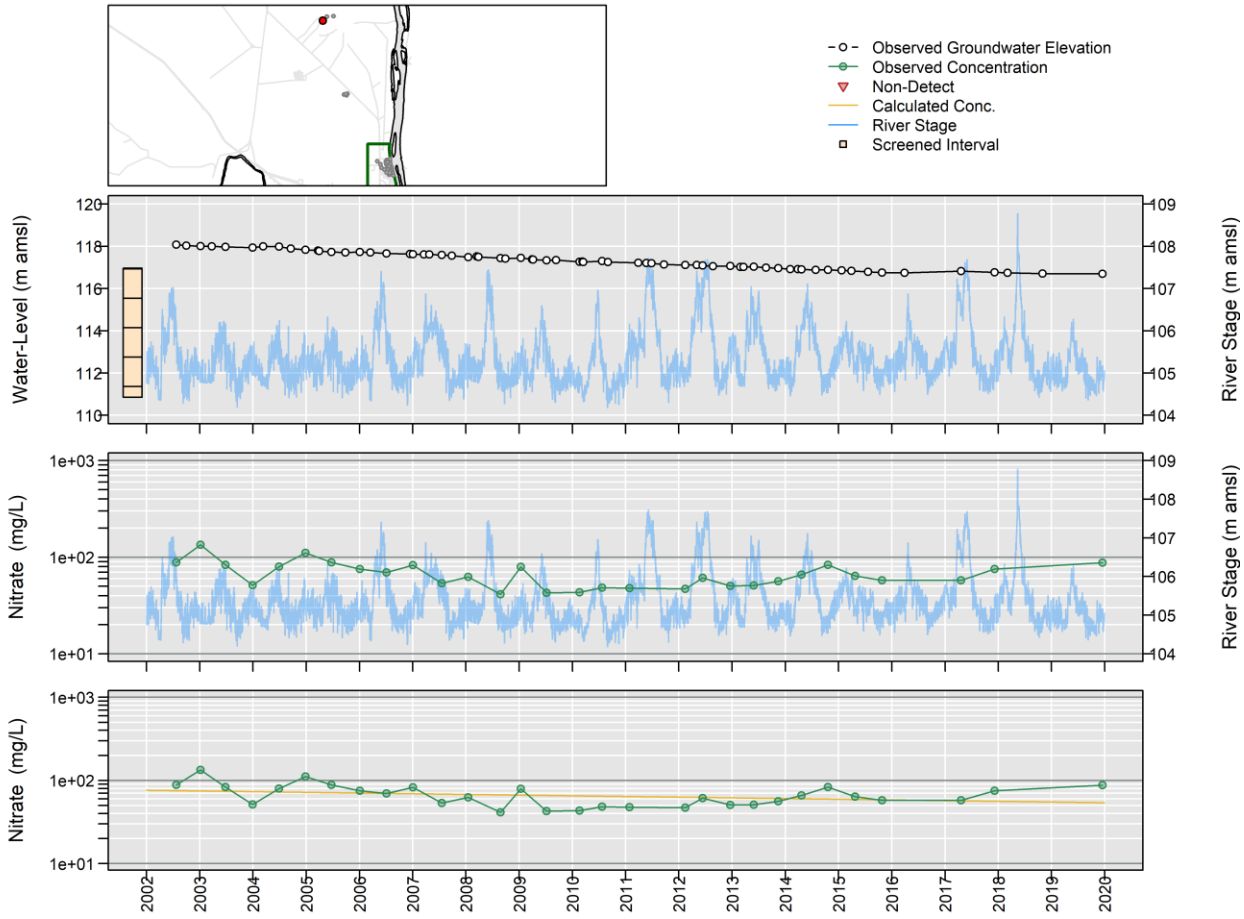
Trend Not Significant

Nitrate

699-12-2C

Distance to River: 5526 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	6	No Covariate
Significance of Trend (p-value):	0	0.077
Significance of Date (p-value):	0.36	0.07
Number of Observations:	67	30
Percent NDs:		0%



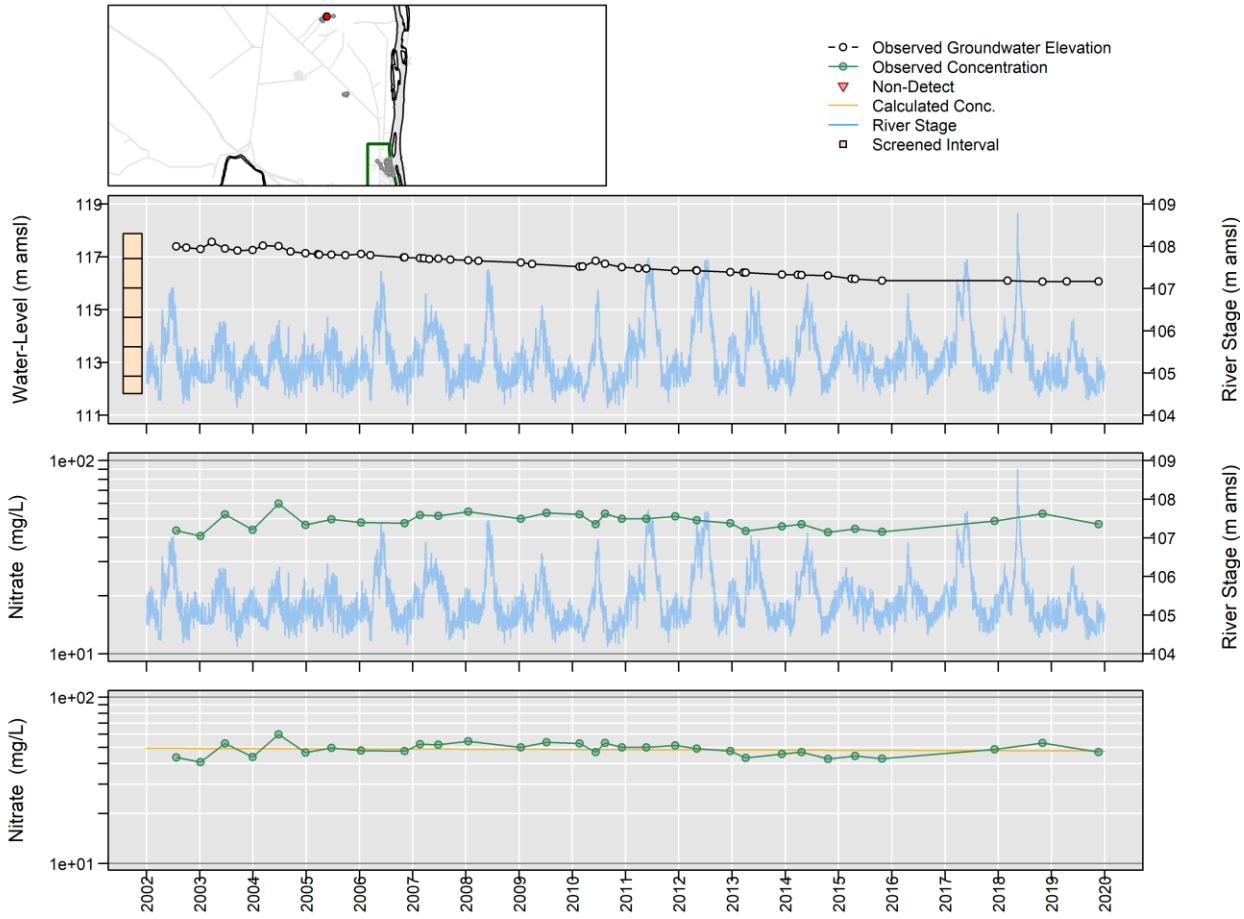
Censored Regression (Tobit) Model

Trend Not Significant

699-13-1E

Distance to River: 5173 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	68	No Covariate
Significance of Trend (p-value):	0	0.55
Significance of Date (p-value):	0.012	0.55
Number of Observations:	52	31
Percent NDs:		0%



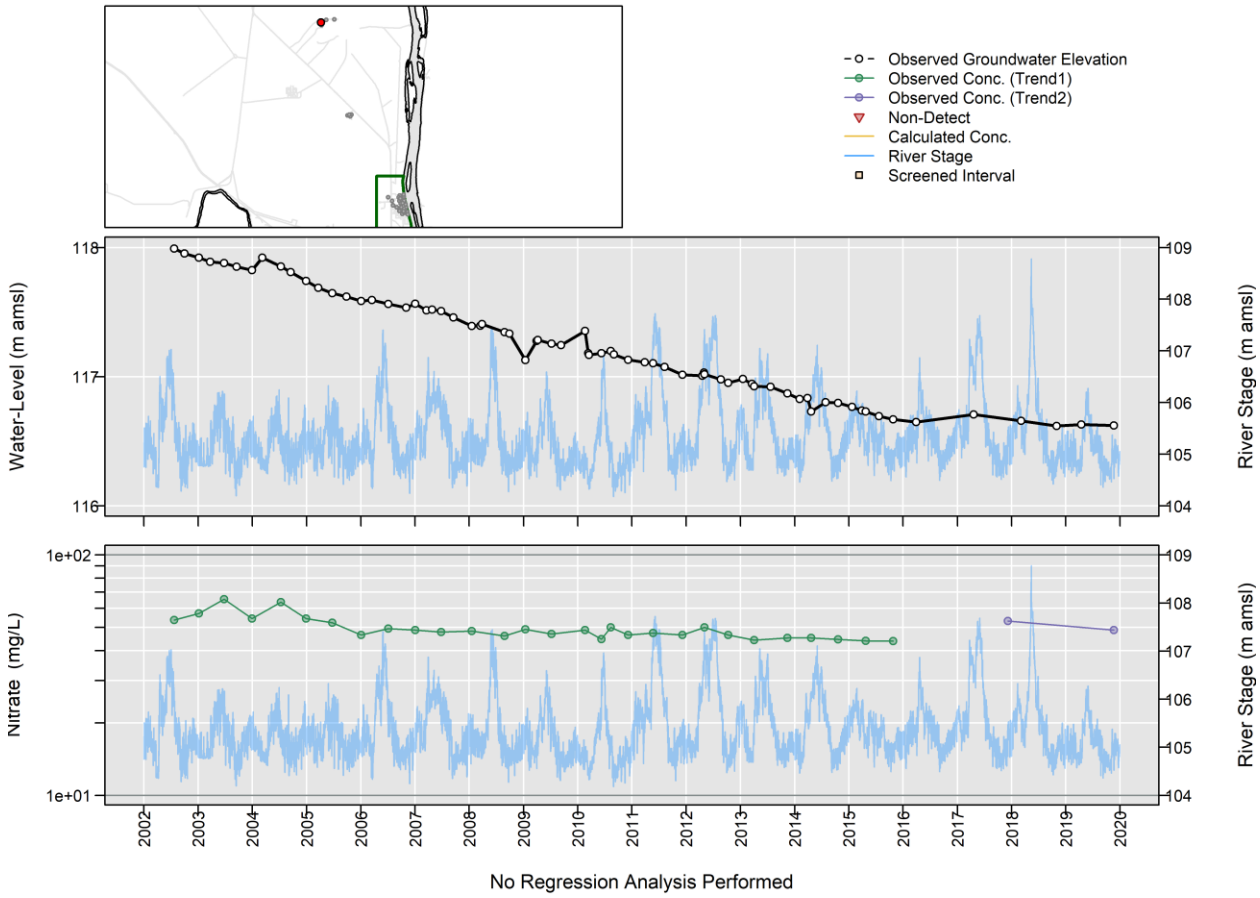
Censored Regression (Tobit) Model

Trend Not Significant

699-13-2D

Distance to River: 5519 m
Number of Trends Calculated: 2

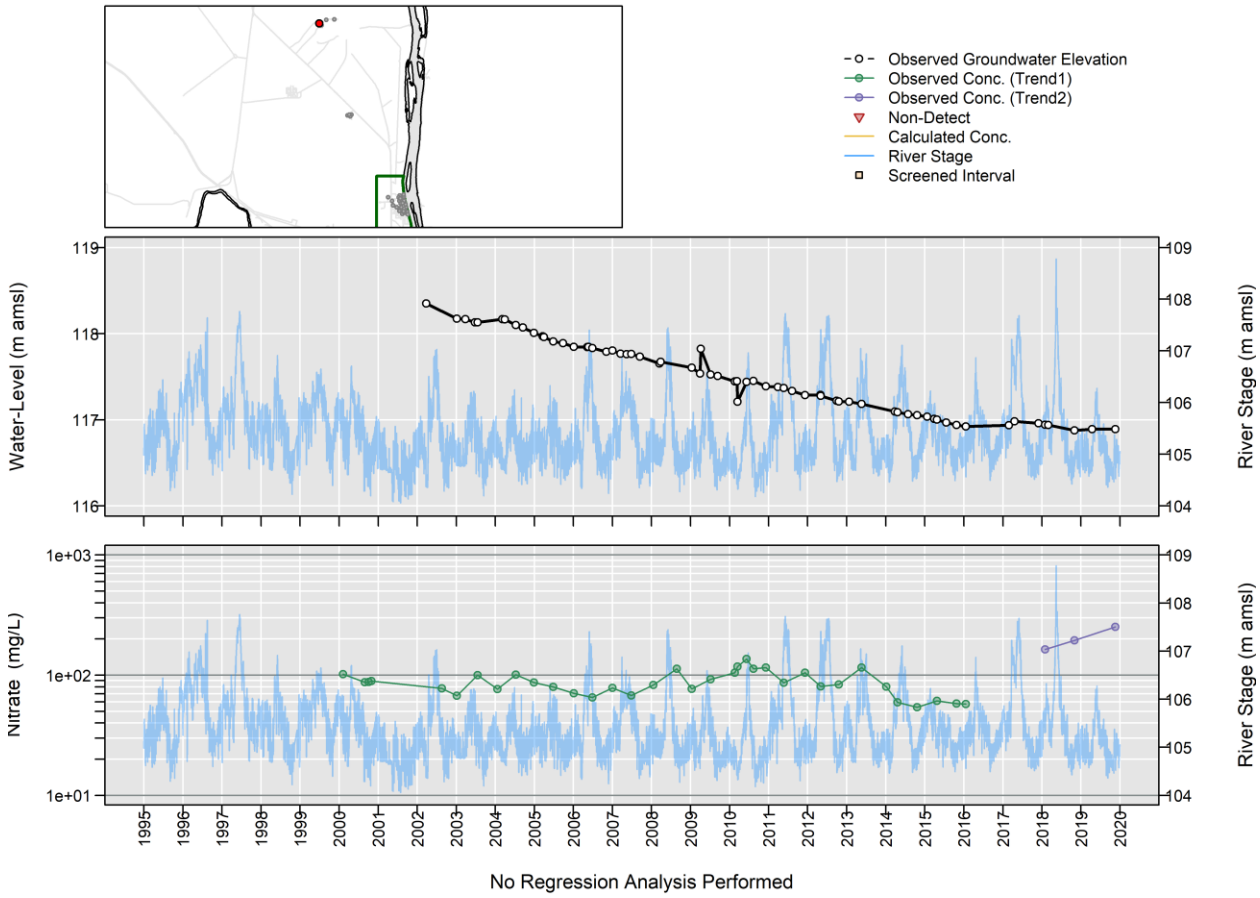
	WL	Trend1	Trend2
Est. Lag Time (days):	15	No Covariate	No RS
Significance of Trend (p-value):	0	7.3e-08	NA
Significance of Date (p-value):	0.96	1.7e-12	NA
Number of Observations:	70	29	2
Percent NDs:		0%	0%



699-13-3A

Distance to River: 5630 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	6	No Covariate	No RS
Significance of Trend (p-value):	0	0.2	NA
Significance of Date (p-value):	0.98	0.19	NA
Number of Observations:	65	35	3
Percent NDs:		0%	0%

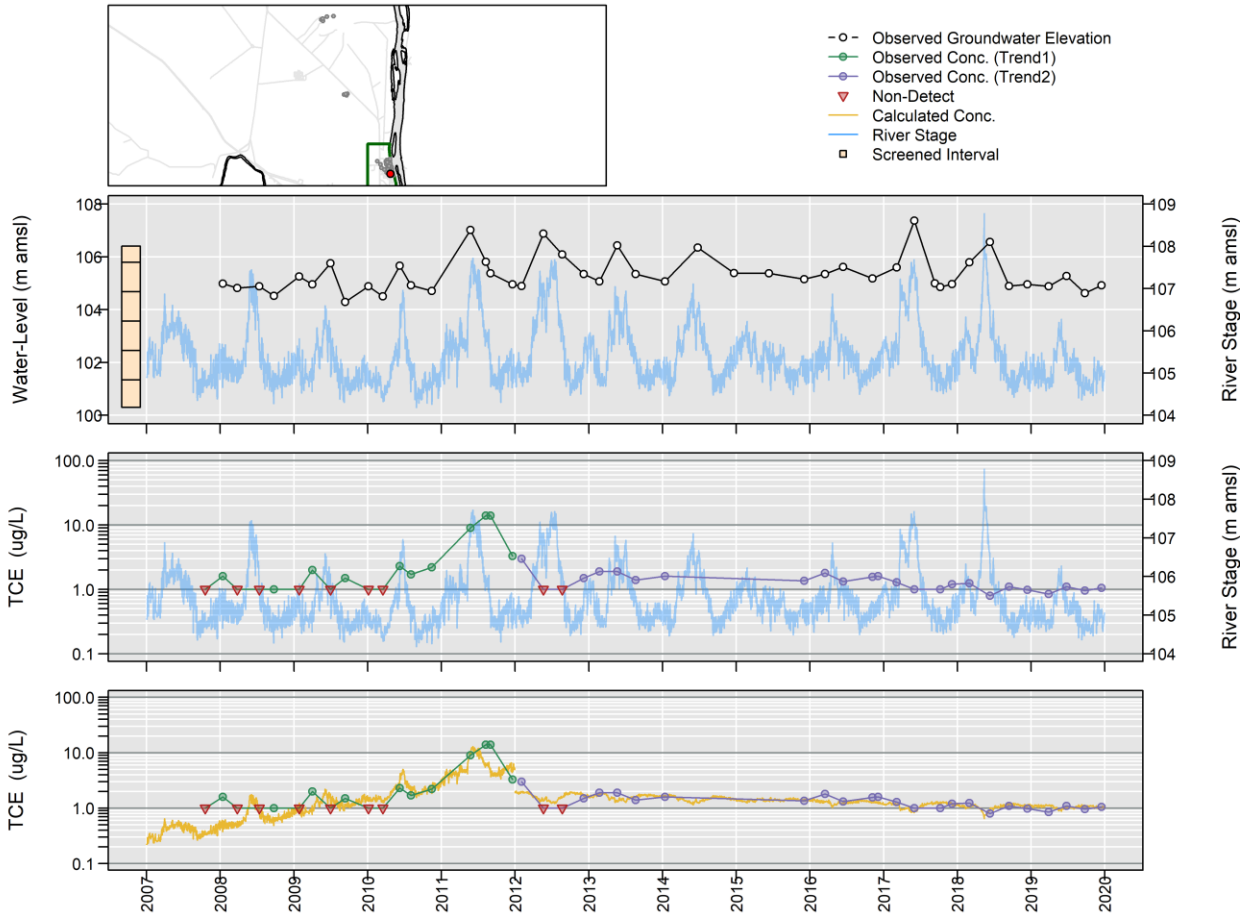


Trichloroethene (TCE)

399-4-14

Distance to River: 247 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	0	0	0
Significance of Trend (p-value):	0	0.00026	0.0011
Significance of River Stage (p-value):	3.1e-24	0.1	0.016
Significance of Date (p-value):	0.032	5.4e-05	2.7e-05
Number of Observations:	45	18	25
Percent NDs:		39%	8%



Censored Regression (Tobit) Model

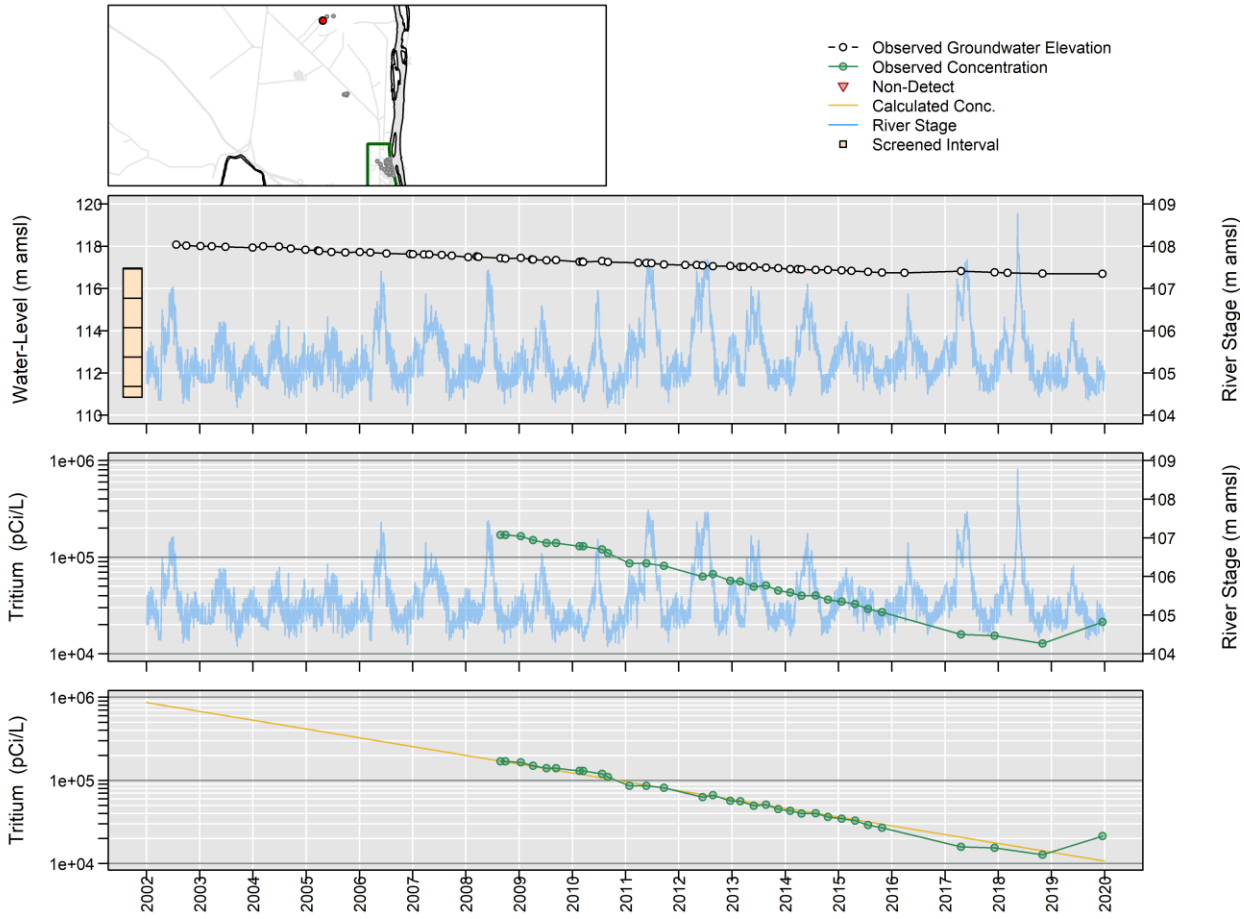
Trend1:
ln Conc. = 0.47 (+/- 0.28)*River Stage + 0.0017 (+/- 0.00042)*Date + -73 (+/- 29)
Trend2:
ln Conc. = -0.16 (+/- 0.065)*River Stage + -0.00022 (+/- 0.000052)*Date + 21 (+/- 7.2)

Tritium

699-12-2C

Distance to River: 5526 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	6	No Covariate
Significance of Trend (p-value):	0	< 0.05
Significance of Date (p-value):	0.36	1.9e-179
Number of Observations:	67	32
Percent NDs:		0%



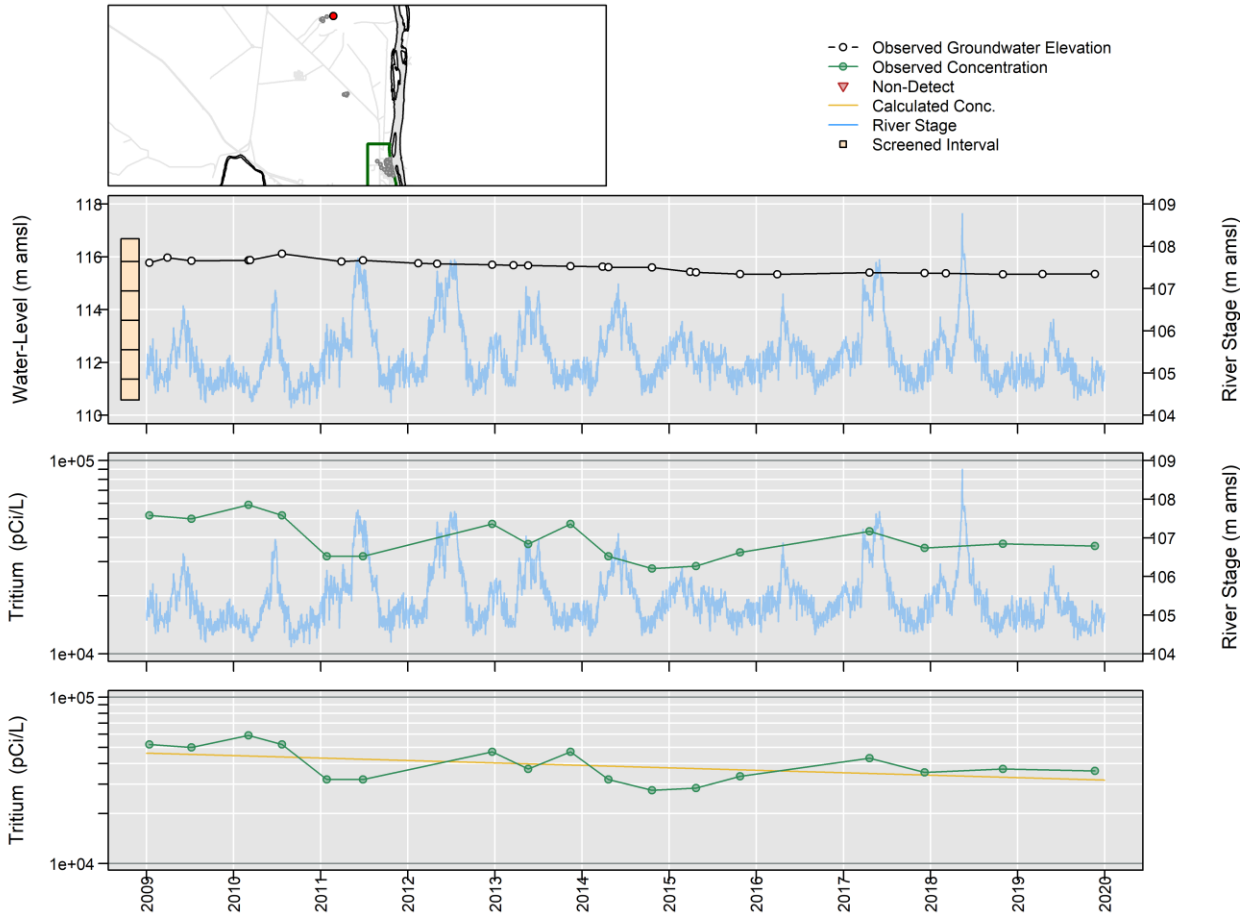
Censored Regression (Tobit) Model

ln Conc. = -0.00067 (+/- 0.000023)*Date + 21 (+/- 0.37)

699-13-0A

Distance to River: 4675 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	27	No Covariate
Significance of Trend (p-value):	2.6e-12	0.032
Significance of Date (p-value):	0.39	0.021
Number of Observations:	27	17
Percent NDs:		0%



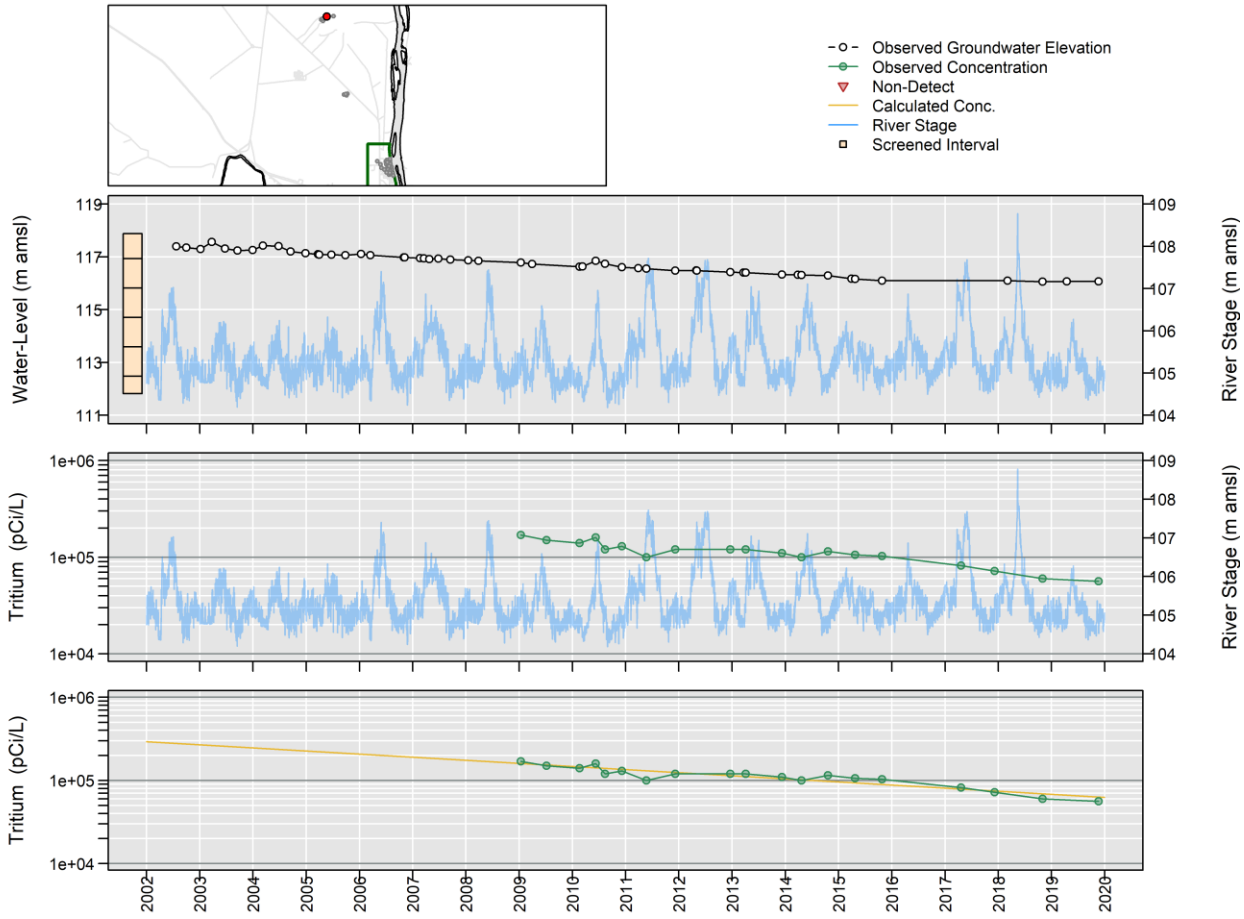
Censored Regression (Tobit) Model

ln Conc. = -0.000093 (+/- 0.00004)*Date + 12 (+/- 0.65)

699-13-1E

Distance to River: 5173 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	68	No Covariate
Significance of Trend (p-value):	0	8.9e-10
Significance of Date (p-value):	0.012	1.6e-27
Number of Observations:	52	19
Percent NDs:		0%



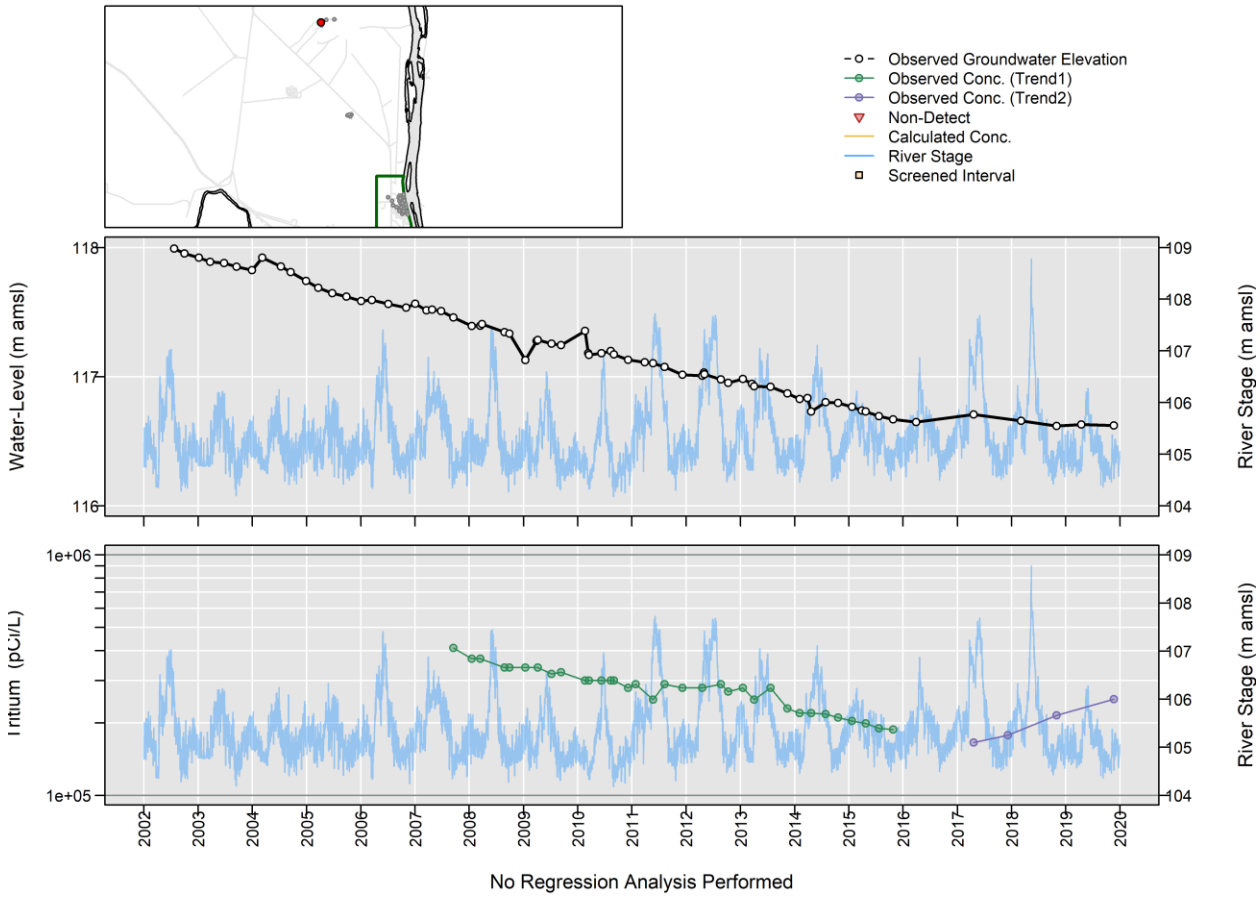
Censored Regression (Tobit) Model

ln Conc. = -0.00023 (+/- 0.000022)*Date + 15 (+/- 0.34)

699-13-2D

Distance to River: 5519 m
Number of Trends Calculated: 2

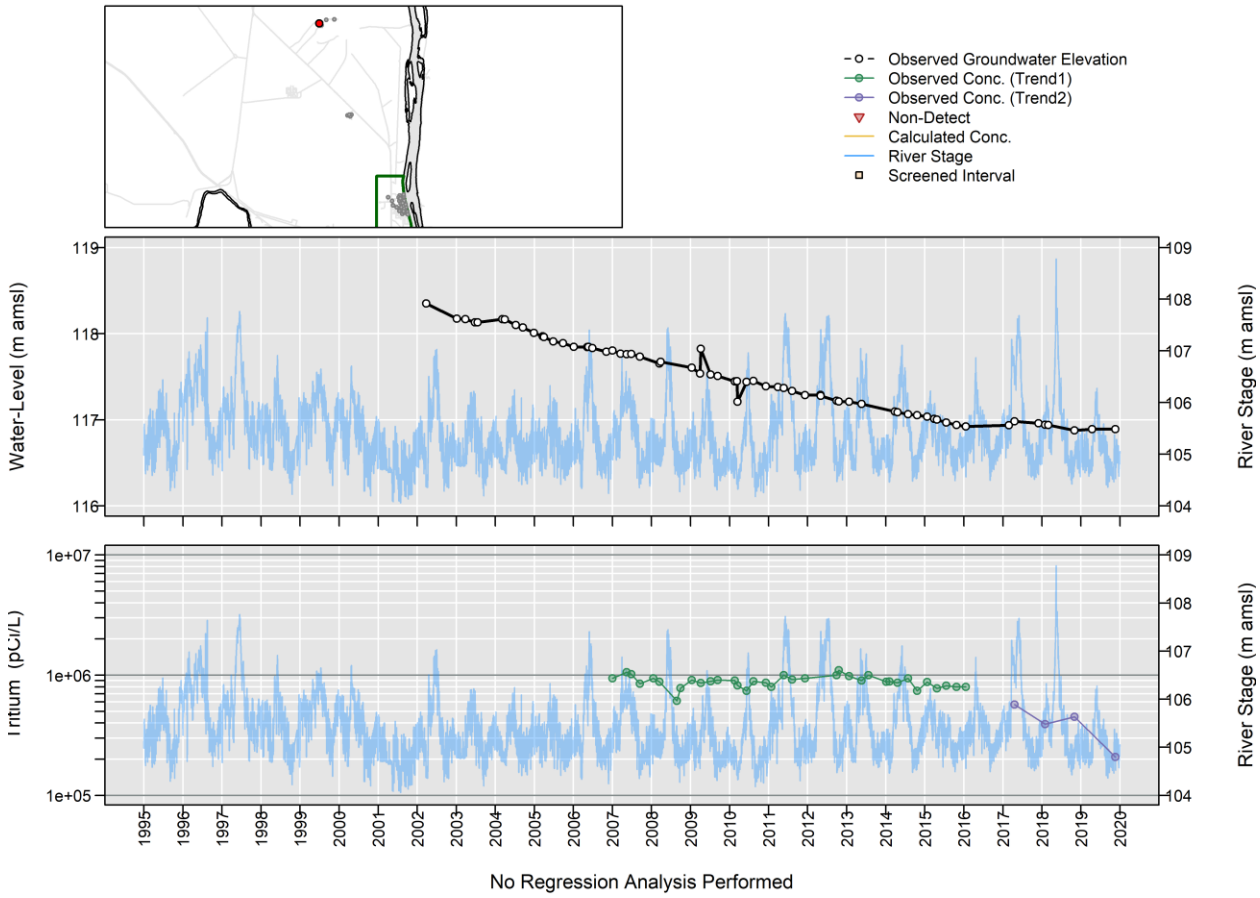
	WL	Trend1	Trend2
Est. Lag Time (days):	15	No Covariate	No RS
Significance of Trend (p-value):	0	< 0.05	NA
Significance of Date (p-value):	0.96	2.5e-86	NA
Number of Observations:	70	34	4
Percent NDs:		0%	0%



699-13-3A

Distance to River: 5630 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	6	No Covariate	No RS
Significance of Trend (p-value):	0	0.47	NA
Significance of Date (p-value):	0.98	0.47	NA
Number of Observations:	65	36	4
Percent NDs:		0%	0%

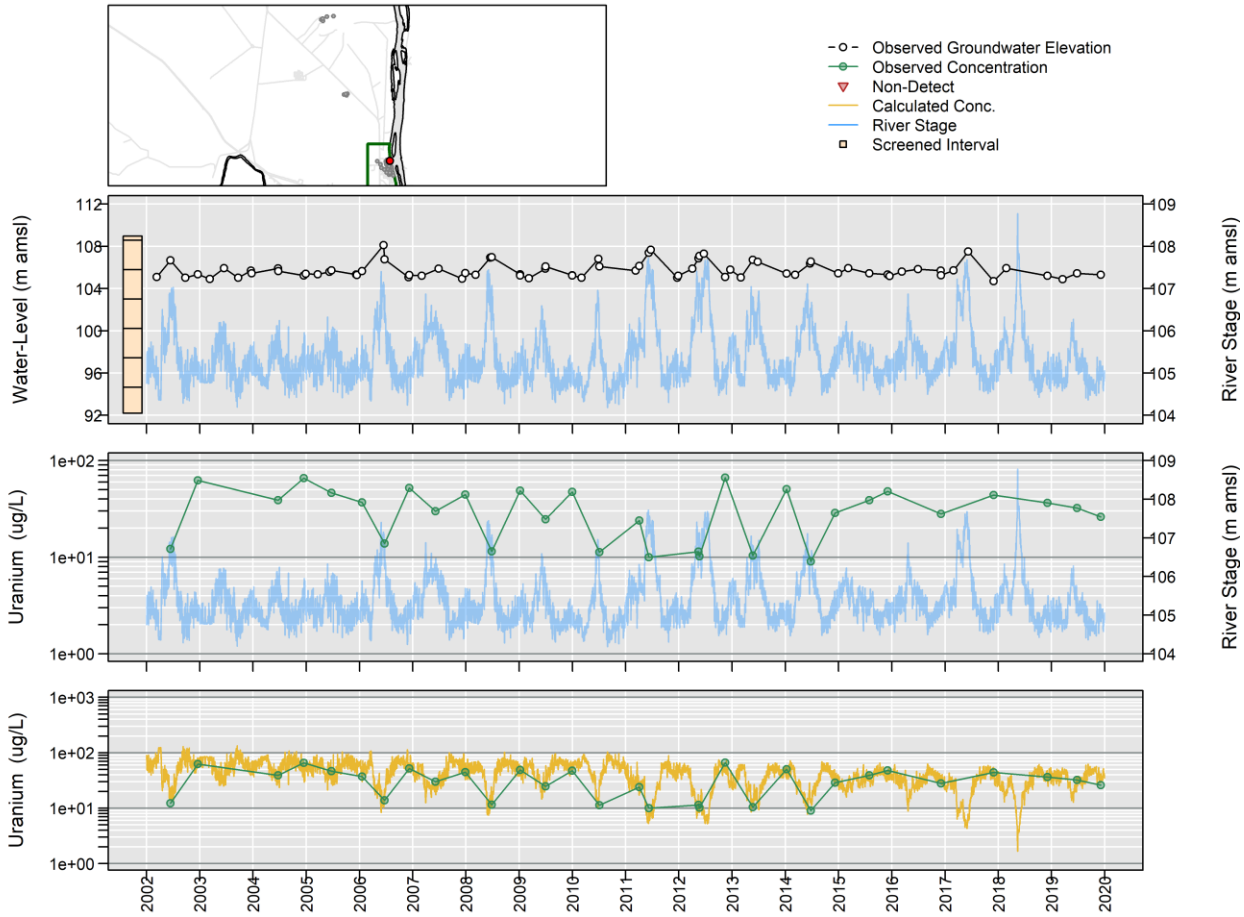


Uranium

399-1-1

Distance to River: 76 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	6.1e-11
Significance of River Stage (p-value):	3.6e-47	1.1e-25
Significance of Date (p-value):	0.59	0.00064
Number of Observations:	76	31
Percent NDs:		0%



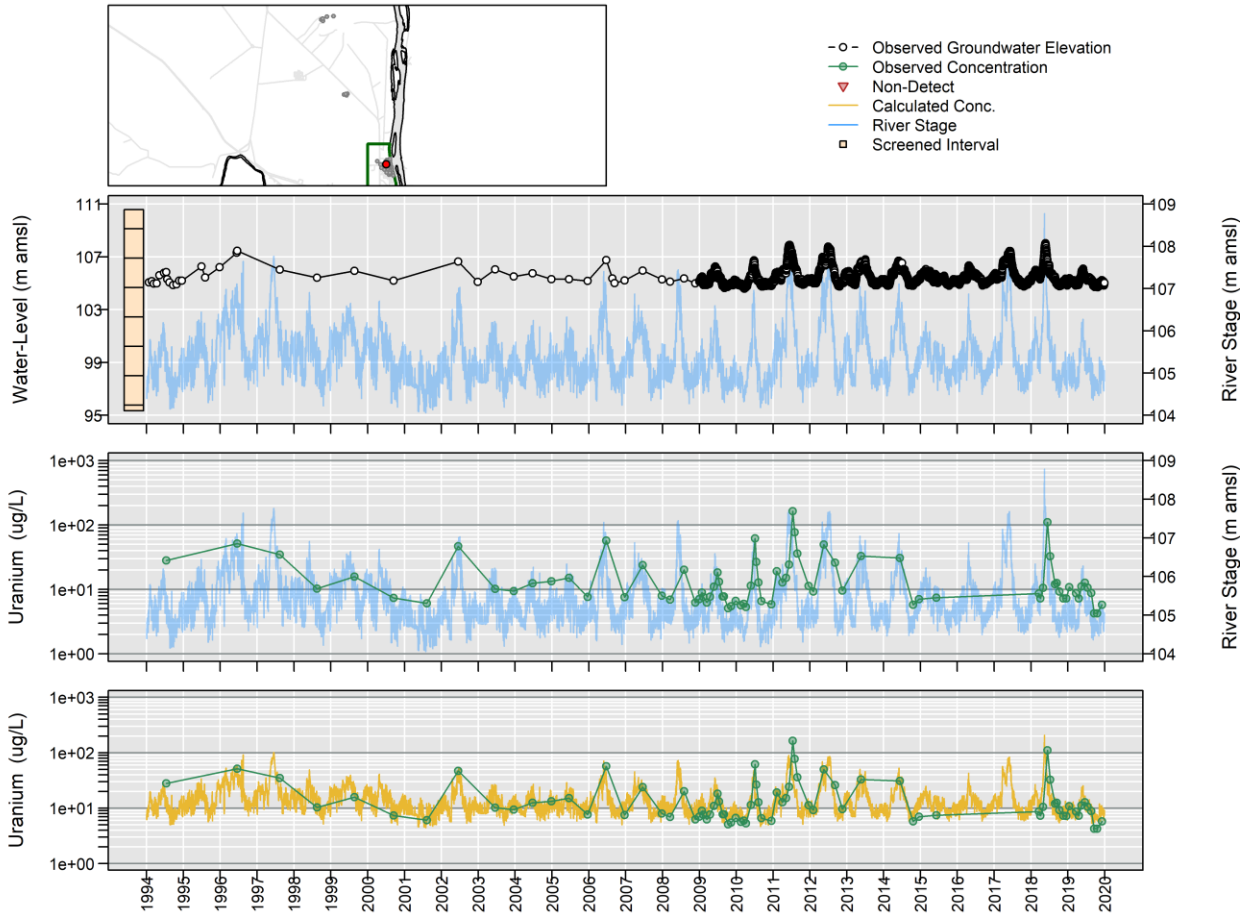
Censored Regression (Tobit) Model

ln Conc. = -0.83 (+/- 0.08)*River Stage + -0.00011 (+/- 0.000031)*Date + 93 (+/- 8.5)

399-1-2

Distance to River: 386 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	1.1e-13
Significance of River Stage (p-value):	0	7.4e-20
Significance of Date (p-value):	2.7e-05	0.53
Number of Observations:	4042	80
Percent NDs:		0%



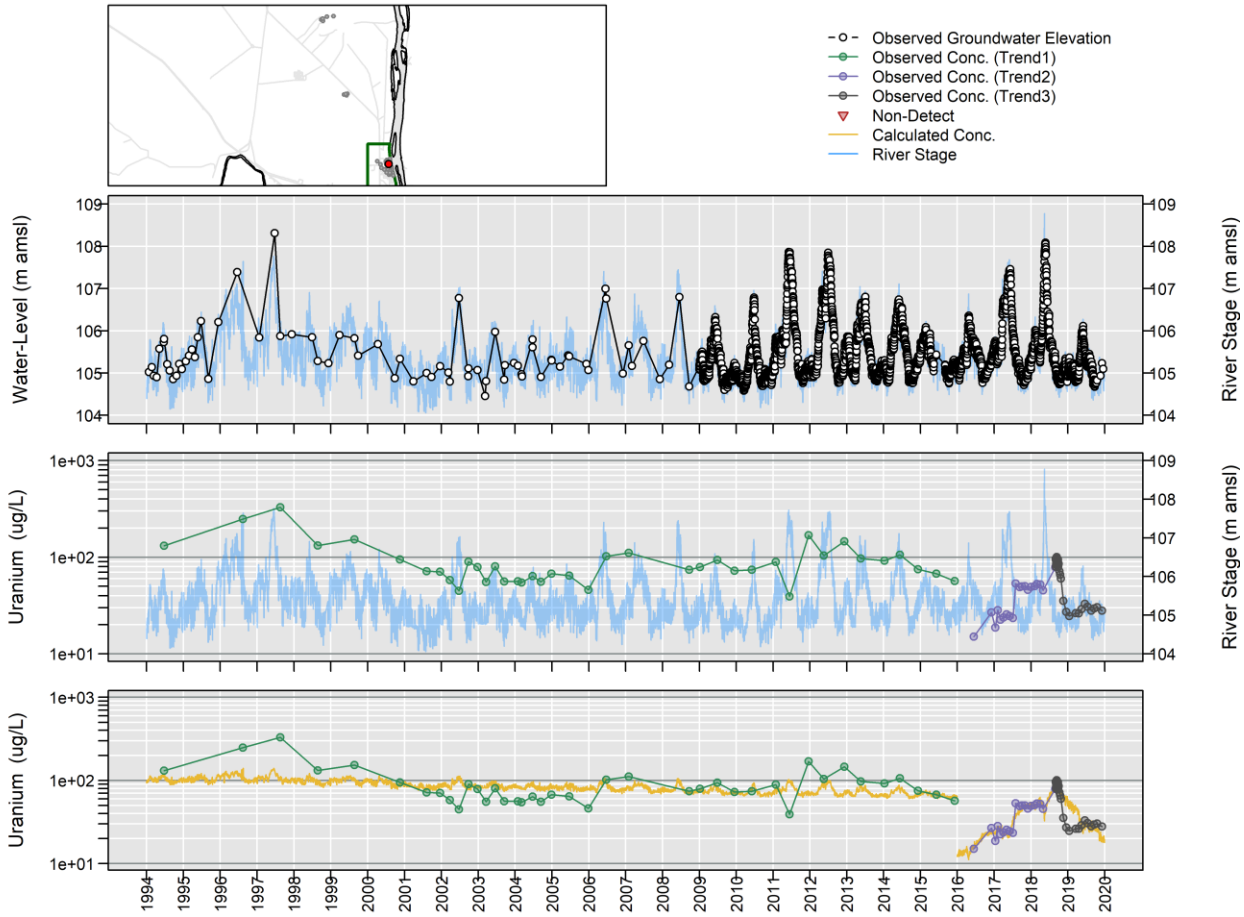
Censored Regression (Tobit) Model

Trend Not Significant

399-1-7

Distance to River: 209 m
Number of Trends Calculated: 3

	WL	Trend1	Trend2	Trend3
Est. Lag Time (days):	1	1	1	1
Significance of Trend (p-value):	0	0.1	8.4e-11	5e-13
Significance of River Stage (p-value):	0	0.13	6e-06	0.047
Significance of Date (p-value):	0.018	0.071	8.9e-34	7.3e-19
Number of Observations:	3890	40	20	40
Percent NDs:		0%	0%	0%



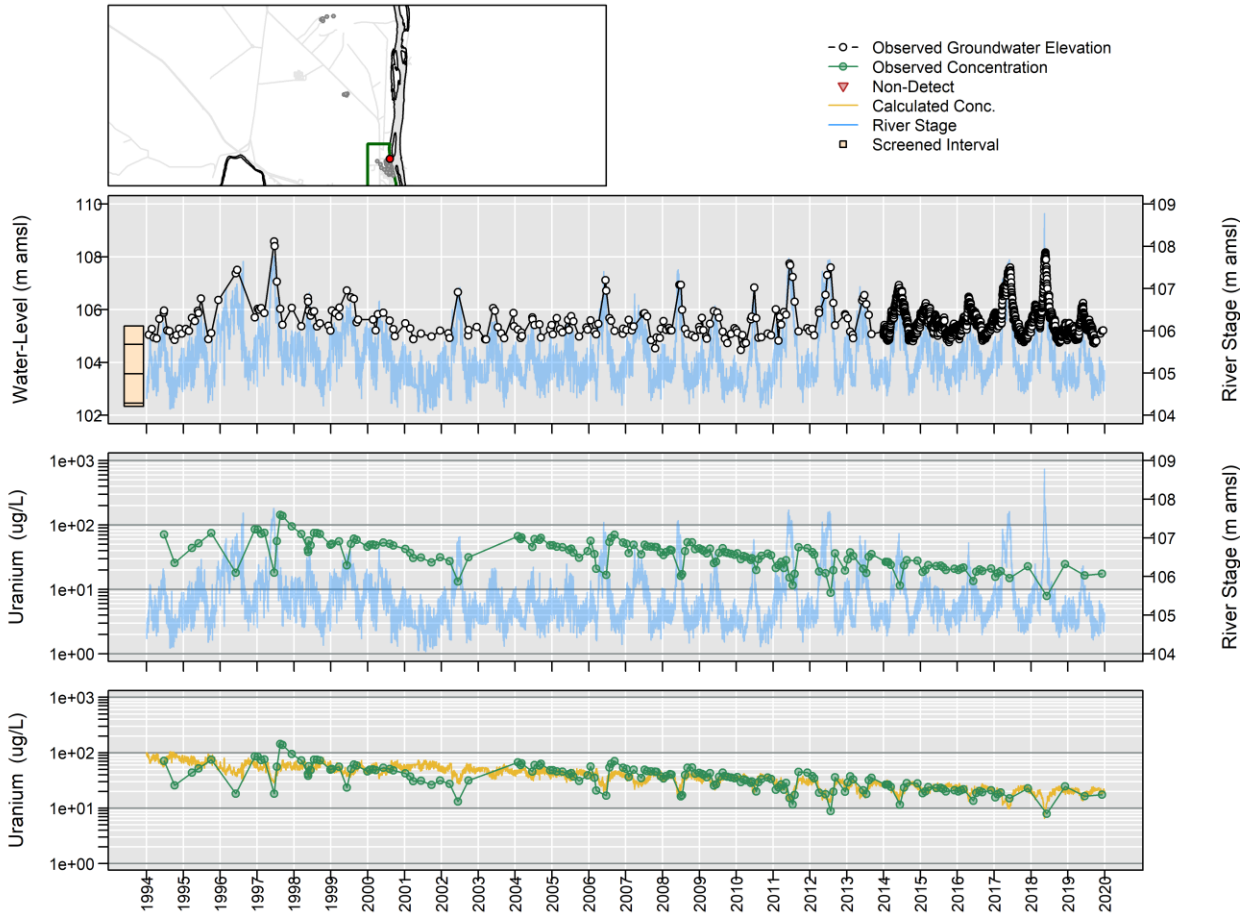
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = -0.2 (+/- 0.043)*River Stage + 0.0019 (+/- 0.00016)*Date + -9.1 (+/- 5.6)
Trend3:
ln Conc. = -0.32 (+/- 0.16)*River Stage + -0.003 (+/- 0.00034)*Date + 92 (+/- 15)

399-1-10A

Distance to River: 70 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	< 0.05
Significance of River Stage (p-value):	0	1.2e-16
Significance of Date (p-value):	0.0015	2.3e-49
Number of Observations:	2304	172
Percent NDs:		0%



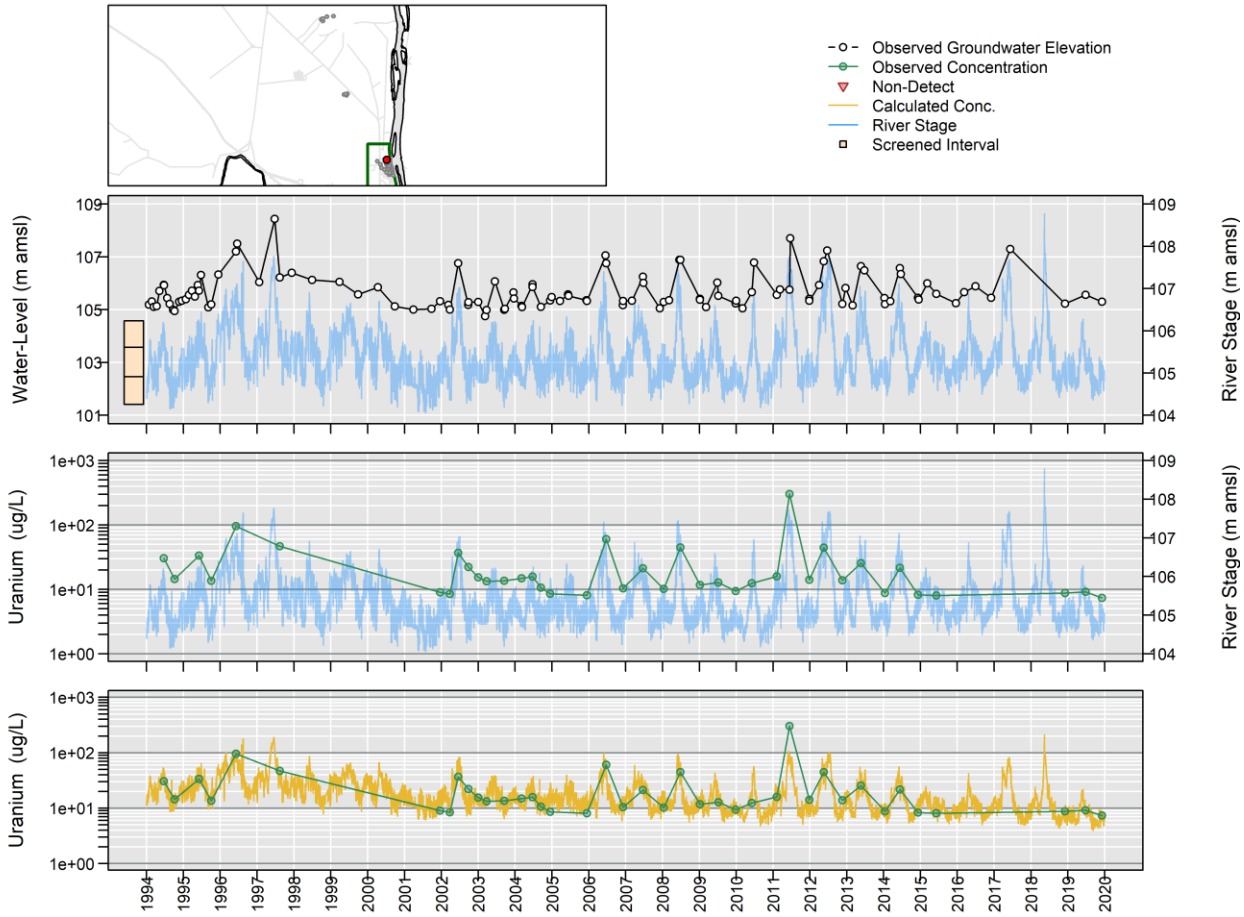
Censored Regression (Tobit) Model

ln Conc. = -0.32 (+/- 0.038)*River Stage + -0.00015 (+/- 0.00001)*Date + 39 (+/- 4)

399-1-11

Distance to River: 314 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0	1.6e-13
Significance of River Stage (p-value):	1.1e-50	3.6e-28
Significance of Date (p-value):	0.089	9.2e-06
Number of Observations:	116	40
Percent NDs:		0%



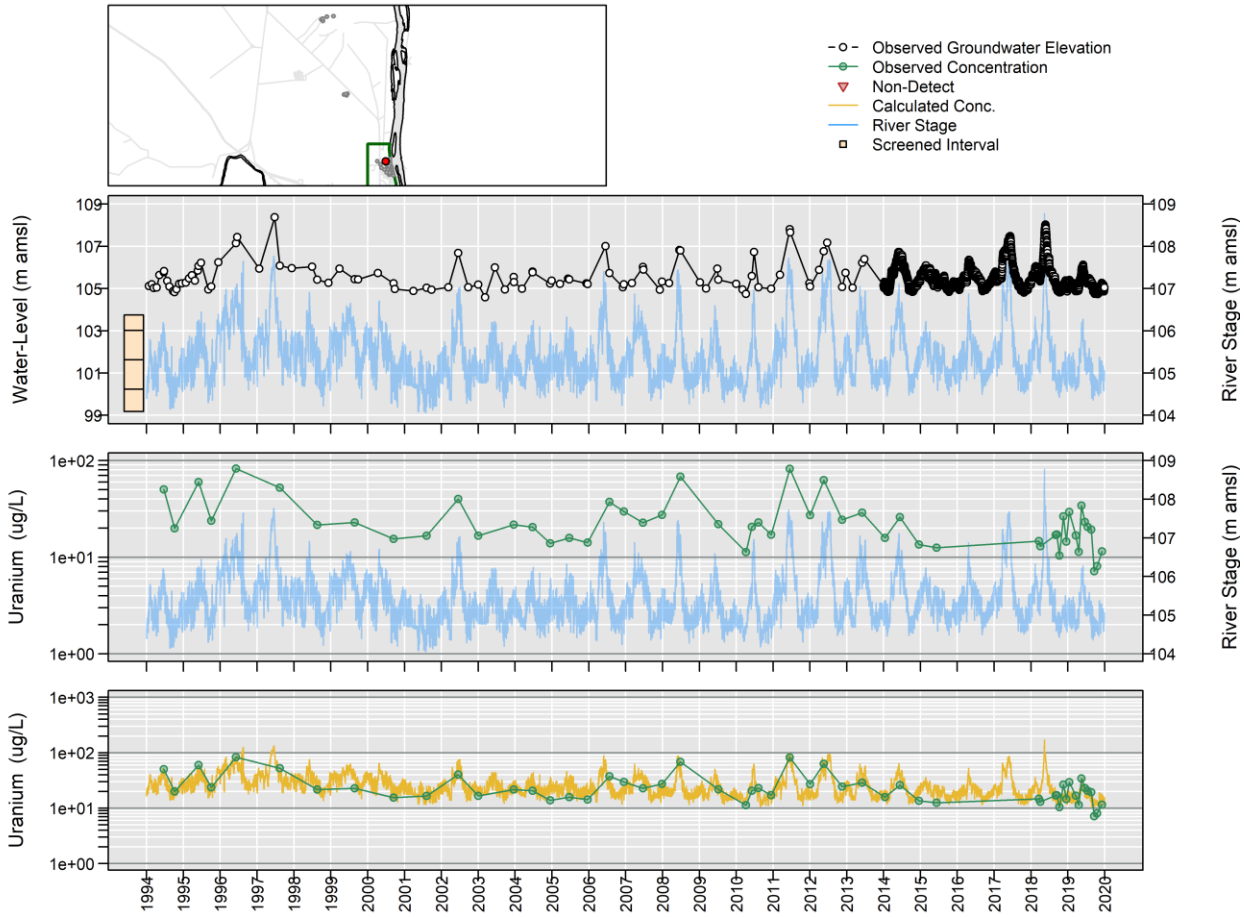
Censored Regression (Tobit) Model

ln Conc. = 0.88 (+/- 0.08)*River Stage + -0.00011 (+/- 0.000024)*Date + -89 (+/- 8.5)

399-1-12

Distance to River: 398 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	2	2
Significance of Trend (p-value):	0	9.9e-14
Significance of River Stage (p-value):	0	5.3e-19
Significance of Date (p-value):	0.16	0.00064
Number of Observations:	2288	53
Percent NDs:		0%



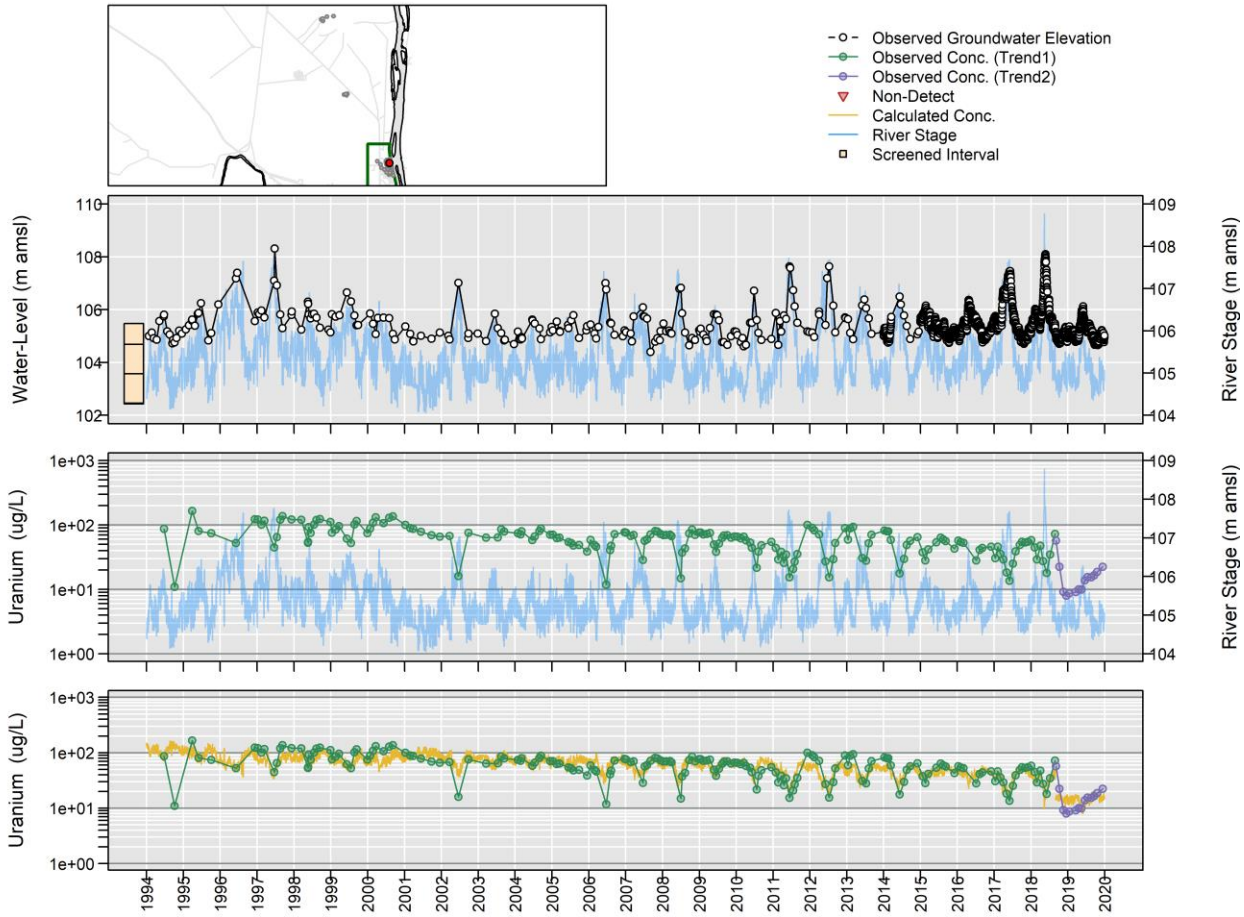
Censored Regression (Tobit) Model

ln Conc. = 0.63 (+/- 0.071)*River Stage + -0.000051 (+/- 0.000015)*Date + -63 (+/- 7.6)

399-1-16A

Distance to River: 141 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	1	1	1
Significance of Trend (p-value):	0	< 0.05	0.45
Significance of River Stage (p-value):	0	1.1e-21	0.2
Significance of Date (p-value):	0.033	8e-23	0.87
Number of Observations:	2116	187	14
Percent NDs:		0%	0%



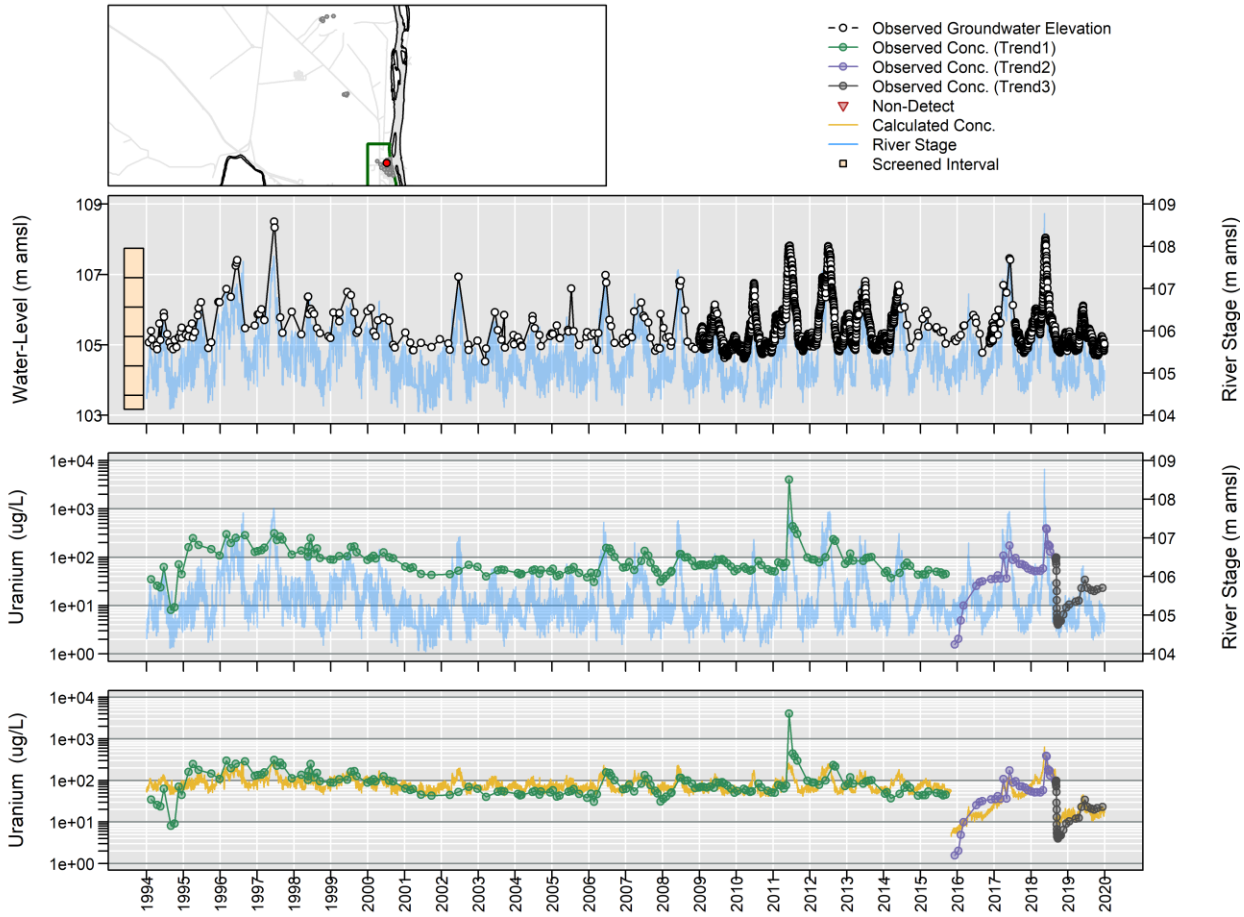
Censored Regression (Tobit) Model

Trend1:
ln Conc. = -0.4 (+/- 0.042)*River Stage + -0.00011 (+/- 0.000011)*Date + 48 (+/- 4.5)
Trend2:
Trend Not Significant

399-1-17A

Distance to River: 344 m
Number of Trends Calculated: 3

	WL	Trend1	Trend2	Trend3
Est. Lag Time (days):	1	1	1	1
Significance of Trend (p-value):	0	4.1e-11	4.8e-11	0.29
Significance of River Stage (p-value):	0	7.1e-13	0.0012	0.26
Significance of Date (p-value):	9.8e-05	0.16	7.1e-18	0.55
Number of Observations:	3037	166	32	40
Percent NDs:		0%	0%	0%



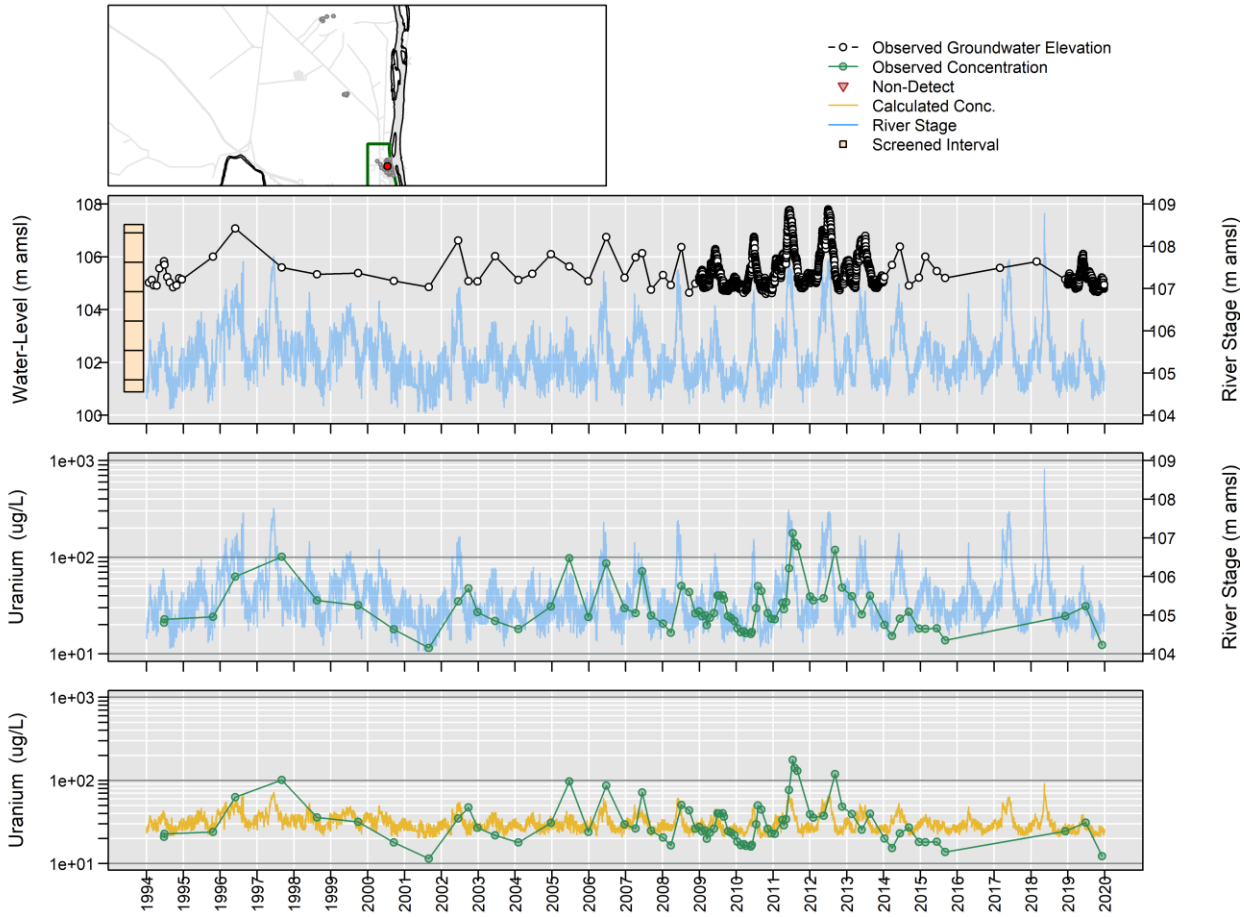
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.5 (+/- 0.15)*River Stage + 0.0031 (+/- 0.00036)*Date + -100 (+/- 16)
Trend3:
Trend Not Significant

399-1-21A

Distance to River: 340 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.0013
Significance of River Stage (p-value):	0	2e-04
Significance of Date (p-value):	0.0044	0.66
Number of Observations:	2216	78
Percent NDs:		0%



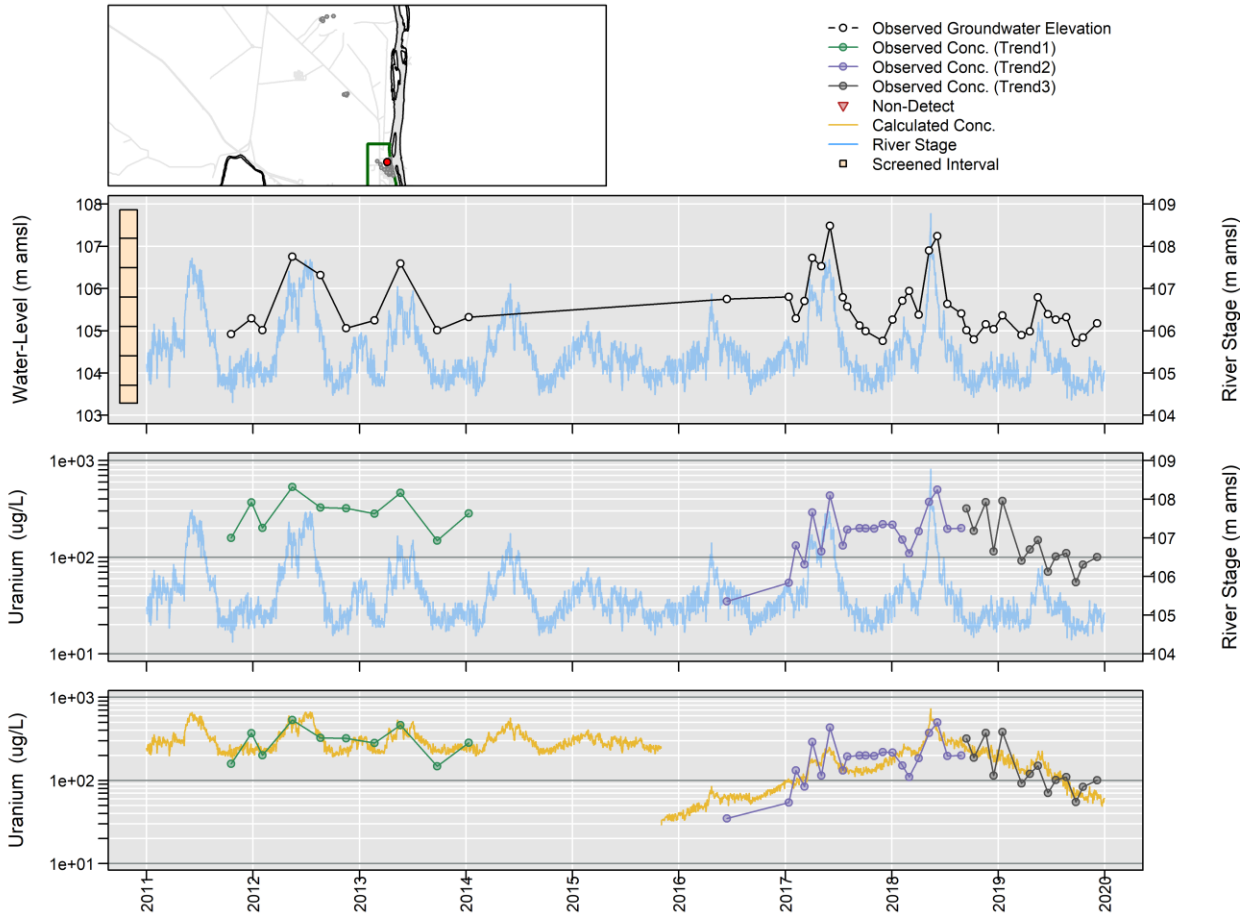
Censored Regression (Tobit) Model

Trend Not Significant

399-1-55

Distance to River: 295 m
Number of Trends Calculated: 3

	WL	Trend1	Trend2	Trend3
Est. Lag Time (days):	3	3	3	3
Significance of Trend (p-value):	0	0.0095	0.00015	0.00088
Significance of River Stage (p-value):	4.4e-27	8.8e-05	0.0027	0.09
Significance of Date (p-value):	0.51	0.81	3.4e-06	2.6e-06
Number of Observations:	44	10	21	14
Percent NDs:		0%	0%	0%



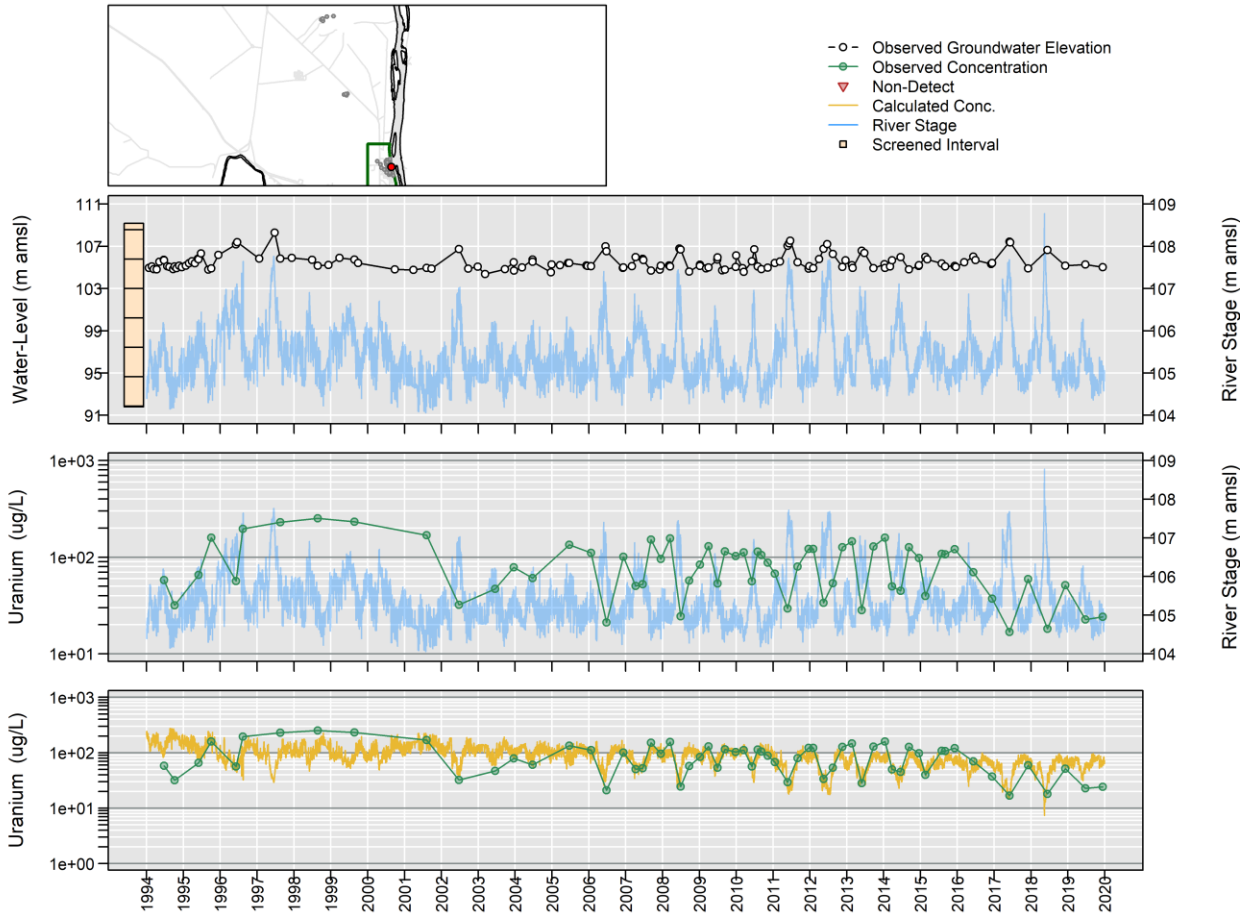
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.32 (+/- 0.11)*River Stage + 0.002 (+/- 0.00044)*Date + -65 (+/- 14)
Trend3:
ln Conc. = 0.51 (+/- 0.3)*River Stage + -0.0032 (+/- 0.00068)*Date + 9.6 (+/- 33)

399-2-1

Distance to River: 57 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	3.4e-10
Significance of River Stage (p-value):	9.4e-69	1.1e-12
Significance of Date (p-value):	0.82	4.4e-05
Number of Observations:	137	63
Percent NDs:		0%



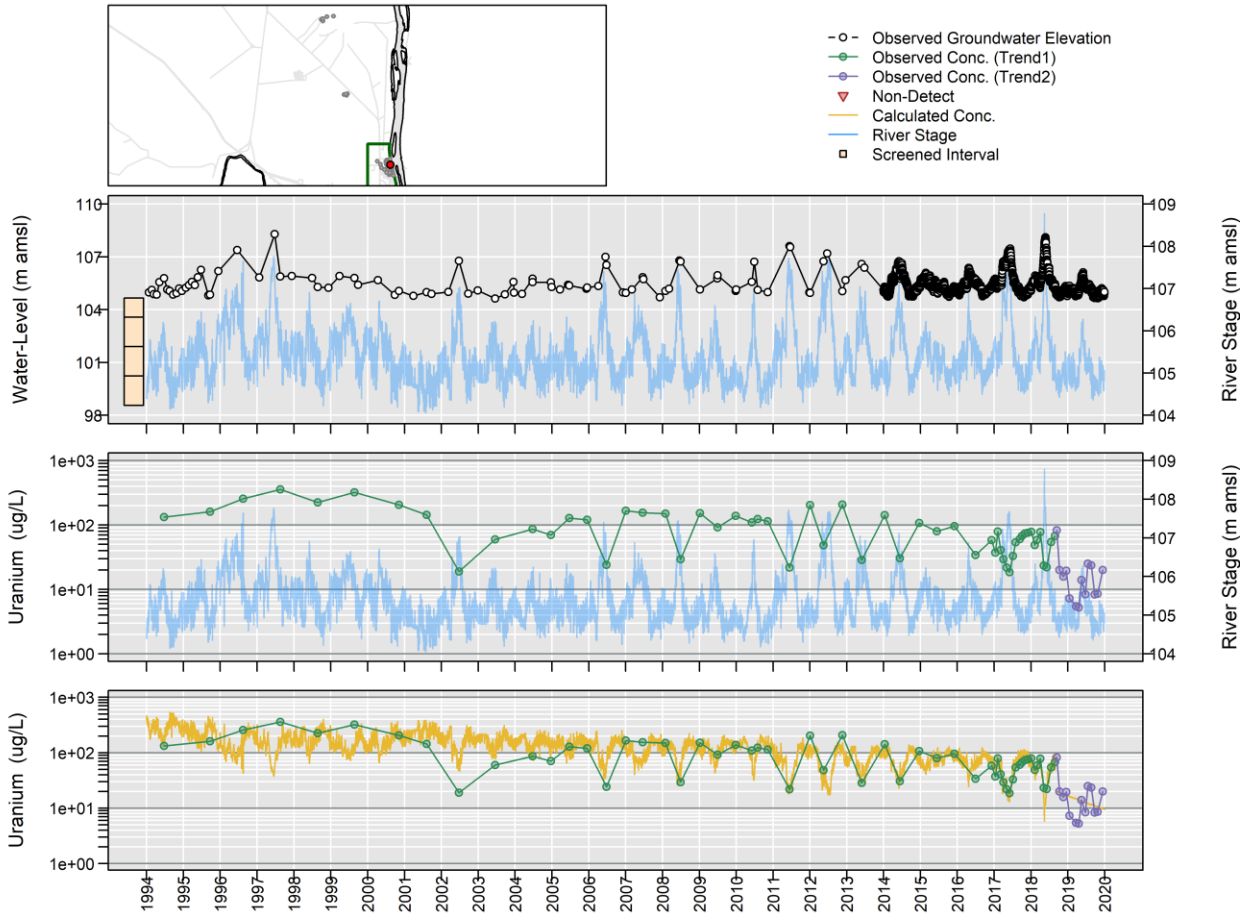
Censored Regression (Tobit) Model

ln Conc. = -0.59 (+/- 0.084)*River Stage + -0.0001 (+/- 0.000025)*Date + 68 (+/- 8.9)

399-2-2

Distance to River: 98 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	1	1	1
Significance of Trend (p-value):	0	1.1e-16	0.5
Significance of River Stage (p-value):	0	2.3e-20	0.92
Significance of Date (p-value):	0.36	3.7e-13	0.24
Number of Observations:	2231	57	14
Percent NDs:		0%	0%



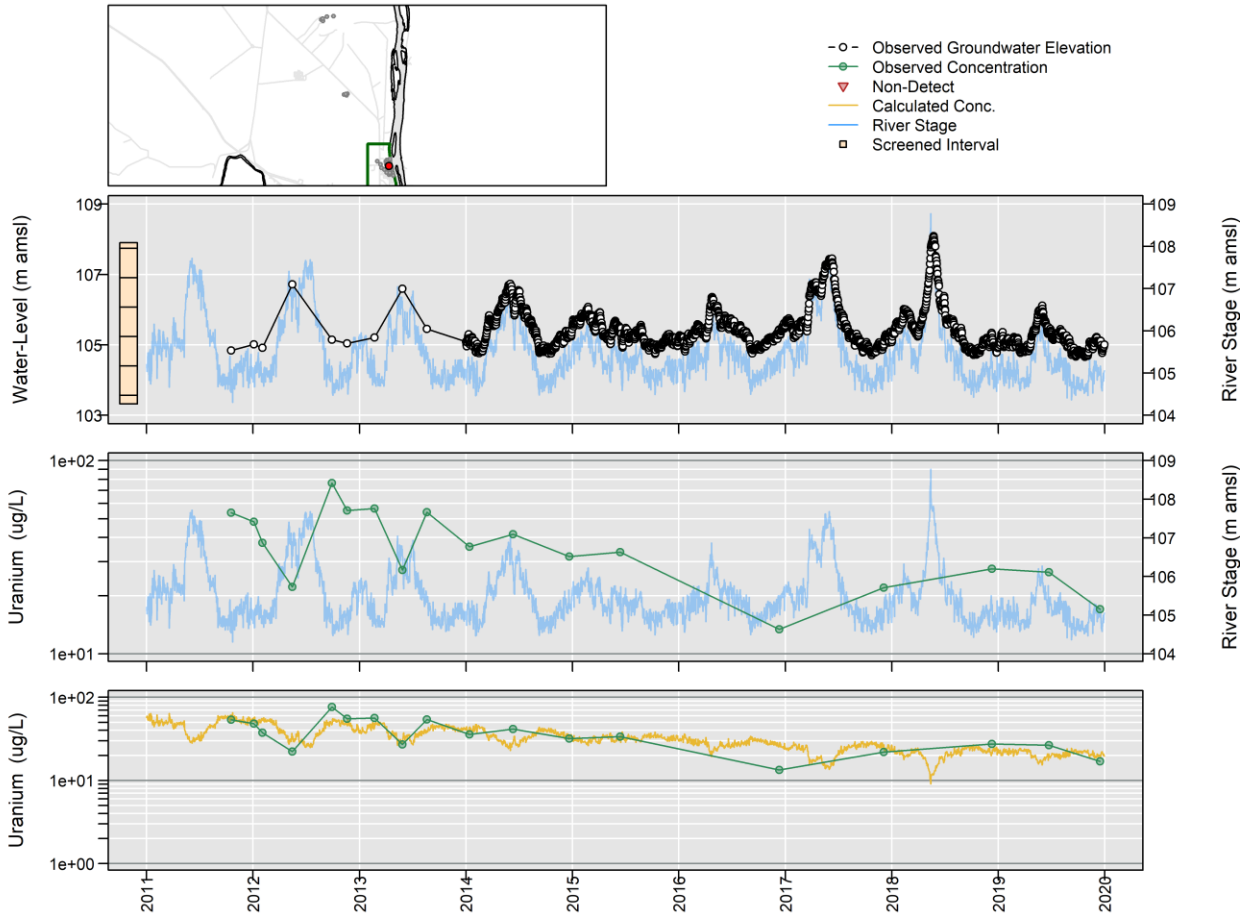
Censored Regression (Tobit) Model

Trend1:
ln Conc. = -0.69 (+/- 0.075)*River Stage + -0.00015 (+/- 0.000021)*Date + 80 (+/- 7.9)
Trend2:
Trend Not Significant

399-2-32

Distance to River: 217 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.00049
Significance of River Stage (p-value):	0	0.026
Significance of Date (p-value):	0.24	3.5e-06
Number of Observations:	2200	18
Percent NDs:		0%



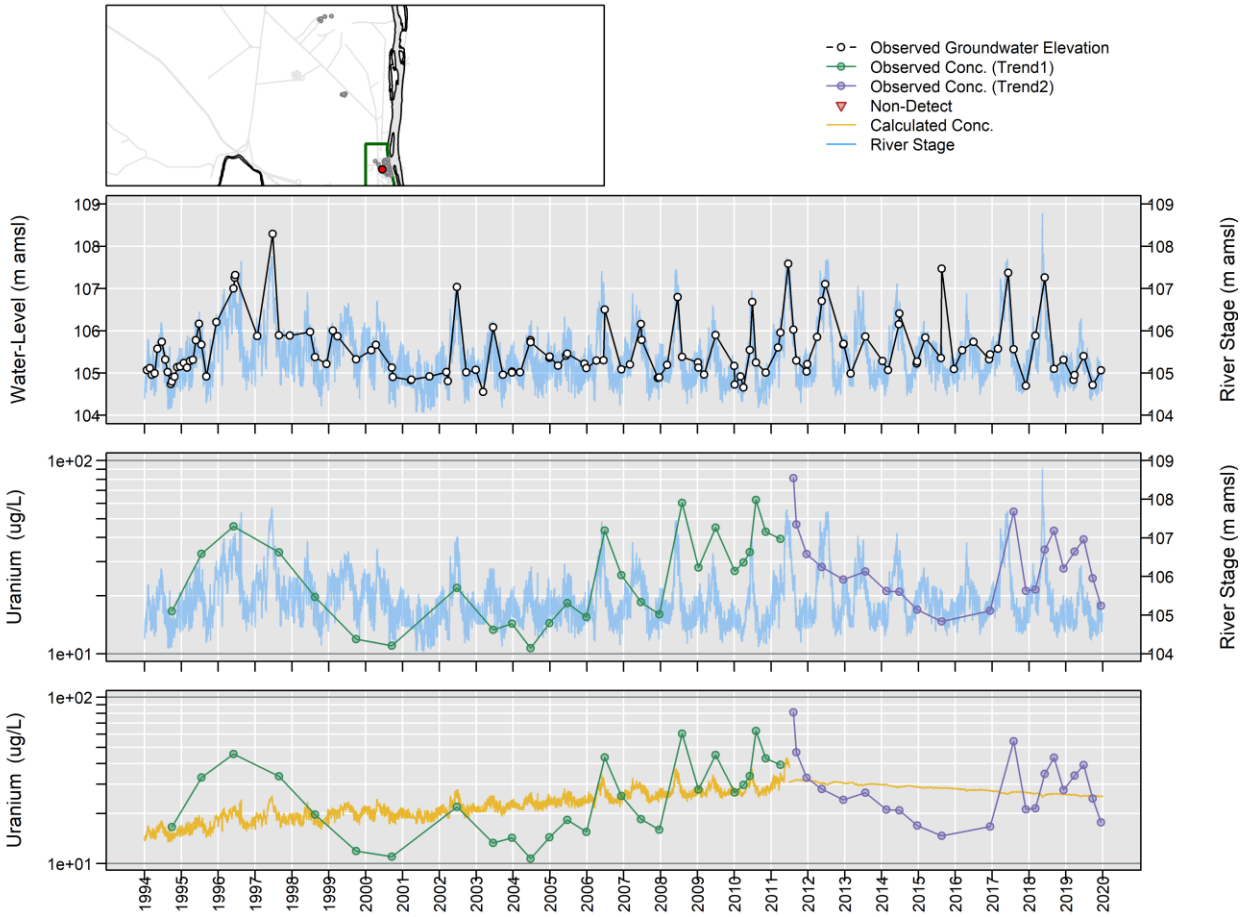
Censored Regression (Tobit) Model

ln Conc. = -0.26 (+/- 0.12)*River Stage + -0.00034 (+/- 0.000073)*Date + 36 (+/- 13)

399-3-6

Distance to River: 623 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	1	1	1
Significance of Trend (p-value):	0	0.11	0.7
Significance of River Stage (p-value):	7.9e-44	0.31	0.92
Significance of Date (p-value):	0.99	0.039	0.39
Number of Observations:	127	27	21
Percent NDs:		0%	0%



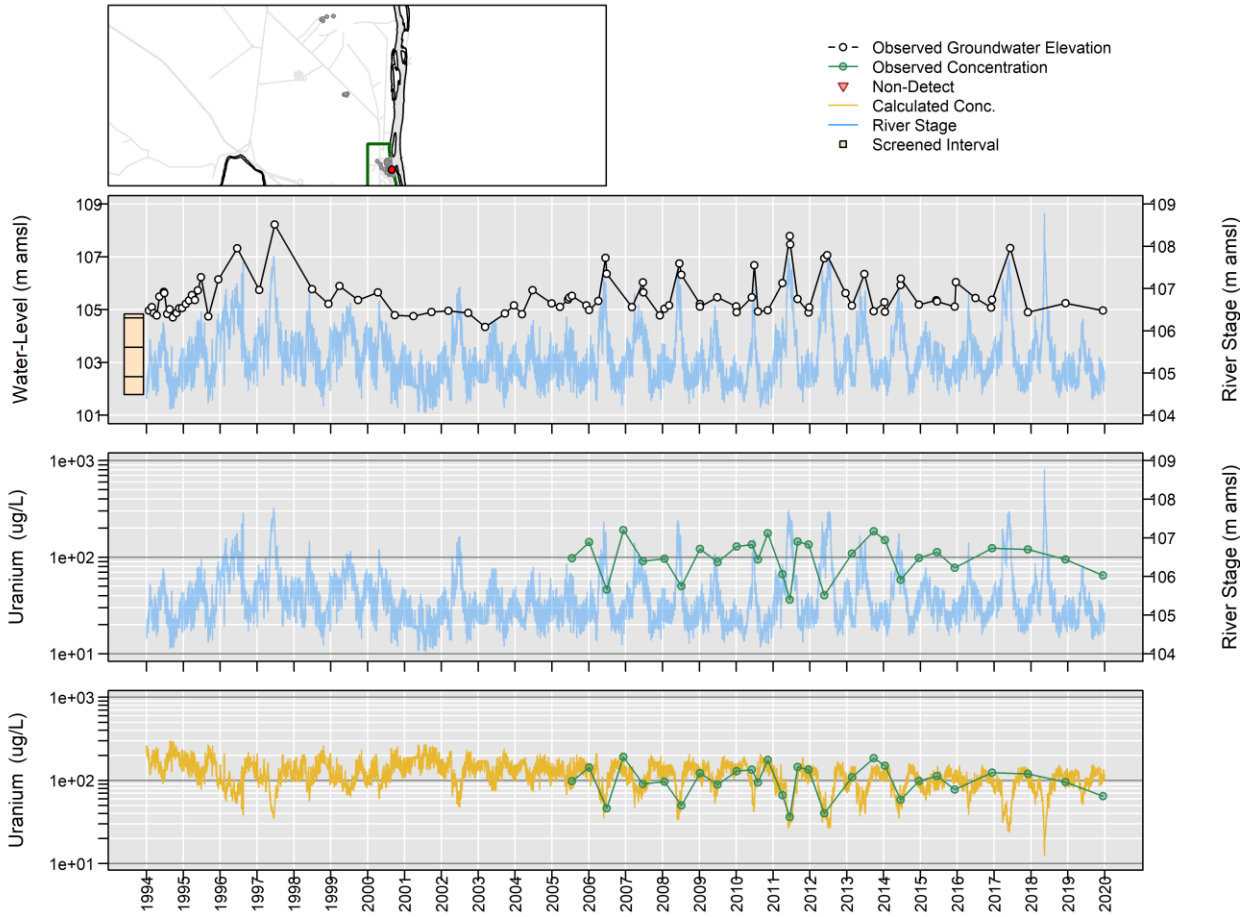
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

399-3-9

Distance to River: 68 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0	4.2e-09
Significance of River Stage (p-value):	6.4e-49	2.7e-19
Significance of Date (p-value):	0.35	0.054
Number of Observations:	94	29
Percent NDs:		0%



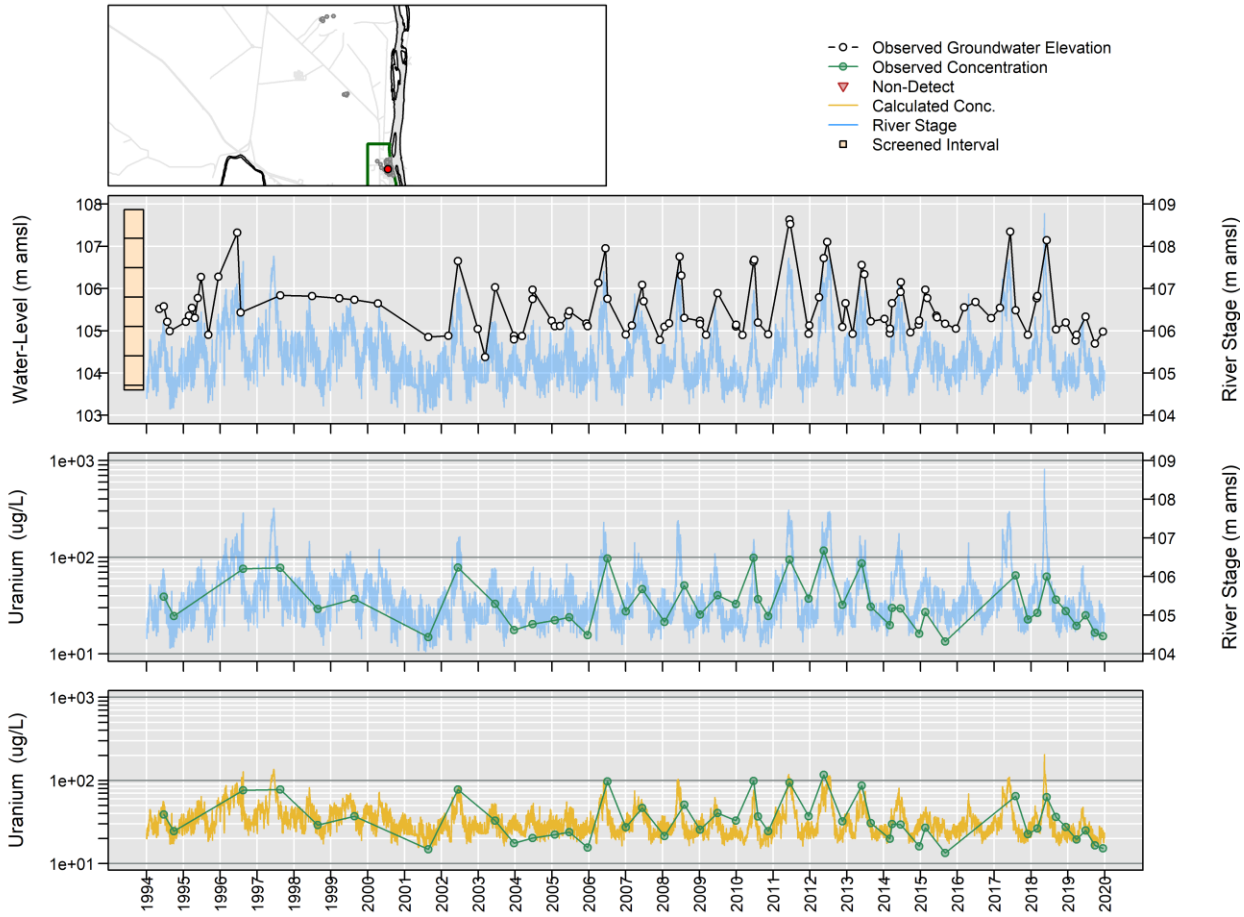
Censored Regression (Tobit) Model

Trend Not Significant

399-3-12

Distance to River: 344 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	9.9e-08
Significance of River Stage (p-value):	3.4e-58	3.8e-11
Significance of Date (p-value):	0.16	0.32
Number of Observations:	106	47
Percent NDs:		0%



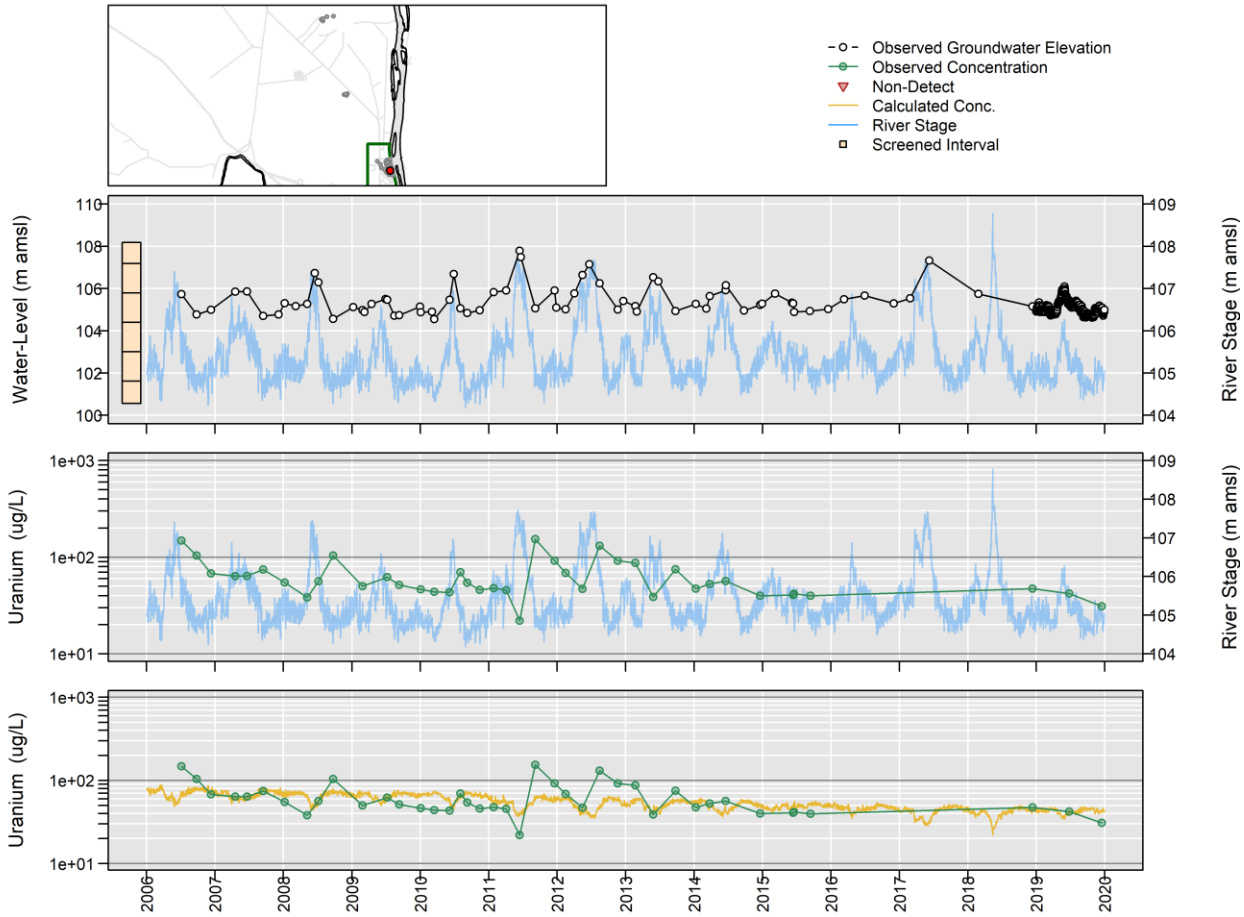
Censored Regression (Tobit) Model

Trend Not Significant

399-3-20

Distance to River: 210 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.0037
Significance of River Stage (p-value):	1.8e-222	0.027
Significance of Date (p-value):	0.00049	0.0079
Number of Observations:	435	41
Percent NDs:		0%



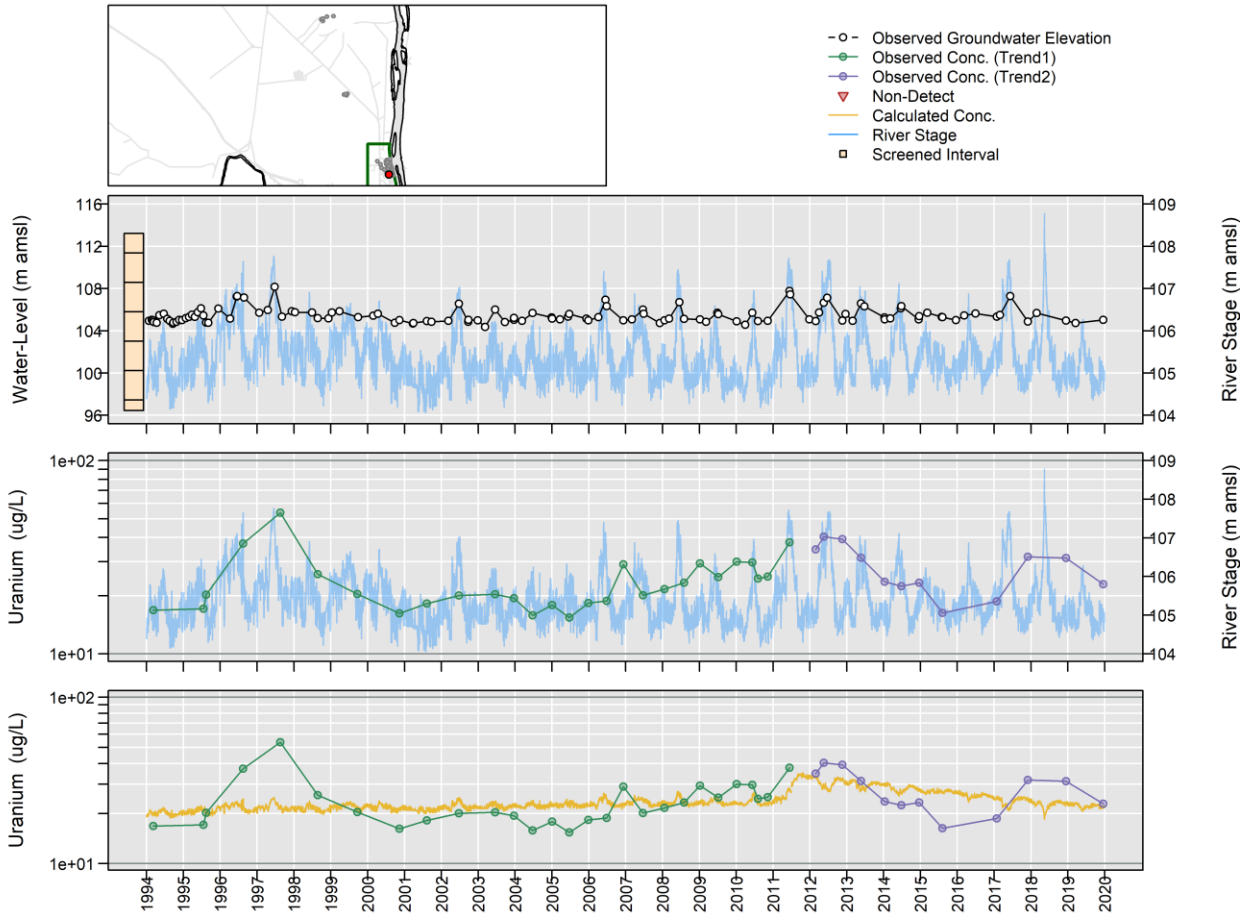
Censored Regression (Tobit) Model

ln Conc. = -0.19 (+/- 0.086)*River Stage + -0.00012 (+/- 0.000045)*Date + 26 (+/- 9.1)

399-4-1

Distance to River: 381 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	1	1	1
Significance of Trend (p-value):	0	0.46	0.3
Significance of River Stage (p-value):	9.2e-57	0.4	0.63
Significance of Date (p-value):	0.48	0.36	0.12
Number of Observations:	121	28	12
Percent NDs:		0%	0%



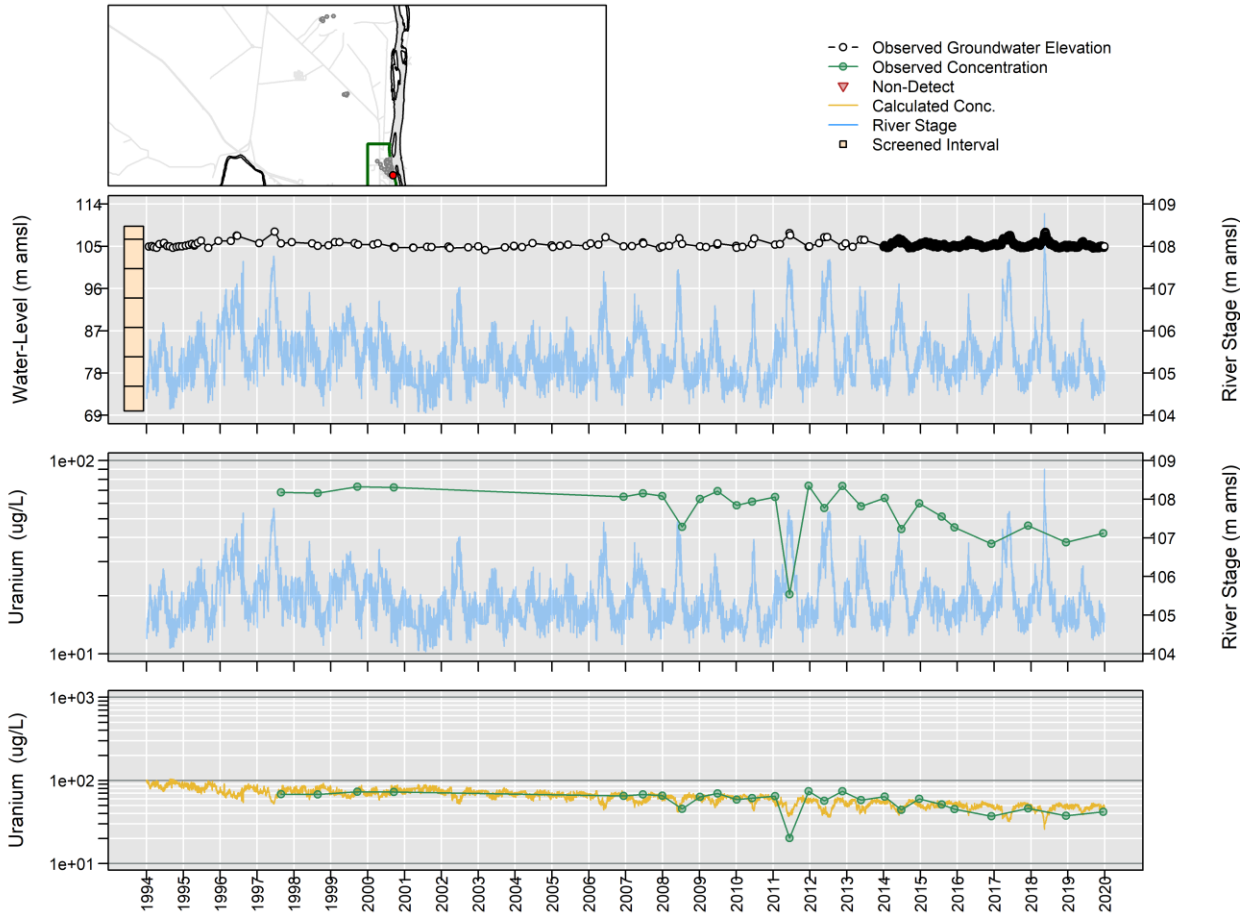
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

399-4-7

Distance to River: 72 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0	0.00036
Significance of River Stage (p-value):	0	0.0032
Significance of Date (p-value):	0.59	3e-04
Number of Observations:	2286	27
Percent NDs:		0%



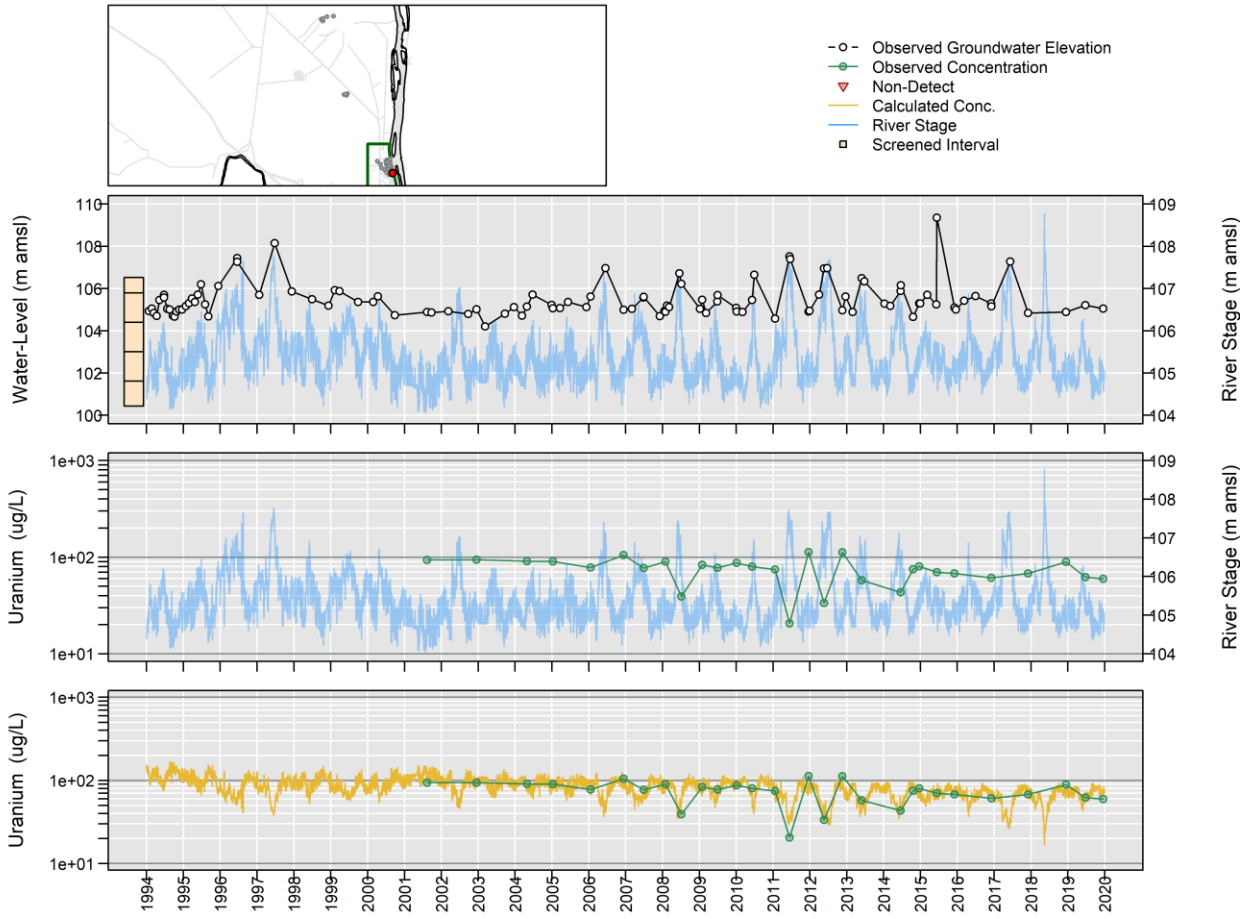
Censored Regression (Tobit) Model

ln Conc. = -0.17 (+/- 0.058)*River Stage + -0.000069 (+/- 0.000019)*Date + 23 (+/- 6.2)

399-4-10

Distance to River: 69 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	6.8e-08
Significance of River Stage (p-value):	8.1e-30	1.4e-13
Significance of Date (p-value):	0.8	0.011
Number of Observations:	110	29
Percent NDs:		0%



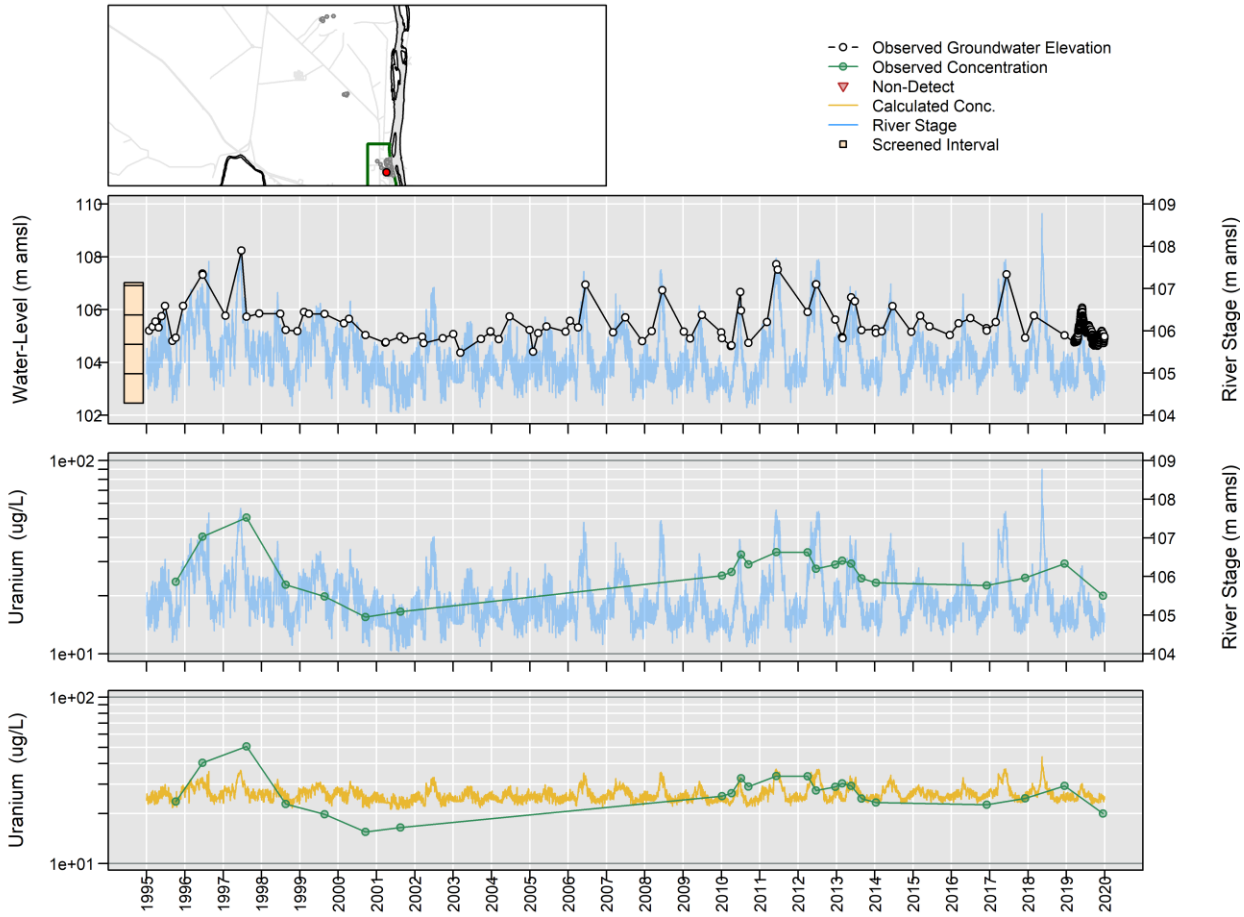
Censored Regression (Tobit) Model

ln Conc. = -0.39 (+/- 0.053)*River Stage + -0.000055 (+/- 0.000021)*Date + 46 (+/- 5.6)

399-4-11

Distance to River: 522 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.047
Significance of River Stage (p-value):	1.1e-206	0.0082
Significance of Date (p-value):	0.17	0.8
Number of Observations:	378	23
Percent NDs:		0%



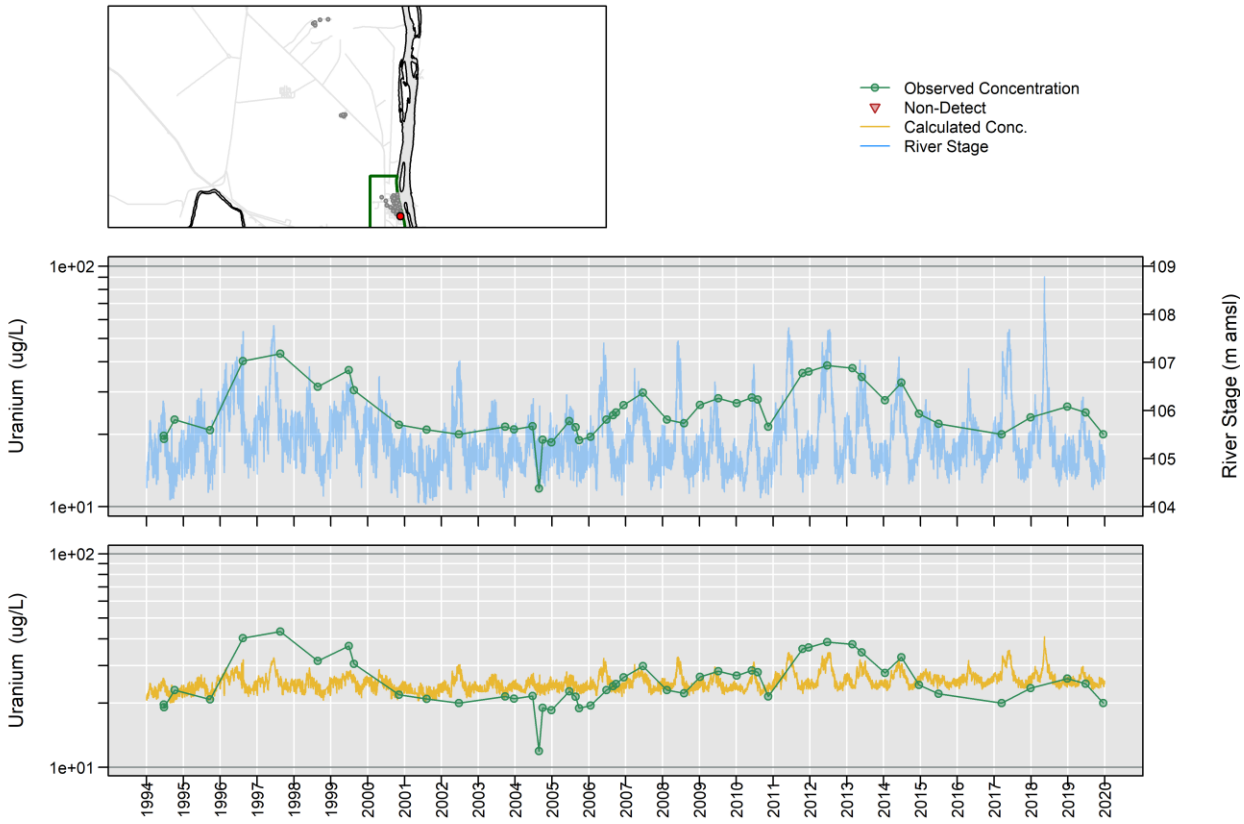
Censored Regression (Tobit) Model

Trend Not Significant

399-4-12

Distance to River: 153 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.066
Significance of River Stage (p-value):	0.023
Significance of Date (p-value):	0.35
Number of Observations:	49
Percent NDs:	0%



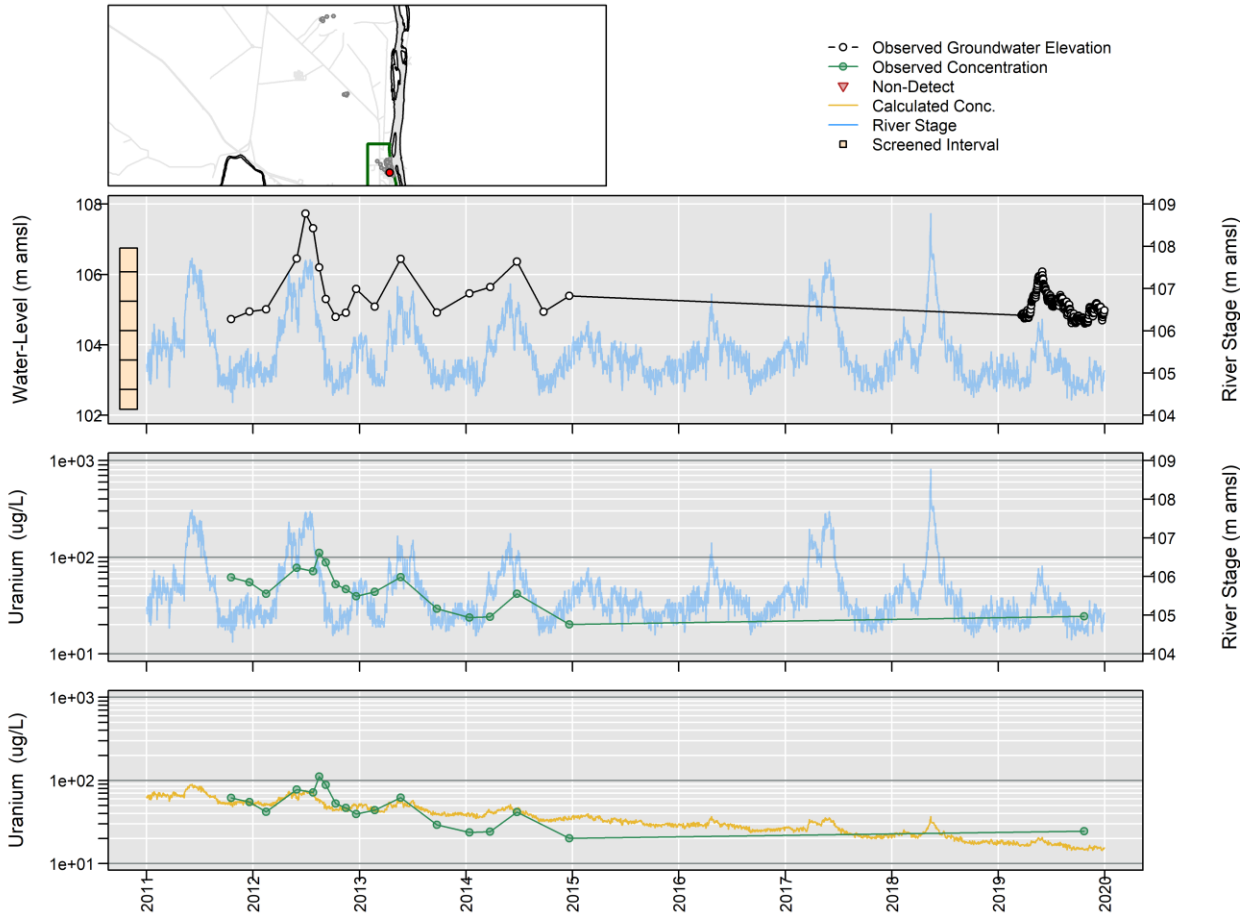
Censored Regression (Tobit) Model

Trend Not Significant

399-4-15

Distance to River: 278 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0	0.0055
Significance of River Stage (p-value):	3.6e-184	0.14
Significance of Date (p-value):	0.00042	0.0014
Number of Observations:	304	18
Percent NDs:		0%



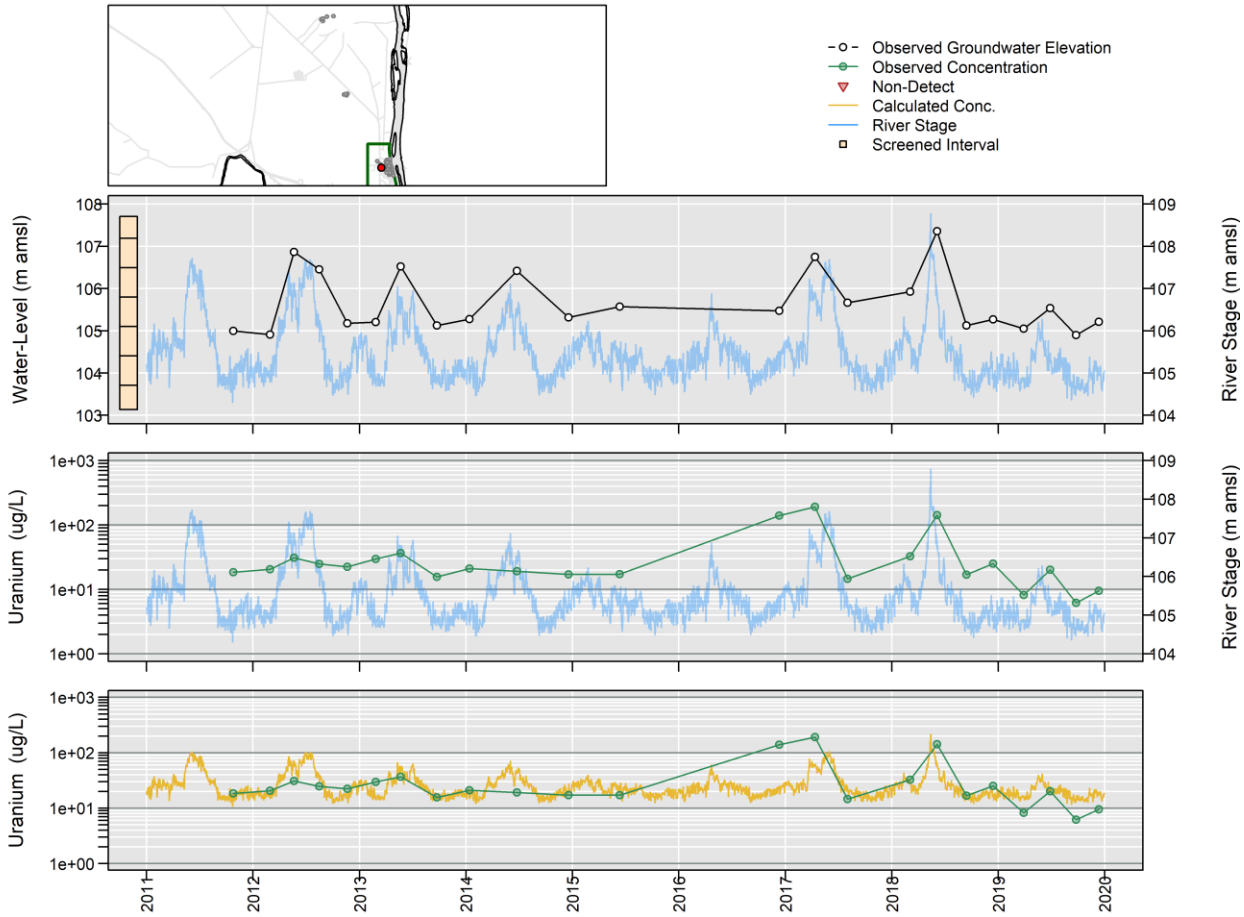
Censored Regression (Tobit) Model

ln Conc. = 0.16 (+/- 0.11)*River Stage + -0.00042 (+/- 0.00013)*Date + -6.9 (+/- 12)

399-6-3

Distance to River: 819 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	3	3
Significance of Trend (p-value):	6.7e-16	0.0021
Significance of River Stage (p-value):	1.2e-14	5.9e-05
Significance of Date (p-value):	0.26	0.92
Number of Observations:	23	23
Percent NDs:		0%



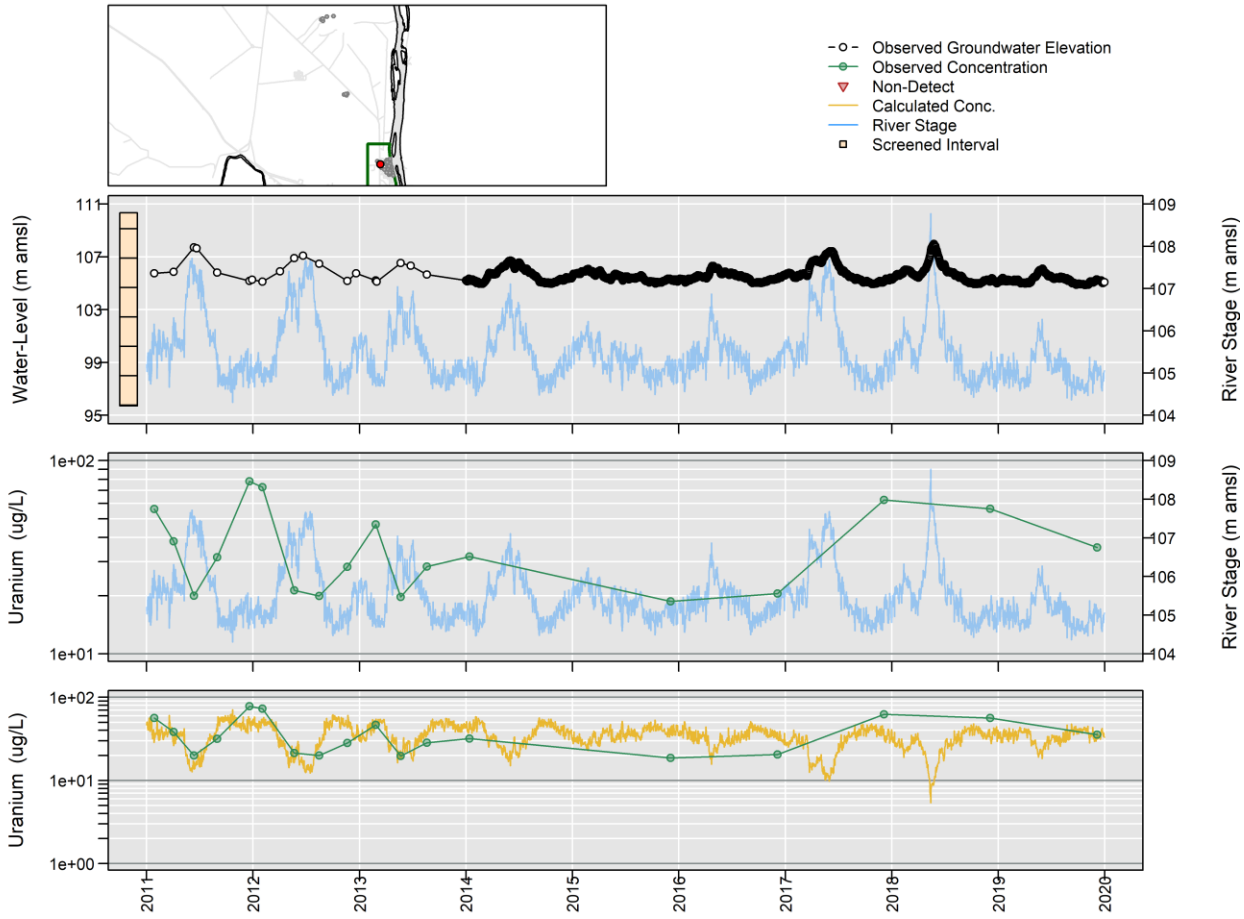
Censored Regression (Tobit) Model

Trend Not Significant

399-8-1

Distance to River: 832 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	3	3
Significance of Trend (p-value):	0	0.0018
Significance of River Stage (p-value):	0	1.9e-05
Significance of Date (p-value):	0.11	0.15
Number of Observations:	2210	18
Percent NDs:		0%



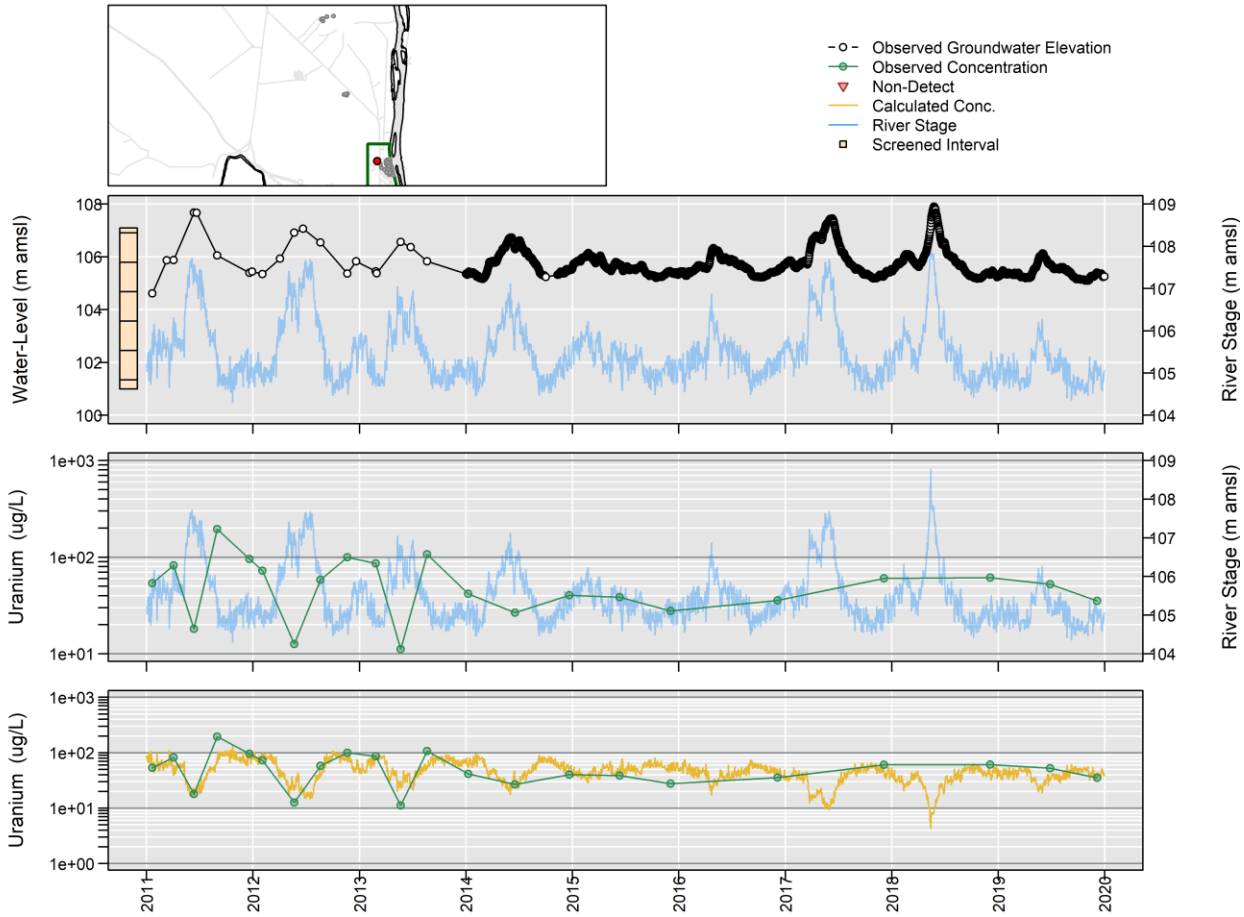
Censored Regression (Tobit) Model

Trend Not Significant

399-8-5A

Distance to River: 1046 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	7	7
Significance of Trend (p-value):	0	0.0025
Significance of River Stage (p-value):	0	9.3e-05
Significance of Date (p-value):	0.0011	0.036
Number of Observations:	2172	22
Percent NDs:		0%



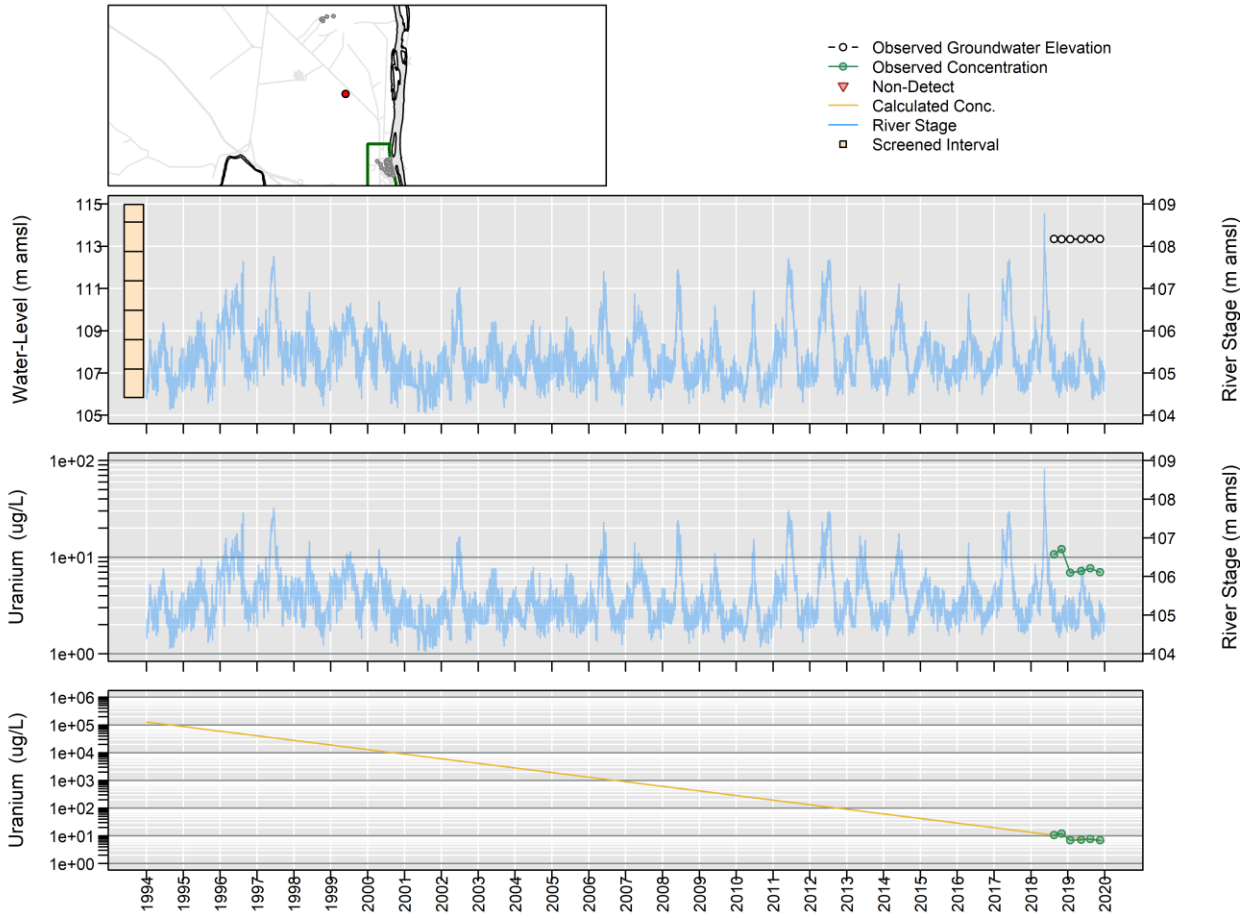
Censored Regression (Tobit) Model

ln Conc. = -0.63 (+/- 0.16)*River Stage + -0.00025 (+/- 0.00012)*Date + 74 (+/- 18)

699-S6-E3

Distance to River: 3568 m
Number of Trends Calculated: 1

	WL	Conc
Est. Lag Time (days):	NA	No Covariate
Significance of Trend (p-value):	NA	0.027
Significance of Date (p-value):	NA	0.006
Number of Observations:	6	6
Percent NDs:		0%



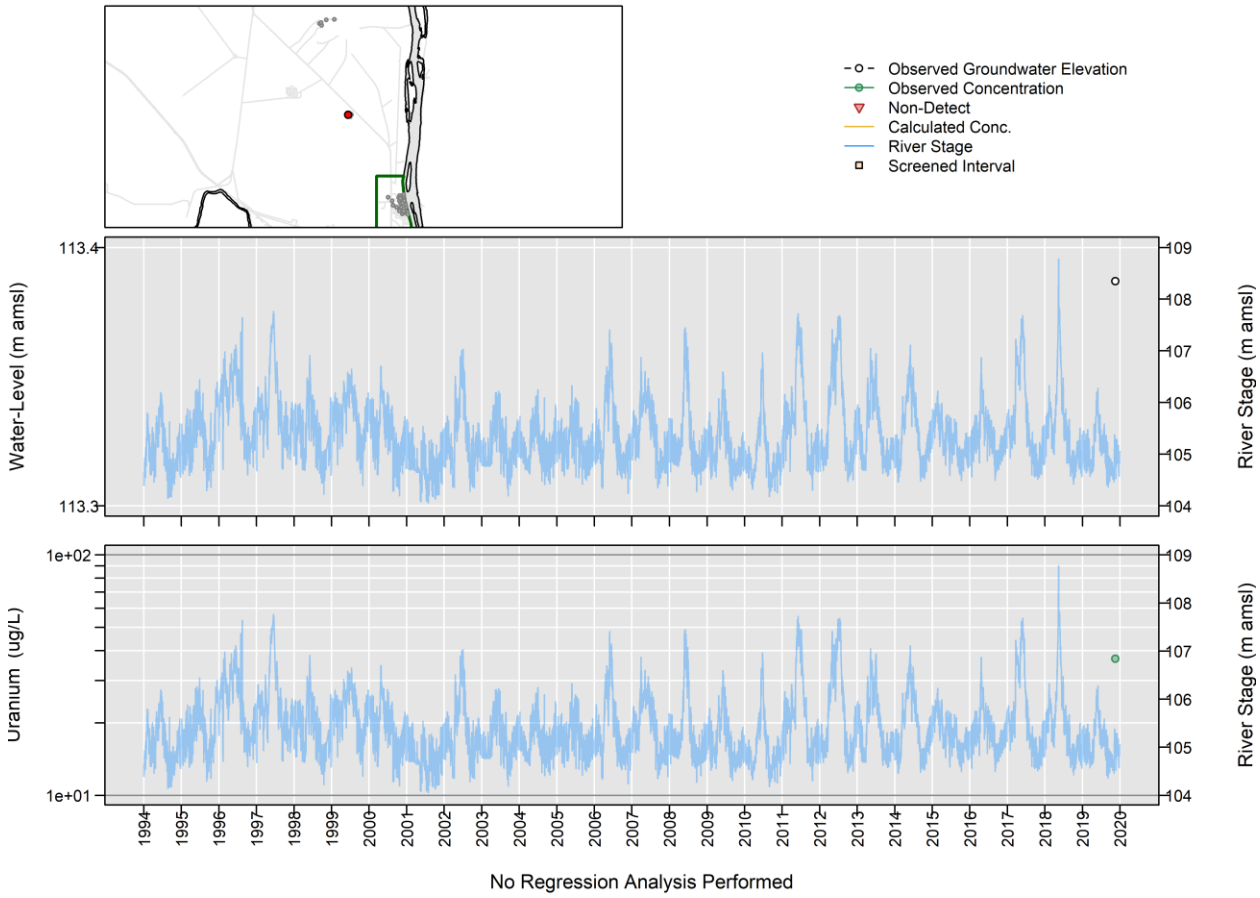
Censored Regression (Tobit) Model

ln Conc. = -0.001 (+/- 0.00038)*Date + 21 (+/- 6.8)

699-S6-E3B

Distance to River: 3637 m
Number of Trends Calculated: 1

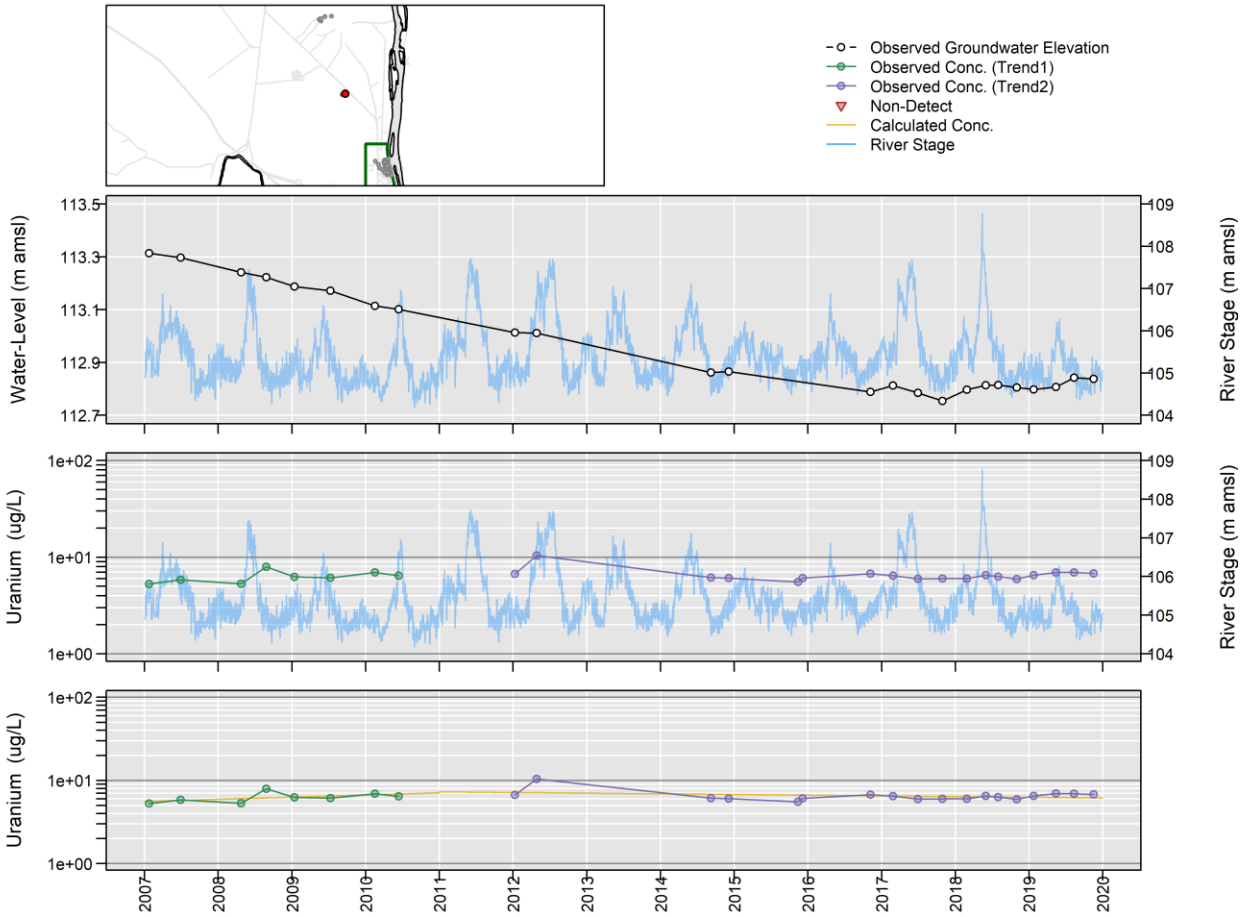
	WL	Conc
Est. Lag Time (days):	NA	No Covariate
Significance of Trend (p-value):	NA	NA
Significance of Date (p-value):	NA	NA
Number of Observations:	1	1
Percent NDs:		0%



699-S6-E4B

Distance to River: 3438 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	5	No Covariate	No RS
Significance of Trend (p-value):	2.3e-14	0.1	0.14
Significance of Date (p-value):	0.86	0.074	0.13
Number of Observations:	24	8	18
Percent NDs:		0%	0%



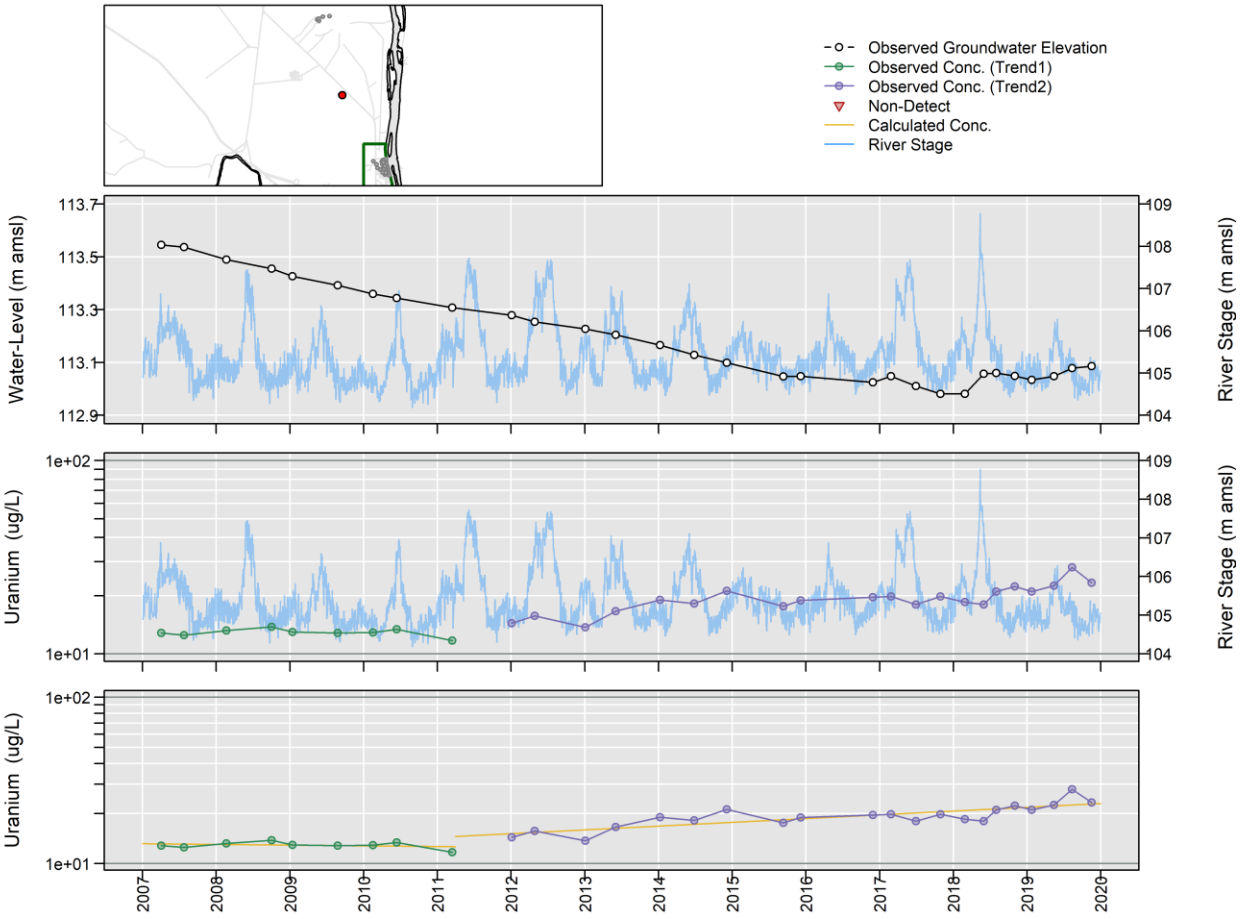
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

699-S6-E4E

Distance to River: 3518 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	85	No Covariate	No RS
Significance of Trend (p-value):	1.1e-16	0.39	2.5e-06
Significance of Date (p-value):	0.1	0.38	3.6e-10
Number of Observations:	30	9	21
Percent NDs:		0%	0%



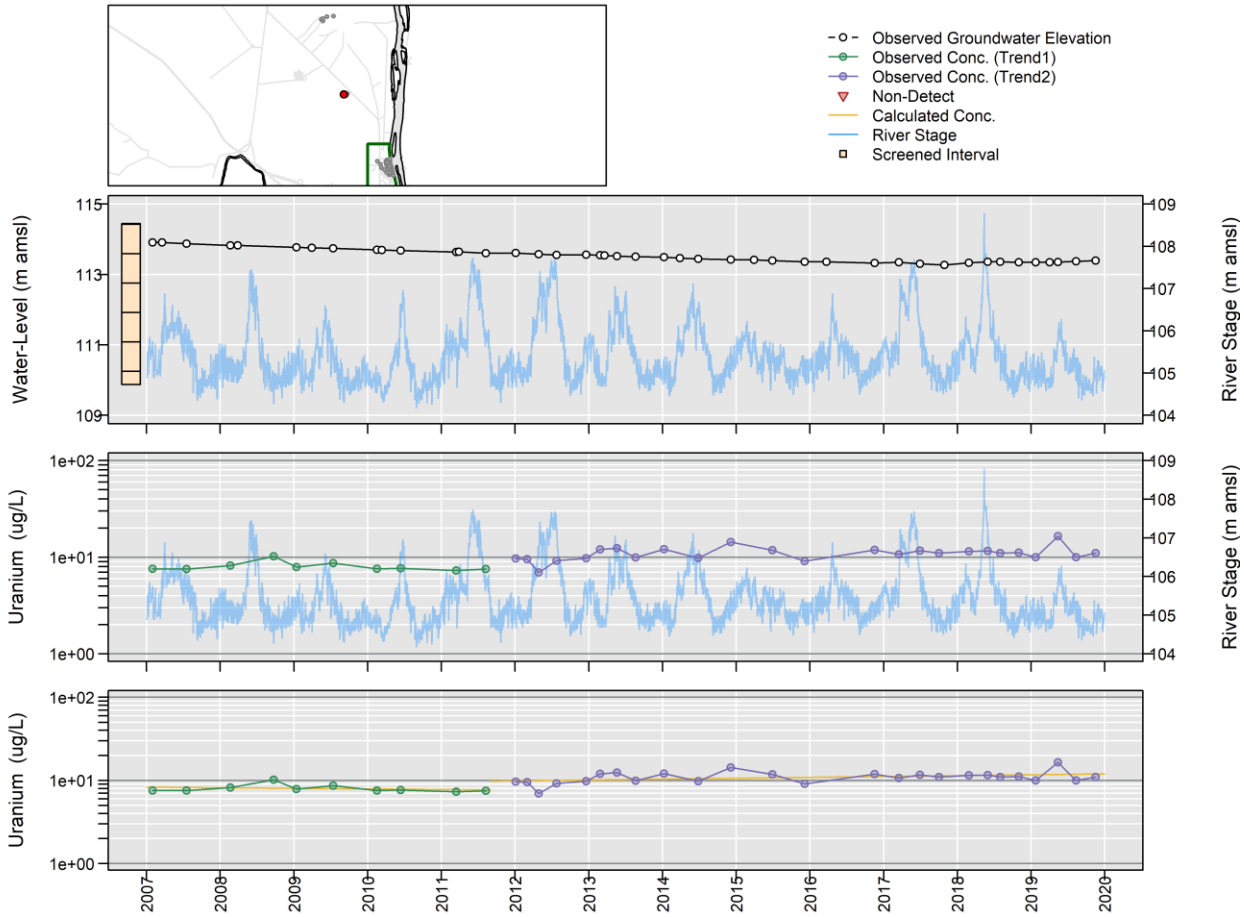
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.00014 (+/- 0.000023)*Date + 0.53 (+/- 0.39)

699-S6-E4K

Distance to River: 3689 m
Number of Trends Calculated: 2

	WL	Trend1	Trend2
Est. Lag Time (days):	6	No Covariate	No RS
Significance of Trend (p-value):	0	0.44	0.041
Significance of Date (p-value):	0.38	0.44	0.033
Number of Observations:	43	10	25
Percent NDs:		0%	0%



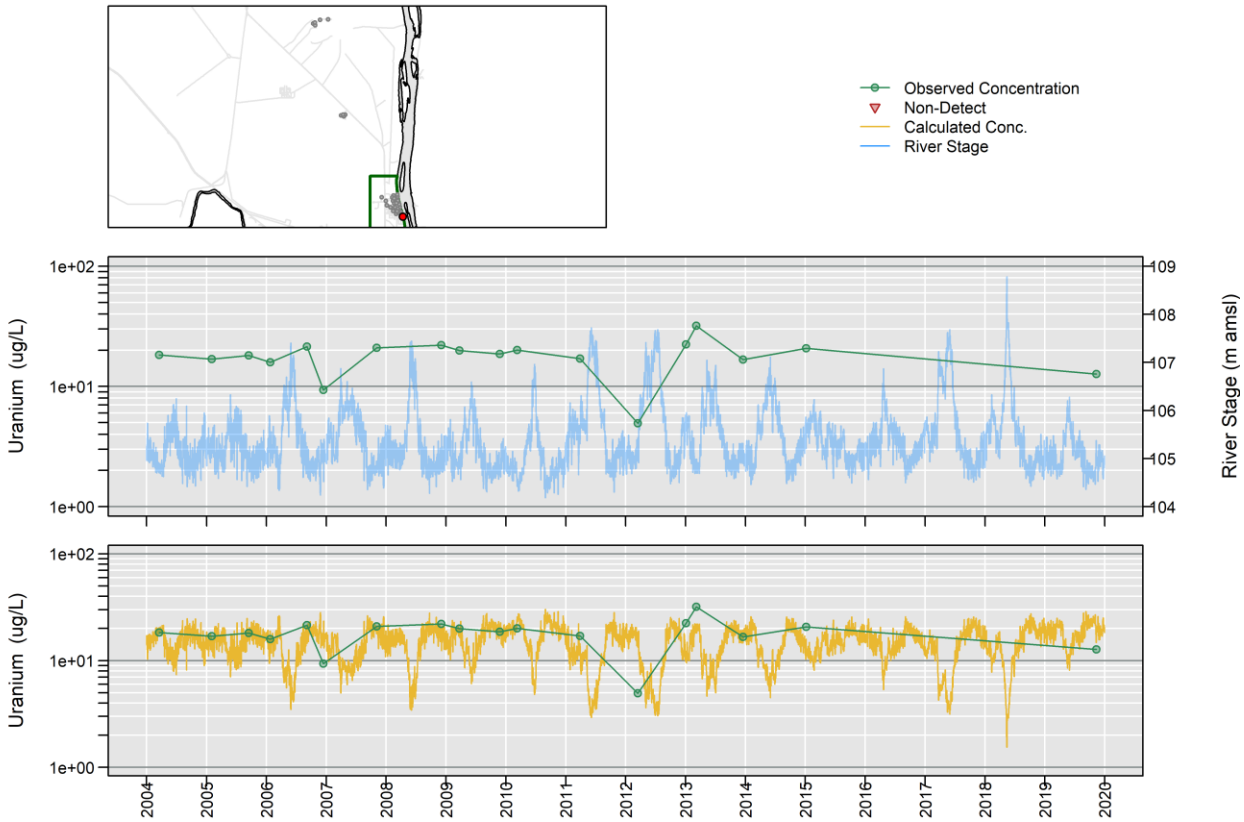
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.000066 (+/- 0.000031)*Date + 1.3 (+/- 0.52)

AT-3-7-M

Distance to River: 5 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.14
Significance of River Stage (p-value):	0.037
Significance of Date (p-value):	0.72
Number of Observations:	18
Percent NDs:	0%



Censored Regression (Tobit) Model

Trend Not Significant

Yearly Mean, UCL, and LCL Results

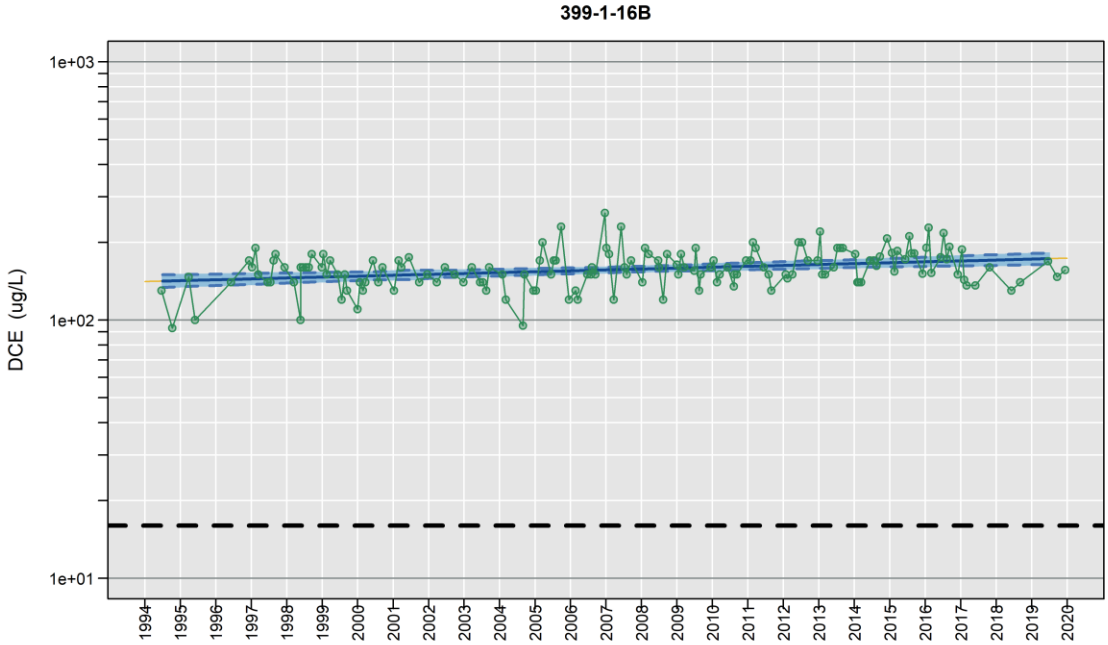
cis-1,2-Dichloroethene (cis-1,2-DCE)

399-1-16B

Distance to River: 135 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.00021
Significance of River Stage (p-value):	0.99
Significance of Date (p-value):	2.5e-05
Number of Observations:	157
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

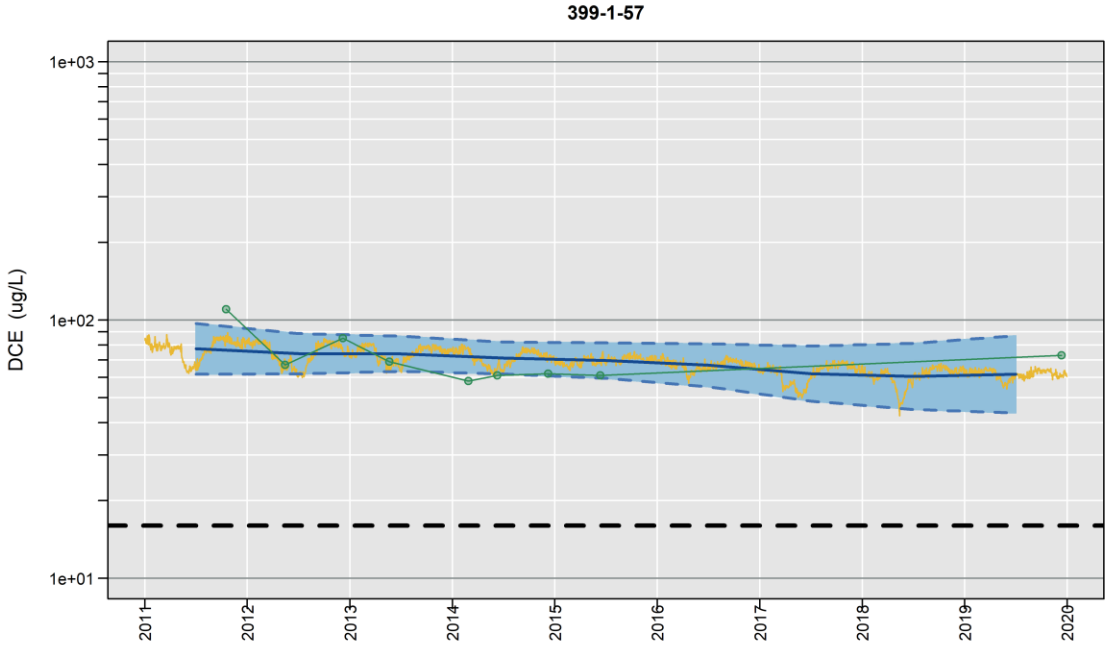
ln Conc. = -0.00026 (+/- 0.019)*River Stage + 0.000022 (+/- 0.0000052)*Date + 4.8 (+/- 2.1)

399-1-57

Distance to River: 86 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.21
Significance of River Stage (p-value):	0.13
Significance of Date (p-value):	0.13
Number of Observations:	9
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

Trend Not Significant

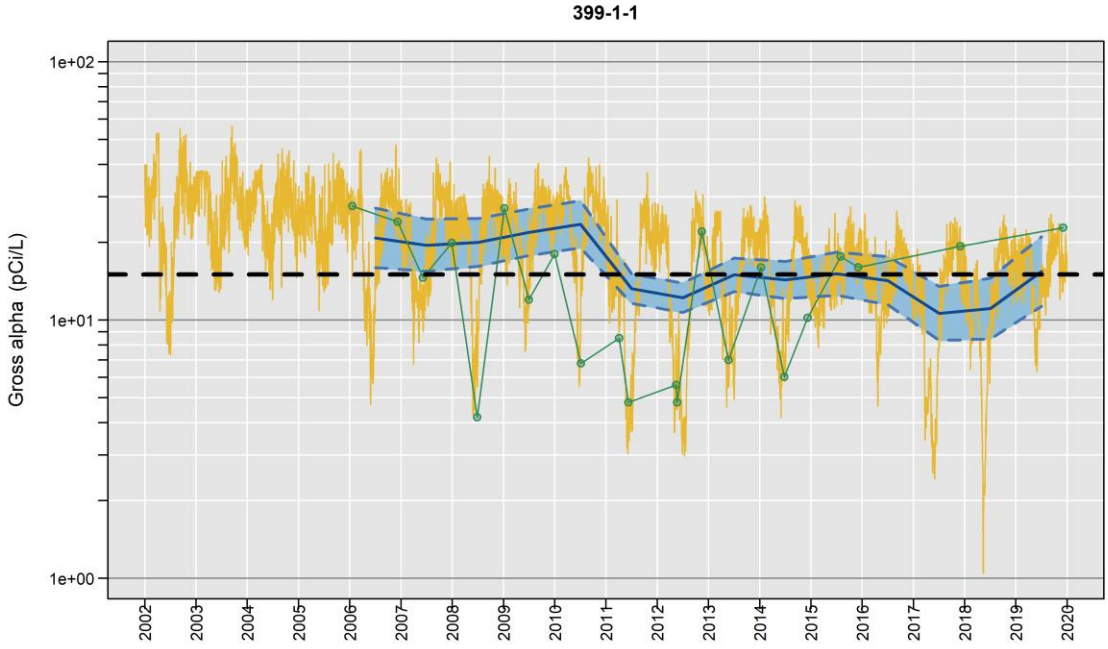
Gross Alpha

399-1-1

Distance to River: 76 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	6.6e-08
Significance of River Stage (p-value):	1.9e-18
Significance of Date (p-value):	0.019
Number of Observations:	22
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

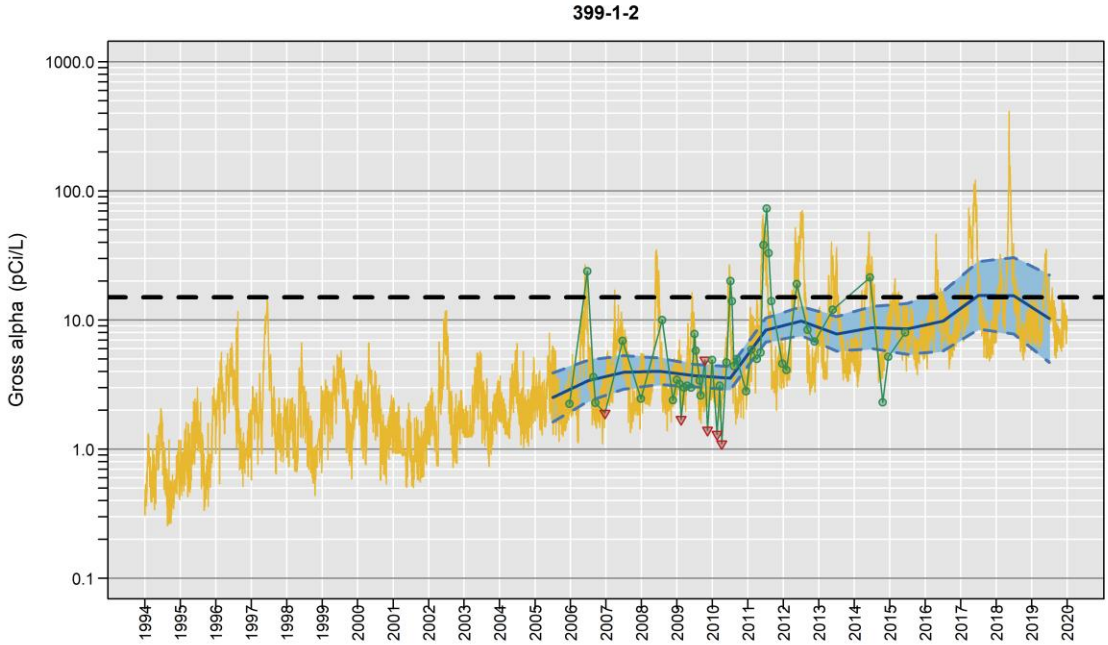
ln Conc. = -0.74 (+/- 0.084)*River Stage + -0.00011 (+/- 0.000048)*Date + 82 (+/- 9.1)

399-1-2

Distance to River: 386 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	1.1e-10
Significance of River Stage (p-value):	1.6e-15
Significance of Date (p-value):	0.0066
Number of Observations:	48
Percent NDs:	12%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

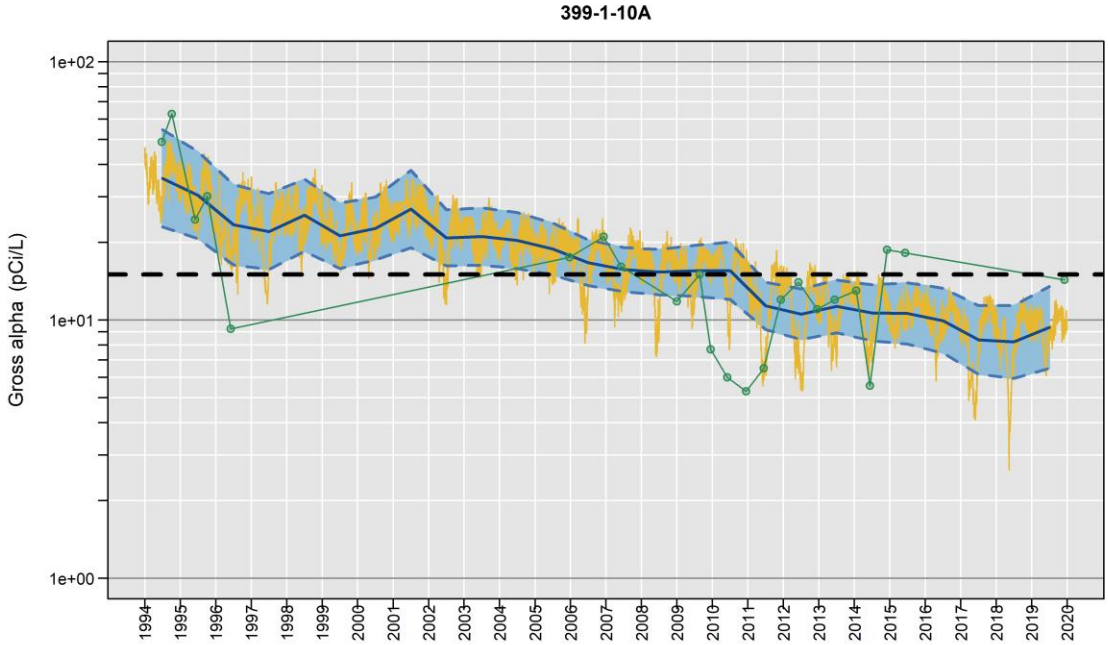
ln Conc. = 1 (+/- 0.13)*River Stage + 0.0003 (+/- 0.00011)*Date + -110 (+/- 14)

399-1-10A

Distance to River: 70 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.00023
Significance of River Stage (p-value):	0.0057
Significance of Date (p-value):	1.3e-05
Number of Observations:	23
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

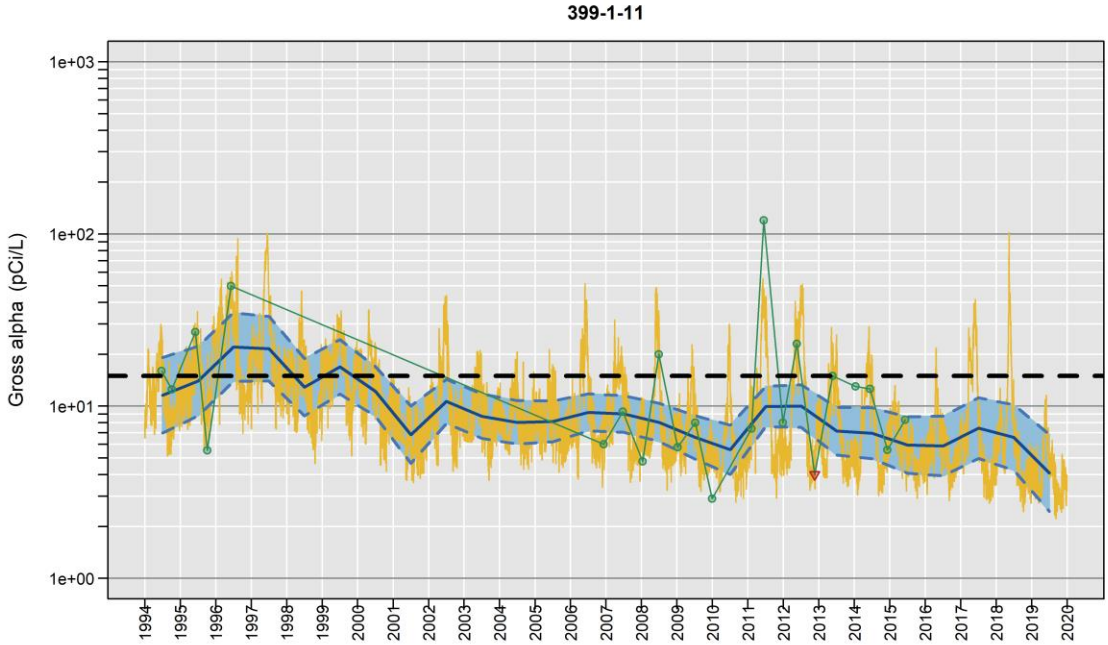
ln Conc. = -0.36 (+/- 0.13)*River Stage + -0.00015 (+/- 0.000034)*Date + 43 (+/- 14)

399-1-11

Distance to River: 314 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	1.4e-05
Significance of River Stage (p-value):	2.6e-09
Significance of Date (p-value):	0.01
Number of Observations:	22
Percent NDs:	5%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

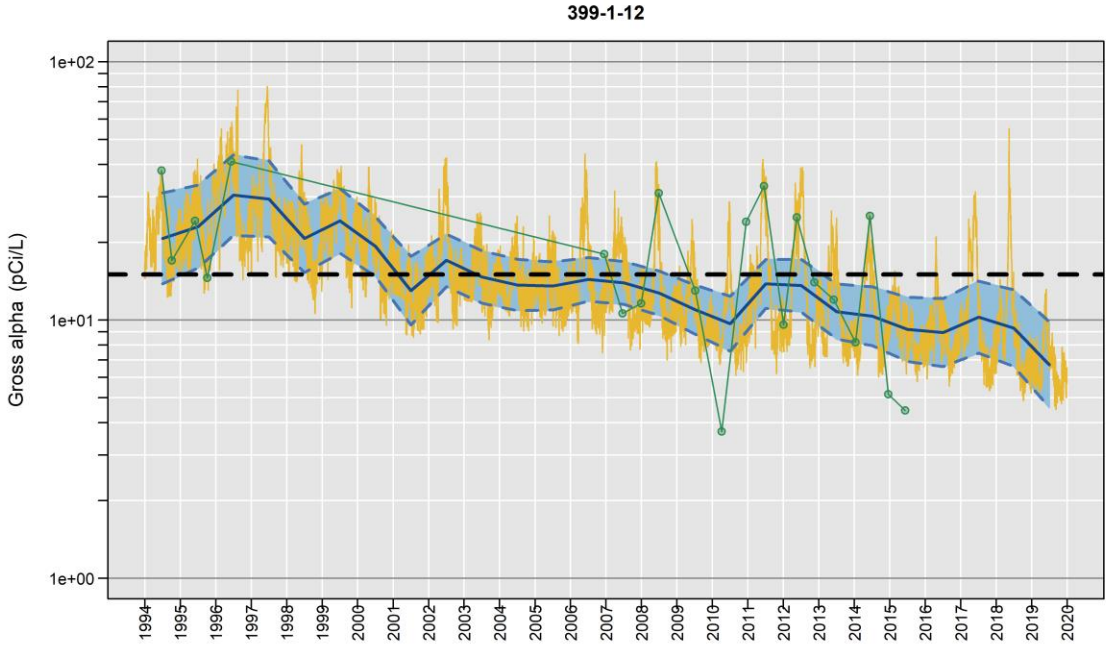
ln Conc. = 0.85 (+/- 0.14)*River Stage + -0.00011 (+/- 0.000044)*Date + -86 (+/- 15)

399-1-12

Distance to River: 398 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	2
Significance of Trend (p-value):	3.1e-05
Significance of River Stage (p-value):	1.9e-06
Significance of Date (p-value):	3e-04
Number of Observations:	21
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

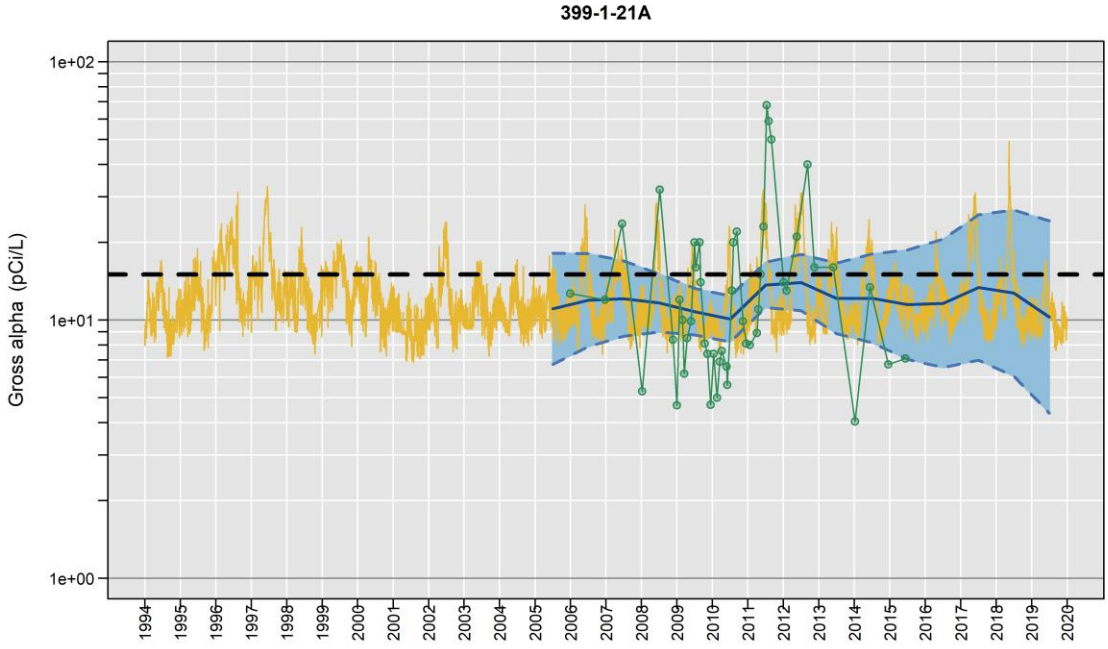
ln Conc. = 0.55 (+/- 0.12)*River Stage + -0.00012 (+/- 0.000034)*Date + -54 (+/- 12)

399-1-21A

Distance to River: 340 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.0073
Significance of River Stage (p-value):	0.0011
Significance of Date (p-value):	0.98
Number of Observations:	48
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

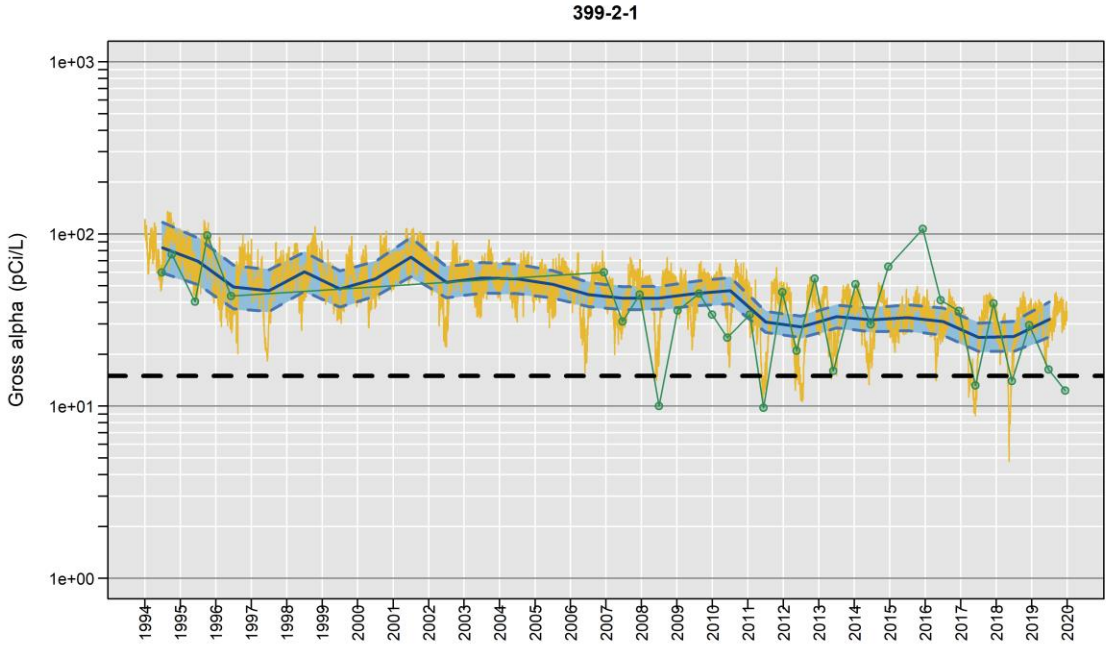
Trend Not Significant

399-2-1

Distance to River: 57 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	1.1e-07
Significance of River Stage (p-value):	3.7e-10
Significance of Date (p-value):	1.3e-05
Number of Observations:	31
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



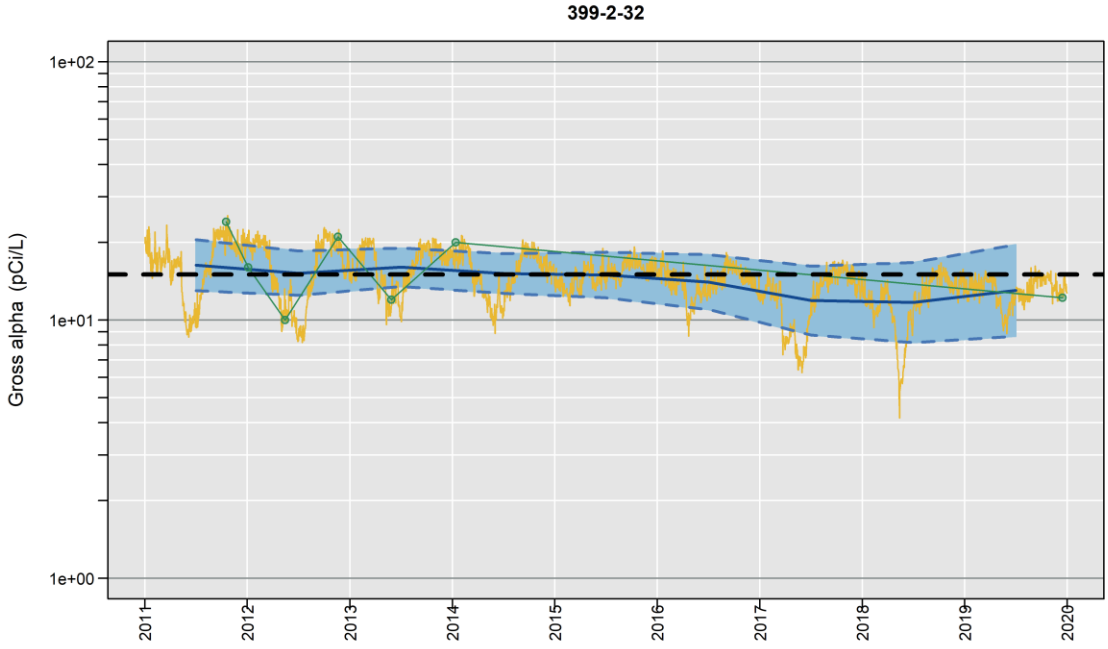
Censored Regression (Tobit) Model

ln Conc. = -0.52 (+/- 0.083)*River Stage + -0.00011 (+/- 0.000024)*Date + 60 (+/- 8.8)

399-2-32

Distance to River: 217 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.0043
Significance of River Stage (p-value):	2.1e-06
Significance of Date (p-value):	0.0079
Number of Observations:	7
Percent NDs:	0%



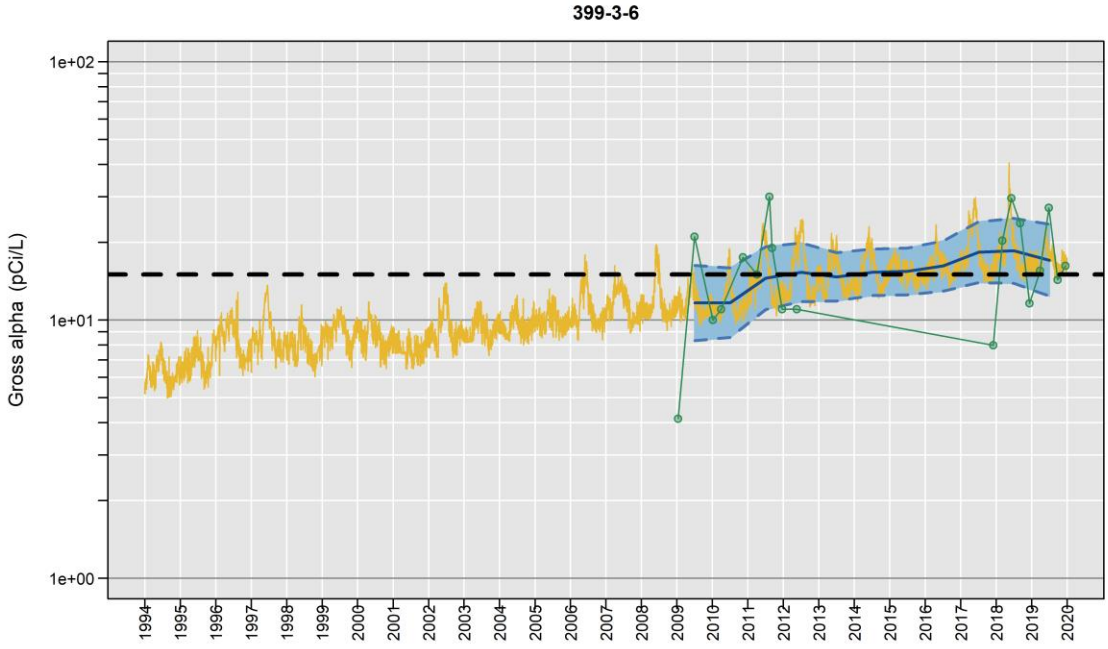
Censored Regression (Tobit) Model

ln Conc. = -0.32 (+/- 0.068)*River Stage + -0.00015 (+/- 0.000056)*Date + 39 (+/- 7.4)

399-3-6

Distance to River: 623 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.076
Significance of River Stage (p-value):	0.072
Significance of Date (p-value):	0.083
Number of Observations:	19
Percent NDs:	0%



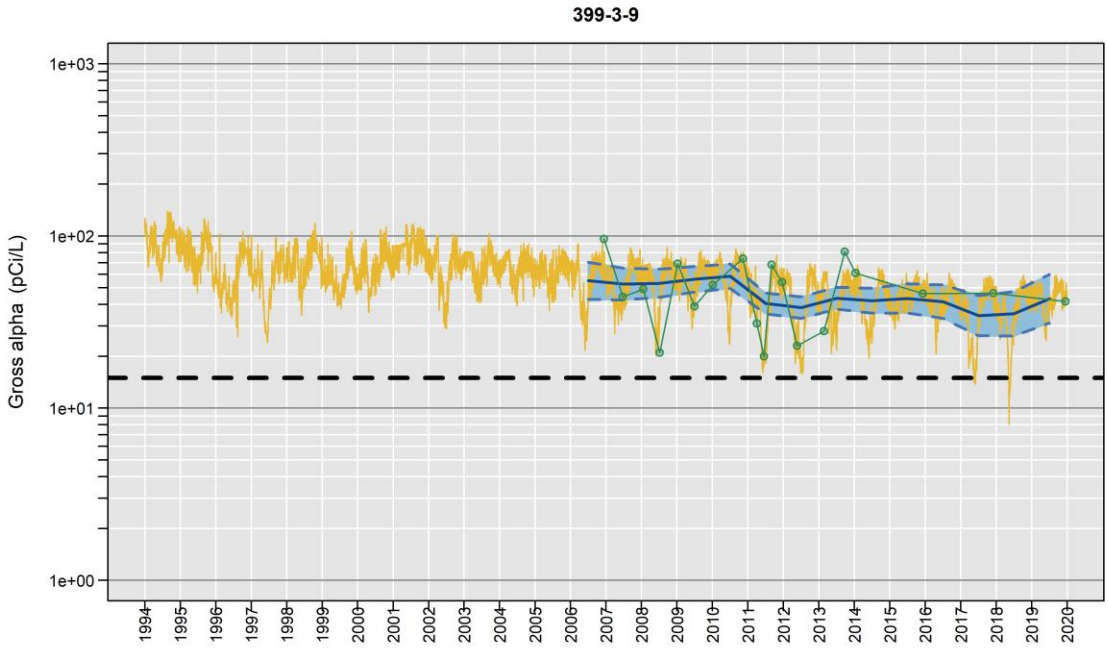
Censored Regression (Tobit) Model

Trend Not Significant

399-3-9

Distance to River: 68 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	5.8e-05
Significance of River Stage (p-value):	6.2e-09
Significance of Date (p-value):	0.1
Number of Observations:	19
Percent NDs:	0%



Censored Regression (Tobit) Model

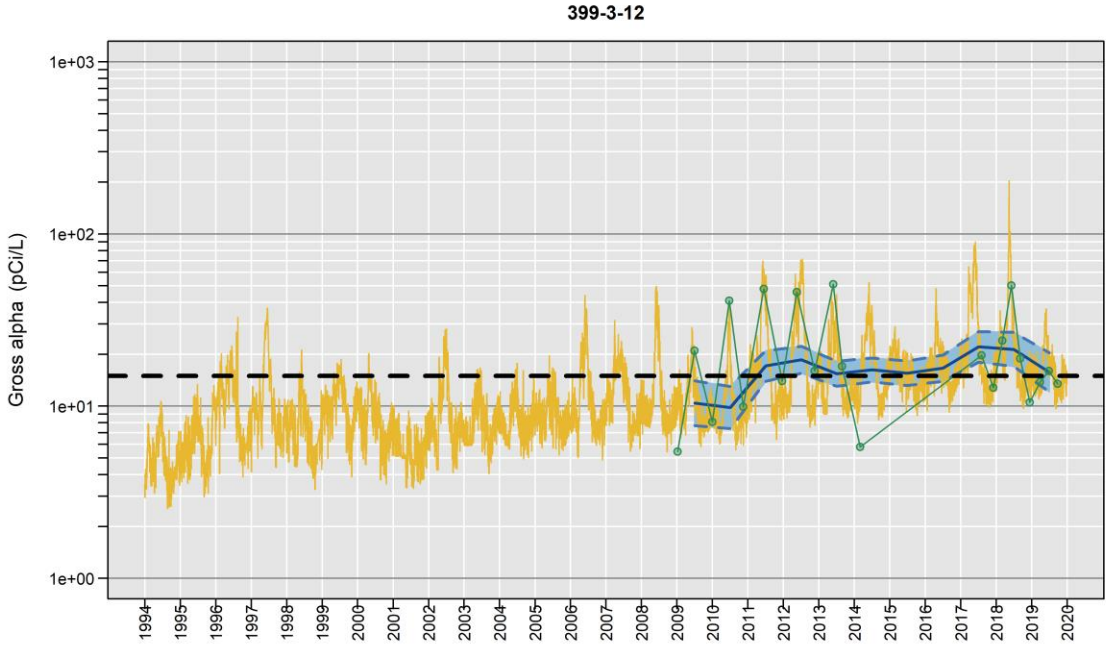
Trend Not Significant

399-3-12

Distance to River: 344 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	8.4e-07
Significance of River Stage (p-value):	2.1e-14
Significance of Date (p-value):	0.021
Number of Observations:	21
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

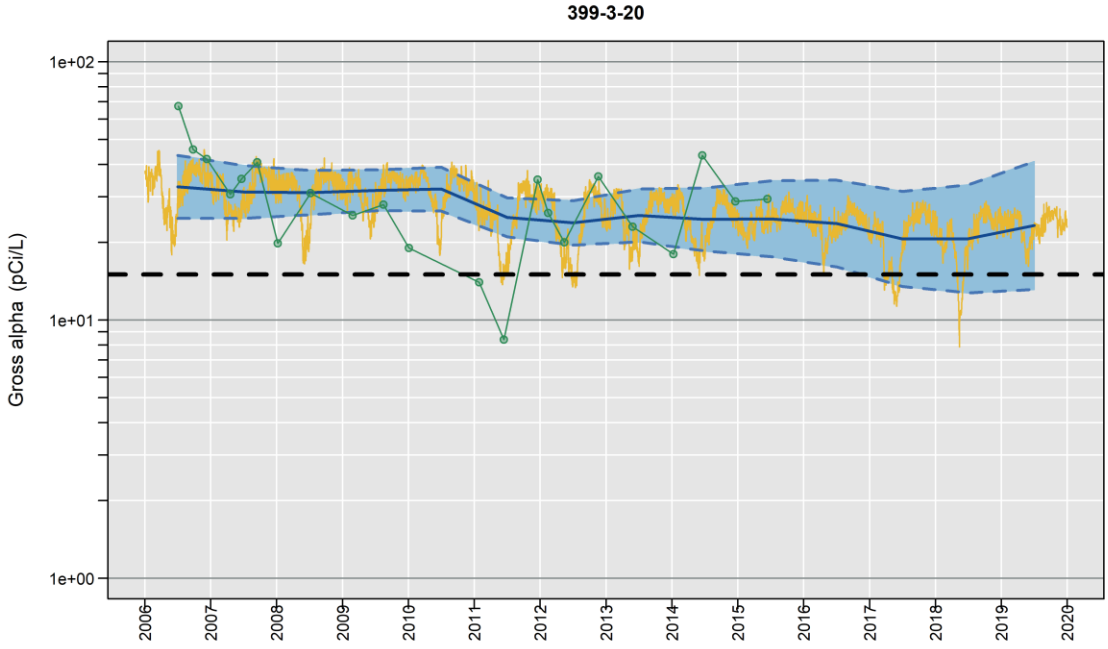
ln Conc. = 0.7 (+/- 0.092)*River Stage + 0.00013 (+/- 0.000056)*Date + -73 (+/- 10)

399-3-20

Distance to River: 210 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.011
Significance of River Stage (p-value):	0.006
Significance of Date (p-value):	0.21
Number of Observations:	22
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



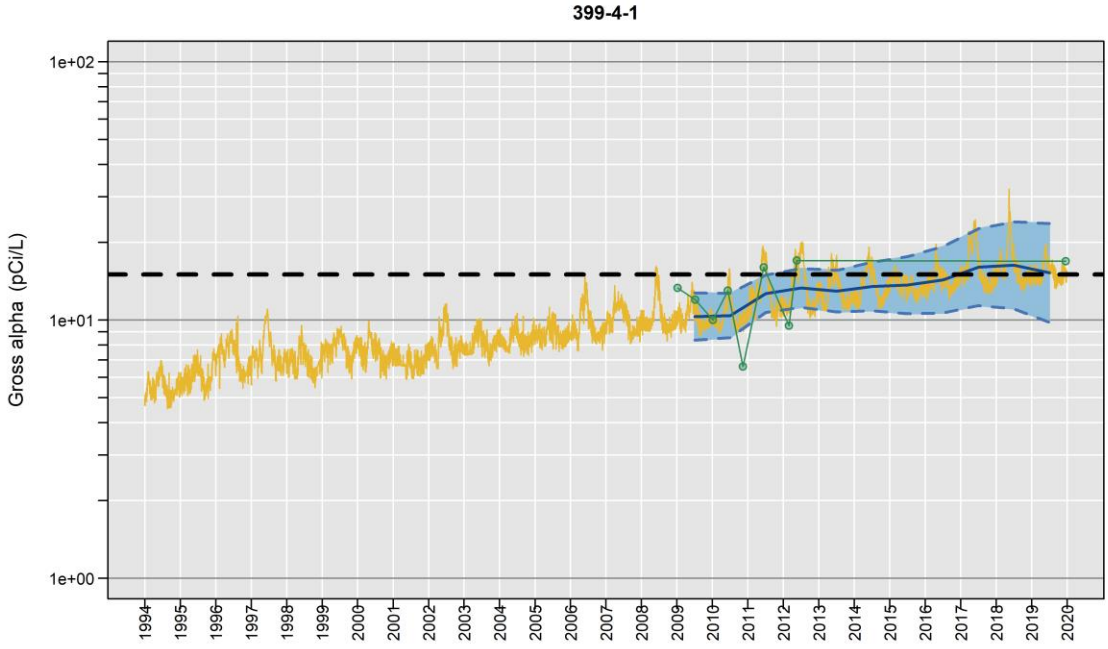
Censored Regression (Tobit) Model

Trend Not Significant

399-4-1

Distance to River: 381 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.018
Significance of River Stage (p-value):	0.0022
Significance of Date (p-value):	0.045
Number of Observations:	9
Percent NDs:	0%



Censored Regression (Tobit) Model

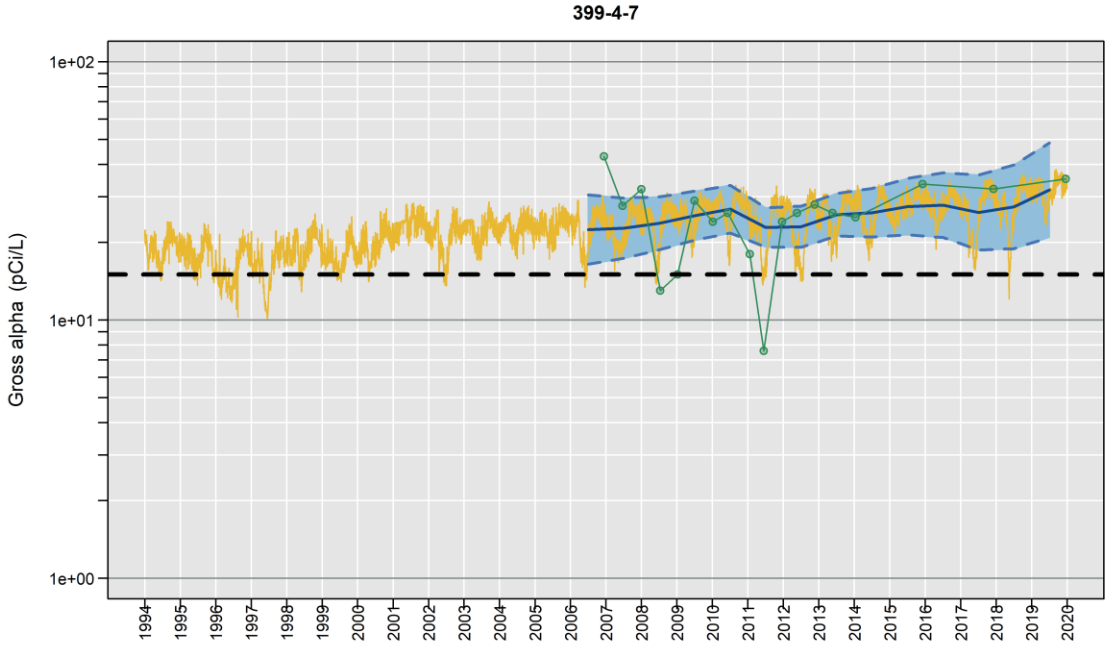
ln Conc. = 0.21 (+/- 0.07)*River Stage + 0.00011 (+/- 0.000056)*Date + -22 (+/- 7.4)

399-4-7

Distance to River: 72 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.039
Significance of River Stage (p-value):	0.011
Significance of Date (p-value):	0.36
Number of Observations:	18
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

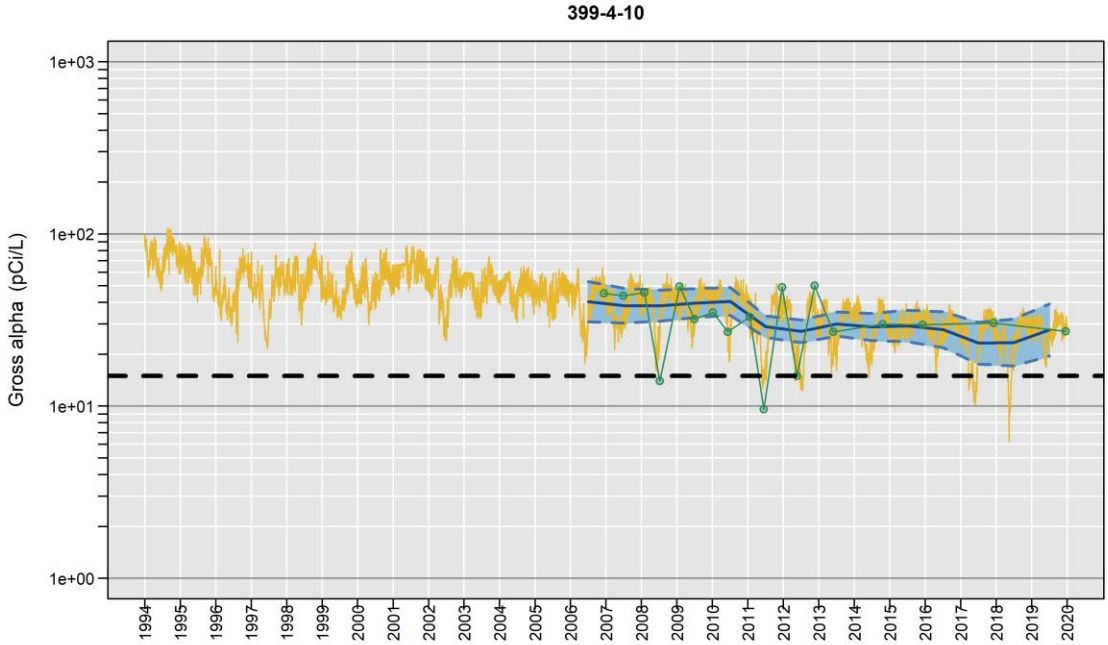
Trend Not Significant

399-4-10

Distance to River: 69 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.00021
Significance of River Stage (p-value):	2.3e-07
Significance of Date (p-value):	0.042
Number of Observations:	18
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

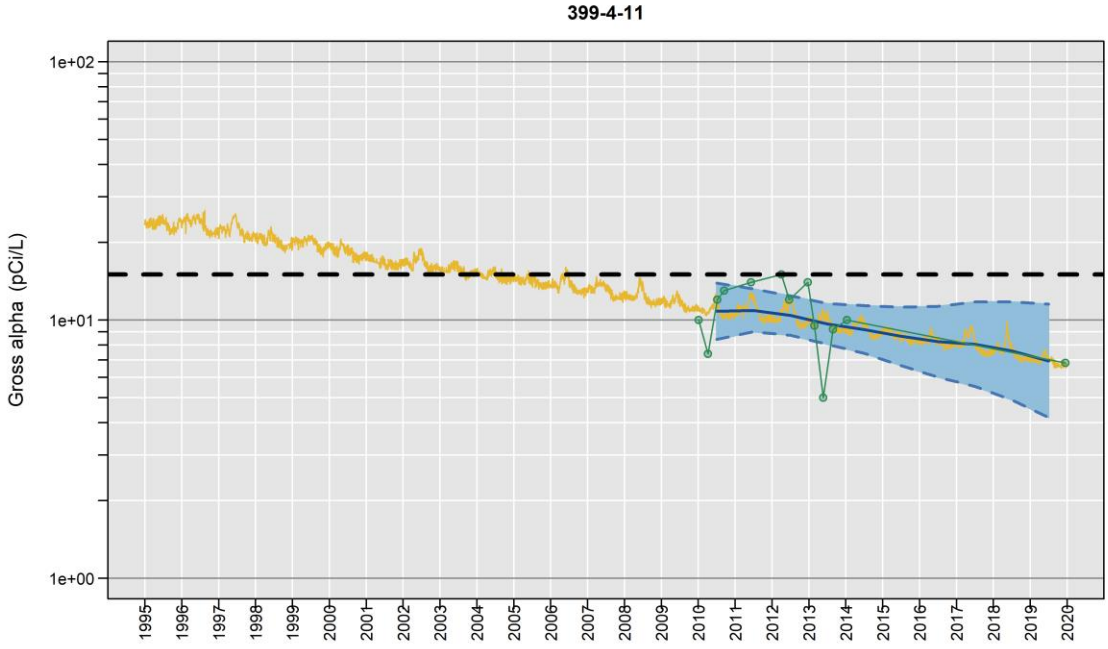
ln Conc. = -0.41 (+/- 0.08)*River Stage + -0.00011 (+/- 0.000053)*Date + 49 (+/- 8.6)

399-4-11

Distance to River: 522 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.19
Significance of River Stage (p-value):	0.32
Significance of Date (p-value):	0.1
Number of Observations:	13
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

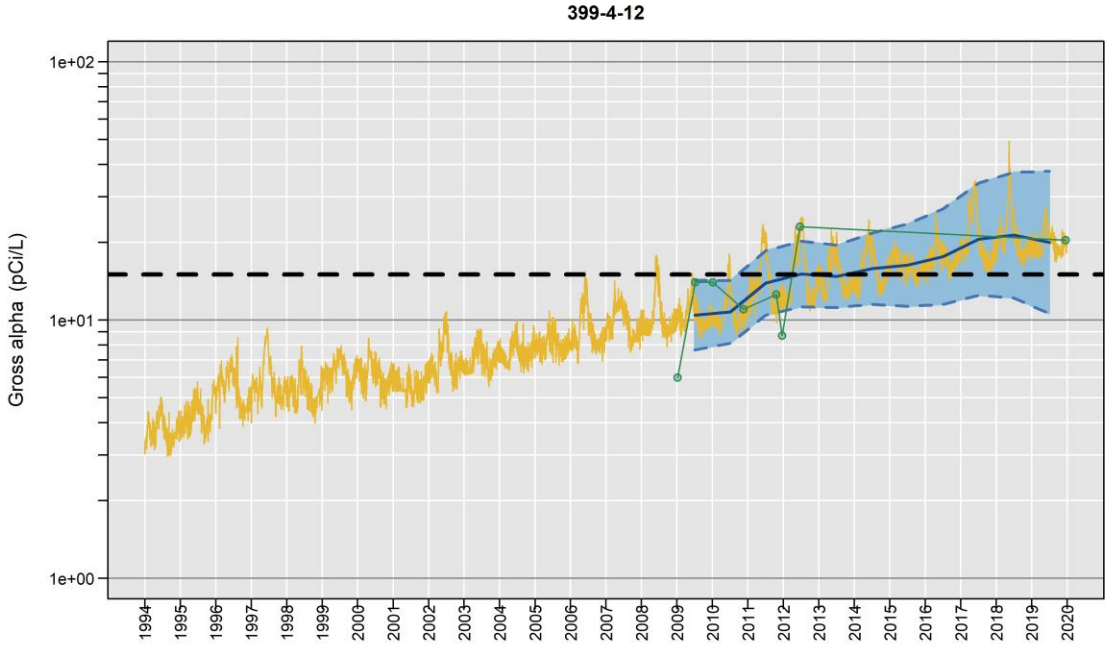
Trend Not Significant

399-4-12

Distance to River: 153 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.021
Significance of River Stage (p-value):	0.014
Significance of Date (p-value):	0.015
Number of Observations:	8
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

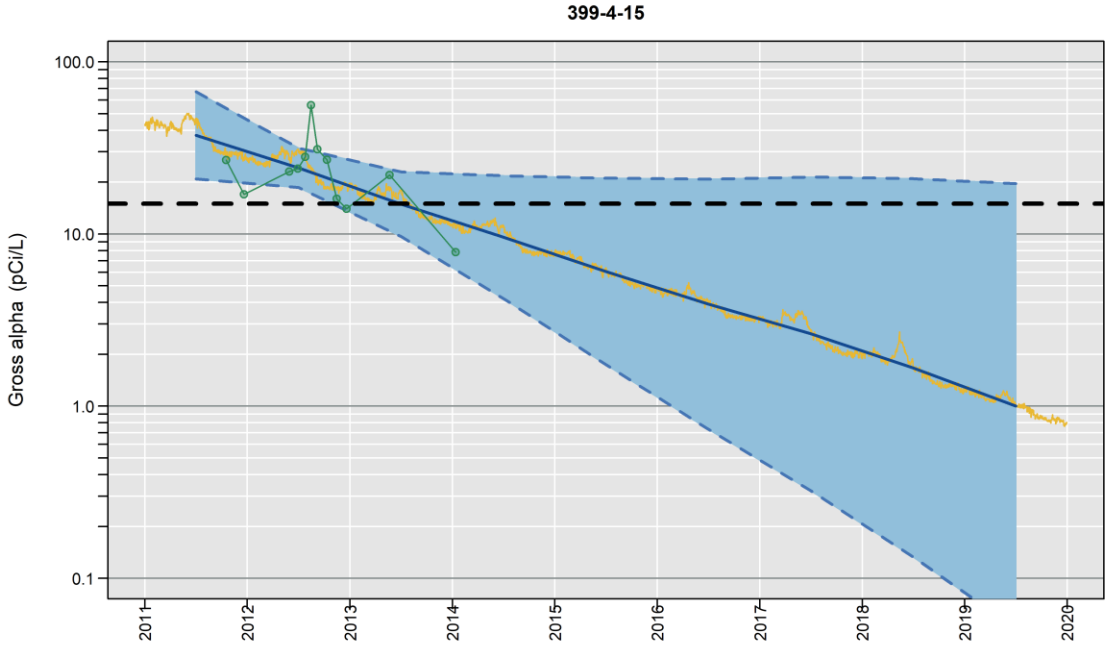
ln Conc. = 0.26 (+/- 0.11)*River Stage + 0.00018 (+/- 0.000075)*Date + -28 (+/- 11)

399-4-15

Distance to River: 278 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.069
Significance of River Stage (p-value):	0.22
Significance of Date (p-value):	0.019
Number of Observations:	12
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



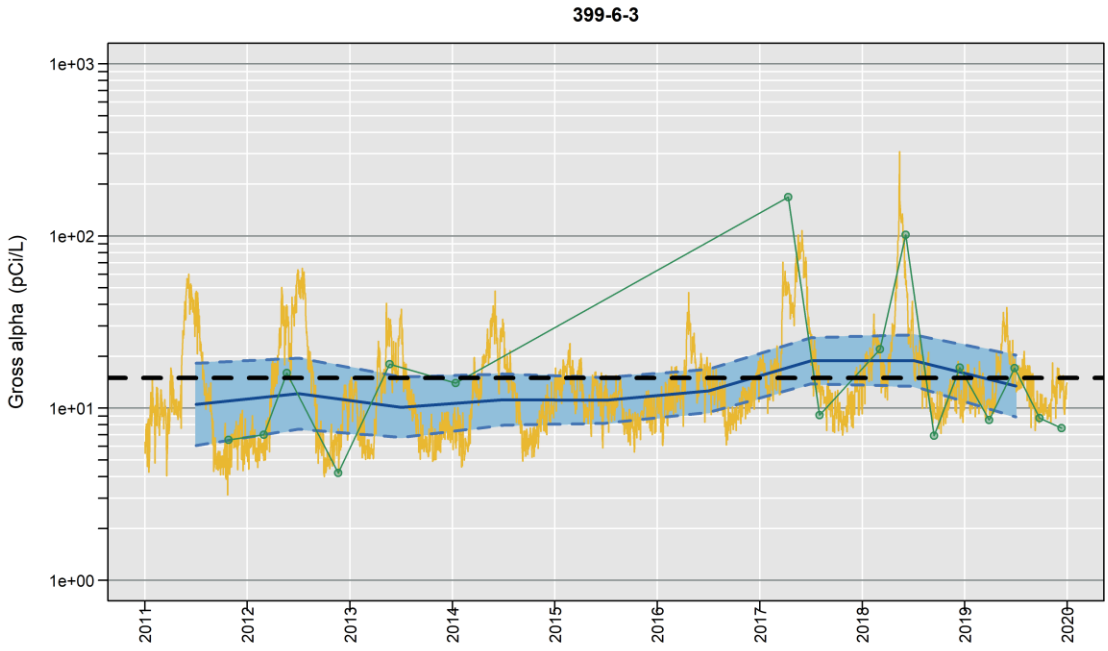
Censored Regression (Tobit) Model

Trend Not Significant

399-6-3

Distance to River: 819 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	3
Significance of Trend (p-value):	6.5e-05
Significance of River Stage (p-value):	3.8e-09
Significance of Date (p-value):	0.018
Number of Observations:	16
Percent NDs:	0%



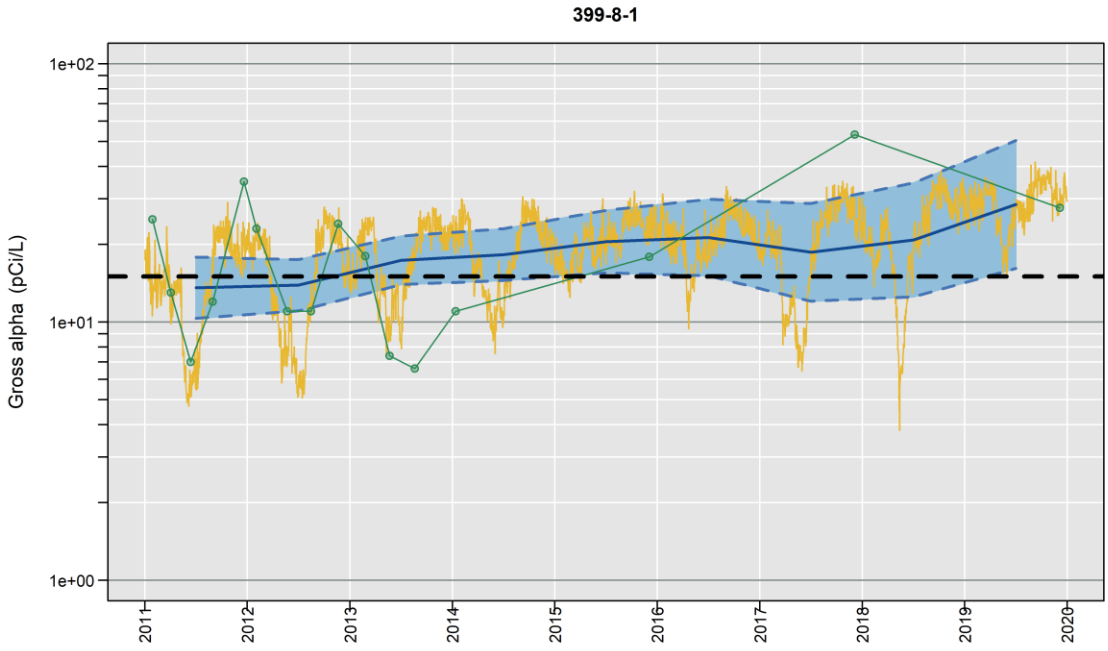
Censored Regression (Tobit) Model

ln Conc. = 0.88 (+/- 0.15)*River Stage + 0.00028 (+/- 0.00012)*Date + -94 (+/- 16)

399-8-1

Distance to River: 832 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	3
Significance of Trend (p-value):	0.0013
Significance of River Stage (p-value):	0.00015
Significance of Date (p-value):	0.24
Number of Observations:	16
Percent NDs:	0%



Censored Regression (Tobit) Model

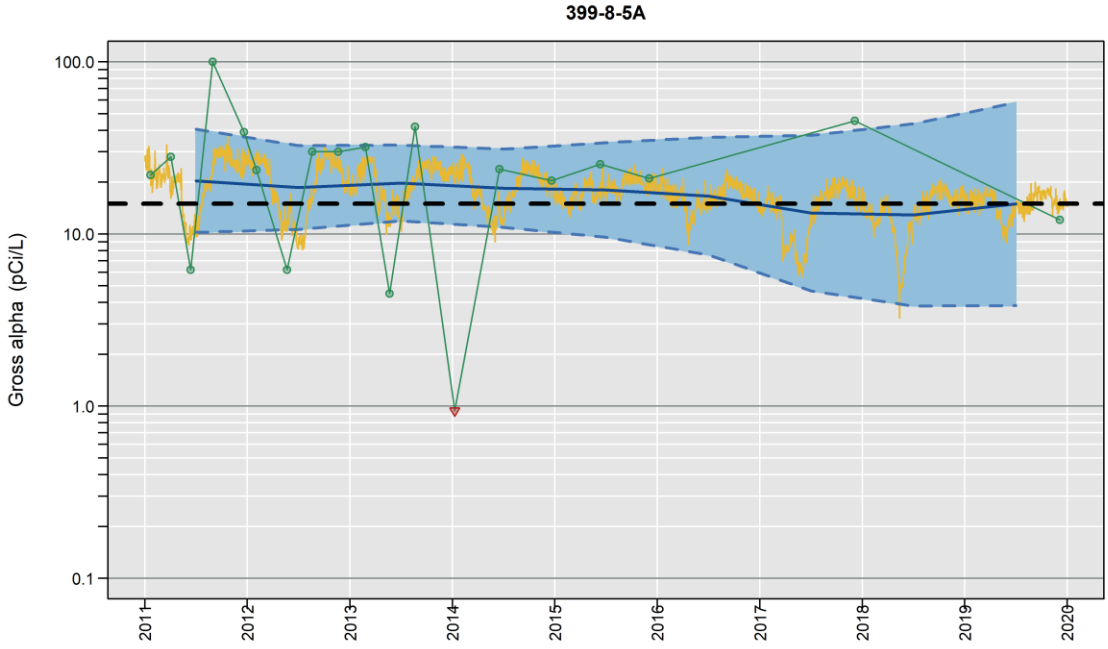
Trend Not Significant

399-8-5A

Distance to River: 1046 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	7
Significance of Trend (p-value):	0.41
Significance of River Stage (p-value):	0.18
Significance of Date (p-value):	0.49
Number of Observations:	19
Percent NDs:	5%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

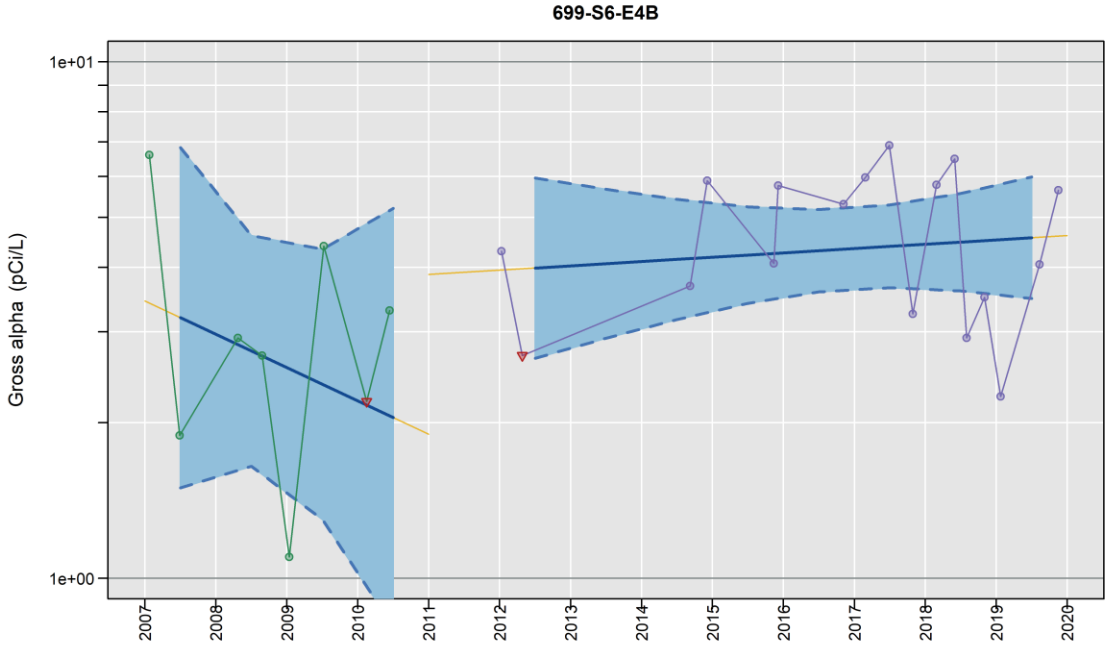
Trend Not Significant

699-S6-E4B

Distance to River: 3438 m
Number of Trends Calculated: 2

	Trend1	**Trend2**
Est. Lag Time (days):	No Covariate	No RS
Significance of Trend (p-value):	0.4	0.61
Significance of Date (p-value):	0.4	0.61
Number of Observations:	8	17
Percent NDs:	12%	6%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



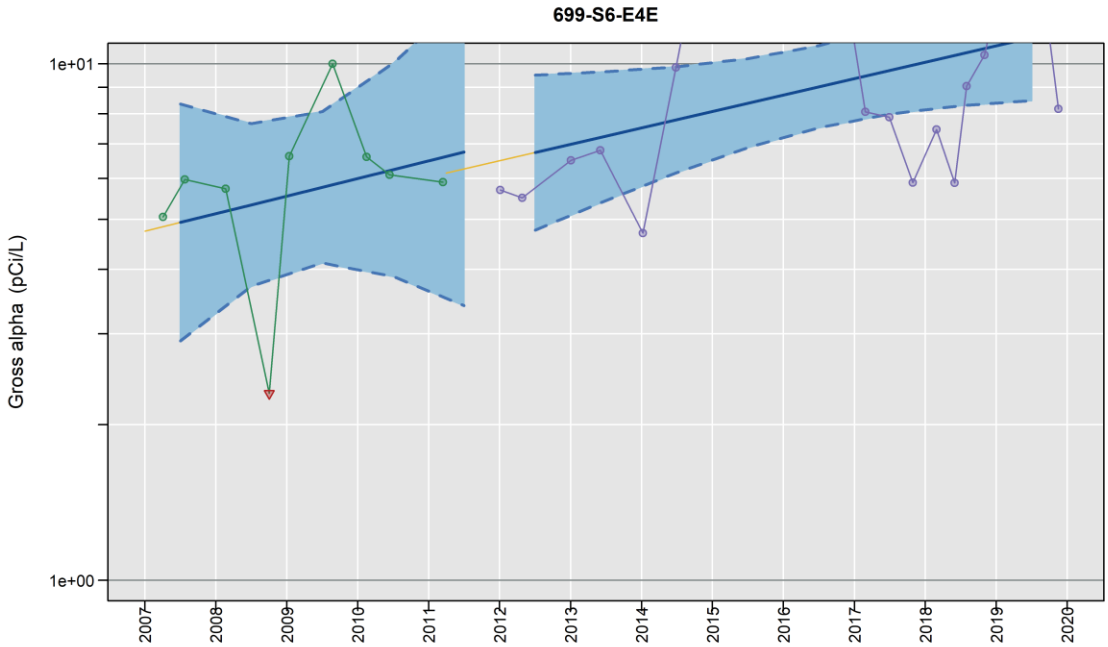
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

699-S6-E4E

Distance to River: 3518 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	No Covariate	No RS
Significance of Trend (p-value):	0.46	0.043
Significance of Date (p-value):	0.45	0.033
Number of Observations:	9	20
Percent NDs:	11%	0%



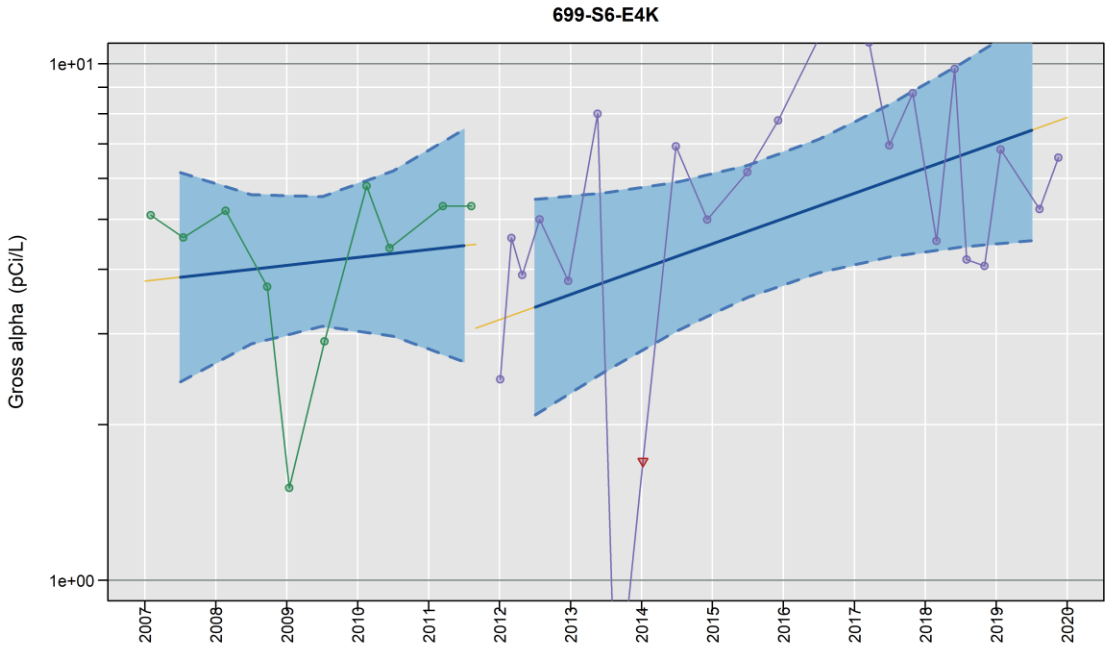
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.0002 (+/- 0.000094)*Date + -1.2 (+/- 1.6)

699-S6-E4K

Distance to River: 3689 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	No Covariate	No RS
Significance of Trend (p-value):	0.68	0.043
Significance of Date (p-value):	0.68	0.035
Number of Observations:	10	23
Percent NDs:	0%	9%



Censored Regression (Tobit) Model

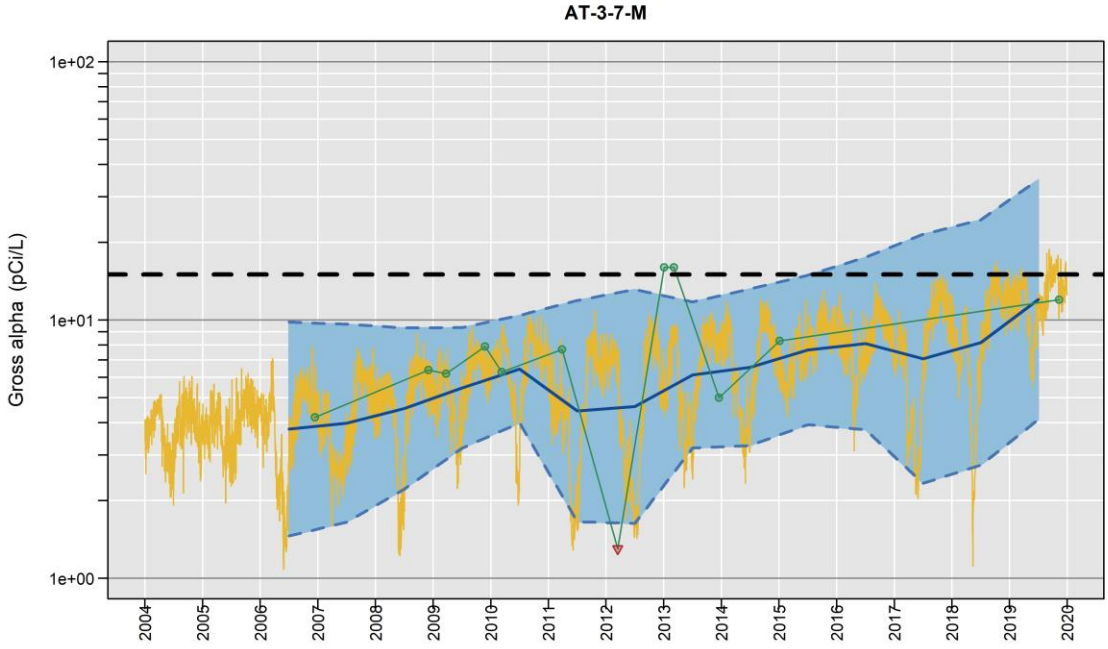
Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.00031 (+/- 0.00015)*Date + -3.6 (+/- 2.5)

AT-3-7-M

Distance to River: 5 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.33
Significance of River Stage (p-value):	0.32
Significance of Date (p-value):	0.19
Number of Observations:	12
Percent NDs:	8%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

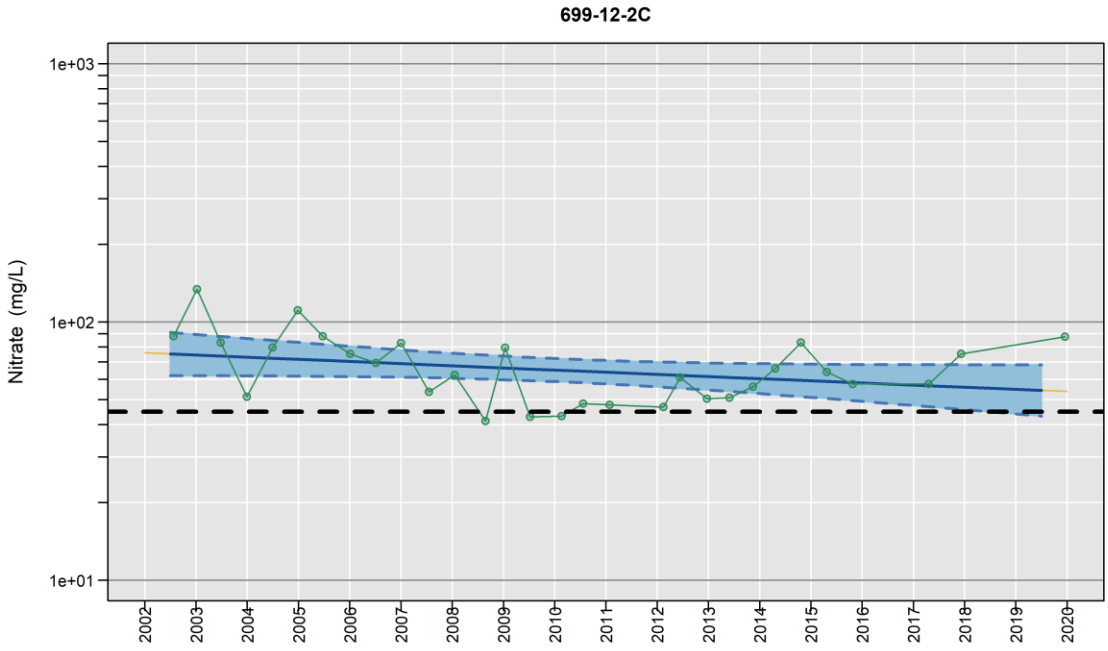
Trend Not Significant

Nitrate

699-12-2C

Distance to River: 5526 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	No Covariate
Significance of Trend (p-value):	0.077
Significance of Date (p-value):	0.07
Number of Observations:	30
Percent NDs:	0%



Censored Regression (Tobit) Model

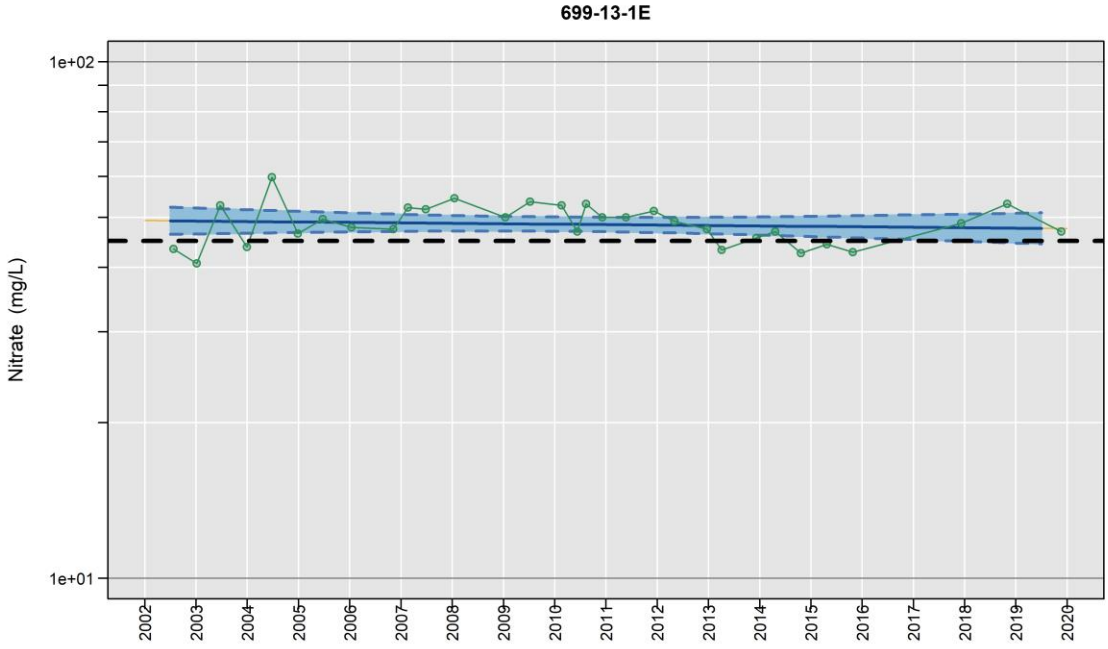
Trend Not Significant

699-13-1E

Distance to River: 5173 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	No Covariate
Significance of Trend (p-value):	0.55
Significance of Date (p-value):	0.55
Number of Observations:	31
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

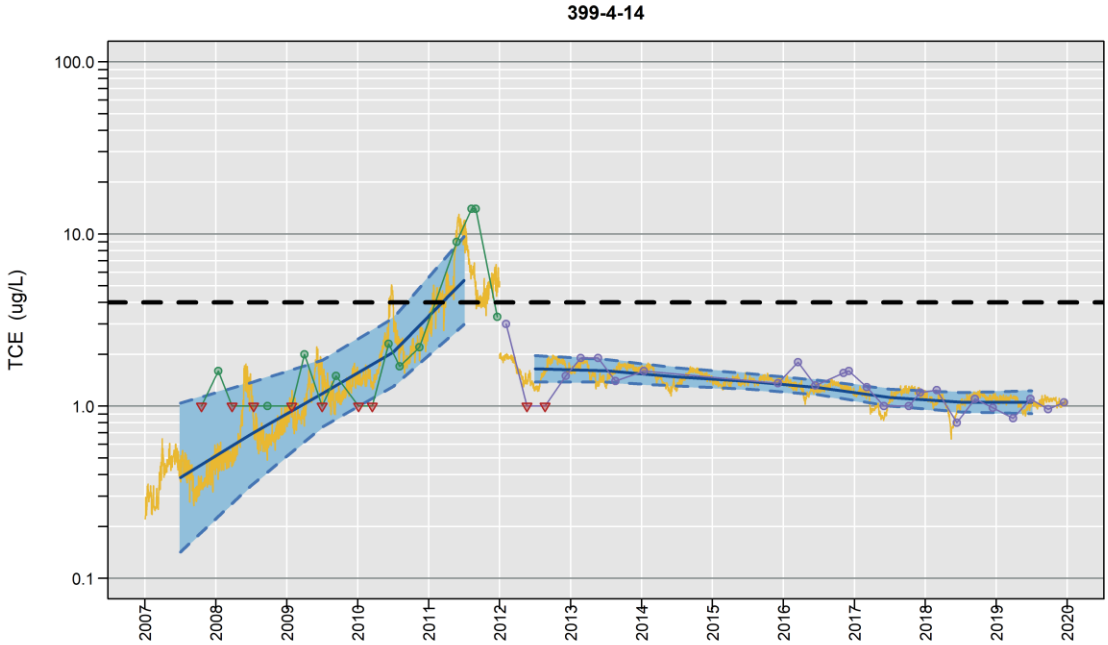
Trend Not Significant

Trichloroethene (TCE)

399-4-14

Distance to River: 247 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	0	0
Significance of Trend (p-value):	0.00026	0.0011
Significance of River Stage (p-value):	0.1	0.016
Significance of Date (p-value):	5.4e-05	2.7e-05
Number of Observations:	18	25
Percent NDs:	39%	8%



Censored Regression (Tobit) Model

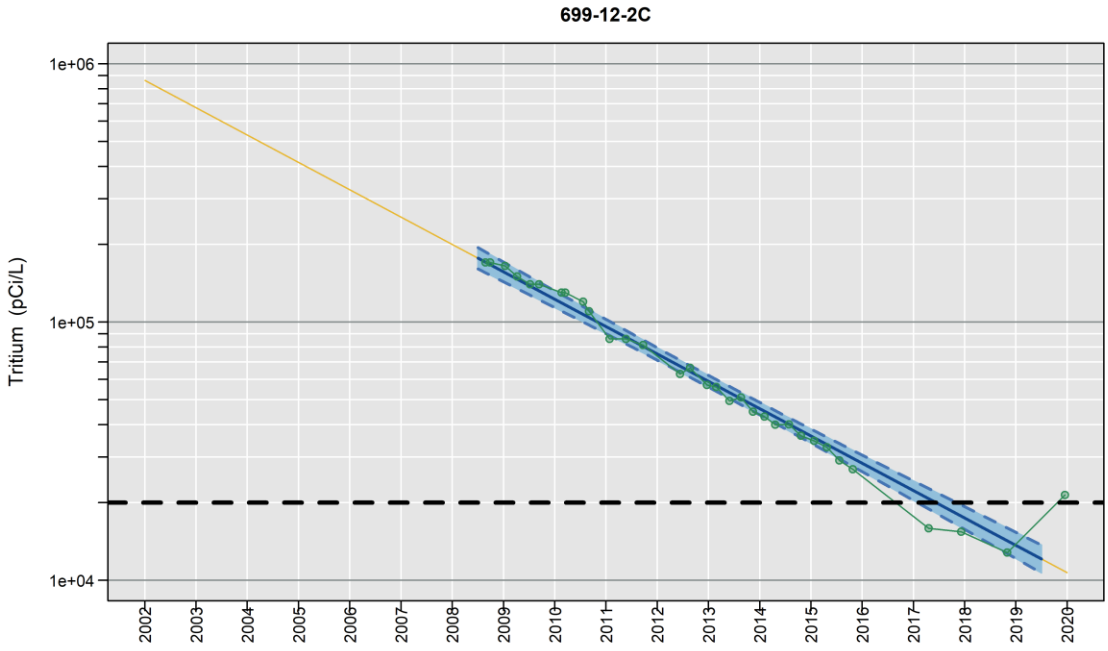
Trend1:
ln Conc. = 0.47 (+/- 0.28)*River Stage + 0.0017 (+/- 0.00042)*Date + -73 (+/- 29)
Trend2:
ln Conc. = -0.16 (+/- 0.065)*River Stage + -0.00022 (+/- 0.000052)*Date + 21 (+/- 7.2)

Tritium

699-12-2C

Distance to River: 5526 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	No Covariate
Significance of Trend (p-value):	< 0.05
Significance of Date (p-value):	1.9e-179
Number of Observations:	32
Percent NDs:	0%



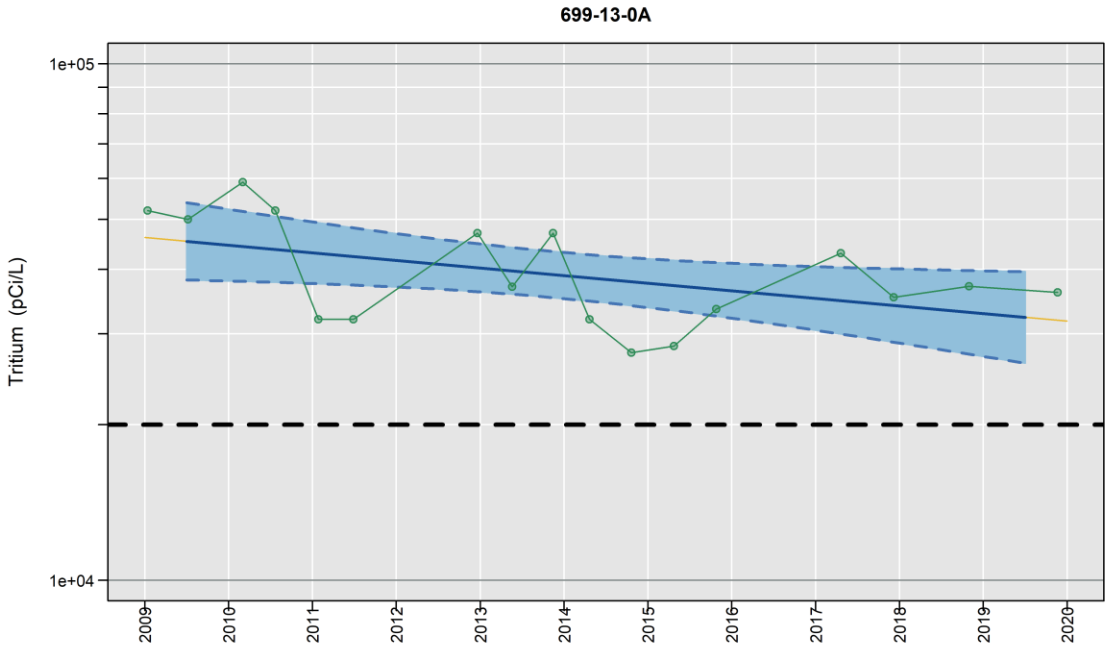
Censored Regression (Tobit) Model

ln Conc. = -0.00067 (+/- 0.000023)*Date + 21 (+/- 0.37)

699-13-0A

Distance to River: 4675 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	No Covariate
Significance of Trend (p-value):	0.032
Significance of Date (p-value):	0.021
Number of Observations:	17
Percent NDs:	0%



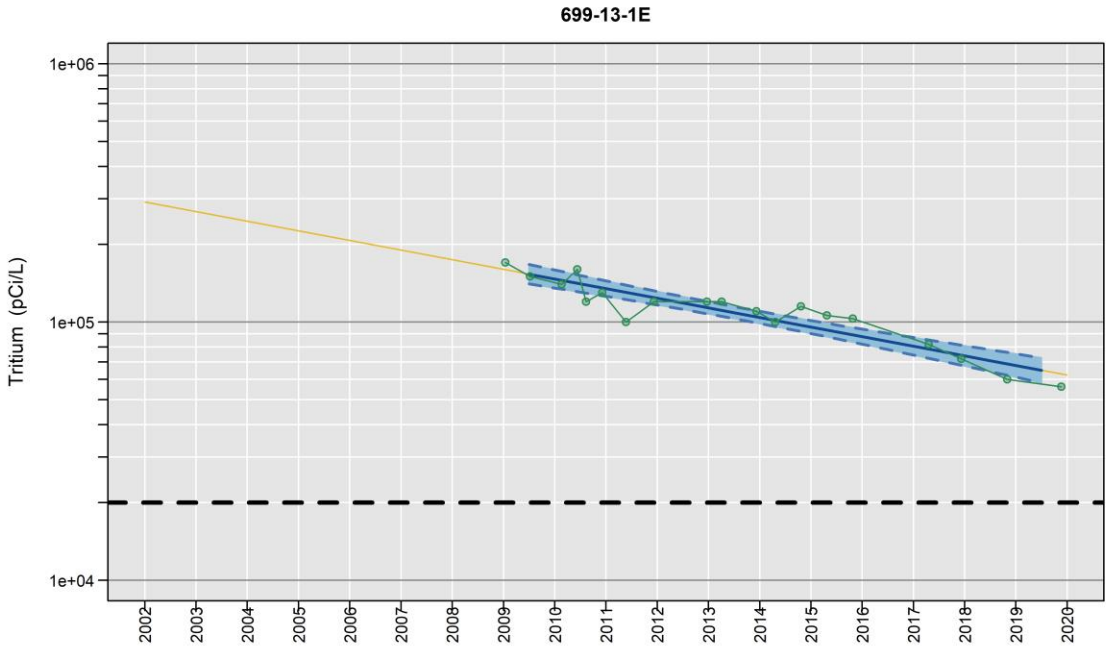
Censored Regression (Tobit) Model

ln Conc. = -0.000093 (+/- 0.00004)*Date + 12 (+/- 0.65)

699-13-1E

Distance to River: 5173 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	No Covariate
Significance of Trend (p-value):	8.9e-10
Significance of Date (p-value):	1.6e-27
Number of Observations:	19
Percent NDs:	0%



Censored Regression (Tobit) Model

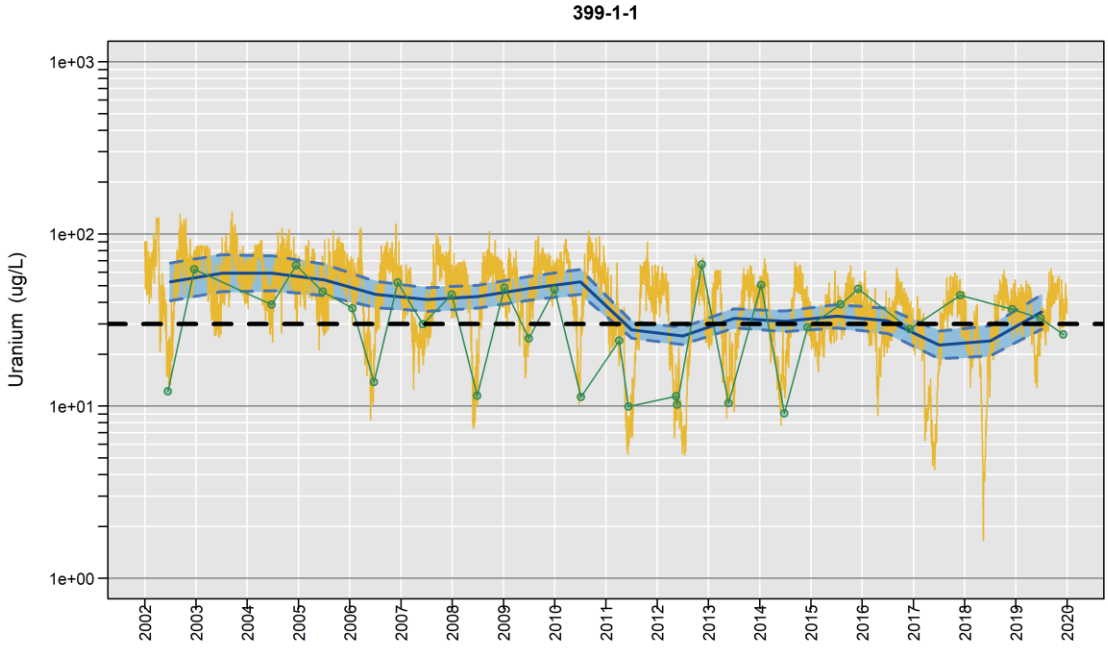
ln Conc. = -0.00023 (+/- 0.000022)*Date + 15 (+/- 0.34)

Uranium

399-1-1

Distance to River: 76 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	6.1e-11
Significance of River Stage (p-value):	1.1e-25
Significance of Date (p-value):	0.00064
Number of Observations:	31
Percent NDs:	0%



Censored Regression (Tobit) Model

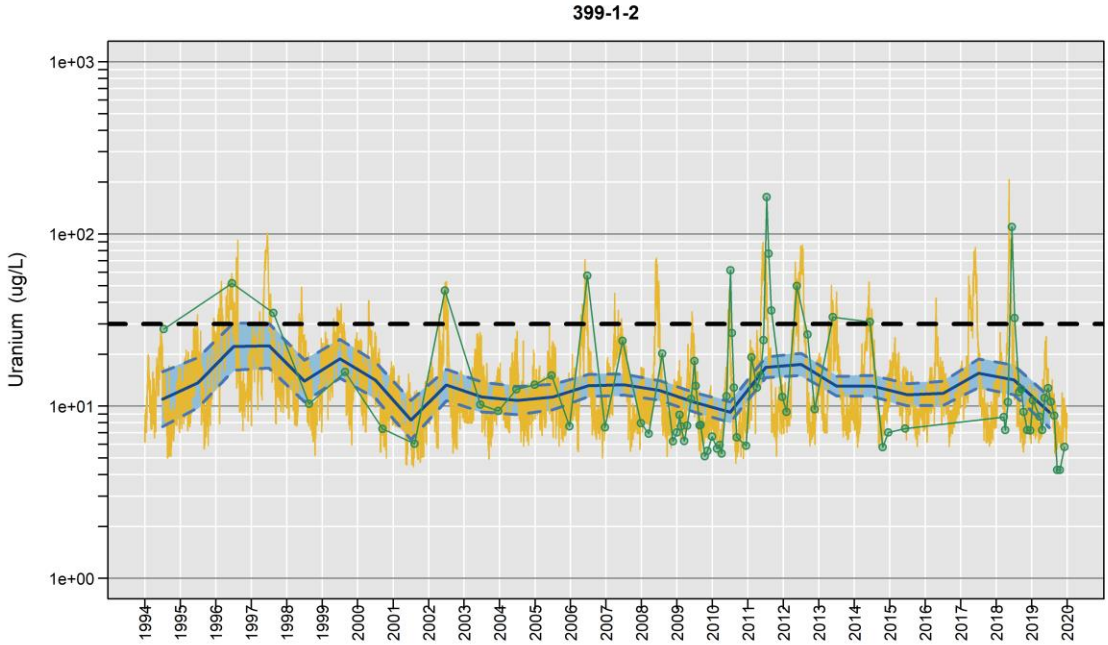
ln Conc. = -0.83 (+/- 0.08)*River Stage + -0.00011 (+/- 0.000031)*Date + 93 (+/- 8.5)

399-1-2

Distance to River: 386 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	1.1e-13
Significance of River Stage (p-value):	7.4e-20
Significance of Date (p-value):	0.53
Number of Observations:	80
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

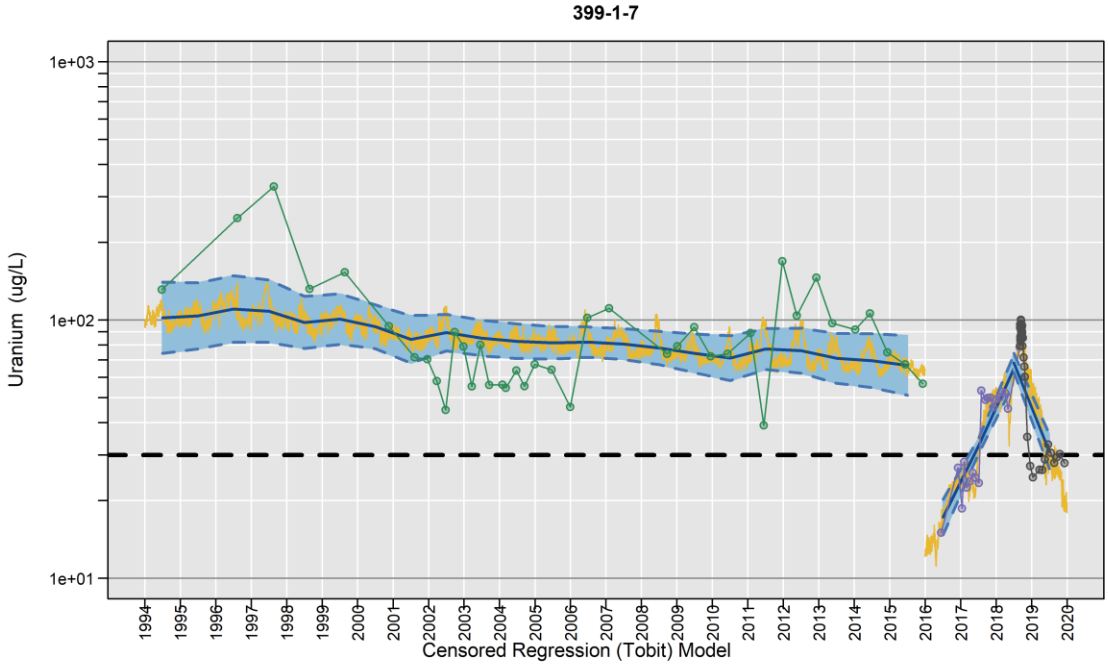
Trend Not Significant

399-1-7

Distance to River: 209 m
Number of Trends Calculated: 3

	Trend1	Trend2	Trend3
Est. Lag Time (days):	1	1	1
Significance of Trend (p-value):	0.1	8.4e-11	5e-13
Significance of River Stage (p-value):	0.13	6e-06	0.047
Significance of Date (p-value):	0.071	8.9e-34	7.3e-19
Number of Observations:	40	20	40
Percent NDs:	0%	0%	0%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Observed Conc. (Trend3)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



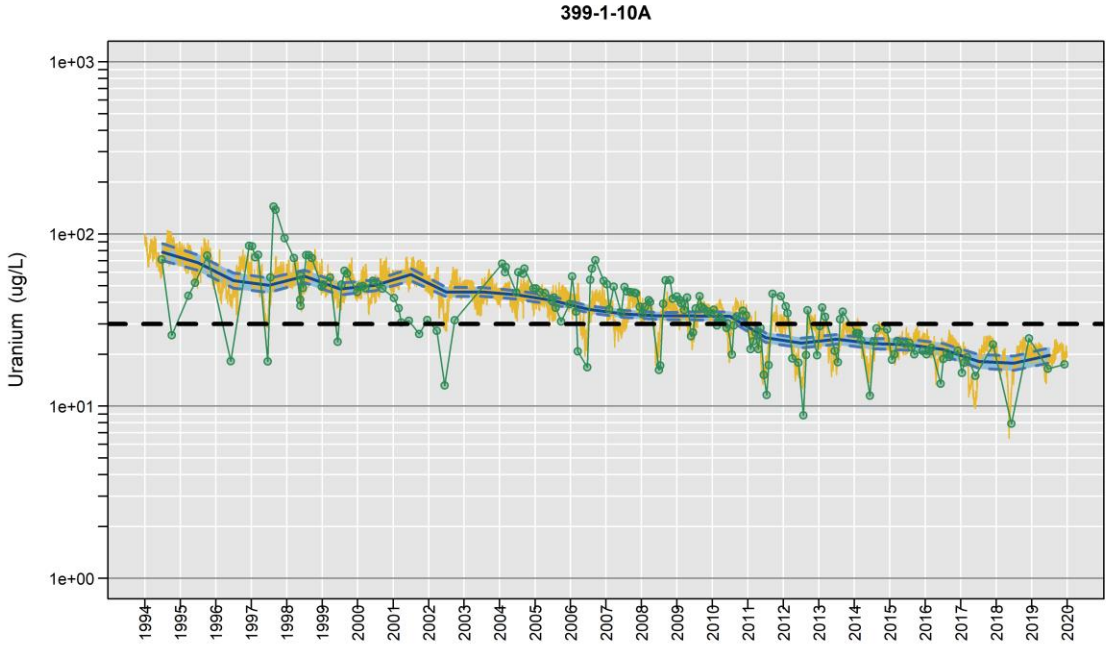
Trend1:
Trend Not Significant
Trend2:
ln Conc. = -0.2 (+/- 0.043)*River Stage + 0.0019 (+/- 0.00016)*Date + -9.1 (+/- 5.6)
Trend3:
ln Conc. = -0.32 (+/- 0.16)*River Stage + -0.003 (+/- 0.00034)*Date + 92 (+/- 15)

399-1-10A

Distance to River: 70 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	< 0.05
Significance of River Stage (p-value):	1.2e-16
Significance of Date (p-value):	2.3e-49
Number of Observations:	172
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

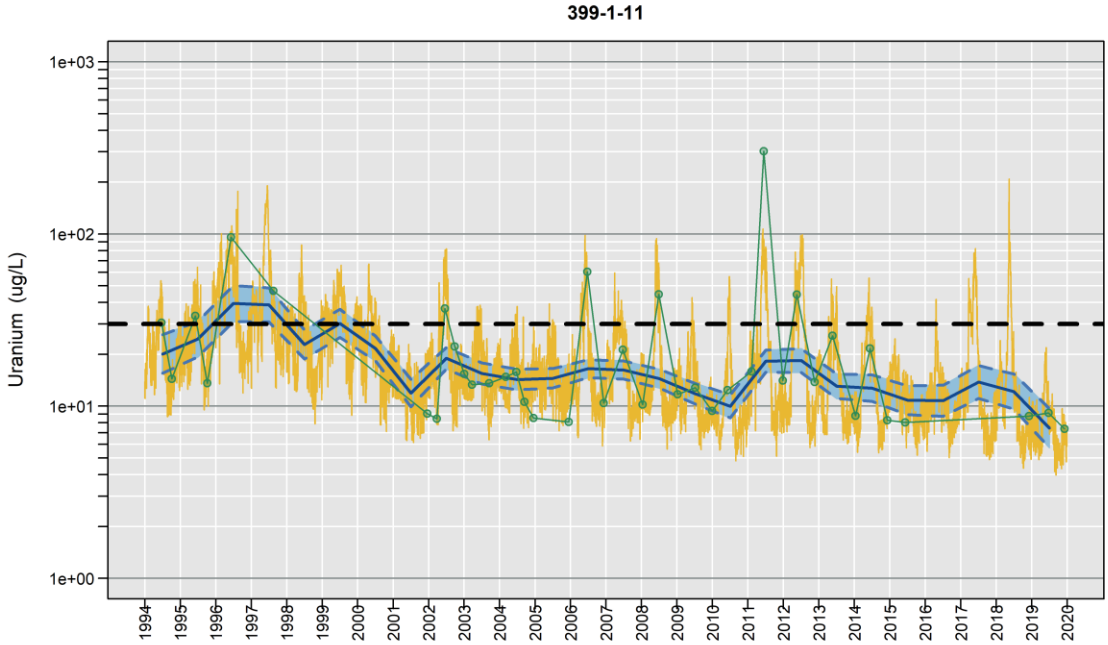
ln Conc. = -0.32 (+/- 0.038)*River Stage + -0.00015 (+/- 0.00001)*Date + 39 (+/- 4)

399-1-11

Distance to River: 314 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	1.6e-13
Significance of River Stage (p-value):	3.6e-28
Significance of Date (p-value):	9.2e-06
Number of Observations:	40
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



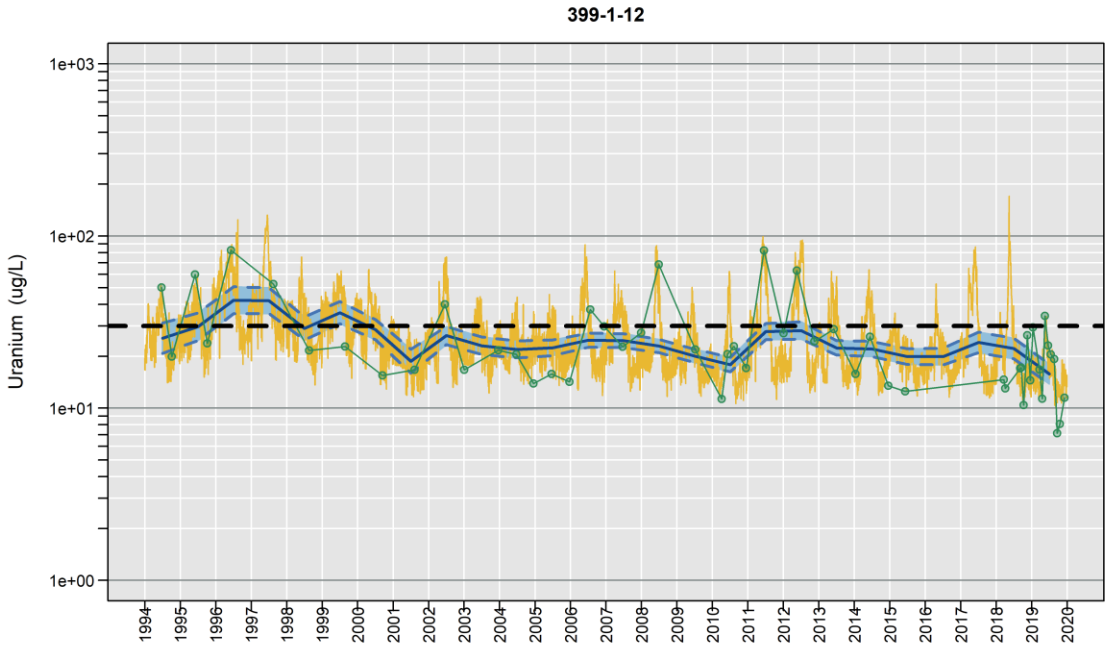
Censored Regression (Tobit) Model

ln Conc. = 0.88 (+/- 0.08)*River Stage + -0.00011 (+/- 0.000024)*Date + -89 (+/- 8.5)

399-1-12

Distance to River: 398 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	2
Significance of Trend (p-value):	9.9e-14
Significance of River Stage (p-value):	5.3e-19
Significance of Date (p-value):	0.00064
Number of Observations:	53
Percent NDs:	0%



Censored Regression (Tobit) Model

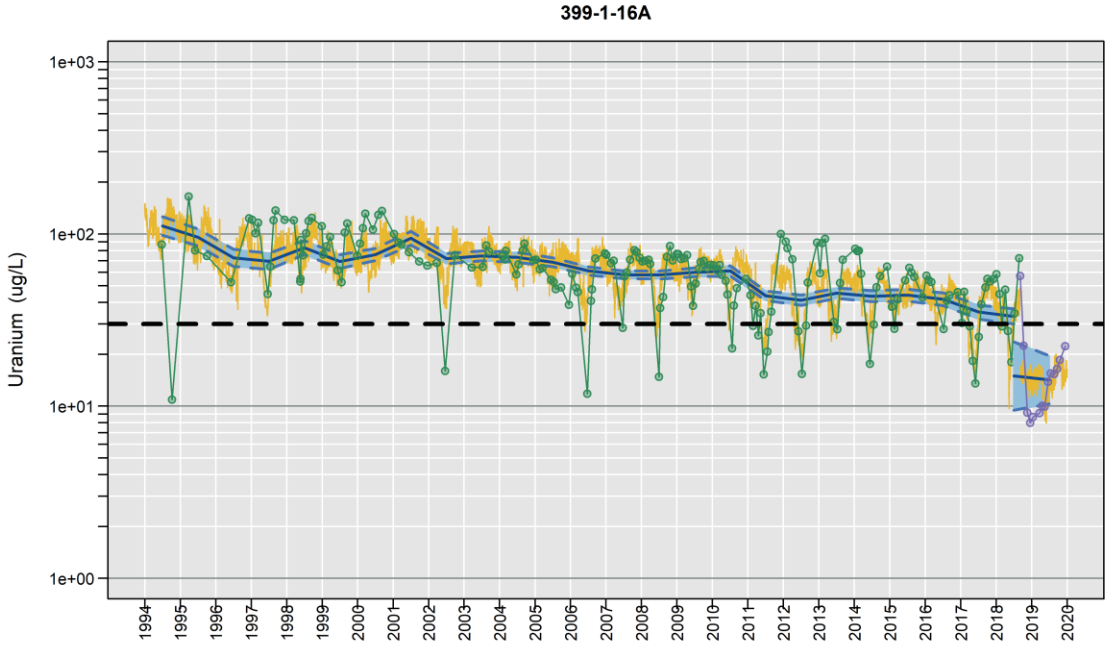
ln Conc. = 0.63 (+/- 0.071)*River Stage + -0.000051 (+/- 0.000015)*Date + -63 (+/- 7.6)

399-1-16A

Distance to River: 141 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	< 0.05	0.45
Significance of River Stage (p-value):	1.1e-21	0.2
Significance of Date (p-value):	8e-23	0.87
Number of Observations:	187	14
Percent NDs:	0%	0%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

Trend1:
ln Conc. = -0.4 (+/- 0.042)*River Stage + -0.00011 (+/- 0.000011)*Date + 48 (+/- 4.5)
Trend2:
Trend Not Significant

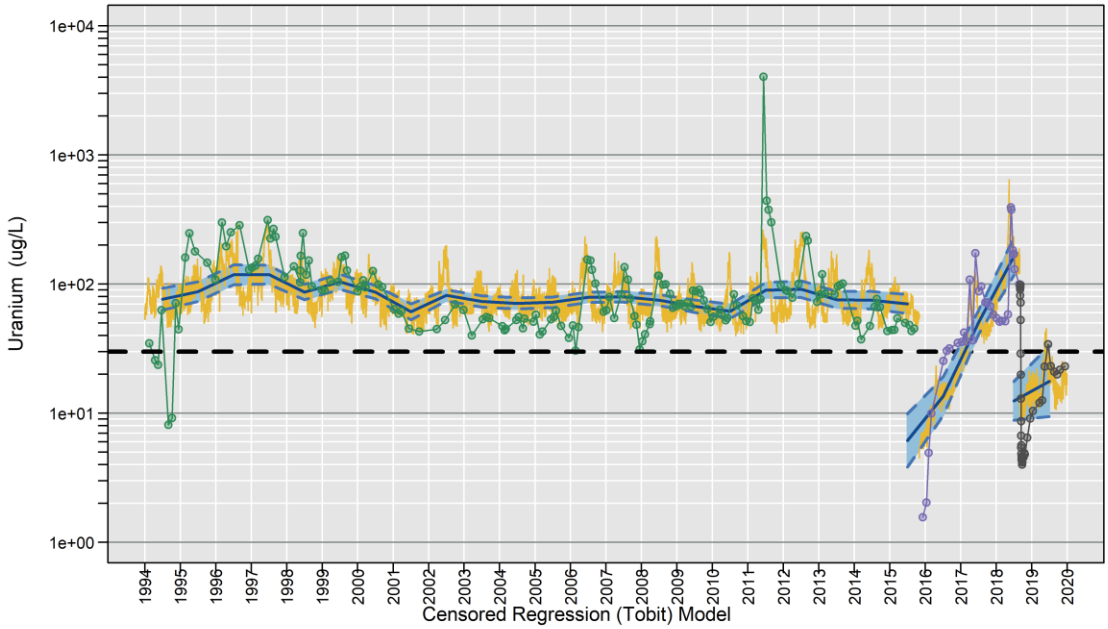
399-1-17A

Distance to River: 344 m
Number of Trends Calculated: 3

	Trend1	Trend2	Trend3
Est. Lag Time (days):	1	1	1
Significance of Trend (p-value):	4.1e-11	4.8e-11	0.29
Significance of River Stage (p-value):	7.1e-13	0.0012	0.26
Significance of Date (p-value):	0.16	7.1e-18	0.55
Number of Observations:	166	32	40
Percent NDs:	0%	0%	0%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Observed Conc. (Trend3)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level

399-1-17A



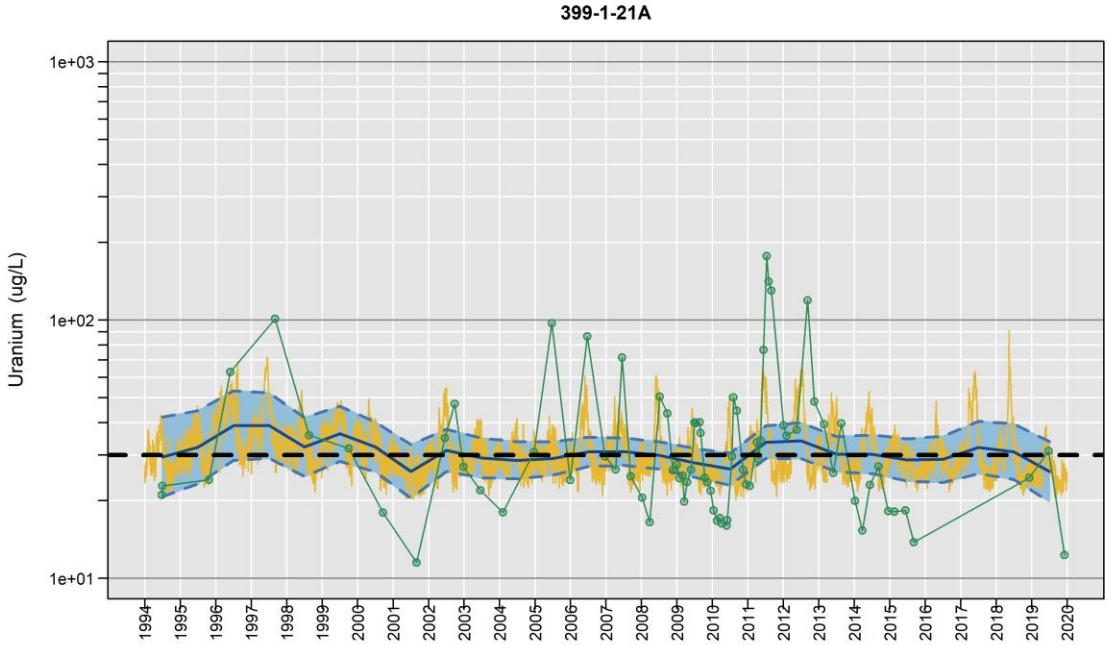
Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.5 (+/- 0.15)*River Stage + 0.0031 (+/- 0.00036)*Date + -100 (+/- 16)
Trend3:
Trend Not Significant

399-1-21A

Distance to River: 340 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.0013
Significance of River Stage (p-value):	2e-04
Significance of Date (p-value):	0.66
Number of Observations:	78
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



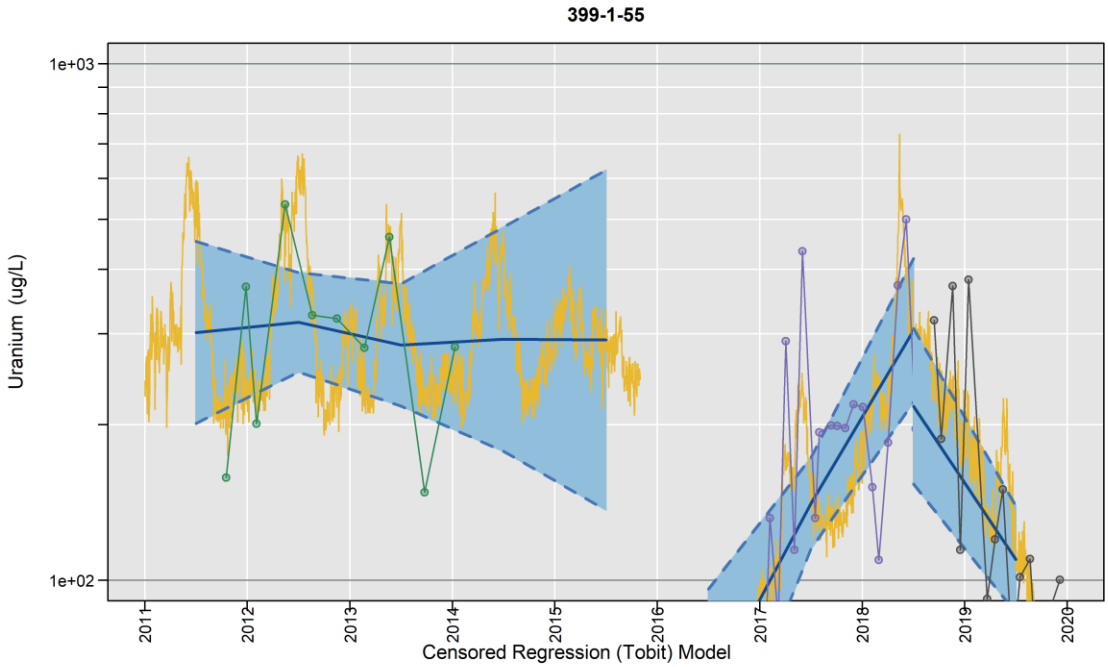
Censored Regression (Tobit) Model

Trend Not Significant

399-1-55

Distance to River: 295 m
Number of Trends Calculated: 3

	Trend1	Trend2	Trend3
Est. Lag Time (days):	3	3	3
Significance of Trend (p-value):	0.0095	0.00015	0.00088
Significance of River Stage (p-value):	8.8e-05	0.0027	0.09
Significance of Date (p-value):	0.81	3.4e-06	2.6e-06
Number of Observations:	10	21	14
Percent NDs:	0%	0%	0%



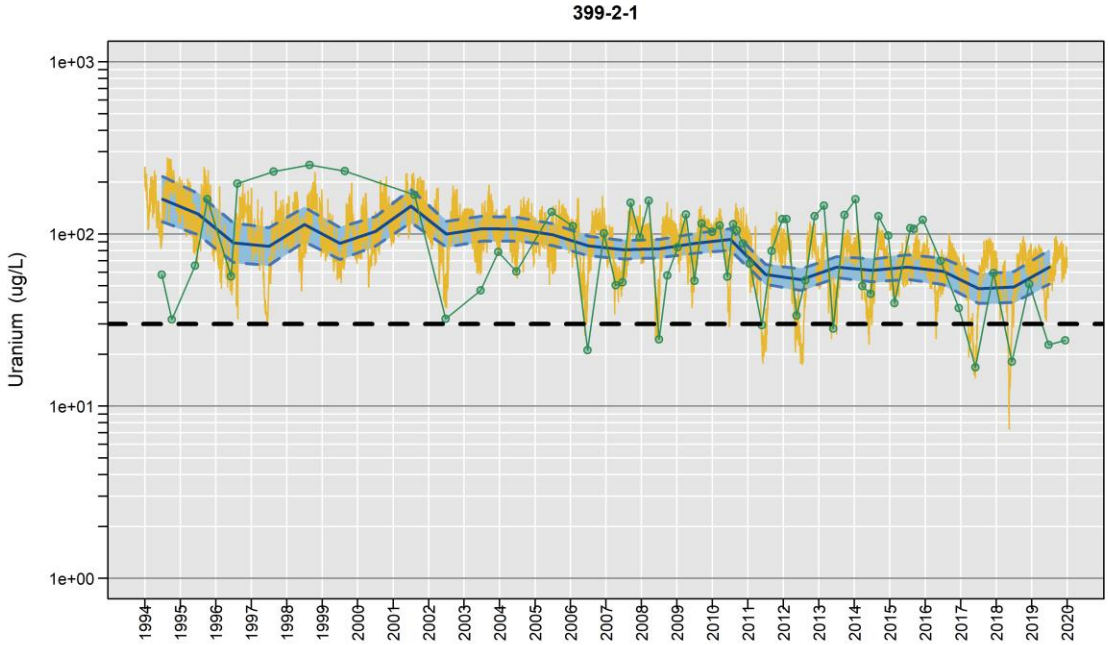
Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.32 (+/- 0.11)*River Stage + 0.002 (+/- 0.00044)*Date + -65 (+/- 14)
Trend3:
ln Conc. = 0.51 (+/- 0.3)*River Stage + -0.0032 (+/- 0.00068)*Date + 9.6 (+/- 33)

399-2-1

Distance to River: 57 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	3.4e-10
Significance of River Stage (p-value):	1.1e-12
Significance of Date (p-value):	4.4e-05
Number of Observations:	63
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



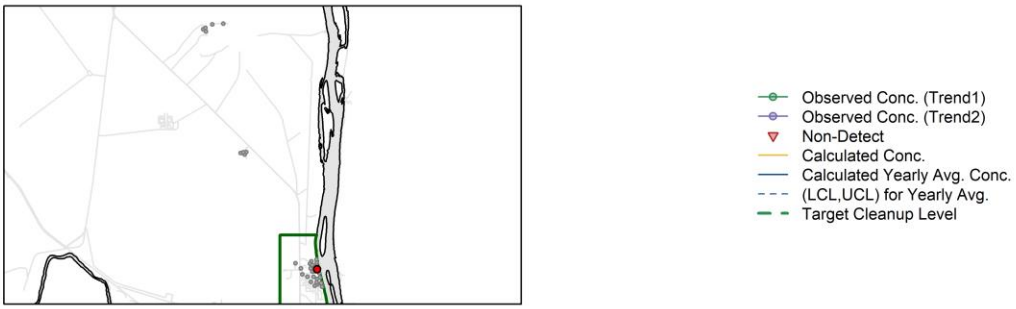
Censored Regression (Tobit) Model

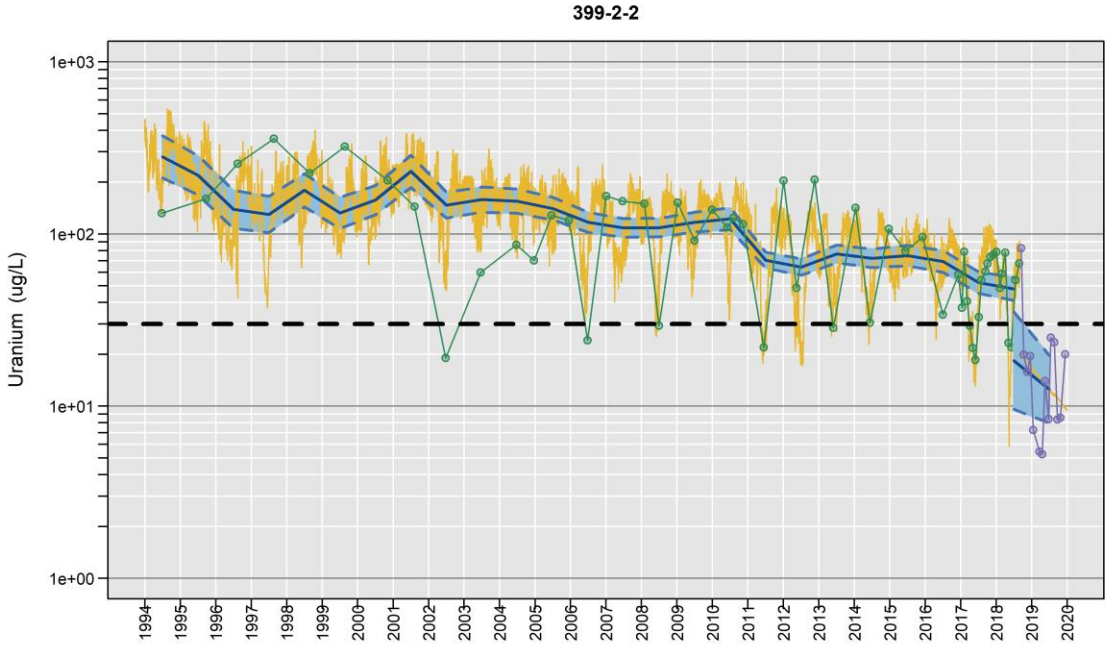
ln Conc. = -0.59 (+/- 0.084)*River Stage + -0.0001 (+/- 0.000025)*Date + 68 (+/- 8.9)

399-2-2

Distance to River: 98 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	1.1e-16	0.5
Significance of River Stage (p-value):	2.3e-20	0.92
Significance of Date (p-value):	3.7e-13	0.24
Number of Observations:	57	14
Percent NDs:	0%	0%





Censored Regression (Tobit) Model

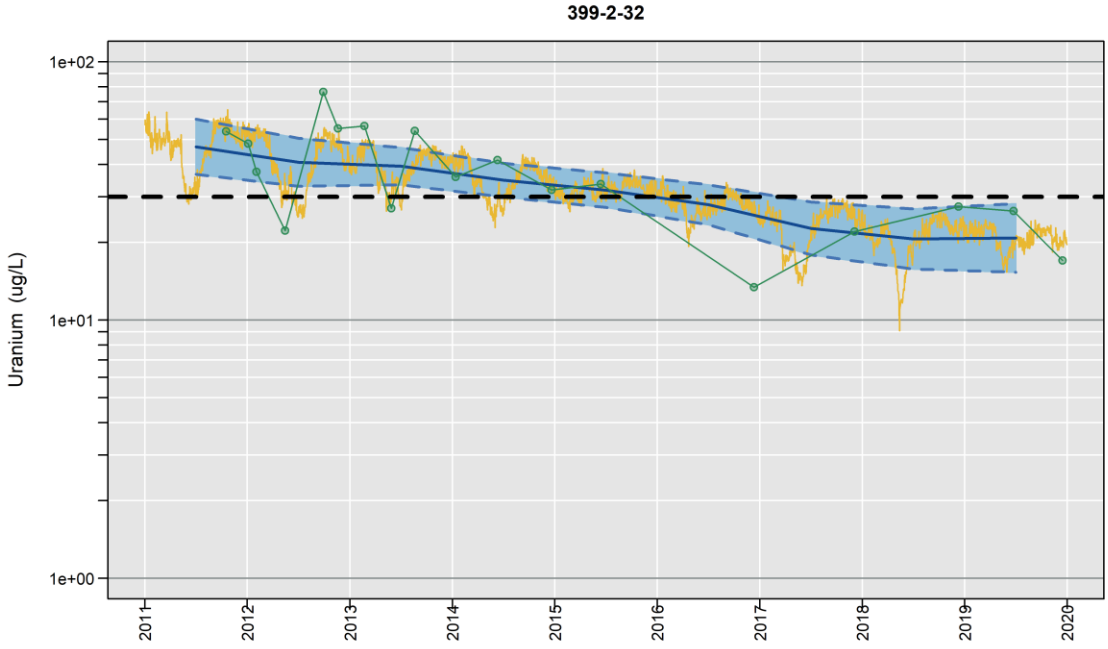
Trend1:
ln Conc. = -0.69 (+/- 0.075)*River Stage + -0.00015 (+/- 0.000021)*Date + 80 (+/- 7.9)
Trend2:
Trend Not Significant

399-2-32

Distance to River: 217 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.00049
Significance of River Stage (p-value):	0.026
Significance of Date (p-value):	3.5e-06
Number of Observations:	18
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

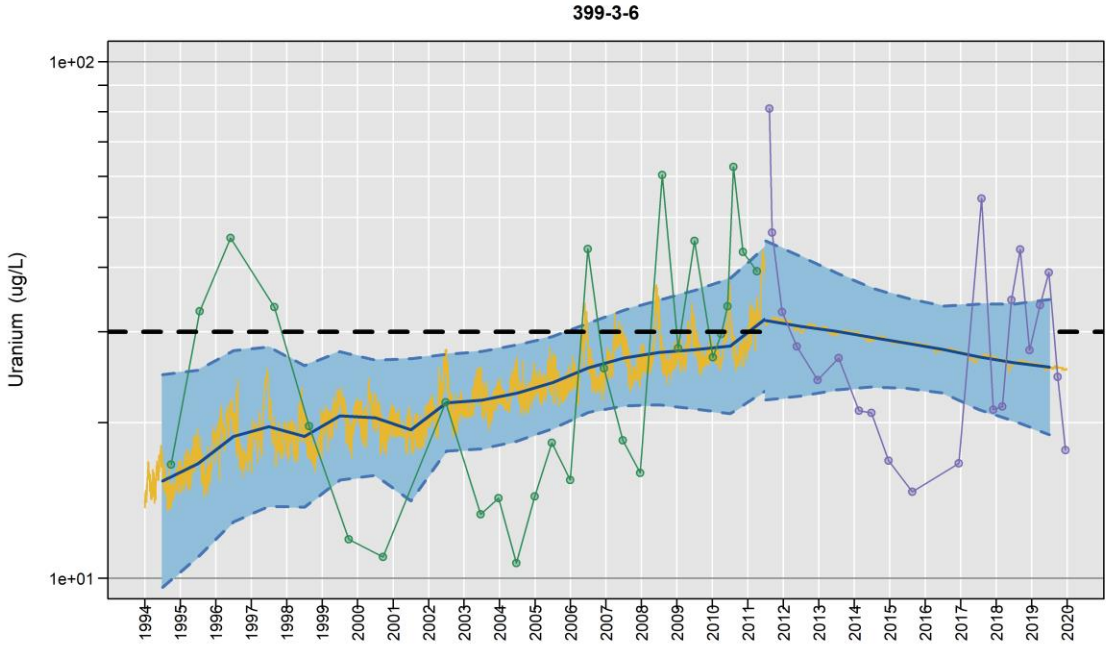
ln Conc. = -0.26 (+/- 0.12)*River Stage + -0.00034 (+/- 0.000073)*Date + 36 (+/- 13)

399-3-6

Distance to River: 623 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0.11	0.7
Significance of River Stage (p-value):	0.31	0.92
Significance of Date (p-value):	0.039	0.39
Number of Observations:	27	21
Percent NDs:	0%	0%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



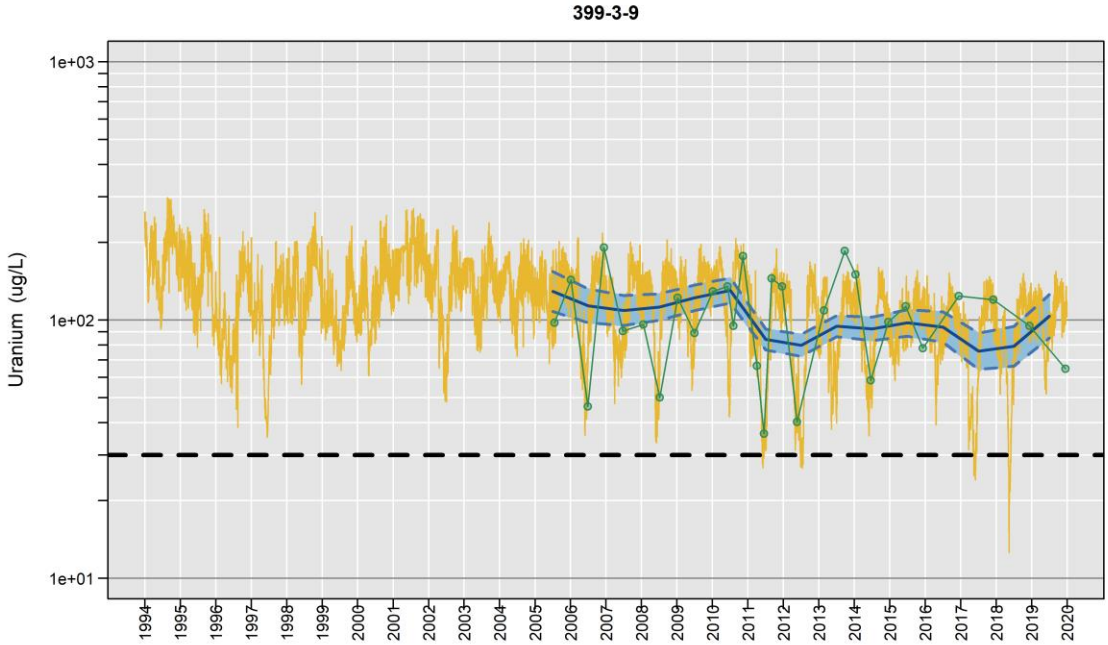
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

399-3-9

Distance to River: 68 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	4.2e-09
Significance of River Stage (p-value):	2.7e-19
Significance of Date (p-value):	0.054
Number of Observations:	29
Percent NDs:	0%



Censored Regression (Tobit) Model

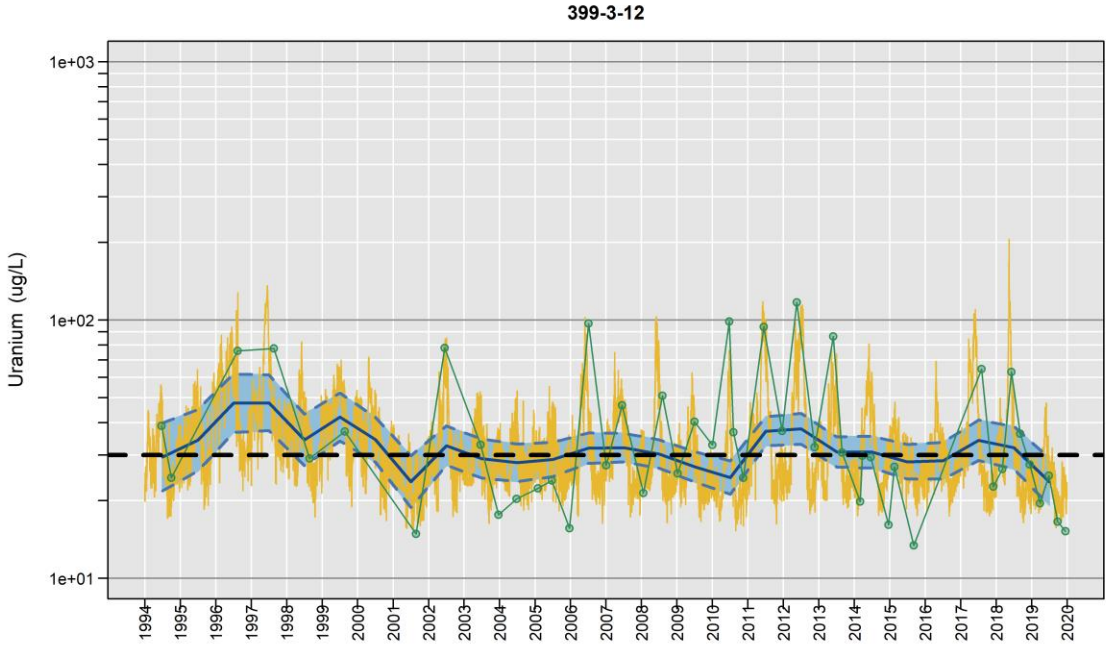
Trend Not Significant

399-3-12

Distance to River: 344 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	9.9e-08
Significance of River Stage (p-value):	3.8e-11
Significance of Date (p-value):	0.32
Number of Observations:	47
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



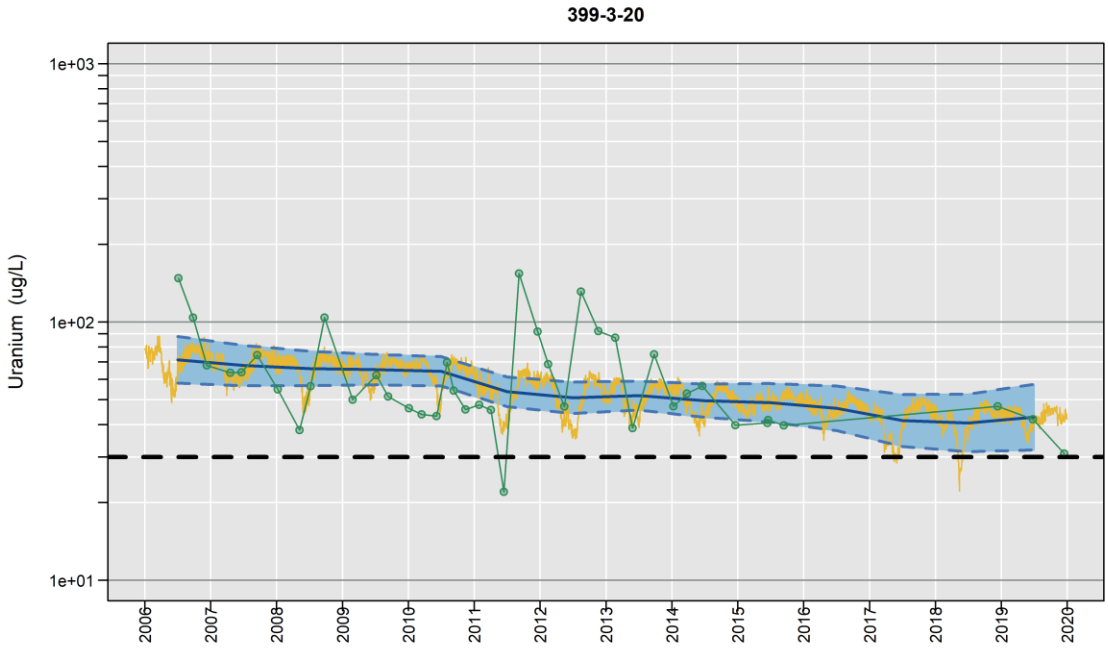
Censored Regression (Tobit) Model

Trend Not Significant

399-3-20

Distance to River: 210 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.0037
Significance of River Stage (p-value):	0.027
Significance of Date (p-value):	0.0079
Number of Observations:	41
Percent NDs:	0%



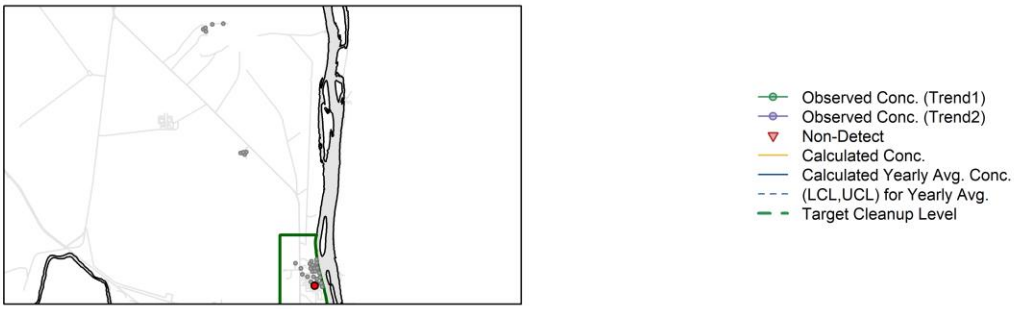
Censored Regression (Tobit) Model

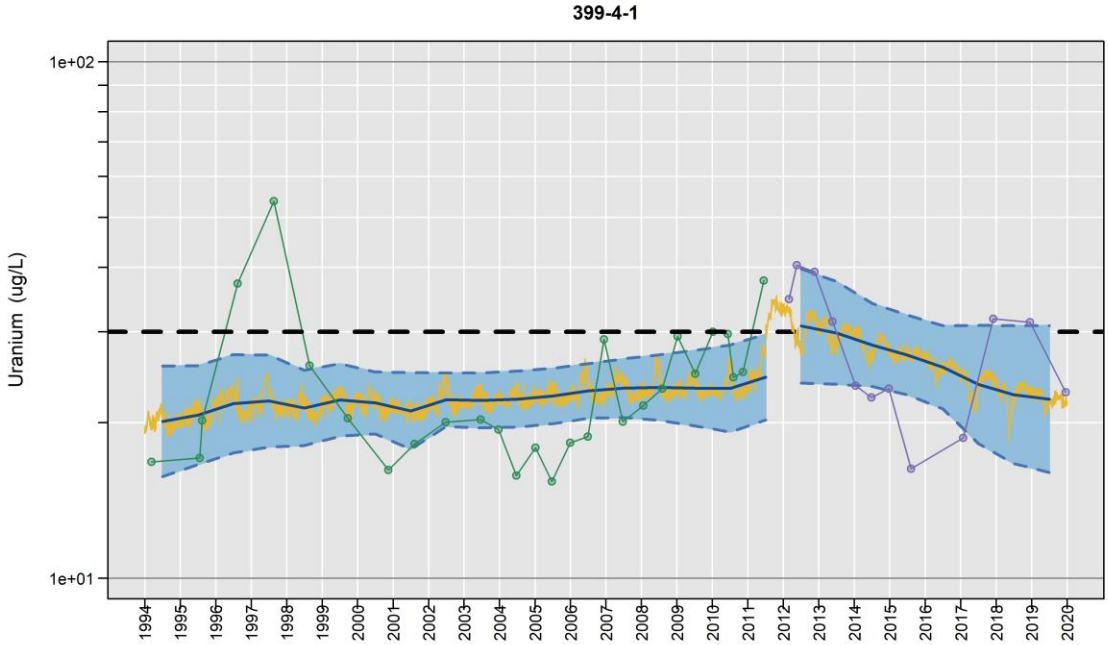
ln Conc. = -0.19 (+/- 0.086)*River Stage + -0.00012 (+/- 0.000045)*Date + 26 (+/- 9.1)

399-4-1

Distance to River: 381 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	1	1
Significance of Trend (p-value):	0.46	0.3
Significance of River Stage (p-value):	0.4	0.63
Significance of Date (p-value):	0.36	0.12
Number of Observations:	28	12
Percent NDs:	0%	0%





Censored Regression (Tobit) Model

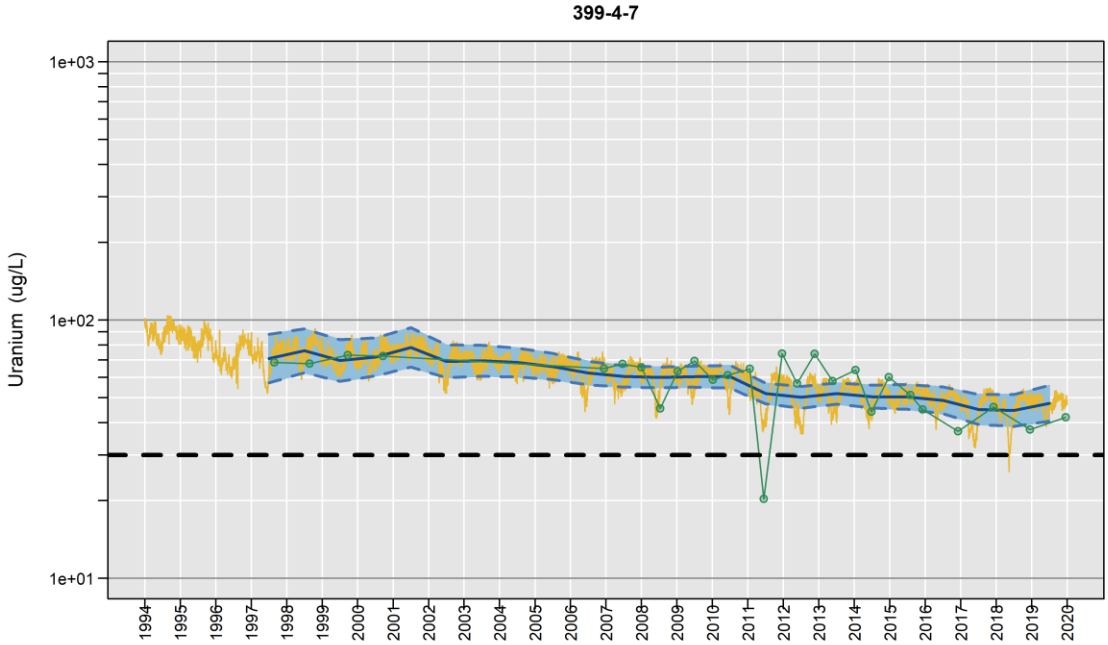
Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

399-4-7

Distance to River: 72 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.00036
Significance of River Stage (p-value):	0.0032
Significance of Date (p-value):	3e-04
Number of Observations:	27
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

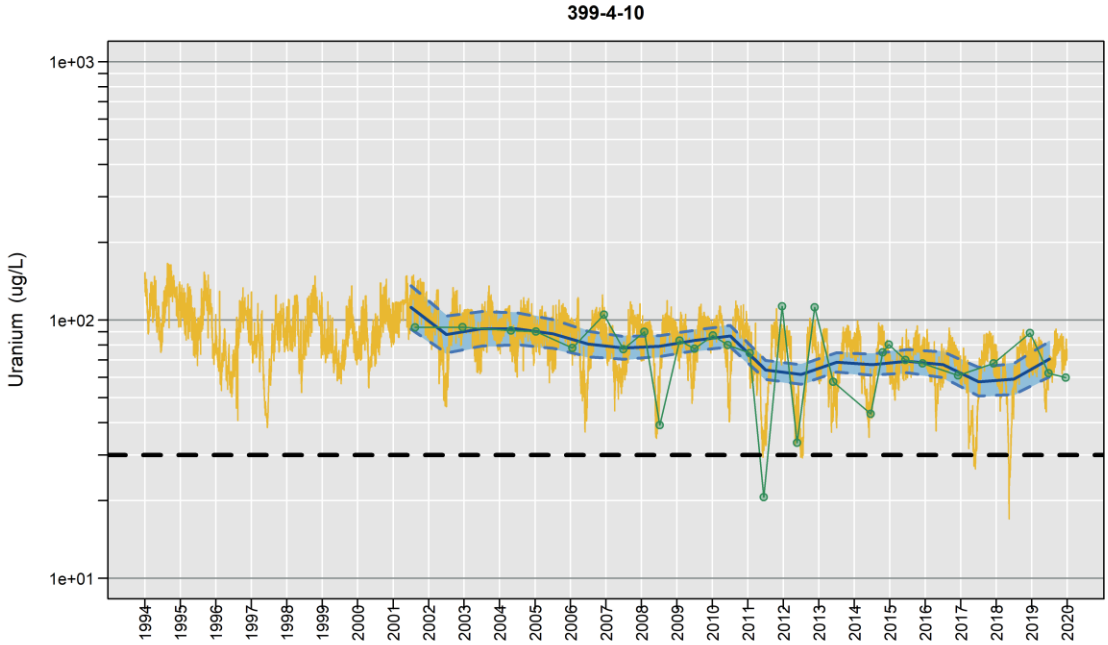
ln Conc. = -0.17 (+/- 0.058)*River Stage + -0.000069 (+/- 0.000019)*Date + 23 (+/- 6.2)

399-4-10

Distance to River: 69 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	6.8e-08
Significance of River Stage (p-value):	1.4e-13
Significance of Date (p-value):	0.011
Number of Observations:	29
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

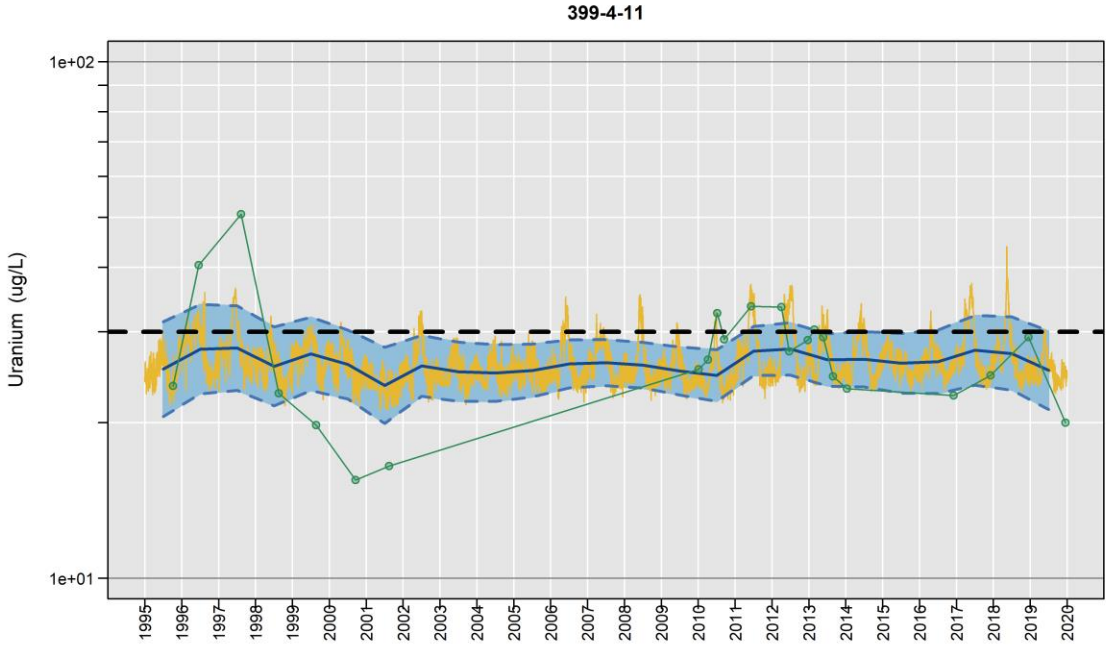
ln Conc. = -0.39 (+/- 0.053)*River Stage + -0.000055 (+/- 0.000021)*Date + 46 (+/- 5.6)

399-4-11

Distance to River: 522 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.047
Significance of River Stage (p-value):	0.0082
Significance of Date (p-value):	0.8
Number of Observations:	23
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

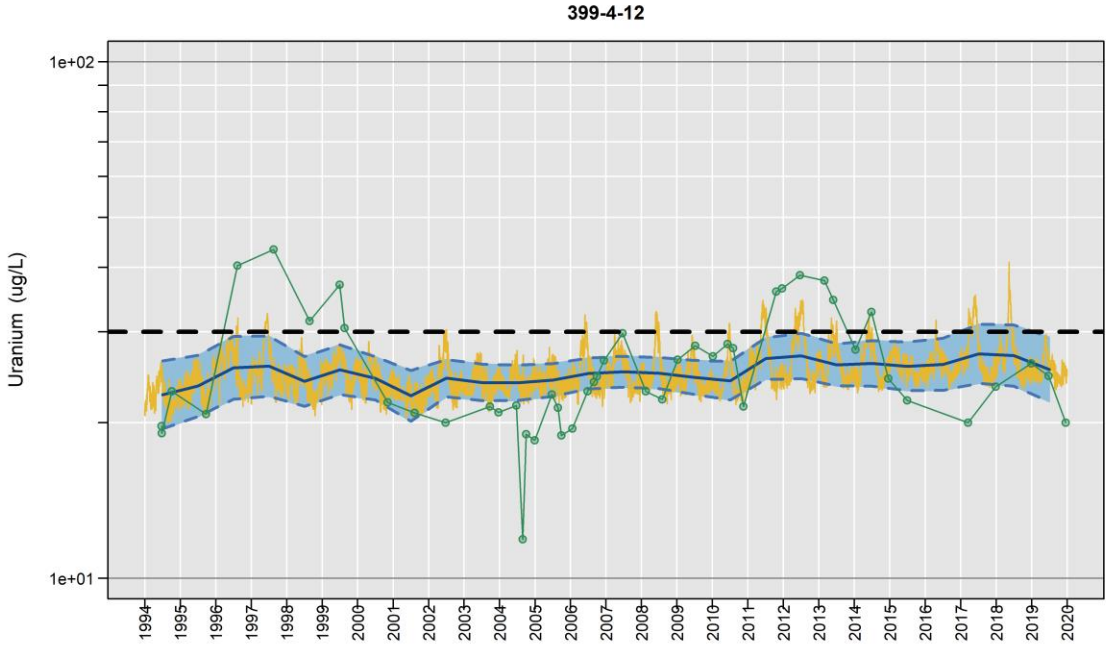
Trend Not Significant

399-4-12

Distance to River: 153 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.066
Significance of River Stage (p-value):	0.023
Significance of Date (p-value):	0.35
Number of Observations:	49
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

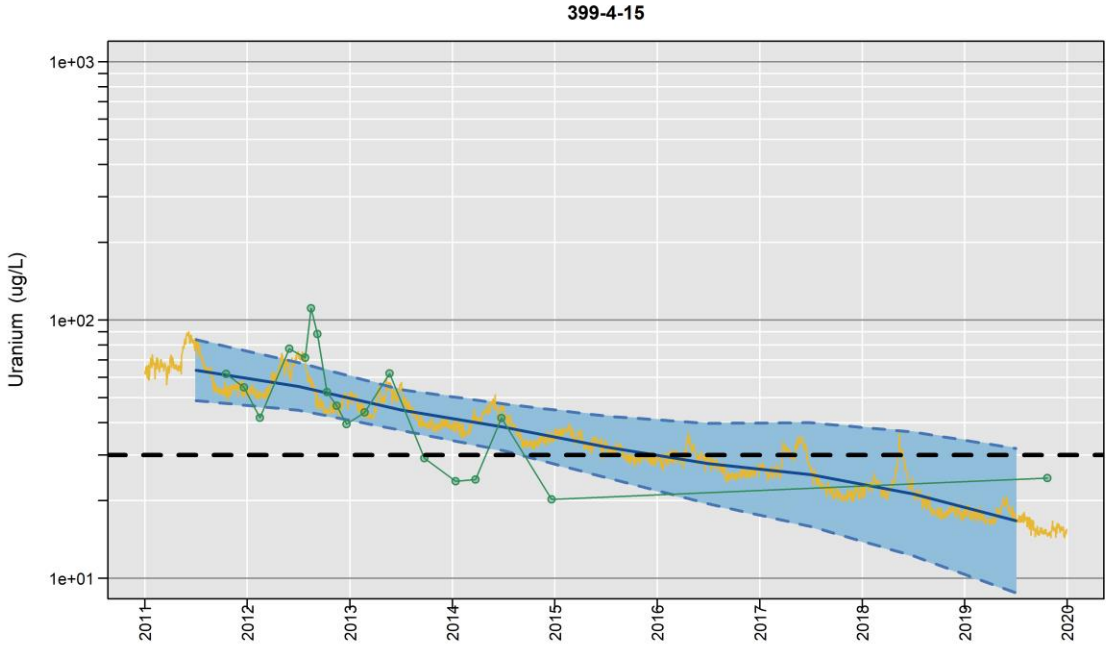
Trend Not Significant

399-4-15

Distance to River: 278 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	1
Significance of Trend (p-value):	0.0055
Significance of River Stage (p-value):	0.14
Significance of Date (p-value):	0.0014
Number of Observations:	18
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



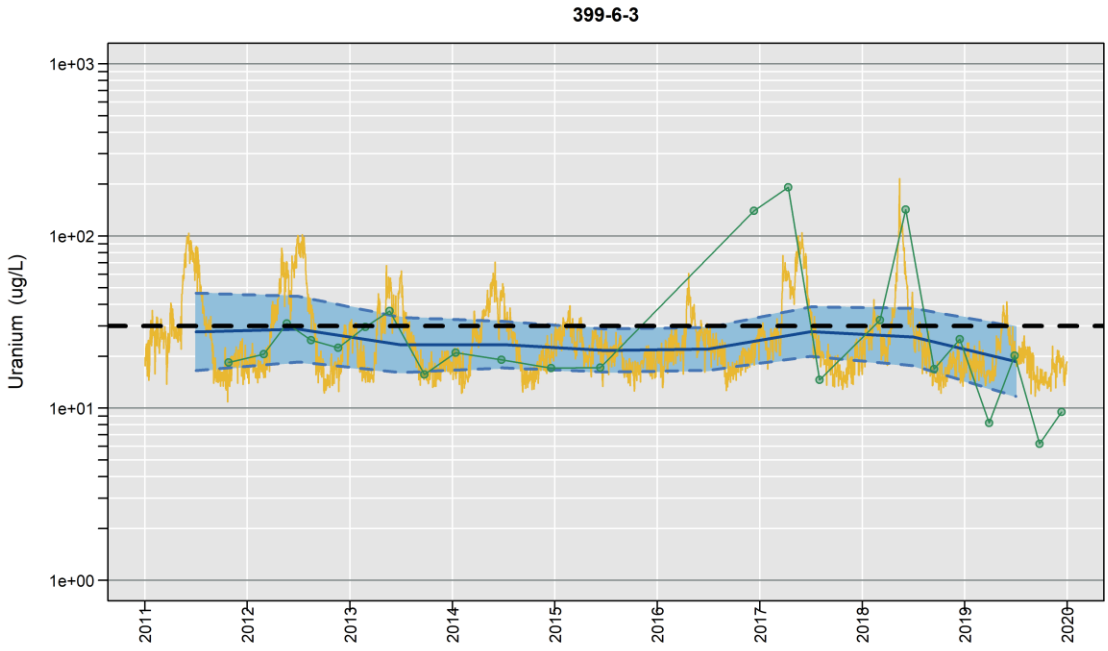
Censored Regression (Tobit) Model

ln Conc. = 0.16 (+/- 0.11)*River Stage + -0.00042 (+/- 0.00013)*Date + -6.9 (+/- 12)

399-6-3

Distance to River: 819 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	3
Significance of Trend (p-value):	0.0021
Significance of River Stage (p-value):	5.9e-05
Significance of Date (p-value):	0.92
Number of Observations:	23
Percent NDs:	0%



Censored Regression (Tobit) Model

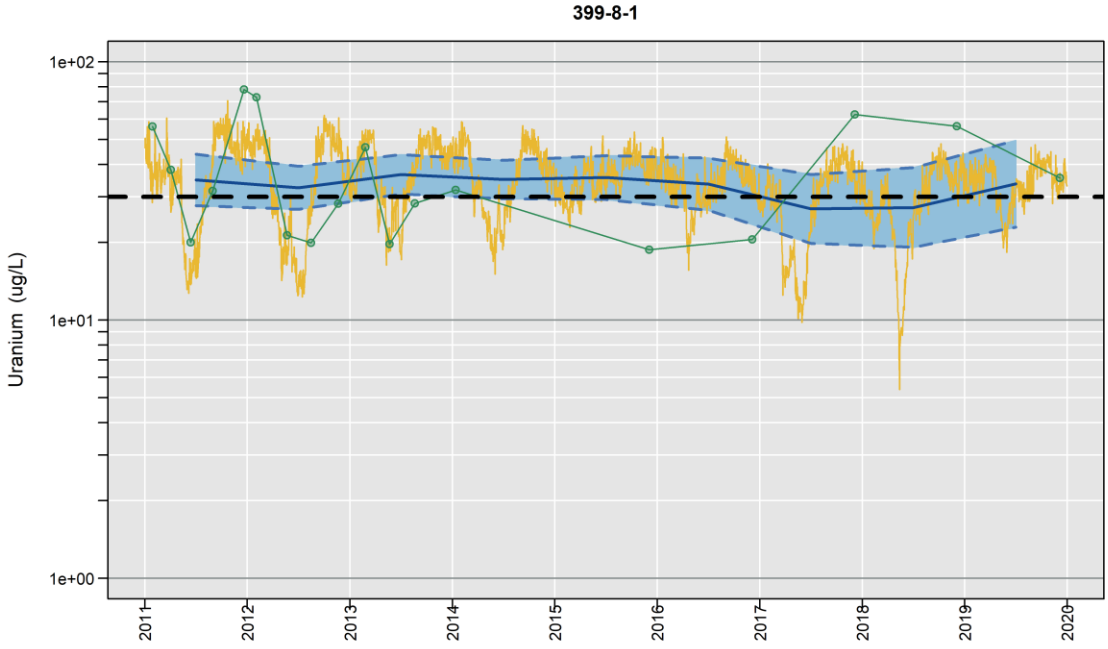
Trend Not Significant

399-8-1

Distance to River: 832 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	3
Significance of Trend (p-value):	0.0018
Significance of River Stage (p-value):	1.9e-05
Significance of Date (p-value):	0.15
Number of Observations:	18
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

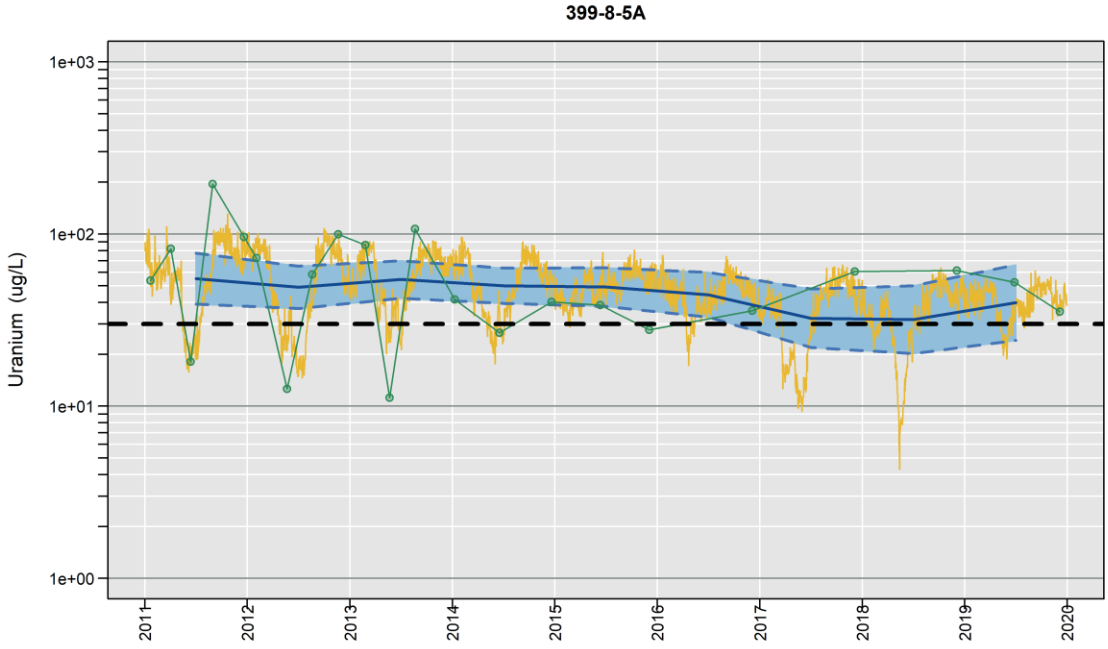
Trend Not Significant

399-8-5A

Distance to River: 1046 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	7
Significance of Trend (p-value):	0.0025
Significance of River Stage (p-value):	9.3e-05
Significance of Date (p-value):	0.036
Number of Observations:	22
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

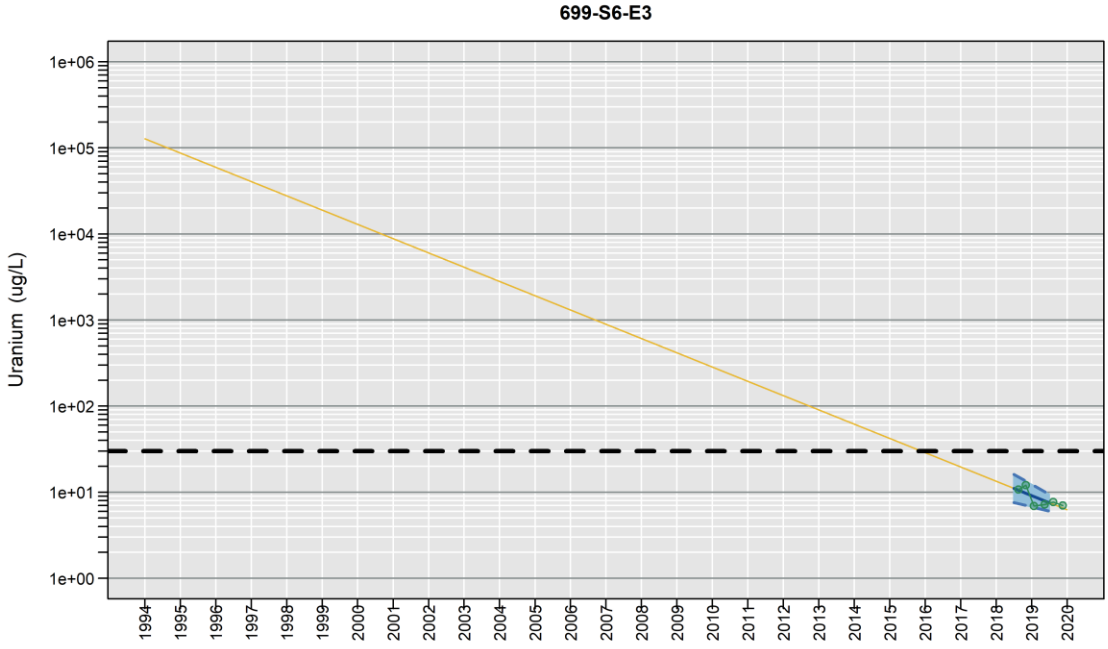
ln Conc. = -0.63 (+/- 0.16)*River Stage + -0.00025 (+/- 0.00012)*Date + 74 (+/- 18)

699-S6-E3

Distance to River: 3568 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	No Covariate
Significance of Trend (p-value):	0.027
Significance of Date (p-value):	0.006
Number of Observations:	6
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

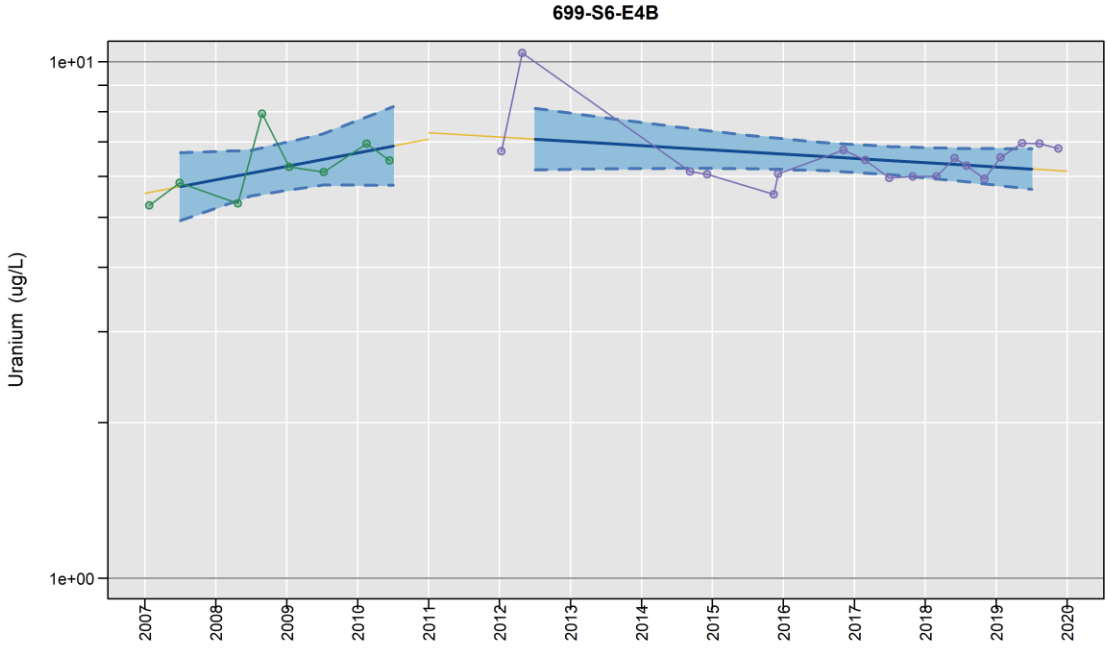
ln Conc. = -0.001 (+/- 0.00038)*Date + 21 (+/- 6.8)

699-S6-E4B

Distance to River: 3438 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	No Covariate	No RS
Significance of Trend (p-value):	0.1	0.14
Significance of Date (p-value):	0.074	0.13
Number of Observations:	8	18
Percent NDs:	0%	0%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

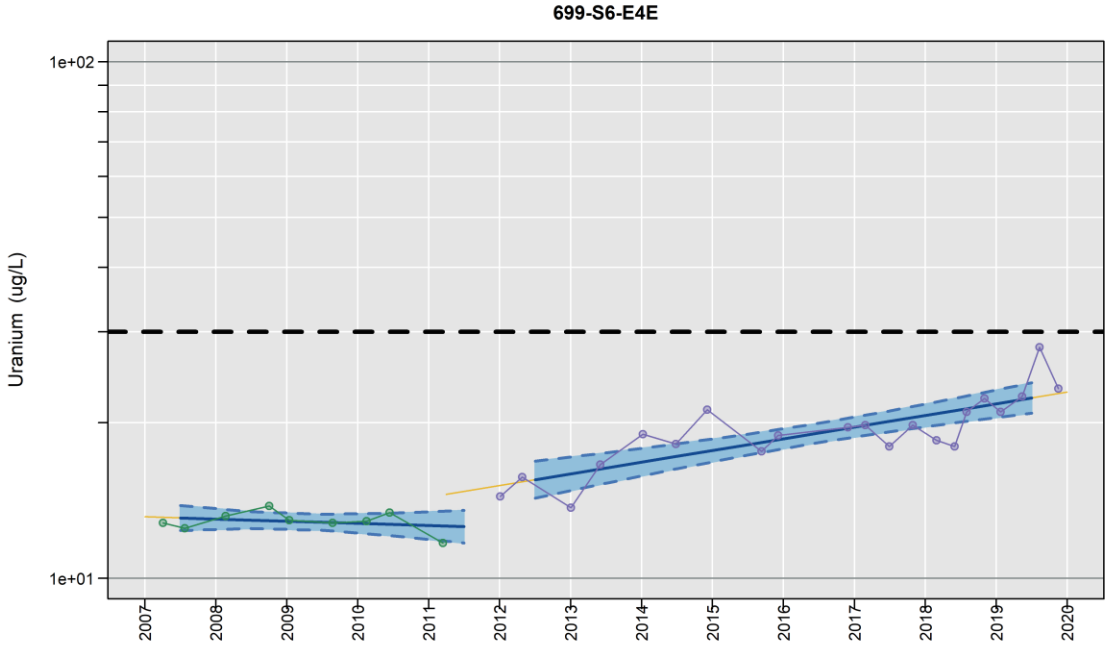
Trend1:
Trend Not Significant
Trend2:
Trend Not Significant

699-S6-E4E

Distance to River: 3518 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	No Covariate	No RS
Significance of Trend (p-value):	0.39	2.5e-06
Significance of Date (p-value):	0.38	3.6e-10
Number of Observations:	9	21
Percent NDs:	0%	0%

Observed Conc. (Trend1)
Observed Conc. (Trend2)
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



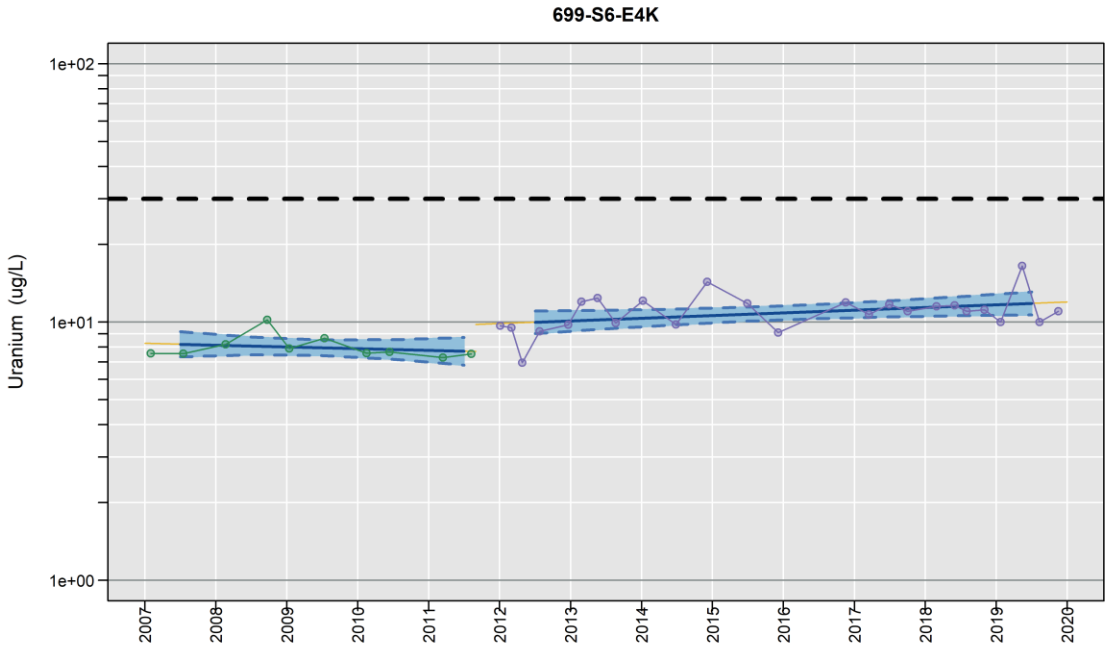
Censored Regression (Tobit) Model

Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.00014 (+/- 0.000023)*Date + 0.53 (+/- 0.39)

699-S6-E4K

Distance to River: 3689 m
Number of Trends Calculated: 2

	Trend1	Trend2
Est. Lag Time (days):	No Covariate	No RS
Significance of Trend (p-value):	0.44	0.041
Significance of Date (p-value):	0.44	0.033
Number of Observations:	10	25
Percent NDs:	0%	0%



Censored Regression (Tobit) Model

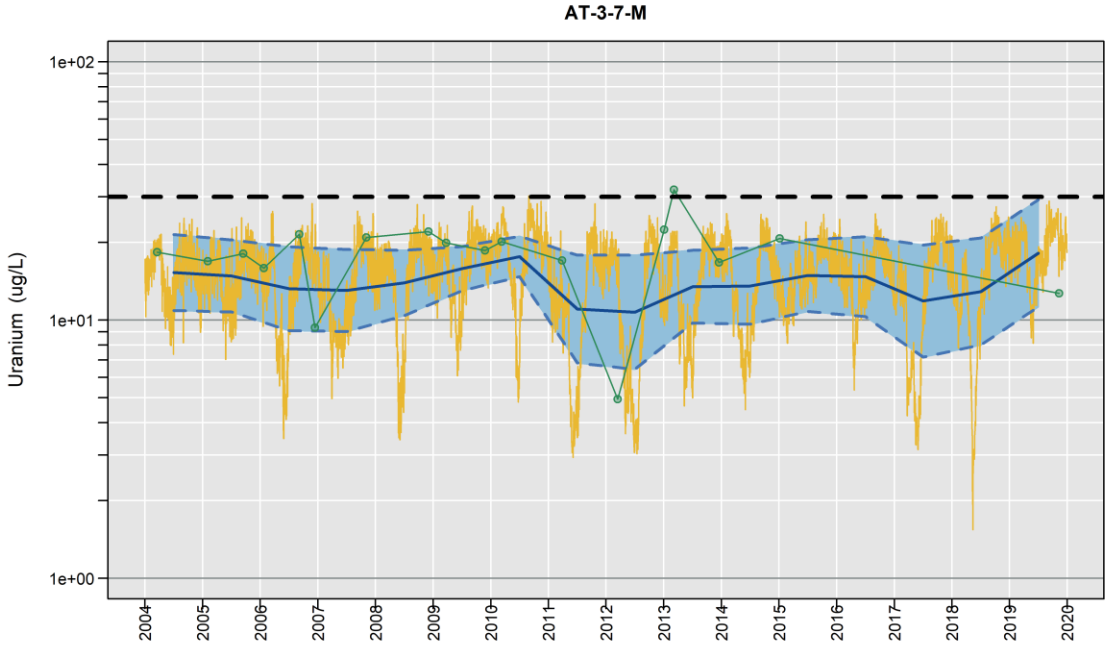
Trend1:
Trend Not Significant
Trend2:
ln Conc. = 0.000066 (+/- 0.000031)*Date + 1.3 (+/- 0.52)

AT-3-7-M

Distance to River: 5 m
Number of Trends Calculated: 1

	Trend
Est. Lag Time (days):	0
Significance of Trend (p-value):	0.14
Significance of River Stage (p-value):	0.037
Significance of Date (p-value):	0.72
Number of Observations:	18
Percent NDs:	0%

Observed Concentration
Non-Detect
Calculated Conc.
Calculated Yearly Avg. Conc.
(LCL,UCL) for Yearly Avg.
Target Cleanup Level



Censored Regression (Tobit) Model

Trend Not Significant

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