Prepared for
Nevada Environmental Response Trust
Henderson, Nevada

Prepared by
Ramboll Environ US Corporation
Emeryville, California

Project Number
21-41400C

Date
October 27, 2017

RI/FS WORK PLAN ADDENDUM: PHASE 3 REMEDIAL INVESTIGATION, Revision 1

NEVADA ENVIRONMENTAL RESPONSE TRUST SITE
HENDERSON, NEVADA

RAMBOLL ENVIRON

RI/FS Work Plan Addendum:
Phase 3 Remedial Investigation, Revision 1

Nevada Environmental Response Trust Site
(Former Tronox LLC Site)
Henderson, Nevada

Nevada Environmental Response Trust (NERT) Representative Certification
I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the system(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee not individually, but solely as President

Signature: Jay A Steinberg, ____________, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

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Title: Solely as President and not individually

Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 10/27/17

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Responsible Certified Environmental Manager (CEM) for this project

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

10/26/2017

John M. Pekala, PG
Senior Manager

Date

Certified Environmental Manager
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Date **October 27, 2017**
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Description **RI/FS Work Plan Addendum: Phase 3 Remedial Investigation, Revision 1**

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ACRONYMS AND ABBREVIATIONS

AOC3	Settlement Agreement and Administrative Order on Consent, BMI Common Areas, Phase 3 (NDEP 2006)
AMPAC	American Pacific Corporation
amsl	above mean sea level
APCC	American Potash and Chemical
ARAR	Applicable or Relevant and Appropriate Requirement
Basic Management	Basic Management Incorporated
BCL	basic comparison level
bgs	below ground surface
Birding Ponds	Henderson Bird Viewing Preserve
BMI	Black Mountain Industrial, Basic Magnesium Incorporated, Basic Management Incorporated, Basic Metals Incorporated
BRC	Basic Remediation Company LLC
CAMU	corrective action management unit
CEM	Certified Environmental Manager
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Chemstar	Chemstar Incorporated
COH	City of Henderson
Combined Metals	Combined Metals Reduction Company
COPCs	chemicals of potential concern; the term “COPC” is used throughout the report to refer to chemicals of potential concern within the NERT RI Study Area and may refer to different specific compounds within different investigation areas, as outlined in Table 1-1 and Figure 1-3
CRC	Colorado River Commission
CSM	Conceptual Site Model
CWA	Clean Water Act
ECI	Environmental Conditions Investigation
ENVIRON	ENVIRON International Corporation
EPA	United State Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
Ft	feet
ft/ft	feet per foot
gpm	gallons per minute
gpm/ft^2	gallons per day per square foot
HASP	Health and Safety Plan
HHRA	human health risk assessments
HISSC	Henderson Industrial Site Steering Committee

HLC	Henderson Legacy Conditions
Kerr-McGee	Kerr-McGee Chemical Corporation
LBCL	leaching basic comparison level
LOU	Letter of Understanding Area
LVW	Las Vegas Wash
MCL	maximum contaminant level
mg/L	milligrams per liter
mph	miles per hour
NDEP	Nevada Division of Environmental Protection
NERT	Nevada Environmental Response Trust
NFA	no further action
Northgate	Northgate Environmental Management, Inc.
OU	operable unit
OSSM	Olin/Stauffer/Syngenta/Montrose
PCB	polychlorinated biphenyl
PEPCON	Pacific Engineering and Production Company of Nevada
Phase 1 RI	Phase 1 RI Data Gap Investigation
Phase 2 RI	Phase 2 RI Data Gap Investigation
Phase 3 RI	Phase 3 RI Data Gap Investigation
PHG	public health goal
Pioneer	Pioneer Chlor Alkai Company, Inc.
PRG	preliminary remediation goal
Qal	Quaternary alluvium
QAPP	Quality Assurance Project Plan
Ramboll Environ	Ramboll Environ US Corporation
RAO	Remedial Action Objectives
RAS	Remedial Alternatives Study
RIB	Rapid Infiltration Basin
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
SAP	Sampling and Analysis Plan
Site	Nevada Environmental Response Trust Site
SNWA	Southern Nevada Water Authority
Stauffer	Stauffer Chemical Company
SVOC	semi-volatile organic carbon
xMCf	Transitional Upper Muddy Creek
TBC	to be considered
TDS	total dissolved solids

TIMET	Titanium Metals Corporation
Tronox	Tronox LLC
Trust	Nevada Environmental Response Trust
µg/L	micrograms per liter
UMCf	Upper Muddy Creek Formation
VOC	volatile organic compound
WECCO	Western Electric Chemical Company
WBZ	water-bearing zone

EXECUTIVE SUMMARY

This document provides the Remedial Investigation and Feasibility Study (RI/FS) Work Plan Addendum for the Phase 3 Remedial Investigation (Phase 3 RI) within the Eastside Study Area (Phase 3 RI Work Plan). This work plan has been prepared in accordance with the Interim Consent Agreement between the Nevada Division of Environmental Protection (NDEP) and the Nevada Environmental Response Trust (NERT or the Trust). This Work Plan expands the boundaries of the NERT RI, which now consists of the NERT Site, the NERT Off-Site Study Area, the Downgradient Study Area, and the Eastside Study Area (collectively, "NERT RI Study Area") (Figure 1-1).

The purpose of this RI/FS Work Plan Addendum is to:

1) Present a work plan for investigation of chemicals of potential concern (COPCs) in the Eastside Study Area. As further defined below, the term "COPC" refers to different potential contaminants of concern in different sub-areas of the NERT RI Study Area. The investigation is designed to determine the extent of COPC contamination originating from the NERT Site in the Eastside Study Area, obtain data to support future feasibility study (FS) evaluations to address COPCs, and to assist in the selection of the final remedy for COPCs in the Eastside Study Area. The investigation activities will be conducted in accordance with the NDEP-approved Sampling and Analysis Plan (SAP), Health and Safety Plan (HASP), Field Sampling Plan (FSP), and Quality Assurance Project Plan (QAPP) developed for the NERT Phase 1 and Phase 2 RI Work Plans.

2) Refine and modify the Remedial Action Objectives (RAOs) for the NERT RI Study Area to incorporate the findings of the NERT Phase 1 RI investigation and expanded NERT RI Study Area, which now includes the Eastside Study Area and the Downgradient Study Area.

The Eastside Study Area is located adjacent to an industrial land use area (the current Black Mountain Industrial [BMI] Complex) and includes approximately 2,527 acres of land located immediately east (cross gradient) of the NERT Site and the NERT Off-Site Study Area and immediately south (upgradient) of the Downgradient Study Area. This area is located approximately 14 miles southeast of the City of Las Vegas and within the City limits of Henderson, with residential properties to the east and north. Figure 1-2 depicts current property ownership.

This Work Plan will involve the investigation of the Eastside Study Area, which encompasses two subareas:

- The Eastside Sub-Area is approximately 1,983 acres and located east of Pabco Road, west of Lake Mead Parkway, and south of Galleria Drive. The majority of the Eastside Sub-Area was historically part of the BMI Common Areas, portions of which were used for wastewater disposal by chemical producers at the neighboring BMI Complex. Much of the Eastside Sub-Area is currently vacant and is no longer associated with any operations within the BMI Complex. The southern portion of the Eastside Sub-Area is currently occupied by a number of commercial businesses. Residential structures are present or under construction in roughly the east-southeastern quarter of the Eastside Sub-Area.

- The Northeast Sub-Area is approximately 544 acres and is located north of Galleria Drive and encompasses much of the area currently occupied by the Chimera Golf Club, Tuscany Village, and other residential communities.

For clarification, the term "COPC" is used throughout this Phase 3 RI Work Plan to refer to chemicals of potential concern within the NERT RI Study Area. However, the term refers to different lists of specific constituents within different investigation areas, as outlined here and summarized in Table 1-1 and Figure 1-3:

<u>Eastside Study Area:</u>

- Eastside Sub-Area: COPCs in the Eastside Sub-Area are limited to perchlorate and chlorate.
- Northeast Sub-Area: COPCs in the Northeast Sub-Area are limited to perchlorate, chlorate, chromium, and hexavalent chromium, the same as the COPCs in the Downgradient Study Area.

<u>Downgradient Study Area</u>: COPCs in the Downgradient Study Area are limited to perchlorate, chlorate, chromium, and hexavalent chromium.

<u>NERT Off-Site Study Area</u>: COPCs in the Off-Site Study Area are limited to perchlorate, chlorate, chromium, hexavalent chromium, chloroform, and total dissolved solids (TDS).

<u>NERT Site</u>: The comprehensive COPC list presented in the RI/FS Work Plan (ENVIRON 2014), including a wider array of contaminants, including volatile organic compounds (VOCs) and other COPCs as defined in the RI/FS Work Plan, remains applicable to the investigation and remediation of the NERT Site.

The Basic Remediation Company LLC (BRC) conducted soil and groundwater investigations and remediation activity within the Eastside Sub-Area (completed in 2014), which served as the basis for NDEP granting No Further Action (NFA) determinations on parcels representing the majority[1] of the Eastside Sub-Area. NDEP's NFA determinations, however, were restricted to the upper 10 feet of the soil horizon and were/are consistent with proposed/current and future land uses. While the investigation outlined in this Phase 3 RI Work Plan includes soil and groundwater samples within the area for which NDEP previously issued NFA determinations, the Trust has no intent to re-open the NFA determinations and the new data obtained by the Trust will only be analyzed for purposes of addressing the COPCs for which the Trust is directed by NDEP to address.

In 2016, NDEP directed the Trust to investigate specific Henderson Legacy Conditions (e.g., perchlorate and chlorate) in the Eastside Sub-Area in order to evaluate the nature and extent of impacts in the subsurface, particularly in soil and the underlying groundwater due to the migration of the COPCs from the NERT Site. As previously indicated, and for the

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[1] As shown in Figure 3-1, NFA determinations were granted for the entire Eastside Sub-Area, with the exception of several parcels in the southern portion of the Eastside Sub-Area that were not part of the BMI Common Areas.

purpose of the Phase 3 RI within the Eastside Sub-Area, these COPCs are limited to perchlorate and chlorate. Chromium and hexavalent chromium, have been included in the COPC list for the Northeast Sub-Area for consistency with investigation of the Downgradient Study Area. This Phase 3 RI Work Plan presents the activities proposed to meet the intent of NDEP's directive. The potential presence of hexavalent chromium and other potential contaminants in groundwater within the Eastside Sub-Area will be investigated and remediated by BRC, if necessary, pursuant to the terms of the Settlement Agreement and Administrative Order on Consent, BMI Common Areas, Phase 3, with NDEP, 2006 (AOC3).

Remedial Action Objectives

The Remedial Action Objectives (RAOs) discussed in this Phase 3 RI Work Plan are not specific to the Eastside Study Area and apply to the entire NERT RI Study Area. RAOs are media-specific (e.g., soil or groundwater) objectives designed to protect human health and the environment from releases and exposures to hazardous substances. The RAOs reflect a preference for permanent solutions, incorporating approaches, where feasible and appropriate, that will reliably reduce contaminant toxicity, mobility, or volume. Applicable or relevant and appropriate requirements (ARARs), which are those federal and state cleanup standards and other environmental protection requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws, are considered during the development of RAOs. An extensive discussion of the ARARs and "to-be-considered" (TBCs) criteria that would apply to the NERT Site were presented in the RI/FS Work Plan (ENVIRON 2014).

The RI/FS Work Plan proposed various RAOs for the NERT Site and the NERT Off-Site Study Area. This Phase 3 RI Work Plan presents modifications to the long-term RAOs to incorporate the findings of the NERT Phase 1 RI and the expansion of the NERT RI Study Area to include the Downgradient Study Area and the Eastside Study Area. The proposed RAO modifications are consistent with and further the Trust's overarching objective of protecting the Las Vegas Wash and downstream interests.

Proposed Operable Units

Consistent with the proposed revision to the RAOs, and with the intent to both accelerate the remedial program schedule and create efficiency and effectiveness in attaining the RAOs, the Trust proposes to organize the entire NERT RI Study Area (i.e. the NERT Site, NERT Off-Site Study Area, the Downgradient Study Area, and the Eastside Study Area, inclusive of both the Eastside Sub-Area and Northeast Sub-Area) into three Operable Units (OUs).

This proposed NERT RI Study Area organization will allow for consistency of RAOs within each OU, which will allow investigation and remedial efforts to be better focused and efficient and move the NERT RI Study Area towards remedy in less time than with a single OU.

Data Gaps

Based on the comprehensive review of existing information and an understanding of both the regulatory intent and past work in the Eastside Study Area, the objectives of the planned Phase 3 RI are to address the following data gaps:

1) The distribution of the COPCs above leaching basic comparison levels (LBCLs) in unsaturated soil within the Eastside Sub-Area;
2) The lateral and vertical distribution of COPCs in groundwater above ARARs/TBCs in the alluvium and the UMCf within both the Eastside and Northeast Sub-Areas;
3) Confirmation of the relatively low COPCs concentrations detected previously in the existing Middle and Deep water-bearing zone (WBZ) wells within the Eastside and Northeast Sub-Areas;
4) Additional characterization of groundwater transport pathways within both the Eastside and Northeast Sub-Areas;
5) Development of a dataset in order to quantify mass flux of COPCs from the Eastside and Northeast Sub-Areas;
6) Further characterization of COPCs in groundwater in the Northeast Sub-Area; and
7) Address certain COPC data gaps for incorporation in the mass estimate technical memorandum within both the Eastside and Northeast Sub-Areas.

Planned Phase 3 RI Activities

The activities proposed to accomplish the above objectives include:

- Baseline sampling of the existing monitoring wells in the Eastside Sub-Area for COPCs (i.e. chlorate and perchlorate) and general water indicators. Due to large variances in COPC concentrations in groundwater from recent sampling events in comparison to prior sampling events, two rounds of comprehensive sampling will be conducted to assess current groundwater conditions.
- Baseline sampling of the existing monitoring wells in the Northeast Sub-Area for COPCs (chlorate, perchlorate, chromium, and hexavalent chromium) and general water indicators. Two rounds of comprehensive sampling will also be conducted at existing wells in the Northeast Sub-Area.
- Completing a combination of 120- to 150-foot deep soil borings (and two locations with 200-foot deep soil borings), followed by well installations at select locations, to characterize the lateral and vertical extent of COPC impacts in the low hydraulic conductivity UMCf. This will include advancing and sampling and analysis of 45 borings for COPCs, installing a total of 32 new wells, including 21 within the Eastside Sub-Area and 11 in the Northeast Sub-Area. Specific well installation activities will include:

- o Installing 11 new wells (ES-1 through ES-11) to provide vertical delineation and COPCs concentration trend data in the UMCf within the Eastside Sub-Area. These eleven wells will be installed adjacent to existing well clusters to the extent feasible.
- o Installing eight new wells and one new well cluster to supplement the existing downgradient boundary monitoring network and provide data needed for mass flux estimates. Additional data is needed to delineate the lateral and vertical extent of COPCs in the UMCf to evaluate the potential for back diffusion into shallow groundwater and currently uncontrolled COPCs migration toward and past the downgradient Eastside Sub-Area boundary (i.e. the mid-plume boundary as discussed later in this document). The line of boundary wells roughly corresponds with well transects located further to the west, within the Phase 1 and 2 RIs, where mass flux estimates have been requested by NDEP as part of the evaluation of the performance metrics for the NERT Site.
- o Installing 11 new wells in the Shallow WBZ within the Northeast Sub-Area to supplement existing wells and provide better delineation of the lateral and vertical extent of COPCs within the alluvium and UMCf.

- Performing focused hydraulic testing during well development, including recovery testing (i.e. measuring well recovery following development activities), to begin to characterize local hydraulic conditions. More comprehensive hydraulic testing will occur at newly installed wells following the completion of well development activities.
- Updating previous interpretations of the top of the UMCf by compiling available stratigraphic data from earlier investigations along with the results of this investigation including focused boring transects where the paleochannels are projected to cross the western and northern downgradient Eastside Sub-Area and Northeast Sub-Area boundaries based on previous interpretations of the top of the UMCf.

Following data collection, data validation and reduction activities will be performed. The investigation results will be presented in the OU-1/OU-2 RI Report, which will include data from the Eastside Sub-Area, as well as from the investigations of the NERT Site and portions of the NERT Off-Site Study Area.[2] The OU-3 RI Report will include data from the Downgradient Study Area, the Northeast Sub-Area and remaining portions of the NERT Off-Site Study Area. The OU-1/OU-2 and OU-3 RI Reports together will comprise the comprehensive "NERT RI Study Area Reports" and will include:

- Updated interpretations of the lateral and vertical distributions of perchlorate and chromium[3] in soil and groundwater within the NERT RI Study Areas (limited to

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[2] While the Trust intends to prepare one consolidated OU-1/OU-2 RI Report, the efficiencies are based on the assumption that the Phase 3 investigation will not be unduly delayed due to access issues. If access isn't granted in a timely manner, a result may be that the OU-1/OU-2 RI Report will be split into two separate reports.

[3] Following NDEP approval in 2016, hexavalent chromium was generally eliminated from NERT's on-going monitoring program following a detailed analysis of hexavalent chromium to total chromium ratios. The analysis found that the ratio of hexavalent chromium to total chromium was approximately 1 within the NERT groundwater plume (i.e., the concentration of total chromium is generally equal to the concentration of hexavalent chromium in groundwater). Therefore, mass estimates of hexavalent chromium, as well as

perchlorate within the Eastside Sub-Area), which will provide the basis for estimates of the residual mass in vadose zone soil and groundwater. The strategy for developing mass estimates and expanded metrics for the NERT RI Study Area will be developed in collaboration with NDEP and the United States Environmental Protection Agency (EPA). The mass estimates are anticipated to include estimates of perchlorate and chromium mass in the unsaturated zone, the saturated alluvium, and the saturated UMCf. The mass estimates are an essential component of the conceptual site model developed in the RI that will form the basis of the evaluation of remedial alternatives to be conducted in the FS. While this Work Plan includes the investigative activities necessary to develop some of these estimates, the methodology for doing so is outside the scope of this document and will be presented under separate cover.

- The subsurface geologic cross-sections developed for the adjacent NERT Off-Site RI Study Area will also be extended into the Eastside Study Area to illustrate subsurface conditions in support of an updated NERT RI Study Area Conceptual Site Model (NERT CSM) encompassing the expanded study area.
- A comprehensive presentation of the nature and extent of contamination migrating from the NERT Site as part of the NERT CSM. Interpretations of all data previously gathered by all parties as part of the NERT RI (i.e. the Phase 1 RI and the Phase 2 RI for the NERT Site and NERT Off-Site Study Area, as well as the Downgradient Study Area).

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interpretations of the lateral and vertical extent of hexavalent chromium in soil and groundwater, performed as part of the RI will primarily rely on total chromium data (rather than hexavalent chromium data).

1.0 INTRODUCTION

This Remedial Investigation and Feasibility Study (RI/FS) Work Plan Addendum for the Phase 3 RI, Revision 1 (Work Plan) is prepared in accordance with the Interim Consent Agreement between the Nevada Division of Environmental Protection (NDEP) and the Nevada Environmental Response Trust ("NERT" as used to describe the geographic area of the work or "Trust" as used to describe the entity), effective February 14, 2011. Ramboll Environ US Corporation (Ramboll Environ) developed this Work Plan on behalf of the Trust.

In May 2016, NDEP directed the Trust to expand its RI Study Area and investigate Henderson Legacy Conditions (HLCs) in "areas to the southeast of the Site, known as the BMI Common Areas [...] due to migration of hazardous substances released at the Henderson Property [Site] prior to the Effective Date of the Trust" (NDEP 2016a). According to the Interim Consent Agreement, HLCs "shall mean the presence or release […] of hazardous substances in or into the environment at, on or below any portion of the Henderson Property, including the presence in any environmental media of such released hazardous substances as a result of migration from any portion of the Henderson Property, whether before or after the Effective Date" (NDEP 2011). For the purpose of the Phase 3 RI within the Eastside Sub-Area, HLCs are limited to perchlorate and chlorate impacts to the subsurface. While hexavalent chromium and other potential contaminants may be present in soil and groundwater within the Eastside Sub-Area, consistent with NDEP's May 2016 directive, NERT's Phase 3 RI within the Eastside Sub-Area is limited to the investigation of perchlorate and chlorate. The potential presence of hexavalent chromium and other potential contaminants in groundwater within the Eastside Sub-Area will be investigated and remediated by BRC, if necessary, pursuant to the terms of AOC3. Chromium and hexavalent chromium, in addition to perchlorate and chlorate, have been included in the COPC list for the Northeast Sub-Area for consistency with the investigation of the Downgradient Study Area. The comprehensive COPC list presented in the RI/FS Work Plan, including a wider array of contaminants, including volatile organic compounds (VOCs) and other COPCs as defined in the RI/FS Work Plan, remains applicable to the investigation and remediation of the NERT Site. For a complete listing of COPCs and a figure depicting the relationship of each of the various study areas, please see Table 1-1 and Figure 1-3, respectively.

This document is an expansion of the project scope as defined in 1) the Phase 1 RI, as described in the RI/FS Work Plan, Revision 2 (ENVIRON 2014); 2) the Phase 2 RI Data Gap Investigation (the "Phase 2 RI"), as described in the Technical Memorandum for the Remedial Investigation Data Evaluation (Ramboll Environ 2016b) and 3) various work plans associated with the investigation of the Downgradient Study Area (AECOM 2016a, AECOM 2016b). The objective of these previous investigations was to characterize conditions and address data gaps within the NERT RI Study Area (as defined in ENVIRON 2014, Ramboll Environ 2016b, AECOM 2016a, AECOM 2016b). Prior to the Phase 3 RI Work Plan, the NERT RI Study Area included the NERT Site, the NERT Off-Site Study Area, and the Downgradient Study Area, as shown on Figure 1-1. The NERT Site is located within the Black Mountain Industrial (BMI)[4] Complex. The current layout of the BMI Complex and surrounding area is shown on Figure 1-2.

Concurrent with the investigation of the NERT Site and NERT Off-Site Study Area, the goal of the downgradient component of the investigation is to evaluate potential site-related impacts near Las Vegas Wash in an area generally north and east of the NERT Off-Site Study Area. Perchlorate and other contaminants found in groundwater in this area migrated from the NERT Site through subsurface transport in shallow groundwater. In addition, parts of this area received process wastewaters generated at the BMI Complex via a series of unlined ditches, which accumulated in a series of unlined waste disposal ponds located upgradient (including within the Eastside Study Area) and within the Downgradient Study Area. The purpose of the NDEP-led Downgradient Study Area investigation is to collect additional data to evaluate the nature and extent of perchlorate (and other NERT site-related contaminants) in groundwater that could migrate to Las Vegas Wash.

The Eastside Study Area, which is the primary subject of the Phase 3 RI, includes approximately 2,527 acres of land located immediately east (cross gradient) of the NERT Off-Site Study Area (northeast of the NERT Site) and immediately south (upgradient) of the Downgradient Study Area (Figure 1-1). The Eastside Study Area encompasses two subareas: the Eastside Sub-Area and the Northeast Sub-Area.

- The Eastside Sub-Area is approximately 1,983 acres and located east of Pabco Road, west of Lake Mead Parkway, and south of Galleria Drive. It was historically part of the BMI Common Areas, as further discussed in Section 2.1. Portions of the Eastside Sub-Area were historically used for the accumulation of process wastewater generated at the neighboring BMI Complex, as further discussed in Sections 2.2 and 2.3.
- The Northeast Sub-Area is approximately 544 acres and is located north of Galleria Drive and encompasses much of the area currently occupied by the Chimera Golf Club, Tuscany Village, and other residential communities. The history of the Northeast Sub-Area is discussed in Sections 2.0 and 4.2.3.

The various investigation sub-areas (NERT Site, NERT Off-Site Study Area, Downgradient Study Area, and Eastside Study Area [inclusive of the Eastside Sub-Area and the Northeast Sub-Area]) are now collectively referred to as the NERT RI Study Area.

Large portions of the Eastside Sub-Area have been the subject of numerous regulatory actions and environmental investigations, as further described in Section 2.0. In 2006, BRC and other companies within the BMI Complex executed a settlement agreement defining the framework for characterization and remediation of the BMI Common Areas and defined steps by which the remedial actions should be performed (NDEP 2006). BRC conducted soil and groundwater investigations and remediation activities (completed in 2014), which served as the basis for NDEP granting NFA determinations on the majority of

[4] The acronym "BMI" has been applied to several entities over the years. From 1941 until 1951, it referred to Basic Magnesium Incorporated; in 1951, a syndicate of tenants formed under the name Basic Management, Inc. to provide utilities and other services at the complex; the group has also been known as Basic Metals, Inc., and at the present is called the Black Mountain Industrial complex.

the parcels comprising the Eastside Sub-Area (see Figure 3-1). NDEP's NFA determinations were restricted to the upper 10 feet of the soil horizon and were consistent with proposed future land uses (BRC 2014). NDEP has directed the Trust to investigate the Eastside Sub-Area in order to evaluate the nature and extent of COPCs (i.e., perchlorate and chlorate) impacts to the subsurface, particularly in soil and the underlying groundwater. While the investigation outlined in this Phase 3 RI Work Plan includes soil and groundwater samples within the area for which NDEP previously issued NFA determinations, the Trust has no intention to re-open the NFA determinations, and the new data obtained by the Trust will only be analyzed for purposes of addressing the COPCs for which the Trust is directed by NDEP to address.

Based on a review of the limited historical data and the initial interpretation of such data, the distribution of perchlorate in shallow groundwater across the entire NERT RI Study Area and the adjacent American Pacific Corporation (AMPAC) site (formerly known as Pacific Electrochemical Production Company [PEPCON], now known as Endeavour) is shown on Figure 1-4. In addition, groundwater seep samples collected in April 2000 by Kerr-McGee and more recent samples of surface water and groundwater adjacent to the Las Vegas Wash (AECOM 2016c) suggest that additional perchlorate may be entering the Wash downstream (east) of the NERT Seep Well Field and Pabco Weir. The purpose of the investigation presented in this Work Plan is to obtain additional data needed to characterize the current distribution of COPCs in soil and groundwater within the Eastside Study Area, as well as the contribution of HLC mass loading to Las Vegas Wash downstream of previously identified impacts.

2.0 SITE BACKGROUND

The information presented in this section was compiled from a review of several reports, including: Geraghty and Miller 1993, Kleinfelder 1993, BRC 2007, ENVIRON 2011, and Ramboll Environ 2016b. Additional details pertaining to the Eastside Study Area will be incorporated into the forthcoming NERT RI Study Area Reports.

2.1 Land Ownership

The BMI Complex (including the NERT Site) was initially developed by the United States Government during World War II, under the Defense Plant Corporation, as a magnesium production facility. Facility construction began in 1941 under a contract with Basic Magnesium Incorporated (BMI) and the plant was operated from August 31, 1942 to November 15, 1944 in support of the war effort.

Starting in 1945, several companies began leasing portions of the complex from the U.S. Government. In 1949, ownership of a majority of the overall industrial complex was transferred to the State of Nevada's Colorado River Commission (CRC). In 1952, the five principal operating companies at the time (Western Electric Chemical Company [WECCO], Stauffer Chemical Company [Stauffer], U.S. Lime, Titanium Metals Corporation of America [TIMET], and Combined Metals Reduction Company [Combined Metals]) purchased operational facilities from the CRC. The CRC conveyed most of its remaining property to Basic Management Incorporated (Basic Management) as a new organization, which was owned by the five principal operating companies.

Basic Management was established to manage facilities and utilities common to all tenants at the complex, including water, power, sanitary sewers, and transportation. Areas used by Basic Management for general facility and utility operations are often referred to as the BMI Common Areas. The majority of the Eastside Sub-Area, which makes up the southern portion of the Eastside Study Area, was part of the BMI Common Areas and was used for a variety of functions including industrial wastewater collection (see Sections 2.2 and 2.3).

Much of the Northeast Sub-Area was vacant prior to the construction of residential housing and a golf course in the late 1990s and early 2000s. However, a portion of the former Henderson Landfill is located within the Northeast Sub-Area, as shown on Figure 2-1.

2.2 Site Description

The Eastside Study Area is located approximately 14 miles southeast of the City of Las Vegas and within the City limits of Henderson (Figure 1-2). The area covers approximately 2,527 acres, and occupies all or portions of Sections 5, 6, 7, 8 of Township 22 S, Range 63 E and Sections 31 and 32 of Township 21 S, Range 63 E.

The Eastside Study Area is located adjacent to an industrial land use area (the current BMI Complex), with residential properties to the east and north. Figure 1-2 depicts current property ownership. Much of the Eastside Study Area is currently vacant. Over the next decade it is expected that residential housing, parks, schools, and retail stores will be developed within much of the vacant area as part of the Cadence planned community. The southern portion of the Eastside Sub-Area is partially occupied by a number of commercial businesses along Lake Mead Parkway. Residential structures are present or under construction within the Eastside Study Area. Two schools, Lake Mead Christian Academy and the Pinecrest Academy Cadence charter school, are located in the southern portion of the Eastside Sub-Area.

2.3 Chemical Production Activities

In 1945, WECCO began chemical manufacturing operations at the NERT Site including the production of chlorate (sodium chlorate and potassium chlorate) and perchlorate (sodium perchlorate and potassium perchlorate). In 1951, ammonium perchlorate production was added. Chlorate and/or perchlorate production continued at the NERT Site by WECCO and its successors, American Potash and Chemical Company (APCC), Kerr-McGee Chemical Corporation (Kerr-McGee), and Tronox LLC (Tronox), until the early 1990s.

Other major chemical manufacturing operations within the BMI Complex included the following:

- Operations at the NERT Site included the production of synthetic electrolytic manganese dioxide (a large pilot plant was placed in operation in 1951) and high purity manganese metal (beginning in 1953). Manganese dioxide continues to be produced by Tronox on a portion of the NERT Site under a long-term lease with the Trust.
- TIMET began producing titanium metal ingots at the BMI Complex in the early 1950s and continues manufacturing at their facility on the east side of the BMI Complex.
- Stauffer operated chlorine and caustic facilities beginning in 1945, a variety of pesticides and organic chemical products beginning in the 1950s and early 1960s. The Pioneer Chlor Alkali Company, Inc. (Pioneer) acquired these operations in the early 1980s. Pioneer, now known as Olin Chlor Alkali currently manufactures bleach in the western portion of the BMI Complex.
- Montrose subleased a portion of the Stauffer property (now part of the Olin Chlor Alkali property) for operation of an organic chemical manufacturing plant beginning in the late 1940s. Montrose ceased operating in the early 1980s and its facility was subsequently demolished.
- U.S. Lime (operated later by the Flintkote Company, Genstar Lime Company, and Chemstar, Inc. [Chemstar], and L'hoist) operated a lime manufacturing facility near the center of the BMI Complex beginning in the late 1940s. Lime manufacturing operations are currently conducted in the same location near the center of the BMI Complex by L'hoist.

2.4 Historical Wastewater Migration and Ponds

Process wastewater generated by industrial operations within the BMI Complex was initially accumulated in the Trade Effluent Ponds and, subsequently migrated to the Upper BMI Ponds via the Beta Ditch (Figure 2-1), which was an unlined east-west trending ditch constructed circa 1941 or 1942. The Beta Ditch historically received a variety of wastes from on-site process operations, in addition to receiving storm water and non-contact cooling water. The Beta Ditch extended east of the NERT Site to a siphon inlet/pond location on what is now TIMET property. As shown on Figure 2-1, the siphon inlet then transmitted flows from the western section of the Beta Ditch under Boulder Highway to the eastern section of the Beta Ditch and subsequently to the Upper BMI Ponds (located within the Eastside Sub-Area) and Lower BMI ponds (located in the Downgradient Study Area to the northwest).

The Alpha Ditch (Figure 2-1) was constructed in approximately 1943 to convey non-contact cooling water to the Las Vegas Wash and, possibly, the Lower BMI ponds. Collection segments on the TIMET property directed flow north and northwest, joined, and then routed the combined flow northeast under Boulder Highway to the main segment of the Alpha Ditch. A cross-over pipe reportedly enabled the ditch operators to divert flow between the Alpha and Beta Ditches (Figure 2-1).

The BMI ponds began operating in approximately 1942 or 1943, and continued until the mid-1970s. The Upper BMI Ponds included numerous small cells that followed the contours and surface drainages of the natural land surface and covered approximately 915 acres. While over 100 evaporation ponds were constructed, historical records and aerial photographs indicate that only the southern-most eight rows within the Upper BMI Ponds were used (BRC 2007) (shown on Figure 2-1).

Between 1970 and 1976, the Upper BMI Ponds also received industrial wastewater and cooling water from the Stauffer and Montrose Facilities via the Beta Ditch Extension in the western portion of the NERT site. Prior to this, liquid wastes from these facilities migrated to the Lower BMI Ponds. The volume and contents of wastes in the BMI Ponds is not well documented, as reported in the 1993 Phase I. By the late 1970s, each of the companies operating within the BMI Complex was required to implement zero discharge industrial wastewater management status.

As shown on Figure 2-2, from 1976 to 1982, TIMET built 31 lined surface impoundments within the southwestern portion of the Upper Ponds for the evaporation of its process waste streams. Several of the lined ponds were reported to have had liner failures and were subsequently upgraded to double-lined systems. In 2005, use of the ponds ceased following construction of a water conservation facility at the TIMET plant. Between 1983 and 1991, TIMET also operated a Spray Wheel within this area for evaporation of its high-TDS effluent.

In addition to the BMI ponds, the City of Henderson (COH) operated several unlined basins, known as the Southern Rapid Infiltration Basins (RIBs), within the Eastside Sub-Area between approximately 1943 and 2005 (Figure 2-2). A similar set of basins, the COH Northern RIBs, were located immediately north of the Eastside Sub-Area and operated between 1992 and the early 2000s. Both sets of RIBs received treated effluent from the COH municipal wastewater treatment process and were replaced by the Henderson Bird Viewing Preserve (Birding Ponds), which is located near the former Upper BMI Ponds, in the early 2000s.

2.5 Physical Setting

Topographic elevation within the Eastside Study Area ranges from approximately 1820 to 1530 feet above mean sea level (amsl). The land surface across the Eastside Study Area generally slopes toward the north at a gradient of approximately 0.02 feet per foot (ft/ft). The developed portions of the Eastside Study Area have been modified by grading to accommodate structures, access roads, recreational spaces, and historical ponds and ditches.

2.6 Climate

The climate of the Las Vegas Valley is arid with mild winters and dry hot summers. Average annual precipitation as measured in Las Vegas between 1971 and 2000 was 4.49 inches (ENVIRON 2014). Precipitation generally occurs during two periods, December through March and July through September. Winter storms generally produce low intensity rainfall over a large area. Summer storms generally produce high intensity rainfalls over a smaller area for a short duration. These violent summer thunderstorms account for most of the documented floods in the Las Vegas area. Winds frequently blow from the south or northwest at a mean velocity of approximately 9 miles per hour (mph); however, velocities in excess of 50 mph are not atypical when weather fronts move through the area. During these windy events, dust, sand, and soil at the ground surface can become airborne and may travel several miles. Temperatures can rise to 120°F in the summer, and the average relative humidity is approximately 20%. The mean annual evaporation from lake and reservoir surfaces ranges from 60 to 82 inches per year (Shevenell 1996).

2.7 Geology and Hydrogeology

The following subsections describe the regional geology, local geology, and local hydrogeology.

2.7.1 Regional Geology

The Eastside Study Area is located within the Las Vegas Valley, which occupies a topographic and structural basin trending northwest-southeast and extending approximately 55 miles from near Indian Springs on the north to Railroad Pass on the south. The valley is bounded by the Las Vegas Range, Sheep Range, and Desert Range to the north; by Frenchman and Sunrise Mountains to the east; by the McCullough Range and River Mountains to the south and southeast; and the Spring Mountains to the west. The mountain ranges bounding the east, north, and west sides of the valley consist primarily of Paleozoic and Mesozoic sedimentary rocks (limestones, sandstones, siltstones, and fanglomerates), whereas the mountains on the south and southeast consist primarily of Tertiary volcanic rocks (basalt, rhyolite, andesite, and related rock types) that overlie Precambrian metamorphic and granitic basement.

Within the Las Vegas Valley, eroded Tertiary and Quaternary sedimentary and volcanic rocks comprise the unconsolidated basin deposits, which can be approximately 13,000 feet thick (ENSR 2007). The valley floor consists of fluvial, paludal (swamp), playa, and lacustrine deposits surrounded by more steeply sloping alluvial fan aprons derived from erosion of the surrounding mountains. Generally, the deposits grade finer with increasing distance from their source and with decreasing elevation. The structure within the Quaternary and Tertiary-aged basin fill is characterized by a series of generally north-south trending fault scarps.

2.7.2 Local Geology

The local geology and hydrogeology are defined by data collected from more than 1,100 borings and wells that have been installed by BMI/BRC and other neighboring parties over approximately the last 30 years in the Eastside Study Area. The following descriptions are summarized from BRC's Conceptual Site Model (BRC CSM) report (BRC 2007). Figure 2-3 is a north-south geologic cross-section of the Eastside Study Area to Las Vegas Wash as presented by BRC in their 2007 Closure Report. The BRC CSM will be evaluated and refined as part of the Trust's development of the NERT CSM and as part of the NERT RI Study Area Reports.

***Alluvium**.* The Eastside Study Area is located on Quaternary alluvial deposits (Qal) that slope north toward Las Vegas Wash. The alluvium consists of a reddish-brown heterogeneous mixture of well-graded sand and gravel with lesser amounts of silt, clay, and caliche. Clasts within the alluvium are primarily composed of volcanic material. Boulders and cobbles are common. Due to the mode of deposition, no distinct beds or units are continuous over the area.

A major feature of the alluvial deposits is the stream-deposited sands and gravels that were laid down within paleochannels eroded into the surface of the Muddy Creek Formation during infrequent flood runoff periods. These deposits vary in thickness and are narrow and generally linear. These generally uniform sand and gravel deposits exhibit higher hydraulic conductivity than the adjacent, well-graded deposits. In general, these paleochannels trend north-eastward toward the Las Vegas Wash.

The thickness of the alluvial deposits ranges from approximately 20 feet to more than 50 feet beneath the Eastside Study Area. The alluvial soils identified in on-site borings include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand. The thickness of the alluvium, as well as the top of the underlying Muddy Creek Formation, was mapped to locate these paleochannels.

***Transitional (or reworked) Muddy Creek Formation**.* Where present, Transitional Muddy Creek Formation (xMCf) is encountered at the base of the alluvium. The Transitional Muddy Creek Formation consists of reworked sediments derived from the Muddy Creek Formation, which is described below. Therefore, the xMCf appears similar to the Muddy Creek Formation, but it consists of reworked, less consolidated and indurated sediments.

***Muddy Creek Formation**.* The Upper Muddy Creek Formation (UMCf) of Pleistocene age occurs in the Las Vegas Valley as valley-fill deposits that are coarse-grained near mountain fronts and become progressively finer-grained toward the center of the valley. Stratigraphic logs from historical borings indicate that, where encountered beneath the Eastside Study Area, the Muddy Creek Formation comprises fine-grained sediment composed of clay and silt interbedded with occasional thin layers of coarse-grained sediments of sand, silt, and gravel. This generally is similar to the conditions beneath the Phase 1 RI areas investigated by the Trust although local differences in depths and thickness of the units are anticipated. The two coarse-grained units of the UMCf present beneath the NERT Site (UMCf-cg1 and UMCf-cg2) were not encountered during previous investigations in the Eastside Study Area.

The Muddy Creek Formation represents deposition in an alluvial apron environment from the Spring Mountains to the west, grading into fluvial, paludal (swamp), playa, and lacustrine environments further out into the valley center. The Muddy Creek does not crop out in the Eastside Study Area, but instead subcrops beneath a veneer of Quaternary alluvium.

The contact between the Quaternary alluvium and the Muddy Creek Formation (UMCf-fg1) is typically marked by the appearance of a well-compacted, moderate brown silt-to-sandy silt or stiff clay-to-sandy clay, whereas near the Las Vegas Wash, the contact is marked by gray-green to yellow-green gypsiferous clays and silts.

Additional Geologic Formations within the Northeast Sub-Area. Bedrock formations mapped as outcropping at the ground surface near the very northernmost part of the Northeast Sub-Area include the Horse Springs Formation, which is dominated by carbonate rocks interbedded with white to yellow calcareous siltstone and shale, and the Thumb Formation, which is locally dominated by red to pink calcareous siltstone and sandstone, gypsiferous shale and claystone (Bell and Smith 1980).

2.7.3 Local Hydrogeology

Background information is summarized herein from the CSM reports prepared by ENSR (2005) and BRC (2007). Depth to groundwater ranges from about 20 to 70 ft bgs with the depth generally greatest in the southernmost portion of the Eastside Study Area, becoming shallower as it approaches the Las Vegas Wash to the north. The direction of the lateral hydraulic gradient, and thus the general trend of groundwater flow is toward the north to north-northwest. The generally uniform flow pattern may be influenced locally by: (a) lateral zones of coarser and more transmissive material (otherwise referred to as paleochannels) eroded into the underlying UMCf; (b) artificial groundwater highs or "hydraulic mounds" created around the COH Water Reclamation Birding Ponds (located outside the Eastside Study Area); and (c) hydraulic depressions created by the groundwater extraction well fields located adjacent to the Eastside Study Area.

NDEP has defined three water-bearing zones (WBZs) that are of interest in the BMI Complex[5]: the Shallow WBZ, which is defined by the first occurrence of groundwater in either the Qal, xMCf, or the UMCf where the xMCf is missing, is unconfined to partially confined, and is considered the "water table aquifer"; the Middle WBZ, which extends from approximately 90 to 300 ft bgs; and the Deep WBZ, which is defined as the contiguous WBZ that is generally encountered between 300 to 400 ft bgs (NDEP 2009).

Environmental investigations within the Eastside Study Area have primarily focused on the Shallow WBZ, although some investigations (MWH 2004) have included a number of Middle and Deep WBZ wells to improve vertical delineation of hydrogeology and chemical constituent distribution. During previous investigations in the Eastside Sub-Area, the base of the Middle WBZ was considered to be 270 ft bgs.

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[5] BRC reports have historically used two groundwater zones, a shallow unconfined WBZ (first encounter between 8 and 65 ft bgs) and a deeper confined WBZ (first encountered between 335 and 395 ft bgs) (BRC 2007). This Work Plan refers to WBZ using NDEP-defined nomenclature rather than the shallow and deep groundwater aquifers referenced in BRC's reports.

Within the Eastside Study Area, the Shallow WBZ is comprised of the saturated portions of the alluvium and the uppermost portion of the UMCf to depths of approximately 90 ft bgs. Beneath the southern portion of the Eastside Sub-Area, the first groundwater encountered occurs at depths of approximately 40 ft bgs or more and shallows northward, occurring near the ground surface at Las Vegas Wash within the Northeast Sub-Area (BRC 2016). In the Shallow WBZ, groundwater flows towards the north-northeast with minor variations, generally mimicking the slope of the ground surface. Based on a review of 2015 groundwater elevation data, the water table occurs in the alluvium in the western part of the Eastside Sub-Area and in the UMCf near the northern boundary and eastern portion of the Eastside Sub-Area where the alluvium has become dewatered.

Based on the results of single well hydraulic tests conducted as "slug tests" at ten wells located within the Eastside Sub-Area in 2007, hydraulic conductivity values ranged from approximately 0.8 to 60 feet/day in wells screened within the alluvium, and from approximately of 0.06 to 0.5 feet/day in wells screened within the UMCf (Kleinfelder 2007). The results of a 48 hour constant discharge pumping test conducted in 1998 approximately 1,700 feet due west of Pabco Road (near current extraction well ART-8A), concluded that hydraulic conductivity of the "channel-fill alluvium" ranged from 1,072-1,698 gallons per day per square foot (gpd/ft^2), transmissivities ranged from 39,666-66,000 gpd/ft, and storage coefficients ranged from 0.03 to 0.11 (Kerr McGee 1998). However, significantly higher groundwater velocities, ranging from approximately 600 to 2,500 ft/yr, have been calculated based on alluvial well pumping and slug tests (Kerr-McGee 1998), and a groundwater velocity of over 12,000 ft/yr was reported based on a tracer test conducted in the alluvial channel between the Athens Road area and the Las Vegas Wash (Errol Montgomery and Associates 2000).

Prior investigations of the Middle WBZ within the Eastside Study Area and surrounding areas indicate that, with a few exceptions, a vertically upward hydraulic gradient exists between the Middle and Shallow WBZs with the magnitude of the vertical head difference generally increasing as depth increases. Within the Eastside Study Area, the deposits that comprise the Middle WBZ and Deep WBZ consist predominantly of the UMCf-fg1. The results of numerical simulations of water infiltration into the Shallow WBZ suggest that substantial mounding readily occurs, which is consistent with the conclusion that historical use of the BMI Ponds likely impacted local hydrology and may have strongly affected the direction and magnitude of lateral and vertical (primarily downward) hydraulic gradient conditions (BRC 2007).

2.8 Surface Water

The Eastside Study Area is located in an arid region with few natural surface water bodies. Currently, surface water in the Eastside Study Area occurs infrequently as storm runoff in shallow washes and flows north toward Las Vegas Wash. Las Vegas Wash is a tributary to Lake Mead and it is the only channel through which the valley's excess water flows to the lake. Lake Mead is a major reservoir on the Colorado River. Historically, groundwater seeps existed in several locations within the NERT RI Study Area, particularly near Las Vegas Wash. Many of these natural seeps are no longer present due to lower groundwater elevations following reductions in surface infiltration (reduced rainfall and man-made infiltration sources), as well as more localized reductions in groundwater elevation due to extraction well pumping. Man-made lakes within the Chimera Golf Club, located in the

Northeast Sub-Area, are reportedly lined and therefore unlikely to result in local groundwater mounding or otherwise interact with the local water table.

Aerial photographs taken between the late 1960s and 1980s suggest that natural groundwater seeps or near-surface moisture may have existed in an area of lower ground elevation near the northwest boundary of the Eastside Sub-Area. Previous work by BRC has also identified the presence of apparent seeps in the same area, while also noting that it is not possible to definitively identify the presence of seeps based on aerial photographs (BRC 2011). The location of this interpreted former surface seep area is shown on Figure 2-2.

3.0 REGULATORY ACTIONS AND SITE INVESTIGATIONS

3.1 Regulatory Actions and Site Investigations in the Eastside Sub-Area

Much of the Eastside Sub-Area, where a portion of the Phase 3 RI will take place, was part of the original BMI Common Areas. The BMI Complex, which historically included the BMI Common Area, has been the subject of numerous regulatory actions and environmental investigations since the early 1970s. The following summary is descriptive of the BMI Complex, with specific reference to the Eastside Sub-Area where appropriate.

The remainder of this section presents an overview of regulatory actions and environmental investigations conducted beginning in 1970 through the present.

During the 1970s, the United States Environmental Protection Agency (EPA), the State of Nevada, and Clark County investigated potential environmental impacts from operations within the BMI Complex, including atmospheric emissions, groundwater and surface water discharges, and soil impacts (ENSR 2007).

Between 1971 and 1980, operators within the BMI Complex modified their manufacturing processes and constructed lined surface impoundments to recycle and evaporate industrial wastewater in response to the 1972 Federal Water Pollution Control Act (the Clean Water Act [CWA]). This included the construction of lined ponds used to contain perchlorate wastes at the NERT Site and lined ponds constructed by TIMET over a portion of the former Upper BMI Ponds. In 1980, the EPA issued a CWA Section 308 letter requesting specific information from the BMI companies regarding their manufacturing and waste management practices.

In April 1991, six entities that had conducted business within the BMI Complex (Kerr-McGee, Montrose, Pioneer, Stauffer, TIMET, and Chemstar) entered into a Consent Agreement with NDEP (NDEP 1991) to conduct environmental studies to assess site-specific environmental conditions at individual company sites, the BMI Common Areas, and any off-site waste management areas that were the result of past and present industrial operations and waste disposal practices. The BMI Common Areas, which includes the majority of Eastside Sub-Area (but not the Northeast Sub-Area), was included in the Consent Agreement with NDEP.

In 1993, the Henderson Industrial Site Steering Committee (HISSC), made up of BMI Complex operators, completed a Phase I assessment of the BMI Commons Areas (Geraghty and Miller 1993). By the early 1990s, limited surface soil sampling had been conducted by Stauffer within the former BMI Upper and Lower Pond areas.

In 1994, NDEP issued a Letter of Understanding (LOU) identifying potential source areas or "items of interest" and specifying the level of environmental investigation to be conducted within the BMI Common Areas (NDEP 1994).

In 1996, parties at the BMI Complex entered into a Consent Agreement with NDEP to perform a Phase II Environmental Conditions Assessment and to conduct Remedial Alternative Studies (RAS), Interim Measures, or Additional Work (NDEP 1996). An Environmental Conditions Investigation (ECI) was completed for the BMI Common Areas the same year, which addressed LOUs identified for additional soil and groundwater characterization (ERM 1996).

***In 1997*,** NDEP granted NFA status to certain non-impacted areas of the BMI Common Areas following the preparation of an Environmental Characterization Report for the Exclusion Areas (ERM 1997). This Environmental Characterization Report included performance of a Phase I Environmental Site Assessment and soil sampling under a NDEP-approved work plan.

***In late 1997*,** perchlorate contamination was discovered in Las Vegas Wash and determined to have originated from what is now the NERT Site and the former PEPCON facilities (NDEP 2011a). Kerr-McGee, the owner/operator of the NERT Site at the time, undertook a characterization study to identify the subsurface pathway(s) and characterize perchlorate concentrations in shallow groundwater downgradient of the NERT Site to the Athens Road area in Henderson (about one mile south of Las Vegas Wash) (Kerr-McGee 1997). Kerr-McGee installed extraction wells in the Athens Road area in September 1998 to remove perchlorate-bearing shallow groundwater (Kerr-McGee 1998). The Athens Road Well Field continues to operate as part of NERT's extraction and treatment system.

By late 1999, Basic Management and NDEP established a Liability Transfer and Assumption Agreement with the other HISSC parties (NDEP 1999b). The agreement assigned primary responsibility for the cleanup and remediation of soils in the BMI Common Areas to BRC.

***In 2001*,** a Record of Decision (ROD) was issued for soils within portions of the BMI Common Areas (Upper Ponds, Lower Ponds, Alpha Ditch, Beta Ditch, Western Ditch and Northwestern Ditch) based on the alternatives described within the earlier RAS (NDEP 2001). The alternative approved by NDEP required encapsulation of excavated soil within a dedicated landfill referred to as the Corrective Action Management Unit (CAMU). BRC sought a cleanup standard that would allow future residential use within large portions of the BMI Common Areas.

As part of BRC's implementation of the ROD, investigation of soil and groundwater within the Eastside Sub-Area, as well as significant soil excavation, has been performed and a large amount of data characterizing impacts to soil and groundwater is available for this area. Most investigations were conducted between 1996 and 2007 and included a wide variety of contaminants (e.g., asbestos, metals, pesticides/polychlorinated biphenyls [PCBs], semi-volatile organic carbons [SVOCs], VOCs, and radionuclides). While the COPCs (i.e., perchlorate and chlorate) were included as analytes in some investigations, they were not the primary focus of those investigations.

***In early 2006*,** BRC and other companies within the BMI Complex executed AOC3 for the BMI Common Areas, which defined the framework for BRC's characterization and remediation of the on-site soil and on-site and off-site groundwater impacts and defined steps by which the remedial actions should be performed. However, BRC was only required to investigate or remediate perchlorate if, and only if, to the extent such investigation or remediation is incidental to the investigation or remediation otherwise being performed by BRC under the AOC.

In 2007, a Closure Plan was prepared in response to AOC3, which describes risk-assessment and risk-based decision making as it relates to remediation, future land use, and NFA determinations (BRC 2007).

Between 2007 and 2016, remediation activities were conducted by BRC in the Eastside Sub-Area. Basic comparison levels (BCLs) were used as screening levels to guide remedial excavations; excavations were expanded laterally and vertically in an iterative manner depending on confirmation sample results. Final confirmation sample results were then used for human health risk assessments (HHRAs). The HHRAs included comprehensive evaluation of residential and commercial/industrial exposure pathways, depending on planned future use, related to shallow soil (less than 10 ft bgs). Except for localized areas where BCL exceedances led to excavation of soil from depths greater than 10 feet, groundwater and soil deeper than 10 feet were not addressed as part of the remediation effort.

While the majority[6] of the Eastside Sub-Area has received NFA-status based on health-based soil BCLs, at many sample locations, particularly below 10 ft bgs, residual concentrations in vadose zone soils are above the leaching basic comparison level (LBCL) for perchlorate in soil (0.0185 milligram per kilogram [mg/kg]) and chlorate in soil (1.13 mg/kg). The distribution of residual perchlorate and chlorate in soil above the LBCL is discussed in Section 4.0. BRC conducted a groundwater monitoring event at specific wells in 2014 and 2015, which are highlighted in Tables 6-1a, 6-1b, and 6-2.

3.2 Regulatory Actions and Site Investigations in the Northeast Sub-Area

The Northeast Sub-Area, which was not part of the BMI Common Areas, has not been the subject of extensive investigation or remediation. The Northeast Sub-Area has, however, been included in several groundwater investigations.

Between 1957 and the early 1970s, a portion of the Henderson Landfill was located in the northeast corner of the Northeast Sub-Area (Figure 2-1). An investigation of the landfill site by the City of Henderson in the early 2000s found no indication of landfill leachate in groundwater (SNWA 2015). The investigation reportedly included the collection of groundwater samples for the analysis of VOCs, SVOCs, pesticides, PCBs, total metals, cyanide, sulfate, nitrate plus nitrite, chloride and fluoride, chemical oxygen demand, carbonate and total alkalinity, methane, ethane, dioxins, and furans. The engineering evaluation and cost analysis (EE/CA) for the former landfill recommended prohibiting land uses that could damage the landfill's cap and also recommended controlling future groundwater use in the area. The City of Henderson continues to maintain shallow groundwater monitoring wells (the MW-series wells) in the vicinity of the former landfill.

Between 2006 and 2016, pursuant to AOC3, BRC agreed to investigate and, if necessary, remediate, on-site and off-site impacts, which might include off-site groundwater impacts in the Northeast Sub-Area. As part of the investigation of off-site groundwater impacts, BRC sampled wells in the Shallow, Middle, and Deep WBZs (which

6 As shown in Figure 3-1, NFA determinations were granted for the entire Eastside Sub-Area, with the exception of several parcels in the southern portion of the Eastside Sub-Area that were not part of the BMI Common Areas.

were previously installed by BRC) within the Northeast Sub-Area. These groundwater monitoring events included analysis for a variety of constituents, including perchlorate, total chromium, and hexavalent chromium. None of the wells located in the Northeast Sub-Area are part of BRC's current groundwater monitoring program.

3.3 Current Investigations

Previous regulatory actions and investigations associated with the NERT Site are described in detail within the RI/FS Work Plan (ENVIRON 2014) and RI Data Evaluation Technical Memorandum (Ramboll Environ 2016b). The NERT Site has been the subject of numerous regulatory actions and environmental investigations since the early 1970s. Perchlorate and hexavalent chromium are the primary Site-related chemicals detected in soil at the NERT Site and in groundwater beneath and downgradient of the Site. Although there is no reported use of chloroform at the Site, chloroform is also detected in groundwater at the Site, at neighboring properties, and in downgradient areas. While significant hexavalent chromium impacts associated with the NERT Site are not an issue in groundwater beneath the Eastside Study Area, previous investigations by BRC have found perchlorate and chlorate impacts in soil and groundwater above LBCLs. BRC is currently developing a groundwater Remedial Alternatives Study (RAS) for the Eastside Sub-Area, excluding perchlorate. However, the approach has not been determined.

4.0 INITIAL SITE EVALUATION

4.1 Initial Evaluation of Current Conditions

The distribution of COPCs in soil and groundwater beneath the Eastside Study Area has been evaluated by Ramboll Environ based on available data from the following sources:

1) The BMI database, maintained by Neptune, NDEP's contractor, contains the data submitted to NDEP by the BMI parties.

2) The NERT database, maintained by Ramboll Environ, contains the data collected as part of investigations conducted on behalf of the Trust from 2011 to the present. Most of the data in the NERT database is also in the BMI database, but the NERT database also includes the results of more recent investigations that have yet to be added by Neptune to the BMI database.

COPCs in Vadose Zone Soil

Eastside Sub-Area: As part of BRC's investigations to support its closure plan (BRC 2007), approximately 800 soil borings were advanced to characterize the presence and extent of chemicals in soil. While the majority of the Eastside Sub-Area has received NFA status for the upper 10 feet of soil from NDEP based on health-based soil BCLs[7], the concentrations of residual COPCs for soil samples from numerous locations within the Eastside Sub-Area exceed the applicable LBCL. The LBCL for perchlorate in soil is 0.0185 mg/kg, and the LBCL for chlorate is 1.13 mg/kg.

The distribution of perchlorate in shallow soil (where "shallow" is defined as a depth of less than 10 feet bgs) within the Eastside Sub-Area is illustrated on Figure 4-1a, with the highest concentrations occurring in the northwest corner of the Eastside Sub-Area in an area of historic seeps that were identified by BRC based on a review of aerial photographs from the mid- to late-1960s (BRC 2011). These seeps may have existed into the 1980s based on Ramboll Environ's review of aerial photographs. The distribution of perchlorate in deeper vadose zone soil below 10 feet is shown on Figure 4-1b. Similar to the shallow soil, residual perchlorate concentrations above the LBCL are present across the site. However, limited perchlorate data are available for samples of deeper soil in the area where historic seeps were documented.

The distribution of chlorate in samples of vadose zone soil above the LBCL of 1.13 mg/kg is generally similar, although the LBCL exceedances are less widespread across the site. The distributions of chlorate in samples of shallow and deeper soil are shown on Figures 4-2a and 4-2b. In both depth intervals, the highest residual chlorate concentrations occur in samples of soil collected from below the southern-most eight rows of the former Upper BMI Ponds, the former Beta Ditch, the former TIMET Spray Wheel, and in the northwest corner of the Eastside Sub-Area in the area of historic surface seeps.

[7] NFA determinations were limited to the upper 10-foot soil horizon; some parcels received a NFA determination based on an industrial land use scenario.

Northeast Sub-Area: Because the Northeast Sub-Area was not part of the BMI Common Areas, the Northeast Sub-Area was not part of BRC's soil investigations. Therefore, no soil investigations for COPCs have been conducted in the Northeast Sub-Area.

COPCs in Groundwater

Many of the existing wells in the Eastside Study Area have not been sampled for the COPCs on a consistent basis, and as a result, assessing the distribution of these constituents using data from a single comprehensive sampling event is not possible.

There is insufficient chlorate data to assemble a cohesive isoconcentration map depicting recent chlorate distribution in the Eastside Study Area. A preliminary understanding of perchlorate distribution in groundwater in this area is illustrated on Figure 4-3a, which shows a time composite interpretation of perchlorate concentrations in groundwater samples from wells screened in the Shallow WBZ using data available in the BMI database. These data were collected during various site investigations dating from 1998 to 2013. The detailed data used to develop the concentration contours are shown on Figure 4-3a, and the same perchlorate isoconcentration contours are shown along with historical water recharge features on Figure 4-3b. The contour lines shown are biased towards the most recent sample results in the combined data sets, supplemented with the more historical data. The data from the BMI database was supplemented with recent well sampling data collected by the Southern Nevada Water Authority (SNWA) near Las Vegas Wash between 2011 and 2014.

Figures 4-3a and 4-3b also include perchlorate results collected from groundwater seeps and springs located near the wash during a sampling event conducted by Kerr-McGee in April 2000. The seep results are important because they indicate locations of groundwater discharge into the wash downgradient of the Eastside Study Area. Since that time, a number of flood and erosion control measures have been installed at the Las Vegas Wash. Between 1999 and 2013, a series of weirs were constructed along the Wash to stabilize the channel bed. The presence of these weirs has effectively raised the water level of the Wash above each weir, submerging most of the groundwater seeps formerly located along the banks of the Wash.

Groundwater flow through alluvium in other areas of the NERT RI Study Area can be influenced by the presence of transmissive deeper erosional channels ("paleochannels") that were incised into the underlying fine-grained unit of the UMCf. However, in the Eastside Sub-Area, the infiltration from ponded water that occurred over decades as well as preferential flow through a more permeable shallow linear zone of recent alluvium that crosses beneath the eastern portion of the Eastside Sub-Area appear to be the dominant factors affecting perchlorate distribution in shallow groundwater.

The historic and current recharge and wastewater infiltration features are shown relative to area geology on Figure 4-3b along with the perchlorate concentrations contours. As shown on Figure 4-3b, the perchlorate impacted groundwater generally occurs in the area downgradient (north) of the former Beta Ditch and the southernmost former ponds, in which facility wastewater was conveyed and disposed. Based on the available historical data, there appear to be three lobes of higher perchlorate concentrations in groundwater. The western and central lobes appear to be separated by an area of lower concentrations that are likely related to the flushing effect of water infiltrated as treated municipal wastewater from the former COH Southern RIBs and Northern RIBs and operation of the TIMET spray wheel. These sources of water were operating during or shortly before the period of groundwater monitoring. The former COH Southern RIBs operated from 1943 to 2005, the COH Northern RIBs operated from 1992 to the early 2000s, and the TIMET Spray Wheel was used between 1983 and 1991.

Similarly, the central and eastern lobes appear to be separated by a linear area of apparently lower concentration groundwater that coincides with a south to north trending linear zone of higher transmissivity recent alluvial deposits (depicted in pale yellow on Figure 4-3b). Groundwater from upgradient areas flowing through the younger alluvial deposits may have flushed out the perchlorate impacted groundwater below the former disposal ponds.

Figure 4-4a presents current perchlorate concentrations in shallow groundwater based on sampling conducted by BRC in 2015 and by AECOM in the Downgradient Study Area wells in April 2016. These perchlorate results have been incorporated into the perchlorate isoconcentration contour map shown on Figure 1-4, which presents the current interpretation of perchlorate distribution in shallow groundwater across the NERT RI Study Area. This initial interpretation is based on perchlorate data for groundwater samples collected in 2015-2016 from all the BMI Complex facilities and the adjacent AMPAC site to the west along with the 2015-2016 data from the Eastside Study Area and the Downgradient Study Area.

In the Eastside and Northeast Sub-Areas, the most recent perchlorate data available for the Middle and Deep Water-Bearing Zone wells are from sampling conducted in 2009. Figure 4-4b presents the data for the existing Middle Water-Bearing Zone wells. Perchlorate concentrations were relatively low, ranging from not detected (ND<0.1 micrograms per liter [µg/L]) to 430 µg/L in the eight wells sampled. Figure 4-4c presents the data for the existing Deep Water-Bearing Zone wells. The 2009 perchlorate concentrations were below the federal preliminary remediation goal (PRG) of 15 µg/L in all of the 17 wells sampled.

Figure 4-5 presents current total chromium concentrations in shallow groundwater within the Eastside Study Area based on sampling conducted by BRC in 2015 and by AECOM in the Downgradient Study Area in April 2016. Within the Northeast Sub-Area, where total chromium and hexavalent chromium are considered COPCs, total chromium concentrations ranged from 5.7 J µg/L to 41 µg/L and hexavalent chromium concentrations ranged from 6 J µg/L to 49 µg/L. The 2015 and 2016 total chromium concentrations are less than the federal MCL of 100 µg/L, which the State of Nevada has adopted, in all six wells sampled within the Northeast Sub-Area. While total chromium data within the Eastside Sub-Area is included on Figure 4-5 for context, total chromium and hexavalent chromium are not considered COPCs in this sub-area for the purposes of NERT's investigation.

<u>Summary of Key Findings</u>

The following provides a summary of key findings that forms the foundation for the conceptual model that guides the data collection activities presented in this Work Plan.

- Historic migration and accumulation of wastewater from the BMI Complex, including the NERT Site, have resulted in soil and groundwater impacts in the Eastside Study Area. Accumulation was confined to the area defined by former ponds and conveyance ditches and migration extends from the NERT Site to and through the Eastside Sub-Area and into the Northeast Sub-Area.
- Remediation activities, conducted by BRC pursuant to obtaining NFA status, have addressed human health risks consistent with designated land uses within the upper 10 feet of soil within the majority of the Eastside Sub-Area.
- While perchlorate groundwater impacts within the Eastside Sub-Area have been investigated, BRC was not required to address the perchlorate as part of its remediation program under AOC3. The potential presence of hexavalent chromium and other potential contaminants in groundwater within the Eastside Sub-Area will be investigated and remediated, if necessary, by BRC pursuant to the terms of AOC3.
- Residual perchlorate is present in samples of soil (vadose and saturated zone) collected from within the Eastside Sub-Area at concentrations exceeding the LBCL (0.0185 mg/kg for perchlorate, 1.13 mg/kg for chlorate).
- Perchlorate is present in samples of shallow groundwater collected from wells located throughout the Eastside Sub-Area and Northeast Sub-Area at concentrations from 3.4 J µg/L to 43,000 µg/L. Perchlorate is also present at substantially lower concentrations in samples from the Middle and Deep WBZs from 0.049 J µg/L to 430 µg/L (a subset of wells screened in the Middle and Deep WBZs have also historically been non-detect for perchlorate [see Figures 4-4b and 4-4c]).
- Chlorate is present in shallow groundwater samples collected from wells located throughout the Eastside Sub-Area and Northeast Sub-Area at concentrations from ~1,200 µg/L to 300,000 µg/L (BRC 2016; AECOM 2016c). Chlorate is also present at substantially lower concentrations in samples from deeper water-bearing zones from <200 µg/L to 1,700 µg/L (AECOM 2016c).
- Over time, the previously saturated alluvium in the Eastside Sub-Area has become dewatered in the eastern and northeastern interior parts of the area. This is likely the result of a combination of factors, including shut down of all the infiltration ponds in 2005 along with the extended drought conditions affecting the entire southwest over the past approximately five years. As a result, the water table and first impacted groundwater occurs in the alluvium in the western part of this area and in the UMCf across much of the eastern portion of this area.
- Chromium is present in samples of shallow groundwater collected from wells within the Northeast Sub-Area at concentrations from 5.7 J µg/L to 41 µg/L. Hexavalent chromium is present in samples of shallow groundwater collected from wells within the Northeast Sub-Area at concentrations from 6 J µg/L to 49 µg/L.

4.2 Preliminary Conceptual Site Model

This preliminary identification of sources, release mechanisms, exposure media, exposure routes, and receptors for the Eastside Study Area is based on a current understanding of on-site and off-site environmental conditions. The NERT CSM will be revised, as appropriate, based on further collection and evaluation of all Remedial Investigation data (i.e. the NERT Site, NERT Off-Site Study Area, the Downgradient Study Area, and the Eastside Study Area, inclusive of both the Eastside Sub-Area and Northeast Sub-Area), and presented within the comprehensive NERT RI Study Area Reports.

4.2.1 Potential Contaminant Sources, Release Mechanisms, and Migration Pathways

As discussed in Section 2.1, the portion of the BMI Complex located east of Pabco Road has historically been referred to as the Eastside Area or BMI Common Areas. Historically, the BMI Common Areas contained a network of unlined ditches, canals, flumes and unlined ponds developed during WWII that were used for industrial process wastewater and other aqueous by products from the BMI Complex manufacturing facilities. The aqueous waste reportedly contained a variable mix of BMI Complex facility-related contaminants including perchlorate, metals, VOCs, and TDS.

According to information in the 2007 BRC Closure Report, the aqueous waste migrated through the former Beta Ditch to the southernmost portion of the Upper BMI Ponds east of Pabco Road and to various Lower BMI Ponds located closer to Las Vegas Wash. Historical evidence indicates that a large number of waste effluent ponds were constructed in the BMI Common Areas during the early 1940s. Only the southern-most eight rows of the Upper BMI Ponds appear to ever have received waste (BRC 2007). Sewage from one of the COH treatment plants was discharged to the Upper BMI Ponds during the early years of operation (BRC 2007). Use of the unlined ponds was discontinued in 1976. Subsequently, lined evaporation ponds were constructed in the Upper Ponds area and were used by TIMET between 1980 and 2005. TIMET also operated an evaporative Spray Wheel for high TDS wastewater in the Upper Ponds area between 1983 and 1991. The locations of the unlined Beta Ditch, the first eight rows of the unlined ponds, and the TIMET Spray Wheel are shown on Figures 2-1 and 2-2.

Recharge of treated wastewater from infiltration ponds located near the BMI Common Areas has also affected local groundwater conditions. From approximately 1992-2002, the COH used RIBs for disposal of treated wastewater. Beginning in 1998, the COH began using the Birding Ponds for disposal of treated wastewater, and use of the Upper RIBs was phased out. The locations of the COH Northern and Southern RIBs and Birding Ponds are shown on Figure 2-2.

4.2.2 Preliminary Groundwater Conceptual Site Model

The CSMs for the NERT RI Study Area (i.e. the NERT Site, NERT Off-Site Study Area, the Downgradient Study Area, and the Eastside Study Area, inclusive of both the Eastside Sub-Area and Northeast Sub-Area), presented below identify sources, release mechanisms, exposure media, and exposure routes based on a current understanding of environmental conditions.

<u>NERT Site Conceptual Site Model</u>

The CSM initially developed by Kerr-McGee for the NERT Site was presented in the RI/FS Work Plan (ENVIRON 2014). In the CSM, lateral transport of perchlorate and other COPCs in groundwater toward Las Vegas Wash occurs mainly within the alluvium, which has characteristically greater transmissivity (and thus greater calculated hydraulic conductivity) than the UMCf. As a result, most previous investigations focused on delineating perchlorate and other COPC impacts within the alluvium and the identification of deeper alluvium-filled paleochannels that would serve as preferential groundwater flow pathways from the Site to Las Vegas Wash.

Based on the findings of the NERT Phase 1 RI, the CSM was refined as presented in the RI Data Evaluation Technical Memorandum (Ramboll Environ 2016b). Perchlorate, which is highly soluble, was detected in the fine-grained UMCf at depths as great as 150 feet bgs. The presence of perchlorate and other COPCs in groundwater prior to the start of groundwater remediation over the long period of NERT Site operations would have caused the diffusion of COPCs downward from the alluvium into the underlying UMCf. In addition, infiltration in areas with unlined ponds and ditches, and by density-driven flow in areas with very high TDS, also likely contributed to the downward transport of COPCs.

Once the COPC concentrations in the alluvium were reduced as a result of remediation, the mass of COPCs (primarily perchlorate) in the UMCf began migrating back upwards into the alluvium as a result of diffusion and upward flow under natural upward vertical gradient (Ramboll Environ 2016b). This back diffusion and upward flow results in continuous “bleeding” of perchlorate-containing groundwater back into the alluvium and is consistent with the relatively slow recent decline in alluvial perchlorate concentrations even though groundwater remediation for perchlorate has been on-going in the NERT RI Study Area since treatment began in the late-1990s (ENSR 2005).

The Phase 2 RI Work Plan, which included additional subsurface investigation work related to back diffusion of perchlorate, was presented as part of the RI Data Evaluation Technical Memorandum (Ramboll Environ 2016b). The Phase 2 RI scope was subsequently approved by NDEP (NDEP 2016a) and implementation of the Phase 2 RI Work Plan began in first quarter 2017. The results of the Phase 2 RI will be incorporated into the NERT CSM.

Eastside Study Area Conceptual Site Model

The BRC CSM for the Eastside Sub-Area was presented in BRC’s 2007 Closure Report. The BRC CSM described herein has been updated by Ramboll Environ in light of the current understanding of conditions at the NERT Site and NERT Off-Site Study Area, although reported COPC concentrations are generally lower within the Eastside Study Area. As described in BRC’s 2007 Closure Report, infiltration from the ponds and ditches resulted in mounding in the shallow groundwater and created a downward vertical gradient from the shallow alluvium to deeper groundwater during the period of operation. Similar to the NERT Site, the presence of COPCs in shallow groundwater over the long period of operation would have caused the diffusion of these constituents downward into the underlying UMCf. COPCs in groundwater in the Eastside Sub-Area will migrate northward (towards the Las Vegas Wash) through the Northeast Sub-Area.

In the Eastside Sub-Area, COPC concentrations in the alluvium were subsequently reduced by incidental vadose zone soil flushing from operation of the TIMET spray wheel and RIBs. Once infiltration ceased and the increased head lessened or became negligible, back diffusion of COPCs upwards into the alluvium from the UMCf likely ensued. This back diffusion and upward flow may have resulted in the relatively slow decline in alluvial concentrations in the Northeast Sub-Area and Downgradient Study Area.

In order to estimate COPC mass in the subsurface and aid in the development of a final remedy, a more complete delineation of the vertical extent of COPCs in the alluvium and UMCf is needed.[8] In the Eastside Sub-Area, the mass and vertical extent of COPCs within the UMCf will be investigated at key locations to be selected based on COPC concentrations in shallow groundwater.

The CSM may be revised, as appropriate, based on further evaluation of environmental data collected during various investigations associated with the NERT RI Study Area. Any changes to the CSM will be presented within the comprehensive NERT RI Study Area Reports.

4.2.3 Land Use, Exposed Populations, and Exposure Pathways

According to information presented in the BRC Closure Plan, exposures to current environmental receptors in the majority of the Eastside Sub-Area are being managed through site access control (BRC 2007). Under the prospective redevelopment plan developed by BRC, the majority of the Eastside Sub-Area will be used for a variety of purposes, including residential housing, parks, schools, places of worship, commercial and/or light industrial development, and streets. The majority of the Eastside Sub-Area will be redeveloped, including the current development of the Cadence community, now that shallow soil remediation is complete and exposures to ecological receptors have been mitigated or removed. Potentially exposed human receptors and their potential routes of exposure were addressed in the BRC Closure Plan and subsequent documents. Following completion of soil remediation activities and post remediation HHRAs for the affected areas, NDEP approved NFA determinations for the upper 10 feet of soil for the majority of the Eastside Sub-Area (BRC 2014). While the investigation outlined in this Phase 3 RI Work Plan includes soil and groundwater samples within the area for which NDEP previously issued NFA determinations, the Trust has no intention to re-open the NFA determinations, and the new data obtained by the Trust will only be analyzed for purposes of addressing the COPCs for which the Trust is directed by NDEP to address.

Much of the Northeast Sub-Area was vacant prior to the construction of residential housing and the Chimera golf course starting in the late 1990s. Between 1957 and the early 1970s, a portion of the Henderson Landfill was located in the northeast corner of the Northeast Sub-Area. An investigation of the landfill site by SNWA in the early 2000s found no indication of landfill leachate in groundwater (SNWA 2015).

[8] The Trust will prepare and submit a technical memorandum providing a strategy for developing mass estimates and expanded performance metrics for the primary NERT COPCs, perchlorate and chromium (as applicable), in the subsurface.

5.0 REMEDIAL ACTION OBJECTIVES AND ARARS

The information presented in this section is not limited to the Eastside Study Area and is included in order to update the Remedial Action Objectives (RAOs) and other CERCLA-required components for the entire NERT RI Study Area, which now consists of the NERT Site, the NERT Off-site Study Area, the Downgradient Study Area and the Eastside Study Area. Application of the RAOs will be specific to the COPCs for each respective area of the NERT RI Study Area. For example, within the Eastside Sub-Area, application of the RAOs will be limited to its COPCs, perchlorate and chlorate. As previously discussed, for a complete listing of COPCs and a figure depicting the relationship of each of the various study areas, please see Table 1-1 and Figure 1-3, respectively.

RAOs provide a high level summary of what the final Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup will be designed to accomplish through implementation of the ROD. RAOs are developed as media specific (e.g., soil or groundwater) objectives designed to protect human health and the environment from releases and exposures to hazardous substances. RAOs incorporate information regarding specific setting, COPCs, potential future uses of the site, and human health and ecological risk-based exposure criteria. The RAOs reflect a preference for permanent solutions, incorporating approaches, where feasible and appropriate, that will reliably reduce contaminant toxicity, mobility, or volume. As additional information is gathered and analyzed during performance of the remedial investigation, preliminary RAOs should be modified, as necessary. Final RAOs will be determined after completion of the RI and the FS, when the remedy is selected in the ROD.

Applicable or relevant and appropriate requirements (ARARs) are considered during the development of RAOs. Applicable requirements are those federal and state cleanup standards, standards of control, and other environmental protection requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. If a requirement is not applicable, it may still be relevant and appropriate. A relevant and appropriate requirement addresses problems or situations that are substantially similar to those encountered at a similar site.

For a state requirement to qualify as an ARAR, it must be promulgated, legally enforceable, more stringent than any corresponding federal requirement, consistently applied, and identified in a timely manner. ARARs fall into one of three identified categories: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs are health- or risk-based numerical limitations or standards that apply to site-specific conditions. Location-specific ARARs are restraints placed on activities conducted in a specific location. Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous waste or site remediation activities.

In addition to chemical-, location-, and action-specific ARARs, advisories, criteria, and guidance developed by USEPA or other federal or state agencies may, as appropriate, be considered in developing remediation alternatives. These criteria are referred to as “to-be-considered” (TBC) criteria.

An extensive discussion of the ARARs and TBCs that apply to the NERT Site was presented in the RI/FS Work Plan (ENVIRON 2014). The proposed RAOs for groundwater have been selected to incorporate the following chemical-specific ARARs/TBCs:

- Perchlorate: Because there are no chemical-specific ARARs for perchlorate, the most applicable and relevant TBC for perchlorate that is protective of human health is the Interim Drinking Water Health Advisory and federal PRG of 15 µg/L (EPA 2008 and EPA 2009a), chosen over the Nevada Interim Action Level of 18 µg/L since it is the lower of the two values.[9]
- Other COPCs: The most prevalent COPC detected in groundwater at the Site other than perchlorate is hexavalent chromium/total chromium.[10] The chemical-specific ARAR for total chromium is the federal maximum contaminant level (MCL) of 100 µg/L, which the State of Nevada has adopted by reference (NAC 445A). For other COPCs, the chemical-specific ARARs/TBCs discussed above will be evaluated based on the results of a site-specific risk assessment and incorporated into the Site FS.

In addition, while acknowledging that other sources are contributing COPCs to Las Vegas Wash and Lake Mead (including sites within the BMI Complex, as well as upgradient and downgradient sources), both short- and long-term remedial actions selected at this Site will help achieve at downstream state boundaries out-of-state MCLs: namely, California's MCL for perchlorate of 6 µg/L (California Code of Regulations [CCR] Title 22, Section 64431); California's MCL for total chromium of 50 µg/L (CCR Title 22, Section 64431); other MCLs for COPCs originating at the Site (CCR Title 22, Division 4, Chapter 15 and Arizona Administrative Code Title 18, R-18-4-104, R-18-109).[11]

5.1 Initially Proposed Long-Term RAOs for the NERT Site and the Off-Site NERT RI Study Area

The long-term RAOs initially proposed and approved for the NERT Site (i.e., limited to the On-Site and Off-Site Study Areas) were described in the RI/FS Work Plan. Long-term RAOs are those that will focus on achieving restoration of downgradient groundwater over a long time frame (i.e., greater than 5 years).

[9] There is currently no federal maximum contaminant level (MCL) for perchlorate. The EPA is currently performing an evaluation and peer review in order to develop an MCL for perchlorate. In December 2016, the EPA reached an agreement in federal court to conduct rulemaking for perchlorate, which could result in final perchlorate regulations by December 2019.

[10] A detailed analysis of hexavalent chromium to total chromium ratios was performed as part of the 2016 Groundwater Monitoring Optimization Plan (Ramboll Environ 2016a). The analysis found that the ratio of hexavalent chromium to total chromium was approximately 1 within the NERT groundwater plume (i.e., the concentration of total chromium is generally equal to the concentration of hexavalent chromium in groundwater). Subsequent to NDEP approval, hexavalent chromium was generally eliminated from NERT's on-going monitoring program in 2016. Therefore, mass estimates of hexavalent chromium, as well as interpretations of the lateral and vertical extent of hexavalent chromium in soil and groundwater, performed as part of the RI will primarily rely on total chromium data (rather than hexavalent chromium data).

[11] Office of Environmental Health Hazard Assessment (OEHHA) within the California Environmental Protection Agency (Cal EPA) has issued a preliminary health goal (PHG) of 1 µg/L for perchlorate in drinking water (Cal EPA 2015). This PHG is considered a health goal and is not enforceable, and is therefore not considered an ARAR or TBC criteria. No California standards have been modified based on this PHG.

- **Downgradient Aquifer Restoration:** The overall RAO for groundwater downgradient of the NERT Site was to restore the alluvial aquifer and UMCf to meet ARARs/TBCs. This RAO was to be achieved incrementally by first focusing on the control of off-site migration of COPCs at the downgradient boundary of the NERT Site (see below).

- **On-Site Groundwater Control:** To achieve the overall long-term RAO of downgradient aquifer restoration, the migration of COPCs present in groundwater at the NERT Site was to be mitigated. Specifically, groundwater immediately downgradient of the northern property boundary of the NERT Site would meet ARARs/TBCs likely through a combination of the implementation of on-site vadose zone source control and the implementation (as required) of barrier groundwater control options (e.g., extraction, hydrogeologic barriers, or in-situ treatment).

- **Vadose Zone Source Control:** To be consistent with the preference for permanent remedies, incorporating approaches that will reliably reduce contaminant toxicity, mobility, or volume through treatment, this RAO was to address the mitigation of significant leaching of perchlorate and other COPCs from vadose zone soils to underlying groundwater. In addition, vadose zone source control would also reduce direct contact with COPCs present in soil. The effectiveness and implementability of this RAO could be limited by the presence of existing operating units at the NERT Site and therefore, was to be evaluated in conjunction with on-site groundwater control alternatives to ensure that ARARs/TBCs would be achieved at the downgradient NERT Site boundary. It was also anticipated that additional areas of vadose zone source control would be identified in the future as NERT Site operations and Unit buildings are altered and/or decommissioned.

5.2 Revised Proposed Long-Term RAOs for the Expanded RI Study Area

The long-term RAOs initially proposed and approved for the NERT Site in the RI/FS Work Plan have been modified to incorporate the findings of the NERT Phase 1 RI investigation, the initial data from the Downgradient Study Area, and considering the expansion of the RI Study Area to include the Eastside Study Area. Figures 5-1 and 5-2 illustrate the proposed RAOs across the NERT RI Study Area compared to the estimated distribution of perchlorate in groundwater, respectively. The factors considered include:

- The Phase 1 RI finding of significant perchlorate mass at depth in the UMCf off-site that will serve as a long-term source of perchlorate into the alluvial aquifer, with the result that aquifer restoration in the mid-plume area could be technically infeasible within a reasonable time frame; and

- Within the Eastside Sub-Area, residual perchlorate above leaching criteria remains in the upper 10 feet of vadose zone soil where NFA status has been granted by NDEP based on human health criteria.

The following revised long-term RAOs, therefore, are proposed for the NERT RI Study Area:

- **Mitigate Discharge in Las Vegas Wash**: The overall RAO for groundwater downgradient of a mid-plume groundwater containment boundary is to mitigate the discharge of COPCs in groundwater to the Las Vegas Wash by reducing COPC concentration in the alluvial aquifer and UMCf to meet ARARs/TBCs.
- **Mid-Plume Containment and Mass Removal**: To achieve the overall long-term RAO of mitigating discharge of COPCs to the Las Vegas Wash, the migration of COPCs present in off-site groundwater will be mitigated. Specifically, groundwater quality immediately downgradient of Galleria Road and the Eastside Sub-Area northern property boundary will be substantially improved likely through a combination of the implementation of on-site vadose zone source and groundwater mass removal actions. As discussed earlier, NERT will only address perchlorate and chlorate impacts immediately north of the Eastside Sub-Area. The mid-plume containment boundary line is shown in Figure 5-3. Contaminant reduction efforts may be necessary to ensure that mitigating discharge to the Las Vegas Wash can be achieved.
- **NERT Site Source Control and Containment:** To achieve the overall long-term RAO of downgradient aquifer restoration, the migration of COPCs present in groundwater at the NERT Site will be mitigated. Specifically, on-site source control and containment at the northern property boundary of the NERT Site will be achieved through a combination of the implementation of on-site vadose zone source control and the implementation (as required) of barrier groundwater control options (e.g., extraction, hydrogeologic barriers, or in-situ treatment).

These revised RAOs (aquifer restoration, mid-plume containment, and site source control and containment) will achieve the same goals for the NERT Site and protection of the Las Vegas Wash as the initially proposed and approved RAOs and are consistent with Nevada regulations, which may take technical feasibility and cost, as well as the groundwater's status as a drinking water source into account when considering clean-up standards.

5.3 Proposed Operable Units

Consistent with the proposed revision to the RAOs, and with the intent to both accelerate the remedial program schedule and create efficiency and effectiveness in attaining the RAOs, the Trust proposes to organize the NERT RI Study Area into three Operable Units (OUs). The proposed boundaries between the OUs would be consistent with the three RAOs as indicated on Figure 5-3 and as supported by the previously presented Figures 5-1 and 5-2. Specifically, the OUs would be comprised as follows:

- **Operable Unit 1 (OU-1):** Includes the NERT Site.
- **Operable Unit 2 (OU-2):** Includes the Eastside Sub-Area and the portion of the NERT Off-Site Study area south (i.e., upgradient) of the mid-plume containment boundary line.

- **Operable Unit 3 (OU-3):** Includes the Northeast Sub-Area, the Downgradient Study Area, and the portion of the NERT Off-Site Study area north (i.e., downgradient) of the mid-plume containment boundary line.

This proposed organization of the NERT RI Study Area will allow for consistency of RAOs within each OU and focus investigation and remedial efforts and accelerate remedy implementation. For example, completion of work within OU-1 and OU-2 will be focused on the long-term RAOs of plume containment and source control/mass removal. This work can be accelerated while efforts to investigate and characterize OU-3 are proceeding and will be consistent with the downgradient long-term RAO of mitigating discharge to the Las Vegas Wash. The results of the OU-1 and OU-2 work, including the RI and FS phases, will directly inform the OU-3 RI work, including treatability studies that will be performed concurrently. Based on the currently envisioned schedule, the division of the NERT RI Study Area into three Operable Units (OU-1, OU-2 and OU-3) will result in the preparation of two RI Reports, two FS Reports and two RODs, one for OU-1/OU-2 and one for OU-3. If there are significant delays associated with completion of the Phase 3 RI, NERT will prepare separate reports for each OU.

6.0 PHASE 3 RI WORK PLAN

This Section presents the components of the Work Plan for the Phase 3 RI following a discussion of the data gaps and objectives to be addressed as part of the investigation.

6.1 Identification of Data Gaps

As previously discussed, large portions of the Eastside Sub-Area have been the subject of numerous regulatory actions and environmental investigations since the early 1970s. Soil and groundwater investigations and remediation activity conducted through 2014 in much of the Eastside Sub-Area served as the basis for HHRAs and subsequent NFA determinations for the upper 10 feet of soil (BRC 2014). As part of BRC's investigation of downgradient groundwater impacts, groundwater monitoring within the Northeast Sub-Area has been conducted as part of these previous investigations.

NDEP directed the Trust to investigate the Eastside Sub-Area in order to evaluate the nature and extent of COPCs in the subsurface, particularly from residual perchlorate in soil above the leaching criterion of 0.0185 mg/L that could potentially be transported to underlying shallow groundwater. In addition, groundwater seep samples collected in April 2000 by Kerr-McGee and more recent samples of surface water and groundwater adjacent to Las Vegas Wash as part of the Downgradient Investigation (AECOM 2016c) indicate that additional perchlorate may be entering the Wash downstream (east) of the NERT Seep Well Field and Pabco Weir. The extent of perchlorate in soil leaching to groundwater east of the NERT Site and its contribution to perchlorate mass loading in the Las Vegas Wash have not been evaluated.

As part of this Work Plan, additional areas have been identified where investigation is needed to better characterize the nature and extent of COPCs in soil and groundwater within the Eastside and Northeast Sub-Areas, and the contribution of COPC mass loading to Las Vegas Wash downstream of the previously identified historic release areas west of Pabco Road.

Summary of Data Gaps

The following is a summary of data gaps to be addressed as part of the Phase 3 RI based primarily on information available from the BMI database and the SNWA database:

- Delineation of residual COPCs in soils that could potentially be transported to underlying shallow groundwater, through installation of additional borings within the Eastside Sub-Area.
- Because the majority of the available historic data was collected in 2009 or earlier, it is important to obtain data that represent current COPC concentration distributions throughout the Eastside Study Area. Additional Shallow WBZ monitoring wells are needed to better delineate COPC mass, plume definition, and hydraulic data for use in the future FS evaluations of potential groundwater remediation alternatives. Existing wells screened within the Shallow WBZ will be used as part of the current investigation, but additional Shallow WBZ wells will be necessary to define COPC concentrations in some areas, particularly within the Northeast Sub-Area located north of Galleria Drive.

- Currently eight Middle WBZ monitoring wells are located within the Eastside Study Area. At least five of these wells are screened below approximately 140 feet, which is deeper than the target depth of this investigation. Previous investigations have shown that wells within the Eastside Study Area that are screened in the deeper portion of the UMCf are typically non-detect for COPCs and therefore do not require further investigation (BRC 2007; AECOM 2016c). However, additional monitoring wells are proposed within shallower portions of the UMCf to delineate the vertical extent of COPCs above BCLs detected near the base of the Shallow WBZ.
- The further delineation of features important for understanding the groundwater flow system and extending the evaluation of hydrogeologic characteristics from the NERT Site and NERT Off-Site Study Area into the Eastside Study Area, including the alluvium/top of Muddy Creek formation contact, available interpretations of incised channels that may affect groundwater flow and transport pathways, and the presence of other geologic units (Horse Springs formation and Thumb formation) within the Northeast Sub-Area.

6.2 Investigation Objectives

The objectives of the Phase 3 RI are to understand:

1. The distribution of COPCs above LBCLs in unsaturated soil within the Eastside Sub-Area;
2. The lateral and vertical distribution of COPCs in groundwater above ARARs/TBCs within the alluvium and the UMCf;
3. Confirmation of the relatively low COPC concentrations detected previously in the existing Middle and Deep WBZ wells;
4. Additional characterization of groundwater transport pathways;
5. Development of a dataset in order to quantify COPC mass flux from the Eastside Sub-Area across the mid-plume containment boundary line;
6. Further characterization of COPCs in groundwater in the Northeast Sub-Area; and
7. Address data gaps for incorporation in the mass estimate technical memorandum (as discussed earlier in this document).

As discussed in Section 4.3, the proposed revised RAOs for the NERT RI Study Area are: 1) source control and groundwater containment at the NERT Site (OU-1); 2) groundwater contaminant concentration reduction and mass removal between the NERT Site and the mid-plume boundary (OU-2); and 3) downgradient aquifer restoration in the off-site area north of Galleria Road (this also includes the Northeast Sub-Area and the adjacent Downgradient Study Area) (OU-3). In addition, NDEP has requested mass flux estimates along specified transects as part of an expanded metrics program[12] (NDEP 2016b). One of these transects coincides with the mid-plume boundary between the Eastside Sub-Area and Northeast Sub-Area.

To support the proposed RAOs, this investigation will focus on delineation of the current distributions of COPCs in unsaturated soil, alluvium, and the UMCf within the Eastside Sub-Area to provide a current dataset to develop an estimate of the current residual COPCs mass in the subsurface. The existing monitoring well network along the mid-plume boundary will be supplemented with new wells screened in the upper portion of the Middle WBZ that are needed to estimate mass flux across the northern boundary transect. In the Northeast Sub-Area, additional monitoring wells will be installed to better delineate and monitor the groundwater plume that extends into this area from the mid-plume boundary.

The planned investigation to achieve these objectives will include the following elements:

- Baseline sampling of all/some of the existing monitoring wells in the Eastside Study Area to provide a comprehensive groundwater data set to evaluate current conditions.
- The completion of approximately 120- to 150-foot deep soil borings (two locations with 200-foot deep soil borings) followed by well installations at selected locations to evaluate the lateral and vertical extent of COPCs impacts in the low transmissivity UMCf.
- A second round of groundwater sampling at both existing and new monitoring well locations.
- Focused hydraulic testing during well installation and/or development with testing also specified for a limited number of existing wells.
- Re-evaluation of previous interpretations of the top of the UMCf by synthesizing available stratigraphic data from previous investigations along with the results of this investigation. This work will include review and re-interpretation (rather than kriging or other statistical method) of previous geophysical survey results and stratigraphic data from available boring logs, supplemented by focused boring transects where the paleochannels are projected to cross the western and northern downgradient site boundaries based on previous interpretations of the top of UMCf.

The planned investigation tasks are described in the following sections and collectively define the scope of the Phase 3 RI. In general, proposed locations are on vacant BRC land, within public rights of way, or along the edges of the Chimera Golf Course near existing well locations. If any changes are made to the scope of this project, NERT will seek NDEP concurrence before implementation. The table below provides a summary of the various investigative activities that will be completed during the Phase 3 RI.

[12] A mass estimate technical memorandum will provide a strategy for developing mass estimates and expanded performance metrics for the primary NERT COPCs, perchlorate and chromium (as applicable), in the subsurface.

Activity	Description	Summary Table	Figures
Inspection and Initial Sampling of Existing Wells (Section 6.3)	Inspection of approximately 119 existing well locations	Tables 6-1a & 6-1b	Figures 6-1a, 6-1b, & 6-1c
	Initial sampling of approximately 119 existing well locations	Tables 6-2 & 6-3	Figures 6-1a, 6-1b, & 6-1c
Investigation of the Deeper Shallow WBZ and Shallow Middle WBZ (Section 6.4)	Installation of 18 soil borings	Table 6-4	Figure 6-2
	Installation of 27 pilot borings and 32 new wells (5 clustered locations)	Table 6-5	Figure 6-2 & 6-3
	Initial sampling of 32 new wells	Tables 6-2 & 6-3	Figure 6-3
Comprehensive Groundwater Sampling (Section 6.6)	Second round sampling of all new and existing wells (approximately 151 wells)	Table 6-2 & 6-3	Figure 6-3
Hydraulic Characterization (Section 6.7)	Single Well Hydraulic Tests at 46 wells (including 32 new wells and 14 existing wells)	Table 6-6	NA
	Transducers installed at approximately 25 well locations	NA	NA

6.3 Inspection and Initial Sampling of Existing Wells

Many of the wells in the Eastside Study Area have not been sampled since 2009, and some may have been decommissioned. The status of the monitoring wells within the Eastside Study Area, as listed in the well information maintained by NDEP, are shown on Figures 6-1a (Shallow WBZ), 6-1b (Middle WBZ), and 6-1c (Deep WBZ). However, the accuracy of this information is unknown. Information about the Eastside Study Area's 102 monitoring wells identified as "active" in the BMI database is presented in Table 6-1a. Inactive and/or decommissioned wells are listed in Table 6-1b. The current status of the wells needs to be verified with the well owner and access obtained as part of planning for the initial sampling event.

Well Inspection Program

Well construction and location information for all former and current wells within the Eastside Study Area are available in the All Wells Database, an Excel spreadsheet maintained by NDEP consultants containing well construction details provided by the BMI Complex parties. However, to verify the existing information, a comprehensive survey of all monitoring wells owned by BMI Complex parties will be performed within the Eastside Study Area prior to sampling. The well inspection program will include a survey of all identifiable well locations, verification of well depth, and assessment of well condition.

Baseline Well Sampling

Following well inspection, an initial baseline sampling event will be conducted at existing wells in the Eastside Study Area (see existing wells listed in Table 6-2) for the COPCs and general chemistry parameters identified in Table 6-3.

6.4 Investigation of the Deeper Shallow WBZ and Upper Middle WBZ

Many of the existing Shallow WBZ monitoring wells are screened across the water table and do not provide information on COPCs concentrations and the vertical extent of these chemicals in the UMCf near the base of the Shallow WBZ (defined as 90 ft bgs) and in the upper portion of the Middle WBZ. The existing Middle WBZ wells are screened near the base of the Middle WBZ (typically at depths greater than 140 ft bgs). Additional data is needed to evaluate COPCs mass in the UMCf, the potential for back diffusion into shallow groundwater, and if significant mass is present at depth, the potential for lateral flow in sandy silt layers that may be present in the UMCf.

Soil samples for chemical analysis were collected during installation of 13 of the deep monitoring wells located in the Eastside Sub-Area. A review of the soil sample concentration data shows that the COPC concentrations in the UMCf generally decrease to below 1 mg/kg between depths of about 80-100 ft bgs. The highest concentrations were typically found between approximately 50-80 feet bgs except in the northwest former surface seep area, where perchlorate was detected at relatively high concentrations from the ground surface to approximately 70 ft bgs. The vertical extent of COPCs impacts in the low transmissivity UMCf will be further investigated using a combination of 150-foot deep soil borings followed by well installations at selected locations (Figures 6-2 and 6-3). The planned investigation is discussed in the following sections.

<u>Soil Borings</u>

A total of 45 borings will be advanced to collect soil data to develop current COPCs mass estimates. As shown in Tables 6-4 and 6-5, soil samples will be collected from 18 soil borings (ESB-1 through ESB-18) and 27 monitoring well pilot borings (ES-1 through ES-27). The planned deep soil borings will be drilled to an approximate depth of 150 feet bgs and soil samples will be collected for chemical analysis at 10 foot intervals to provide COPCs data to support vertical delineation and mass estimates (Tables 6-2 and 6-3). Two of the borings, ES-17 and ES-18, are located adjacent to and downgradient of existing well MCF-12C, which is screened from 155-175 feet bgs and where perchlorate has been detected at 430 µg/L. These two borings will be advanced to 200 feet bgs to better define the vertical extent of perchlorate impact in this area. The soil concentrations will be used to calculate a corresponding groundwater concentration based on the mass in the soil sample and the water content. Because of its very high solubility, only minimal perchlorate mass will sorb to soil particles. Therefore, perchlorate measured in a soil sample should be roughly equivalent to the mass measured in a groundwater sample collected from the same depth. For chlorate, dissolved mass would be calculated from the total mass estimated from the soil data using partitioning assumptions. To support this calculation, selected soil samples will be tested for fraction organic carbon (foc), porosity, and bulk density to provide site-specific soil properties that will be used to improve the partitioning assumptions and resulting mass estimates.

<u>New Monitoring Wells</u>

A total of 32 new monitoring wells will be installed including 21 wells within the Eastside Sub-Area and 11 wells in the Northeast Sub-Area. The planned new monitoring well locations are shown on Figure 6-3, and the anticipated well construction details are provided in Table 6-5. The screened intervals specified in Table 6-5 may be adjusted during well installation based on depth to groundwater, the local thickness of the units, or in order to span sandy lenses within or close to the target well depth. The specified screen lengths were selected to provide representative groundwater samples at the selected depth.

- Eleven new wells (ES-1 through ES-11) will be installed to provide vertical delineation and COPCs trend data within the Eastside Sub-Area. These eleven wells will to be installed adjacent to existing well clusters to the extent feasible.

- In the area near the Eastside Sub-Area downgradient boundary (the mid-plume boundary), additional data are needed to delineate the lateral and vertical extent of COPCs in the UMCf to evaluate the potential for back diffusion into shallow groundwater and currently uncontrolled COPCs migration toward and past the downgradient mid-plume boundary. A review of available groundwater elevations in the wells screened across the water table indicates that in the majority of these wells, the alluvium is dewatered and first groundwater occurs in the UMCf. The exceptions are three wells (DBMW-7, AA-18, DM-7B) located within interpreted paleochannels and which are screened in saturated alluvium (the alluvium is deeper in the paleochannels). In nearby wells located outside the paleochannels, the alluvium is unsaturated.

  Eight new deeper wells (ES-12, ES-13, ES-15 through ES-20) and one new well cluster (ES-14A/ES-14B) will be installed to supplement the existing downgradient boundary monitoring network and provide data needed for mass flux estimates. The line of boundary wells roughly corresponds with well transects located further to the west, within the Phase 1 and 2 RI Study Areas, where mass flux estimates have been requested by NDEP as part of the evaluation of the performance metrics for the NERT Site (NDEP 2016b).

- In the Northeast Sub-Area, 11 wells will be installed in the Shallow WBZ to supplement existing wells and provide better delineation of the lateral and vertical extent of COPCs within the alluvium and UMCf. Three new well clusters (ES-21A/ES-21B, ES-22A/ES-22B, ES-23A/ES-23B, ES-25A/ES-25B) will each include a shallow well screened across the water table and a deeper well in the UMCf. Three deeper wells (ES-24, ES-26, and ES-27) will be installed adjacent to existing shallow wells to provide additional vertical delineation.

The planned monitoring well depths may be modified based on the pilot boring sample results, and additional deeper wells may be needed to fully delineate the vertical extent of COPCs. Following installation and development, the new wells will be sampled as described in Section 6.6.

6.5 Investigation of the Deep WBZ

No new wells will be installed within the Deep WBZ (>270 ft bgs) as part of this investigation. Historically, wells screened in the Deep WBZ have yielded groundwater samples that are free of detectable concentrations of COPCs and therefore do not require further investigation. To confirm the previous results, existing wells screened within the Deep WBZ will be sampled as described in Section 6.3.

6.6 Comprehensive Groundwater Sampling

A review of recent COPCs data concentration trends collected from 34 existing wells indicates substantial concentration differences between sampling events for about half of the wells sampled (see COPCs data included as Appendix A). Therefore, in addition to the baseline sampling event described in Section 6.3 and the initial sampling of new wells described in Section 6.4, a second comprehensive round of sampling will be conducted to assess current groundwater conditions at as many existing wells as feasible, as well as new wells to be installed as part of the Eastside Study Area investigation. The groundwater sampling plan for the new and existing wells is presented in Table 6-2, and the well locations are shown on Figure 6-3. All the monitoring wells sampled will be tested for COPCs and general chemistry parameters, as outlined in Table 6-3. Field parameters including temperature, pH, dissolved oxygen (DO) and oxygen reduction potential (ORP), turbidity, and electrical conductivity (EC) will be measured during sampling.

6.7 Hydraulic Characterization

The hydraulic well testing proposed for the Eastside Study Area will provide data to evaluate the hydraulic conditions within the alluvium and UMCf. Based on previous hydraulic characterization activities within the Eastside Study Area, it is expected that many monitored locations will represent aquifer conditions with relatively low transmissivity, however, some areas of higher transmissivity may be encountered. Hydraulic properties within the Eastside Study Area will be characterized using both single well hydraulic tests and longer-term water level monitoring using in-well pressure transducers to evaluate seasonal trends, vertical gradients, and/or hydraulic responses to recharge events in areas where data gaps have been identified. The objective of this testing is to provide an indication of the representative transmissivity (and calculated hydraulic conductivity) in each location. Data generated from the aquifer testing will be incorporated into the numerical model developed to assess remedial scenarios for groundwater.

<u>Hydraulic Tests</u>

Each newly installed well will be monitored for water level recovery immediately following development completion. Based on the approximate withdrawal rate used during development, and consideration that water level recovery is an indication of residual drawdown from pumping, an empirical estimate of transmissivity will be calculated, provided that water level recovery can be reasonably monitored. This estimate will then be used to determine which subsequent hydraulic testing method is most appropriate for select locations specified in Table 6-6. Additional hydraulic testing is likely to include a combination of single well constant drawdown or constant rate tests, constant-rate step tests, borehole dilution tests, and slug testing.

Slug testing will be used to evaluate hydraulic conditions of select existing well locations specified in Table 6-6. Adjustments to the types of hydraulic testing to be performed may be made following evaluation of subsurface conditions from data collected during boring and well installation, and the observed hydraulic response during well development. Conventional hydraulic test analytical methods will be used to evaluate the test data, including deviations of Theis equation methods for constant-rate/drawdown testing and Bouwer-Rice methods for slug testing.

Single well borehole dilution testing will be performed in up to six of the newly installed wells to evaluate volumetric flow in the alluvium and UMCf within the field test area. Single-well borehole dilution tests consist of mixing a tracer compound into the groundwater in a well, and then observing the decline in tracer concentration in the well as a function of time using downhole instruments (e.g., Pitrak et al., 2007). The decline in tracer concentration in the well is due to dilution by volumetric groundwater flow, and the results will be used to estimate groundwater velocity in the immediate vicinity of the well.

Transducer Installation

This scope includes deploying transducers in groundwater monitoring wells within approximately 25 monitoring wells within the Eastside Study Area. Locations will be selected to support the evaluation of vertical gradients, groundwater transport pathways, and groundwater level conditions. The proposed locations of these transducers will be confirmed or updated as necessary following the inspection of existing monitoring wells in the Eastside Study Area, as described in Section 6.6.

6.8 Delineation of the Top of Muddy Creek Formation

A comprehensive review of the existing interpretations of the top of the UMCf is necessary to resolve the areas that are important to the overall conceptual model of the Eastside Study Area. This work will include a review of the geophysical survey results conducted by BRC along with verifying the available UMCf topographic surface maps by comparing the contour elevations to available boring log contact elevations. In addition, the presence of the paleochannels will be confirmed by six short boring transects (labelled A through F) drilled across the projected channel locations, generally at locations close to where they cross the Eastside Study Area boundaries. A seventh transect (labelled G) is located near existing well AA-27, where the interpreted depth of alluvium (147 ft bgs) appears anomalously deep. Each transect will include 5-6 borings located approximately 20 feet apart. The borings will be advanced through the alluvium and approximately 10-15 feet into the UMCf to confirm the depth of the alluvium/UMCf contact. The planned transect locations are shown on Figure 6-4.

The purpose of this task is to assist with furthering the evaluation of the effect of paleochannels on groundwater flow in the Eastside Study Area. Two different interpretations of the topography of the Muddy Creek formation exist and resolution of these interpretations is important for characterizing the behavior of COPCs in groundwater in this area, particularly due to the likely impact of the associated incised channels (the paleochannels) that can serve as preferential flow pathways in the alluvium. The two previous interpretations include:

- BRC 2007. The 2007 BRC Closure Report includes two relevant figures. Figure 5-3 in the BRC report presents a contour map of the topographic surface of the UMCf with interpreted paleochannel locations. Figure 5-4 in the BRC report presents geophysical survey transect locations for two surveys conducted in 2003 and 2005. The 2003 survey was conducted within the BMI Common Areas and four transects across Las Vegas Wash and one perpendicular to a postulated fault zone that cut across the Wash where basement rock material was exposed in the Wash about 1.8 miles downstream of the Pabco Weir at this location. The 2005 transects are shown within the area north of the BMI Common Areas and the Las Vegas Wash. The 2007 report does not specifically discuss how the geophysical survey results and other data were considered in developing the UMCf topography.

- Northgate 2010. Northgate incorporated kriged paleochannel locations as part of the development of the NERT groundwater flow model.

The two previous paleochannel interpretations are shown along with the proposed transect locations on Figure 6-4.

6.9 Data Evaluation and Reporting

Following data collection, Ramboll Environ will complete data validation and reduction activities. The results of this Phase 3 RI, as well as the NERT Phase 1 Data Gap Investigation, the current Phase 2 Investigation, the Unit Building Investigation, and the Downgradient Study Area investigation will be incorporated into a comprehensive RI Report for the NERT RI Study Area. As described in Section 5.3, the reporting will be organized to present the data for OU-1 and OU-2 initially, followed by reporting focused on OU-3 after completion of the planned investigations in the Downgradient Study Area.

The OU-1/OU-2 and OU-3 RI Reports together will comprise the comprehensive NERT RI Study Area Reports and will include:

1. Updated interpretations of the lateral and vertical distributions of COPCs in soil and groundwater, in addition to updating the comprehensive conceptual model regarding the groundwater flow system and mass transport characteristics. In addition, the data developed during the Phase 3 RI will be incorporated into the estimates of the residual perchlorate mass in vadose zone soil and groundwater. The strategy for developing mass estimates and expanded metrics for the NERT RI Study Area will be developed in collaboration with NDEP and EPA. The mass estimates are anticipated to include estimates of perchlorate and hexavalent chromium mass in the unsaturated zone, the saturated alluvium, and the saturated UMCf. The mass estimates are an essential component of the conceptual site model developed in the RI that will form the basis of the evaluation of remedial alternatives to be conducted in the FS.

2. The subsurface geologic cross-sections developed for the NERT Off-Site Study Area will be extended into the Eastside Study Area to illustrate subsurface conditions in support of an area-wide conceptual site model. In addition, the updated top of UMCf topographic contour map will be integrated with the subsurface investigation results at the adjacent NERT Off-Site Study Area.

3. Interpretations of data previously gathered as part of the NERT Phase 1 Data Gap Investigation and Phase 2 RI for the NERT Site and NERT Off-Site Study Area, the Eastside Study Area, as well as the Downgradient Study Area. These data will form the refined NERT CSM for the NERT RI Study Area.

Along with development of the NERT RI Study Area Reports, several remedy treatability and pilot studies are being performed. The results from both the RI and treatability programs will be integrated into the FS for the entire NERT RI Study Area to support the development of a comprehensive and final remedy. However, the division of the NERT RI

Study Area into three Operable Units (OU-1, OU-2 and OU-3) will result in the preparation of two coordinated RI Reports, one for OU-1/OU-2 and one for OU-3.

7.0 PROJECT SCHEDULE AND PROJECT MANAGEMENT

7.1 Project Organization and Responsibilities

Mr. Weiquan Dong, PE is the NDEP Project Manager for the NERT Site and handles all NERT Site-related correspondence. Mr. J. Carlton Parker, Supervisor, is responsible for supervision of the technical activities performed by the Bureau of Site Investigation and Cleanup. Mr. James Dotchin has responsibility for overall supervision of all projects in the NDEP Bureau of Industrial Site Cleanup. All NERT Site characterization activities and remedial actions carried out by the Trust for the NERT Site are subject to NDEP oversight under the Settlement Agreement, effective February 14, 2011.

The responsibilities of the project team are as follows:

<u>Nevada Environmental Response Trust</u>

The Trust will provide overall project coordination and will be responsible for communications with NDEP and the property owners. Mr. Steve Clough, Remediation Director, directs all RI/FS activities performed by the Trust and will coordinate Ramboll Environ's field investigation activities.

<u>Ramboll Environ</u>

- Provide technical expertise and input for the Trust's ongoing investigation and remediation of the NERT RI Study Area, including the Eastside Study Area. This support includes implementation and documentation of activities related to health and safety requirements, cost control procedures, sample and data management, and project schedule tracking.
- Assist with maintaining compliance with environmental permits and regulations.
- Direct investigation activities related to the Eastside Study Area investigation.
- Provide technical input to the preparation of environmental documents.
- Perform community relations duties.

The Ramboll Environ project manager and task leaders working on this project include:

- Principal-in-Charge, **Allan J. DeLorme, PE** – The Principal-in-Charge is responsible for the overall technical and policy decisions involving the project, including interaction and coordination with Ramboll Environ project staff, the Trust, and NDEP.
- Project Manager, **John M. Pekala, PG, CEM** – The Project Manager is responsible for the overall development and implementation of Ramboll Environ's remediation strategy as approved by NDEP.
- Task Leader, **Scott D. Warner, PG, CHG, CEG** – The Task Leader is responsible for the overall execution of the approved Work Plan. He will work with the Project Manager and Quality Assurance (QA) Officer to ensure that work is conducted in compliance with project-specific objectives and applicable QA procedures.

- Project (QA) Officer, **Kristin A Drucquer –** The QA Officer is responsible for reviewing the project QA program as it relates to the collection and completeness of data from field and laboratory programs.
- Data Manager, **Craig J. Knox** – The data manager is responsible for management of the applicable databases, including updating and maintaining the databases as needed.

7.2 Anticipated Schedule for Investigation and Reporting

The overall schedule for the Phase 3 RI is described in this section. The schedule identifies the primary tasks, beginning with the submittal of this Work Plan and continuing through preparation and NDEP approval of the NERT RI Study Area RI and FS reports. The projected durations of each task are provided, as well as the relationships between the various tasks.

The following major elements of the Eastside Study Area investigative process are identified in the schedule:

- Within 30 Days Following Receipt of NDEP Comments: Submittal of Response to Comments (RTC) and Revised RI/FS Work Plan Addendum for the Eastside Study Area, if necessary
- Within 45 Days Following Work Plan Approval: Mobilization efforts in support of field work implementation (includes bidding, review, contracting, and field preparations)
- Within 4 Months Following Mobilization: Implementation of field investigation activities outlined in this RI/FS Work Plan Addendum for the Eastside Study Area

The OU-1/OU-2 RI Report, which will include data from the Eastside Study Area, as well as from the investigations of the NERT Site and portions of the NERT Off-Site Study Area, is currently scheduled for submittal to NDEP in late 2018. The OU-3 RI Report, which will include data from the Downgradient Investigation and remaining portions of the NERT Off-Site Study Area will be prepared following completion of the on-going investigation, currently anticipated to be late 2019. If additional data gaps are identified, or if additional study areas are defined by NDEP, the date may need to be adjusted.

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TABLES

Table 1-1. Chemicals of Potential Concern
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

ANALYTES	NERT RI Study Area					
	NERT Site[2]		NERT Off-Site Study Area	Downgradient Study Area[3]	Eastside Study Area	
					Northeast Sub-Area	Eastside Sub-Area
	Soil	Groundwater	Groundwater[1]	Groundwater[1]	Groundwater[1]	Groundwater[1]
Chlorates						
Perchlorate	X	X	X	X	X	X
Chlorate	X	X	X	X	X	X
Metals						
Aluminum	X	X				
Antimony	X					
Arsenic	X	X				
Barium	X					
Boron	X	X				
Cadmium	X					
Chromium	X					
Chromium VI		X	X	X	X	
Chromium (total)		X	X	X	X	
Cobalt	X	X				
Copper	X					
Iron	X	X				
Lead	X	X				
Magnesium	X	X				
Manganese	X	X				
Mercury	X					
Molybdenum	X					
Nickel	X					
Niobium	X					
Palladium	X					
Selenium	X					
Silver	X					
Strontium	X	X				
Thallium	X					
Tungsten	X	X				
Zinc	X					
Zirconium	X					
Volatile Organic Compounds (VOCs)						
Benzene	X	X				
Bromodichloromethane		X				
Bromoform		X				
2-Butanone	X					
Carbon Tetrachloride	X	X				
Chlorobenzene	X	X				
Chloroform	X	X	X			
Chloromethane		X				
Dibromochloromethane		X				
1,2-Dichlorobenzene	X	X				
1,4-Dichlorobenzene	X	X				
1,2-Dichloroethane	X	X				
1,1-Dichloroethane		X				
1,1-Dichloroethene	X	X				
1,1-Dichloropropene	X					
1,4-Dioxane	X	X				
Ethyl tert-butyl ether	X					
Methylene Chloride	X	X				
Tetrachloroethene	X	X				

Table 1-1. Chemicals of Potential Concern
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

ANALYTES	NERT RI Study Area					
	NERT Site[2]		NERT Off-Site Study Area	Downgradient Study Area[3]	Eastside Study Area	
					Northeast Sub-Area	Eastside Sub-Area
	Soil	Groundwater	Groundwater[1]	Groundwater[1]	Groundwater[1]	Groundwater[1]
Volatile Organic Compounds (VOCs) - continued						
1,2,3-Trichlorobenzene	X					
Trichloroethene	X	X				
1,2,3-Trichloropropane	X	X				
1,2,4-Trimethylbenzene	X					
Semivolatile Organic Compounds (SVOCs)						
bis(2-Ethylhexyl)phthalate		X				
Dimethylphthalate	X					
Formaldehyde	X					
1-Methylnaphthalene	X					
2-Methylnaphthalene	X					
Octachlorostyrene	X					
Organophosphorus Pesticides (OPPs)						
Dimethoate	X					
Stirphos	X					
Organochlorine Pesticides (OCPs)						
alpha-BHC	X	X				
beta-BHC	X					
gamma-BHC	X					
2,4'-DDE	X					
4,4'-DDE	X					
4,4'-DDT	X					
Dieldrin	X					
Endosulfan I	X					
Endosulfan Sulfate	X					
Endrin Ketone	X					
Heptachlor epoxide		X				
Hexachlorobenzene	X					
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthylene	X					
Benzo(a)anthracene	X					
Benzo(a)pyrene	X					
Benzo(b)fluoranthene	X					
Benzo(g,h,i)perylene	X					
Indeno(1,2,3-cd)pyrene	X					
Phenanthrene	X					
Polychlorinated Biphenyls (PCBs)						
Aroclor-1260	X					
PCB-081	X					
PCB-118	X					
PCB-126	X					
PCB-169	X					
PCB-209	X					
Total PCBs	X					
Dioxins/Furans						
2,3,7,8-tetrachlorodibenzo-p-dioxin	X					
Other 16 congeners with TEFs	X					
Organic Acids						
4-Chlorobenzenesulfonic acid		X				
Phthalic Acid	X					

Table 1-1. Chemicals of Potential Concern
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

ANALYTES	NERT RI Study Area					
	NERT Site[2]		NERT Off-Site Study Area	Downgradient Study Area[3]	Eastside Study Area	
					Northeast Sub-Area	Eastside Sub-Area
	Soil	Groundwater	Groundwater[1]	Groundwater[1]	Groundwater[1]	Groundwater[1]
Radionuclides						
Radium-226	X	X				
Radium-228	X	X				
Thorium-228	X	X				
Thorium-230	X	X				
Thorium-232	X	X				
Uranium-234	X					
Uranium-235	X					
Uranium-238	X	X				
Uranium	X	X				
Total Petroleum Hydrocarbons (TPH)						
TPH-diesel	X					
TPH-gasoline	X					
TPH-oil	X					
General Chemistry Parameters						
Ammonia	X	X				
Bromide	X	X				
Carbonate	X					
Chloride	X	X				
Cyanide (total)		X				
Nitrate	X	X				
Nitrite	X	X				
Phosphorus (total)	X	X				
Ortho-Phosphate	X					
Silicon	X					
Sulfate	X	X				
Sulfur	X					
Total Dissolved Solids		X	X			

Notes:

(1) Soil may be analyzed for certain groundwater COPCs in soil borings to obtain data focused on vertical delineation in groundwater.

(2) COPCs for the NERT Site were included in the *Remedial Investigation and Feasibility Study Work Plan, Revision 2* for the Nevada Environmental Response Trust Site, Henderson, Nevada, dated June 19, 2014 and approved by NDEP on July 2, 2014 (ENVIRON 2014).

(3) COPCs for the Downgradient Study Area have not been explicitly established. Analytes listed here were included in the *Groundwater Sampling Plan for the NERT Remedial Investigation - Downgradient Study Area,* Nevada Environmental Response Trust Site, Henderson, Nevada dated February 2016 (AECOM, 2016a). General chemistry parameters included in the sampling plan (chloride, bromide, and total dissolved solids) have not been included as COPCs.

TABLE 6-1a. EXISTING ACTIVE MONITORING WELL CONSTRUCTION DETAILS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Top of Casing Elevation (ft msl)	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology
Wells in the Eastside Sub-Area										
AA-01	BRC	830921.03	26720238.72	1757.16	1755.02	49	29	49	20	Qal
AA-09	BRC	831041.59	26723441.40	1695.87	1694.26	70	30	65	35	Qal
AA-11	BRC	830672.55	26725458.88	1660.00	1658.18	28	9	29	20	Qal
AA-13	BRC	833889.39	26722860.98	1724.69	1722.37	51	38	58	20	Qal/UMCf
AA-14	BRC	833615.67	26724283.54	1701.05	1698.07	58	38	58	20	Qal
AA-15	BRC	831753.70	26726004.23	1658.13	1655.46	36	20	40	20	Qal/UMCf
AA-18	BRC	836690.87	26727656.38	1669.00	1665.60	62	45	65	20	Qal
AA-19	BRC	832521.44	26727447.10	1642.32	1639.84	39	22	42	20	Qal/UMCf
AA-20	BRC	831811.79	26728007.77	1628.46	1625.98	27	10	30	20	Qal/UMCf
AA-27	BRC	832471.34	26719301.66	1789.43	1787.03	67	62	82	20	Qal/UMCf
AA-UW1	BRC	831427.20	26719624.99	1774.45	1771.22	55	55	65	10	UMCf
AA-UW2	BRC	832819.54	26718117.11	1821.36	1817.63	61	55	75	20	Qal/UMCf
AA-UW3	BRC	835097.86	26718183.94	1812.72	1809.07	65	60	80	20	Qal/UMCf
AA-UW4	BRC	836517.02	26720029.40	1800.28	1796.79	32	35	55	20	UMCf
AA-UW5	BRC	838134.66	26722958.50	1768.68	1765.05	45	37	57	20	Qal/UMCf
AA-UW6	BRC	839469.22	26725552.51	1740.81	1737.01	33	37	57	20	UMCf
BEC-1	BRC	830926.00	26721120.00	1732.04	1731.91	30	25	40	15	Qal/UMCf
BEC-10	BRC	835778.56	26727623.50	1657.39	1657.38	30	73	88	15	UMCf
BEC-12	BRC	840870.00	26728991.00	1683.84	1683.50	41	45	60	15	UMCf
BEC-4	BRC	830699.33	26723946.72	1681.34	NA	39	25	40	15	Qal
BEC-5	BRC	834179.00	26725181.00	1689.64	1689.66	58	54	69	15	Qal/UMCf
BEC-6	BRC	835794.86	26724104.56	1725.52	1725.26	55	65	80	15	UMCf
BEC-7	BRC	832697.00	26725933.00	1662.82	1662.82	48	45	60	15	Qal/UMCf
BEC-9	BRC	833049.52	26727221.50	NA	1647.74	37	44	59	15	UMCf
DBMW-1	BRC	830469.80	26727999.08	1626.60	1624.13	40	19	49	30	Qal/UMCf

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RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Top of Casing Elevation (ft msl)	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology
DBMW-10	BRC	836955.59	26727918.57	1663.96	1660.83	60	55	75	20	Qal/UMCf
DBMW-11	BRC	837595.56	26727990.80	1667.46	1664.20	30	50	70	20	UMCf
DBMW-12	BRC	838000.97	26727975.84	1669.68	1666.36	30	45	75	30	UMCf
DBMW-13	BRC	838576.96	26727960.53	1678.79	1675.93	30	45	75	30	UMCf
DBMW-14	BRC	838987.26	26727957.62	1684.96	1681.89	36	35	65	30	UMCf
DBMW-15	BRC	839477.50	26727964.31	1693.20	1690.25	36	40	65	25	UMCf
DBMW-16	BRC	840514.78	26728557.03	1694.14	1691.08	95	85	110	25	Qal/UMCf
DBMW-17	BRC	840772.27	26728097.27	1712.38	1709.57	64	52	72	20	Qal/UMCf
DBMW-18	BRC	840571.34	26727750.53	1717.15	1714.11	47	45	65	20	Qal/UMCf
DBMW-2	BRC	830530.28	26728059.44	1627.00	1625.01	45	20	50	30	Qal
DBMW-3	BRC	831032.81	26728150.18	1625.86	1623.40	31	19	39	20	Qal/UMCf
DBMW-4	BRC	832295.98	26729903.30	1603.42	1605.81	25	10	30	20	Qal/UMCf
DBMW-5	BRC	833399.07	26729807.30	1609.61	1606.65	12	15	35	20	UMCf
DBMW-6	BRC	834409.71	26728947.31	1632.43	1629.55	39	30	50	20	Qal/UMCf
DBMW-7	BRC	835304.94	26729069.98	1631.61	1628.99	41	50	70	20	UMCf
DBMW-8	BRC	835406.66	26729026.85	1632.03	1628.99	41	48	68	20	UMCf
DBMW-9	BRC	836248.43	26727788.85	1659.92	1656.76	40	54	74	20	UMCf
DM-1	BRC	832745.01	26722024.65	1727.21	1729.11	55	30	55	25	Qal
DM-2	BRC	833704.11	26722367.71	1728.39	1728.80	50	30	65	35	Qal/UMCf
DM-3	BRC	832896.61	26724052.01	1695.04	1694.71	55	29	64	35	Qal/UMCf
DM-5	BRC	833187.31	26728698.85	1625.40	1623.51	23	7	22	15	Qal
DM-7B	BRC	837165.66	26727896.49	1663.30	1660.24	41	25	45	20	UMCf
DM-8	BRC	838790.56	26727795.18	1684.78	1682.22	38	19	39	20	Qal
DM-9	BRC	836017.85	26725421.14	1704.70	1702.68	56	40	60	20	Qal/UMCf
HMW-17	COH	833609.38	26722107.54	1731.90	1729.50	NA	NA	NA	NA	NA
HMW-18	COH	832673.60	26721690.00	1734.90	1732.50	NA	NA	NA	NA	NA
HMW19	COH	832870.20	26721300.30	1744.90	1742.50	NA	NA	NA	NA	NA

TABLE 6-1a. EXISTING ACTIVE MONITORING WELL CONSTRUCTION DETAILS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Top of Casing Elevation (ft msl)	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology
HMW-20	COH	834158.70	26721321.70	1753.90	1751.50	NA	NA	NA	NA	NA
HMW-21	COH	835446.90	26721504.20	1762.30	1760.00	NA	NA	NA	NA	NA
HMWWT1	COH	836377.27	26724079.77	1729.21	1729.66	40	51	66	15	UMCf
HMWWT4	COH	832430.00	26721385.60	NA	1741.00	30	36	51	15	UMCf
HMWWT6	COH	837455.79	26722112.82	1774.04	1774.31	30	36	51	15	UMCf
HMWWT8	COH	833239.40	26720421.60	1766.00	1766.00	50	56	71	15	UMCf
LG025	NA	830873.80	26720915.00	1739.50	1738.60	24	19	23	4	Qal
MCF-01A	BRC	830905.30	26720244.86	1756.61	1754.44	53	335	355	20	UMCf
MCF-01B	BRC	830888.59	26720256.83	1756.28	1753.95	49	55	85	30	UMCf
MCF-02A	BRC	833801.41	26718435.24	1818.42	1816.44	78	360	380	20	UMCf
MCF-02B	BRC	833785.68	26718432.16	1819.38	1816.36	77	215	235	20	UMCf
MCF-03A	BRC	836835.26	26721058.78	1784.06	1783.23	38	364	384	20	UMCf
MCF-03B	BRC	836813.17	26721066.60	1785.72	1783.46	40	57	77	20	UMCf
MCF-04	BRC	837630.23	26723668.56	1750.42	1748.35	38	379	399	20	UMCf
MCF-05	BRC	832871.14	26728512.87	1627.26	1625.00	25	221	231	10	UMCf
MCF-06A-R	BRC	834929.39	26729028.09	1632.77	1630.00	43	333	373	40	UMCf
MCF-06B	BRC	834930.85	26729012.56	1633.01	1630.27	43	67	82	15	UMCf
MCF-06C	BRC	834945.70	26729004.80	1632.95	1630.28	43	44	59	15	UMCf
MCF-09A	BRC	831024.27	26723427.11	1695.87	1694.26	70	270	290	20	UMCf
MCF-09B	BRC	831019.19	26723449.62	1695.77	1693.00	70	105	125	20	UMCf
MCF-11	BRC	830656.16	26725461.46	1659.95	1657.75	32	94	104	10	UMCf
MCF-12A	BRC	840058.76	26727429.27	1716.16	1713.68	52	350	370	20	UMCf
MCF-12B	BRC	840046.01	26727441.77	1714.88	1712.74	52	64	84	20	UMCf
MCF-12C	BRC	840042.06	26727428.91	1715.27	1713.03	52	155	175	20	UMCf
MCF-16A	BRC	835886.90	26726023.31	1691.66	1689.67	70	365	385	20	UMCf
MCF-16B	BRC	835867.57	26726026.53	1692.26	1689.75	47	284	314	30	UMCf
MCF-16C	BRC	835846.38	26726030.18	1691.98	1689.88	70	53	73	20	Qal/UMCf

TABLE 6-1a. EXISTING ACTIVE MONITORING WELL CONSTRUCTION DETAILS
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Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Top of Casing Elevation (ft msl)	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology
MCF-20A	BRC	833381.19	26728860.07	1626.23	1622.99	17	360	380	20	UMCf
MCF-21A	BRC	838100.00	26727963.00	1663.70	1663.63	25	345	365	20	UMCf
MCF-23A	BRC	830726.53	26726048.99	1646.90	1643.86	42	362	382	20	UMCf
MCF-24A	BRC	833661.11	26725570.88	1676.98	1674.07	43	355	375	20	UMCf
MCF-24B	BRC	833839.36	26725619.34	1684.60	1680.00	49	150	170	20	UMCf
MCF-25A	BRC	830660.58	26722042.79	1711.57	1708.72	38	325	365	40	UMCf
MCF-27	BRC	832488.11	26719293.06	1789.43	1787.03	67	362	382	20	UMCf
MCF-32A	BRC	835743.75	26724066.56	1732.26	1727.88	56	350	370	20	UMCf
MCF-32B	BRC	835753.14	26724074.91	1732.70	1728.31	56	140	160	20	UMCf
PG211	NA	831877.09	26725840.81	1660.03	1659.66	35	15	35	20	Qal
PG220	NA	834703.20	26724769.87	1699.50	1699.60	66	26	66	40	Qal
POD2	BRC	831847.40	26724896.90	1673.94	1673.80	49	41	46	5	Qal
POD2-R	BRC	831955.50	26724825.40	1673.40	1673.80	51	45	60	15	Qal
POD2-R2	BRC	831879.04	26724833.55	1675.00	1675.00	47	45	60	15	Qal/UMCf
POD3-R	BRC	833450.65	26724439.47	NA	1688.88	NA	NA	NA	NA	NA
POD4	BRC	833983.50	26724840.00	1690.01	1692.39	54	47	52	5	Qal
POD4-R	BRC	834026.90	26725123.80	1692.70	1692.69	55	47	52	5	Qal
POD5-R	BRC	831382.90	26723030.30	NA	1692.57	33	11	31	20	Qal
POD6	BRC	831969.00	26723512.90	1699.13	1697.70	48	61	66	5	UMCf
POD6-R	BRC	832061.50	26723201.00	1697.70	1698.10	54	21	46	25	Qal
POD7	BRC	832881.20	26724196.90	1690.92	1692.78	52	48	53	5	Qal
POD7-R	BRC	832450.70	26723526.00	1698.60	1698.60	47	NA	NA	NA	NA
POD8	BRC	833586.10	26724789.80	1691.33	1691.16	74	43	73	30	Qal
POU1	BRC	832851.30	26722139.80	1728.04	1728.75	58	48	58	10	Qal
POU2	BRC	834652.10	26723328.80	1725.55	1724.88	39	33	38	5	Qal
POU3	BRC	831329.98	26721664.71	1728.51	1728.00	55	35	65	30	Qal

TABLE 6-1a. EXISTING ACTIVE MONITORING WELL CONSTRUCTION DETAILS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Top of Casing Elevation (ft msl)	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology
Wells in the Northeast Sub-Area										
AA-07	BRC	837100.42	26729559.52	1612.63	1610.12	52	30	50	20	Qal
AA-26	BRC	840176.49	26733349.15	1566.67	1563.56	110	32	52	20	Qal
DBMW-22	BRC	839141.01	26733030.27	1535.03	1532.08	15	35	55	20	UMCf
LG231	NA	837411.60	26728199.40	1661.30	1660.00	30	89	99	10	UMCf
LG232	NA	837354.50	26728203.20	1661.25	1660.00	30	290	300	10	UMCf
MCF-07	BRC	837113.60	26729569.85	1612.70	1610.07	45	350	370	20	UMCf
MCF-22A	BRC	840735.00	26729054.00	1681.55	1680.62	65	342	382	20	UMCf
MW-04	COH	838288.65	26733551.66	1530.64	1527.85	25	20	30	10	Qal/UMCf
MW-05	COH	840501.38	26733563.04	1569.13	1567.75	35	NA	NA	NA	NA
MW-10	COH	840223.23	26734019.86	1546.44	1543.40	NA	NA	NA	NA	NA
MW-11	COH	839738.37	26733930.02	1543.35	1539.53	NA	NA	NA	NA	NA
MW-18	COH	840946.07	26734674.06	1582.48	1581.77	NA	NA	NA	NA	NA
MW-1	CGC	838593.43	26731476.23	1563.29	1563.81	NA	NA	NA	NA	NA
MW-2	CGC	838816.81	26731044.43	1579.96	1580.35	NA	NA	NA	NA	NA

Notes:

Highlighted wells are part of BRC's current groundwater monitoring program.

BRC = Basic Remediation Company

COH = City of Henderson

CGC = Chimera Golf Course

Qal = Alluvium

UMCf = Upper Muddy Creek Formation

[a] appears anomalous

NA = Not Available

ft msl = feet, mean sea level datum

ft bgs = feet below ground surface

TABLE 6-1b. INACTIVE PLUGGED AND ABANDONED WELLS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Lithology
Inactive Wells in the Eastside Sub-Area									
DM-10	BRC	835055.71	26724019.66	1717.18	40	20	40	20	Qal
DM-4	BRC	830802.17	26728130.60	1620.93	23.5	8	23	15	Qal
DW-01	Unknown	831874.10	26728426.00	1625.00	50	NA	NA	NA	NA
HMW-1	City of Henderson	836445.20	26724037.50	1730.00	40	NA	NA	NA	NA
HMW10	City of Henderson	835043.04	26723055.10	1741.27	44	38	53	15	Qal/UMCf
HMW11	City of Henderson	834720.20	26722792.78	1737.34	72.3	40	55	15	Qal
HMW12	City of Henderson	833849.00	26721901.00	1745.00	70	NA	NA	NA	NA
HMW-2	City of Henderson	835464.80	26723253.20	1735.00	35	NA	NA	NA	NA
HMW-3	City of Henderson	833849.30	26721927.20	1745.00	35	NA	NA	NA	NA
HMW4	City of Henderson	832430.00	26721385.60	1741.00	30	NA	NA	NA	NA
HMW5	City of Henderson	831169.40	26720853.40	1745.00	18	NA	NA	NA	NA
HMW6	City of Henderson	837341.70	26722142.00	1773.00	30	NA	NA	NA	NA
HMWWT10	City of Henderson	831390.70	26720251.15	1759.00	40	39	54	15	UMCf
HMWWT2	City of Henderson	835372.66	26723175.39	1735.52	35	32	47	15	UMCf
HMWWT3	City of Henderson	833751.00	26721998.00	1744.00	35	NA	NA	NA	NA
HMWWT5	City of Henderson	831169.40	26720853.40	1745.00	18	NA	NA	NA	NA
HMWWT7	City of Henderson	835468.99	26721327.35	1763.71	45	41	56	15	Qal/UMCf
HMWWT9	City of Henderson	831542.90	26719648.80	1773.00	39	40	55	15	UMCf
LG013	Unknown	834115.03	26725144.23	1689.91	57	241	243	2	UMCf
LG014	Unknown	835541.27	26725106.27	NA	NA	NA	NA	NA	NA
LG021	Unknown	831479.80	26728495.40	1613.00	30	37	39	2	UMCf
LG022A	Unknown	831699.80	26728826.20	1613.00	22	NA	NA	NA	NA
LG023	Unknown	833979.70	26724921.20	1698.50	45	43	44	1	Qal
LG024	Unknown	833831.30	26725022.20	1693.00	30	1	30	29	Qal
LG026	Unknown	830889.30	26720916.20	1738.30	58	87	90	3	UMCf

TABLE 6-1b. INACTIVE PLUGGED AND ABANDONED WELLS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Lithology
MCF-19A	BRC	830525.00	26728055.00	1625.00	34.5	320	360	40	UMCf
PG203	Unknown	830606.00	26720531.70	1738.30	46.4	NA	NA	NA	NA
PG204	Unknown	830810.00	26720684.40	1742.30	50	10	30	20	Qal
PG206	Unknown	830470.10	26722131.00	1706.80	38	16	36	20	Qal
PG210	Unknown	830734.70	26725542.00	1656.50	30	10	20	10	Qal
PG214	Unknown	830651.71	26727983.15	1620.60	20	10	20	10	Qal
PG215	Unknown	831127.48	26728153.67	1618.50	20	5	20	15	Qal
PG219	Unknown	835178.29	26723814.62	1722.98	52.2	22	52	30	Qal
PG221	Unknown	833749.70	26725890.00	NA	55	28	38	10	Qal
PG222	Unknown	832748.00	26725481.40	1670.00	50.6	20	40	20	Qal
PG231	Unknown	832628.40	26728945.20	1614.10	18.6	7	17	10	Qal
PG232	Unknown	833251.40	26729006.70	1615.10	15.6	7	17	10	Qal
PG233	Unknown	833861.30	26728966.10	1621.10	25	20	30	10	Qal/UMCf
PG242	Unknown	830715.30	26722933.60	1695.90	38	21	41	20	Qal/UMCf
POD1	BRC	830987.60	26724688.30	1672.58	37	42	52	10	UMCf
POD1-R	BRC	831299.20	26724551.70	1673.00	NA	NA	NA	NA	NA
POD3	BRC	833164.30	26724593.60	1689.35	50	66	76	10	UMCf
POD5	BRC	831337.70	26723287.60	1694.00	37	31	36	5	Qal
WTB-1	Unknown	831339.37	26720870.40	1741.20	59	NA	NA	NA	NA
WTB-2	Unknown	833640.45	26722000.36	1732.50	52	NA	NA	NA	NA
WTB-3	Unknown	836448.40	26724233.81	1725.10	47	NA	NA	NA	NA
WTB-4	Unknown	832891.09	26720977.05	1749.00	67	NA	NA	NA	NA
WTB-5	Unknown	832138.87	26719843.73	1766.30	65	NA	NA	NA	NA
WTB-6	Unknown	834306.67	26720826.16	1761.20	64	NA	NA	NA	NA
WTB-7	Unknown	837328.47	26722272.20	1768.90	40.5	NA	NA	NA	NA

TABLE 6-1b. INACTIVE PLUGGED AND ABANDONED WELLS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Easting	Northing	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Lithology
Inactive Wells in the Northeast Sub-Area									
LG180	Unknown	836827.50	26728213.70	1655.00	NA	NA	NA	NA	NA
MW-07	City of Henderson	841228.14	26735162.90	1578.43	NA	NA	NA	NA	NA
MW-08	City of Henderson	841021.90	26734440.76	1581.02	NA	NA	NA	NA	NA
MW-09	City of Henderson	841337.98	26735550.28	1532.84	NA	NA	NA	NA	NA
RMW-10	Unknown	838327.30	26732382.80	1550.00	10	NA	NA	NA	NA
RMW-3	Unknown	836157.80	26729506.90	1587.80	13	NA	NA	NA	NA
RMW-4	Unknown	837713.40	26730309.60	1594.00	5	NA	NA	NA	NA
RMW-5	Unknown	840409.40	26731274.00	1590.10	65	NA	NA	NA	NA
RMW-7	Unknown	839535.20	26732460.00	1539.40	38.5	NA	NA	NA	NA
RMW-9	Unknown	839611.60	26729845.70	1622.00	10	NA	NA	NA	NA
RPZ-3	Unknown	839562.00	26730229.50	1613.20	28	NA	NA	NA	NA
RPZ-4	Unknown	839114.90	26731546.00	1577.40	30	NA	NA	NA	NA
WW-6	Unknown	836483.66	26728801.46	NA	NA	120	200	80	UMCf

Notes:

BRC = Basic Remediation Company

Qal = Alluvium

UMCf = Upper Muddy Creek Formation

NA = Not Available

ft msl = feet, mean sea level datum

ft bgs = feet below ground surface

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
EASTSIDE SUB-AREA										
Planned New Wells										
ES-1	NERT	NA	NA	95	110	15	TBD	--	X	X
ES-2	NERT	NA	NA	45	65	20	TBD	--	X	X
ES-3	NERT	NA	NA	45	65	20	TBD	--	X	X
ES-4	NERT	NA	NA	70	90	20	TBD	--	X	X
ES-5	NERT	NA	NA	70	85	15	TBD	--	X	X
ES-6	NERT	NA	NA	55	75	20	TBD	--	X	X
ES-7	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-8	NERT	NA	NA	90	110	20	TBD	--	X	X
ES-9	NERT	NA	NA	80	100	20	TBD	--	X	X
ES-10	NERT	NA	NA	45	65	20	TBD	--	X	X
ES-11	NERT	NA	NA	35	55	20	TBD	--	X	X
ES-12	NERT	NA	NA	45	65	20	TBD	--	X	X
ES-13	NERT	NA	NA	90	105	15	TBD	--	X	X
ES-14A	NERT	NA	NA	45	65	20	TBD	--	X	X
ES-14B	NERT	NA	NA	100	115	15	TBD	--	X	X
ES-15	NERT	NA	NA	70	90	20	TBD	--	X	X
ES-16	NERT	NA	NA	80	100	20	TBD	--	X	X
ES-17	NERT	NA	NA	80	100	20	TBD	--	X	X
ES-18	NERT	NA	NA	80	100	20	TBD	--	X	X
ES-19	NERT	NA	NA	90	110	20	TBD	--	X	X
ES-20	NERT	NA	NA	90	110	20	TBD	--	X	X

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
Shallow Water-Bearing Zone Wells (<90 ft bgs)										
AA-01	BRC	1755.02	49	29	49	20	Qal	X	--	X
AA-09	BRC	1694.26	70	30	65	35	Qal	X	--	X
AA-11	BRC	1658.18	28	9	29	20	Qal	DRY	--	DRY?
AA-14	BRC	1698.07	58	38	58	20	Qal	X	--	X
AA-18	BRC	1665.60	62	45	65	20	Qal	X	--	X
BEC-4	BRC	NA	39	25	40	15	Qal	X	--	X
DBMW-2	BRC	1625.01	45	20	50	30	Qal	X	--	X
DM-1	BRC	1729.11	55	30	55	25	Qal	X	--	X
DM-5	BRC	1623.51	23	7	22	15	Qal	DRY	--	DRY?
DM-8	BRC	1682.22	38	19	39	20	Qal	X	--	X
LG025	NA	1738.60	24	19	23	4	Qal	X	--	X
PG211	NA	1659.66	35	15	35	20	Qal	X	--	X
PG220	NA	1699.60	66	26	66	40	Qal	X	--	X
POD2	BRC	1673.80	49	41	46	5	Qal	X	--	X
POD4	BRC	1692.39	54	47	52	5	Qal	X	--	X
POD4-R	BRC	1692.69	55	47	52	5	Qal	X	--	X
POD5-R	BRC	1692.57	33	11	31	20	Qal	X	--	X
POD6-R	BRC	1698.10	54	21	46	25	Qal	X	--	X
POD7	BRC	1692.78	52	48	53	5	Qal	X	--	X
POD8	BRC	1691.16	74	43	73	30	Qal	X	--	X
POU1	BRC	1728.75	58	48	58	10	Qal	X	--	X
POU2	BRC	1724.88	39	33	38	5	Qal	X	--	X
POU3	BRC	1728.00	55	35	65	30	Qal	X	--	X

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
AA-13	BRC	1722.37	51	38	58	20	Qal/UMCf	X	--	X
AA-15	BRC	1655.46	36	20	40	20	Qal/UMCf	X	--	X
AA-19	BRC	1639.84	39	22	42	20	Qal/UMCf	X	--	X
AA-20	BRC	1625.98	27	10	30	20	Qal/UMCf	X	--	X
AA-27	BRC	1787.03	67	62	82	20	QalUMCf	X	--	X
AA-UW2	BRC	1817.63	61	55	75	20	Qal/UMCf	X	--	X
AA-UW3	BRC	1809.07	65	60	80	20	Qal/UMCf	X	--	X
AA-UW5	BRC	1765.05	45	37	57	20	Qal/UMCf	X	--	X
BEC-1	BRC	1731.91	30	25	40	15	Qal/UMCf	X	--	X
BEC-5	BRC	1689.66	58	54	69	15	Qal/UMCf	X	--	X
BEC-7	BRC	1662.82	48	45	60	15	Qal/UMCf	X	--	X
DBMW-1	BRC	1624.13	40	19	49	30	Qal/UMCf	X	--	X
DBMW-3	BRC	1623.40	31	19	39	20	Qal/UMCf	X	--	X
DBMW-4	BRC	1605.81	25	10	30	20	Qal/UMCf	X	--	X
DBMW-6	BRC	1629.55	39	30	50	20	Qal/UMCf	X	--	X
DM-7B	BRC	1660.24	41	25	45	20	Qal/UMCf	X	--	X
DBMW-10	BRC	1660.83	60	55	75	20	Qal/UMCf	X	--	X
DBMW-14	BRC	1681.89	36	35	65	30	Qal/UCMf	X	--	X
DBMW-17	BRC	1709.57	64	52	72	20	Qal/UMCf	X	--	X
DBMW-18	BRC	1714.11	47	45	65	20	Qal/UMCf	X	--	X
DM-2	BRC	1728.80	50	30	65	35	Qal/UMCf	X	--	X
DM-3	BRC	1694.71	55	29	64	35	Qal/UMCf	X	--	X
DM-9	BRC	1702.68	56	40	60	20	Qal/UMCf	X	--	X
MCF-16C	BRC	1689.88	70	53	73	20	Qal/UMCf	X	--	X
POD2-R	BRC	1673.80	51	45	60	15	Qal/UMCf	X	--	X
POD2-R2	BRC	1675.00	47	45	60	15	Qal/UMCf	X	--	X

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
POD3-R	BRC	1688.88	NA	NA	NA	NA	NA	X	--	X
AA-UW1	BRC	1771.22	55	55	65	10	UMCf	X	--	X
AA-UW4	BRC	1796.79	32	35	55	20	UMCf	X	--	X
AA-UW6	BRC	1737.01	33	37	57	20	UMCf	X	--	X
BEC-6	BRC	1725.26	55	65	80	15	UMCf	X	--	X
BEC-9	BRC	1647.74	37	44	59	15	UMCf	X	--	X
BEC-10	BRC	1657.38	30	73	88	15	UMCf	X	--	X
BEC-12	BRC	1683.50	41	45	60	15	UMCf	X	--	X
DBMW-5	BRC	1606.65	12	15	35	20	UMCf	X	--	X
DBMW-7	BRC	1628.99	41	50	70	20	UMCf	X	--	X
DBMW-8	BRC	1628.99	41	48	68	20	UMCf	X	--	X
DBMW-9	BRC	1656.76	40	54	74	20	UMCf	X	--	X
DBMW-11	BRC	1664.20	30	50	70	20	UMCf	X	--	X
DBMW-12	BRC	1666.36	30	45	75	30	UMCf	X	--	X
DBMW-13	BRC	1675.93	30	45	75	30	UMCf	X	--	X
DBMW-15	BRC	1690.25	36	40	65	25	UMCf	X	--	X
DBMW-16	BRC	1691.08	95 [a]	85	110	25	UMCf	X	--	X
HMW-17	COH	1729.50	NA	NA	NA	NA	NA	X	--	X
HMW-18	COH	1732.50	NA	NA	NA	NA	NA	X	--	X
HMW-19	COH	1742.50	NA	NA	NA	NA	NA	X	--	X
HMW-20	COH	1751.50	NA	NA	NA	NA	NA	X	--	X
HMW-21	COH	1760.00	NA	NA	NA	NA	NA	X	--	X
HMWWT1	COH	1729.66	40	51	66	15	UMCf	X	--	X
HMWWT4	COH	1741.00	30	36	51	15	UMCf	X	--	X
HMWWT6	COH	1774.31	30	36	51	15	UMCf	X	--	X
HMWWT8	COH	1766.00	50	56	71	15	UMCf	X	--	X

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
MCF-01B	BRC	1753.95	49	55	85	30	UMCf	X	--	X
MCF-03B	BRC	1783.46	40	57	77	20	UMCf	X	--	X
MCF-06B	BRC	1630.27	43	67	82	15	UMCf	X	--	X
MCF-06C	BRC	1630.28	43	44	59	15	UMCf	X	--	X
MCF-12B	BRC	1712.74	52	64	84	20	UMCf	X	--	X
POD6	BRC	1697.70	48	61	66	5	UMCf	X	--	X
POD7-R	BRC	1698.60	47	NA	NA	NA	NA	X	--	X
Middle Water-Bearing Zone Wells (90-270 ft bgs)										
MCF-02B	BRC	1816.36	77	215	235	20	UMCf	X	--	--
MCF-05	BRC	1625.00	25	221	231	10	UMCf	X	--	--
MCF-09B	BRC	1693.00	70	105	125	20	UMCf	X	--	--
MCF-11	BRC	1657.75	32	94	104	10	UMCf	X	--	--
MCF-12C	BRC	1713.03	52	155	175	20	UMCf	X	--	X
MCF-24B	BRC	1680.00	49	150	170	20	UMCf	X	--	X
MCF-32B	BRC	1728.31	56	140	160	20	UMCf	X	--	X
Deep Water-Bearing Zone Wells (>270 ft bgs)										
MCF-01A	BRC	1754.44	53	335	355	20	UMCf	X	--	--
MCF-02A	BRC	1816.44	78	360	380	20	UMCf	X	--	--
MCF-03A	BRC	1783.23	38	364	384	20	UMCf	X	--	--
MCF-04	BRC	1748.35	38	379	399	20	UMCf	X	--	--
MCF-06A-R	BRC	1630.00	43	333	373	40	UMCf	X	--	--
MCF-09A	BRC	1694.26	70	270	290	20	UMCf	X	--	--
MCF-12A	BRC	1713.68	52	350	370	20	UMCf	X	--	--
MCF-16A	BRC	1689.67	70	365	385	20	UMCf	X	--	--
MCF-16B	BRC	1689.75	47	284	314	30	UMCf	X	--	--

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
MCF-20A	BRC	1622.99	17	360	380	20	UMCf	X	--	--
MCF-21A	BRC	1663.63	25	345	365	20	UMCf	X	--	--
MCF-23A	BRC	1643.86	42	362	382	20	UMCf	X	--	--
MCF-24A	BRC	1674.07	43	355	375	20	UMCf	X	--	--
MCF-25A	BRC	1708.72	38	325	365	40	UMCf	X	--	--
MCF-27	BRC	1787.03	142 [a]	362	382	20	UMCf	X	--	--
MCF-32A	BRC	1727.88	56	350	370	20	UMCf	X	--	--
NORTHEAST SUB-AREA										
Planned New Wells										
ES-21A	NERT	NA	NA	30	50	20	TBD	--	X	X
ES-21B	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-22A	NERT	NA	NA	30	50	20	TBD	--	X	X
ES-22B	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-23A	NERT	NA	NA	30	50	20	TBD	--	X	X
ES-23B	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-24	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-25A	NERT	NA	NA	30	50	20	TBD	--	X	X
ES-25B	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-26	NERT	NA	NA	60	80	20	TBD	--	X	X
ES-27	NERT	NA	NA	60	80	20	TBD	--	X	X

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling
Existing Monitoring Wells										
AA-07	BRC	1610.12	52	30	50	20	Qal	X	--	X
AA-26	BRC	1563.56	110 [a]	32	52	20	Qal	X	--	X
DBMW-22	BRC	1532.08	15	35	55	20	UMCf	X	--	X
LG231	NA	1660.00	30	89	99	10	UMCf	X	--	X
LG232	NA	1660.00	30	290	300	10	UMCf	X	--	X
MCF-07	BRC	1610.07	45	350	370	20	UMCf	X	--	X
MCF-22A	BRC	1680.62	65	342	382	20	UMCf	X	--	X
MW-04	COH	1527.85	25	20	30	10	Qal/UMCf	X	--	X
MW-05	COH	1567.75	35	NA	NA	NA	NA	X	--	X
MW-10	COH	1543.40	NA	NA	NA	NA	NA	X	--	X
MW-11	COH	1539.53	NA	NA	NA	NA	NA	X	--	X
MW-18	COH	1581.77	NA	NA	NA	NA	NA	X	--	X
MW-1	CGC	1563.81	NA	NA	NA	NA	NA	X	--	X
MW-2	CGC	1580.35	NA	NA	NA	NA	NA	X	--	X

TABLE 6-2. GROUNDWATER MONITORING WELL SAMPLING PLAN
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

Well ID	Well Owner	Ground Surface (ft msl)	Depth to Qal/ UMCf Contact (ft bgs)	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Screen Length (feet)	Screened Lithology	Baseline Sampling Event	New Well Initial Sampling	Eastside Study Area Sampling

Notes:

1. See Table 6-3 for analytical testing program. Field parameters including temperature, pH, dissolved oxygen (DO), oxygen reduction potential (ORP), electrical conductivity (EC), and turbidity will be measured during sampling.

Highlighted wells are part of BRC's current groundwater monitoring program.

BRC = Basic Remediation Company

COH = City of Henderson

CGC = Chimera Golf Course

Qal = Alluvium

UMCf = Upper Muddy Creek Formation

[a] appears anomalous

NA = Not Available

ft msl = feet, mean sea level datum

ft bgs = feet below ground surface

Table 6-3. Analytical Plan for Soil and Groundwater Samples
RI/FS Work Plan Addendum: Phase 3 Remedial Investigation
Nevada Environmental Response Trust (NERT) Site; Henderson, Nevada

	Eastside Sub-Area		Northeast Sub-Area		
Analytes	**Groundwater**	**Soil**	**Groundwater**	**Soil**	**Analytical Method**
Perchlorate	X	X	X	X	EPA Method 314.0
Chlorate	X	X	X	X	EPA Method 300.1
Hexavalent Chromium	--	--	X	--	EPA 218.7
Chromium	--	--	X	X	EPA 200.7
Calcium	X	--	X	--	EPA Method 200.7
Magnesium	X	--	X	--	EPA Method 200.7
Sodium	X	--	X	--	EPA Method 200.7
Potassium	X	--	X	--	EPA Method 200.7
Total Dissolved Solids	X	--	X	--	SM 2540C
Sulfate	X	--	X	--	EPA Method 300.0
Nitrate	X	--	X	--	EPA Method 300.0
Chloride	X	--	X	--	EPA Method 300.0
Bicarbonate/Carbonate/ Hydroxide Alkalinity	X	--	X	--	SM 2320B
pH	X	--	X	--	EPA 9040C
Moisture Content	--	X	--	X	ASTM D2216

Notes:

-- = Not analyzed in Phase 3 RI sampling program.

ASTM = American Society for Testing and Materials

EPA = United States Environmental Protection Agency

SM = Standard Method

TABLE 6-4. SOIL SAMPLING AT NEW SOIL BORINGS
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Boring Number	Rationale for Sampling	Planned Soil Samples*			Soil Analytical Testing Program [1]		
		Boring Depth (ft bgs)	Planned Soil Sample Depths (ft bgs)	No. of Samples	Perchlorate	Chlorate	Moisture Content (ASTM D2216)
ESB-1	Delineation of the vertical and lateral extent of perchlorate and chlorate in the alluvium and upper portion of the UMCf	150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-2		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-3		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-4		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-5		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-6		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-7		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-8		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-9		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-10		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-11		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-12		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-13		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-14		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-15		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-16		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-17		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X
ESB-18		150	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150	15	X	X	X

Notes:

* Sample depths may be modified based on subsurface lithologies encountered during drilling.

ft bgs: feet below ground surface

[1] Approximately 20% of the soil samples will be tested for physical properties, including Atterberg Limits (ASTM D4318) and/or USCS Classification (ASTM D2487), grain size distribution (ASTM D422/D4464 combined or ASTM 4464 laser method), porosity (ASTM D425 modified), bulk density (ASTM D2937), and fraction organic carbon (foc) (Walkley Black). Approximately 5% of the soil samples will be selected for vertical permeability testing.

TABLE 6-5. SOIL SAMPLING AND WELL CONSTRUCTION AT NEW GROUNDWATER MONITORING WELLS
RI/FS Work Plan Addedndum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Pilot Boring Number	Rationale for Sampling	Planned Soil Samples [1]			Soil Analytical Testing Program [2]				Construction Details for New Wells [1,3]						
		Boring Depth (ft bgs)	Planned Soil Sample Depths (ft bgs)	No. of Samples	Perchlorate	Chlorate	Total Chromium	Moisture Content	Monitoring Well ID	Casing Diameter and Type	Screen Size (inches)	Screened Interval (ft bgs)	Sand Pack Interval (ft bgs)	Target WBZ	Sand Pack Size
Eastside Sub-Area															
ES-1	Delineation of the vertical and lateral extent of perchlorate and chlorate in the alluvium and upper portion of the UMCf	120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-1	4" PVC	0.01	95-110	93-110	Shallow WBZ - UMCF	No. 2/12
ES-2		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-2	4" PVC	0.01	45-65	43-65	Shallow WBZ - Alluvium	No. 2/12
ES-3		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-3	4" PVC	0.01	45-65	43-65	Shallow WBZ - Alluvium	No. 2/12
ES-4		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-4	4" PVC	0.01	70-90	68-90	Shallow WBZ - UMCF	No. 2/12
ES-5		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-5	4" PVC	0.01	70-85	68-85	Shallow WBZ - UMCF	No. 2/12
ES-6		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-6	4" PVC	0.01	55-75	53-75	Shallow WBZ - UMCF	No. 2/12
ES-7		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-7	4" PVC	0.01	60-80	58-80	Shallow WBZ - UMCF	No. 2/12
ES-8		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-8	4" PVC	0.01	90-110	88-110	Middle WBZ	No. 2/12
ES-9		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-9	4" PVC	0.01	80-100	78-100	Shallow WBZ - UMCF	No. 2/12
ES-10		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-10	4" PVC	0.01	45-65	43-65	Shallow WBZ - UMCF	No. 2/12
ES-11		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-11	4" PVC	0.01	35-55	33-55	Shallow WBZ - UMCF	No. 2/12
ES-12		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-12	4" PVC	0.01	45-65	43-65	Shallow WBZ - UMCF	No. 2/12
ES-13		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-13	4" PVC	0.01	90-105	88-105	Shallow WBZ - UMCF	No. 2/12
ES-14		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-14A	4" PVC	0.01	45-65	43-65	Shallow WBZ - UMCF	No. 2/12
									ES-14B	4" PVC	0.01	100-115	98-115	Middle WBZ	No. 2/12
ES-15		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-15	4" PVC	0.01	70-90	68-90	Shallow WBZ - UMCF	No. 2/12
ES-16		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-16	4" PVC	0.01	80-100	78-100	Middle WBZ	No. 2/12
ES-17		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-17	4" PVC	0.01	80-100	78-100	Middle WBZ	No. 2/12
ES-18		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X		X	ES-18	4" PVC	0.01	80-100	78-100	Middle WBZ	No. 2/12
ES-19		200	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200	20	X	X		X	ES-19	4" PVC	0.01	90-110	88-110	Middle WBZ	No. 2/12
ES-20		200	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200	20	X	X		X	ES-20	4" PVC	0.01	90-110	88-110	Middle WBZ	No. 2/12

TABLE 6-5. SOIL SAMPLING AND WELL CONSTRUCTION AT NEW GROUNDWATER MONITORING WELLS
RI/FS Work Plan Addedndum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Pilot Boring Number	Rationale for Sampling	Planned Soil Samples [1]			Soil Analytical Testing Program [2]				Construction Details for New Wells [1,3]						
		Boring Depth (ft bgs)	Planned Soil Sample Depths (ft bgs)	No. of Samples	Perchlorate	Chlorate	Total Chromium	Moisture Content	Monitoring Well ID	Casing Diameter and Type	Screen Size (inches)	Screened Interval (ft bgs)	Sand Pack Interval (ft bgs)	Target WBZ	Sand Pack Size
Northeast Sub-Area															
ES-21	Delineation of the vertical and lateral extent of perchlorate and chlorate in the alluvium and upper portion of the UMCf	120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-21A	4" PVC	0.02	30-50	28-50	Shallow WBZ - UMCF	No. 3
									ES-21B	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12
ES-22		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-22A	4" PVC	0.02	30-50	28-50	Shallow WBZ - UMCF	No. 3
									ES-22B	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12
ES-23		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-23A	4" PVC	0.02	30-50	28-50	Shallow WBZ - UMCF	No. 3
									ES-23B	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12
ES-24		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-24	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12
ES-25		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-25A	4" PVC	0.02	30-50	28-50	Shallow WBZ - UMCF	No. 3
									ES-25B	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12
ES-26		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-26	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12
ES-27		120	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120	12	X	X	X	X	ES-27	4" PVC	0.01	60-80	58-80	Middle WBZ	No. 2/12

Notes:

ft bgs: feet below ground surface

[1] Soil sample depths and well construction details may be modified based on subsurface lithologies encountered during drilling.

[2] Approximately 20% of the soil samples will be tested for physical properties, including Atterberg Limits (ASTM D4318), USCS Classification (ASTM D2487), grain size distribution (ASTM D422/D4464 combined or ASTM 4464 laser method), porosity (ASTM D425 modified), bulk density (ASTM D2937), and fraction organic carbon (foc) (Walkley Black). Approximately 5% of the soil samples will be selected for vertical permeability testing.

[3] New monitoring wells in the Eastside Study Area will be sampled for perchlorate and chlorate (Northeast Sub-Area wells will also be sampled for total chromium and hexalvalent chromium), and general chemistry parameters including total dissolved solids (TDS) and majors ions (calcium, magnesium, sodium, potassium, sulfate, nitrate, chloride, and bicarbonate/carbonate/hydroxide alkalinity). Field parameters including temperature, pH, dissolved oxygen (DO) and oxygen reduction potential (ORP), turbidity, and electrical conductivity (EC) will be measured during sampling. See Tables 6-2 and 6-3.

TABLE 6-6. PLANNED SINGLE WELL HYDRAULIC TESTING PROGRAM
RI/FS Work Plan Addedndum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Monitoring Well ID [1]	Location	Well Construction Details						Well Hydraulic Testing		
		Casing Diameter and Type	Screen Size (inches)	Screened Interval (ft bgs)	Sand Pack Interval (ft bgs)	Sand Pack Size	Unit Screened	Dev. Recovery Tests [2]	Slug Test	Slug or Specific Capacity Test
Eastside Sub-Area										
ES-1	Upgradient Study Area Boundary	4" PVC	0.01	95-110	93-110	No. 2/12	UMCf	X		
ES-2	North of Former Beta Ditch	4" PVC	0.01	45-65	43-65	No. 2/12	Qal	X		
ES-3		4" PVC	0.01	45-65	43-65	No. 2/12	Qal	X		
ES-4		4" PVC	0.01	70-90	68-90	No. 2/12	UMCf	X		X
ES-5	Near Western Study Area Boundary	4" PVC	0.01	70-85	68-85	No. 2/12	UMCf	X		
AA-09		4" PVC	0.01	30-65	27-67	No. 2/12	Qal		X	
MCF-09B		4" PVC	0.01	105-125	103-127	No. 2/12	UMCf		X	
ES-6		4" PVC	0.01	55-75	53-75	No. 2/12	UMCf	X		X
ES-7	Near Former Beta Ditch	4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-8	Former Pond Area	4" PVC	0.01	90-110	88-110	No. 2/12	UMCf	X		X
ES-9		4" PVC	0.01	80-100	78-100	No. 2/12	UMCf	X		X
ES-10	Near Northwest Study Area Boundary	4" PVC	0.01	45-65	43-65	No. 2/12	UMCf	X		
AA-20		4" PVC	0.01	10-30	8-32	No. 2/12	Qal/UMCf		X	
DBMW-3		4" PVC	0.02	19-39	17-40	No. 10/20	Qal/UMCf		X	
ES-11	Galleria Road (west)	4" PVC	0.01	35-55	33-55	No. 2/12	UMCf	X		
ES-12	Northern Study Area Boundary	4" PVC	0.01	45-65	43-65	No. 2/12	UMCf	X		X
DBMW-4		4" PVC	0.02	10-30	8-40	No. 10/20	Qal/UMCf		X	
ES-13		4" PVC	0.01	90-105	88-105	No. 2/12	UMCf	X		
DBMW-8		4" PVC	0.02	19-39	[3]	No. 10/20	Qal		X	
DBMW-7		4" PVC	0.02	50-70	48-70	No. 10/20	UMCf		X	
MCF-06B		4" PVC	0.01	67-82	65 - 84	No. 10/20	UMCf		X	
MCF-06C		4" PVC	0.01	44-59	42 - 60	No. 2/12	UMCf		X	
ES-14A	Near Galleria Road	4" PVC	0.01	45-65	43-65	No. 2/12	UMCf	X		
ES-14B		4" PVC	0.01	100-115	98-115	No. 2/12	UMCf	X		
BEC -10		4" PVC	0.02	73-88	70-88	No. 3	UMCf		X	
ES-15	Galleria Road	4" PVC	0.01	70-90	68-90	No. 2/12	UMCf	X		X
ES-16		4" PVC	0.01	80-100	78-100	No. 2/12	UMCf	X		X
ES-17		4" PVC	0.01	80-100	78-100	No. 2/12	UMCf	X		
DBMW-13		4" PVC	0.02	45-75	42-75	No. 10/20	UMCf		X	
ES-18		4" PVC	0.01	80-100	78-100	No. 2/12	UMCf	X		X
ES-19		4" PVC	0.01	90-110	88-110	No. 2/12	UMCf	X		X
DBMW-17		4" PVC	0.02	52-72	[3]	No. 10/20	Qal/UMCf		X	
ES-20	South of Galleria Road	4" PVC	0.01	90-110	88-110	No. 2/12	UMCf	X		X
MCF-12B		4" PVC	0.01	64-84	60-86	No. 3	UMCf		X	
MCF-12C		4" PVC	0.01	155-175	150-160	No. 3	UMCf		X	

TABLE 6-6. PLANNED SINGLE WELL HYDRAULIC TESTING PROGRAM
RI/FS Work Plan Addedndum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Monitoring Well ID [1]	Location	Well Construction Details						Well Hydraulic Testing		
		Casing Diameter and Type	Screen Size (inches)	Screened Interval (ft bgs)	Sand Pack Interval (ft bgs)	Sand Pack Size	Unit Screened	Dev. Recovery Tests [2]	Slug Test	Slug or Specific Capacity Test
Northeast Sub-Area										
ES-21A	Northwest Boundary	4" PVC	0.02	30-50	28-50	No. 3	Qal	X		X
ES-21B		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-22A	Chimera Golf Course	4" PVC	0.02	30-50	28-50	No. 3	Qal	X		X
ES-22B		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-23A		4" PVC	0.02	30-50	28-50	No. 3	Qal	X		X
ES-23B		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-24		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-25A	Northwest Boundary	4" PVC	0.02	30-50	28-50	No. 3	Qal	X		X
ES-25B		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-26		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X
ES-27		4" PVC	0.01	60-80	58-80	No. 2/12	UMCf	X		X

Notes:

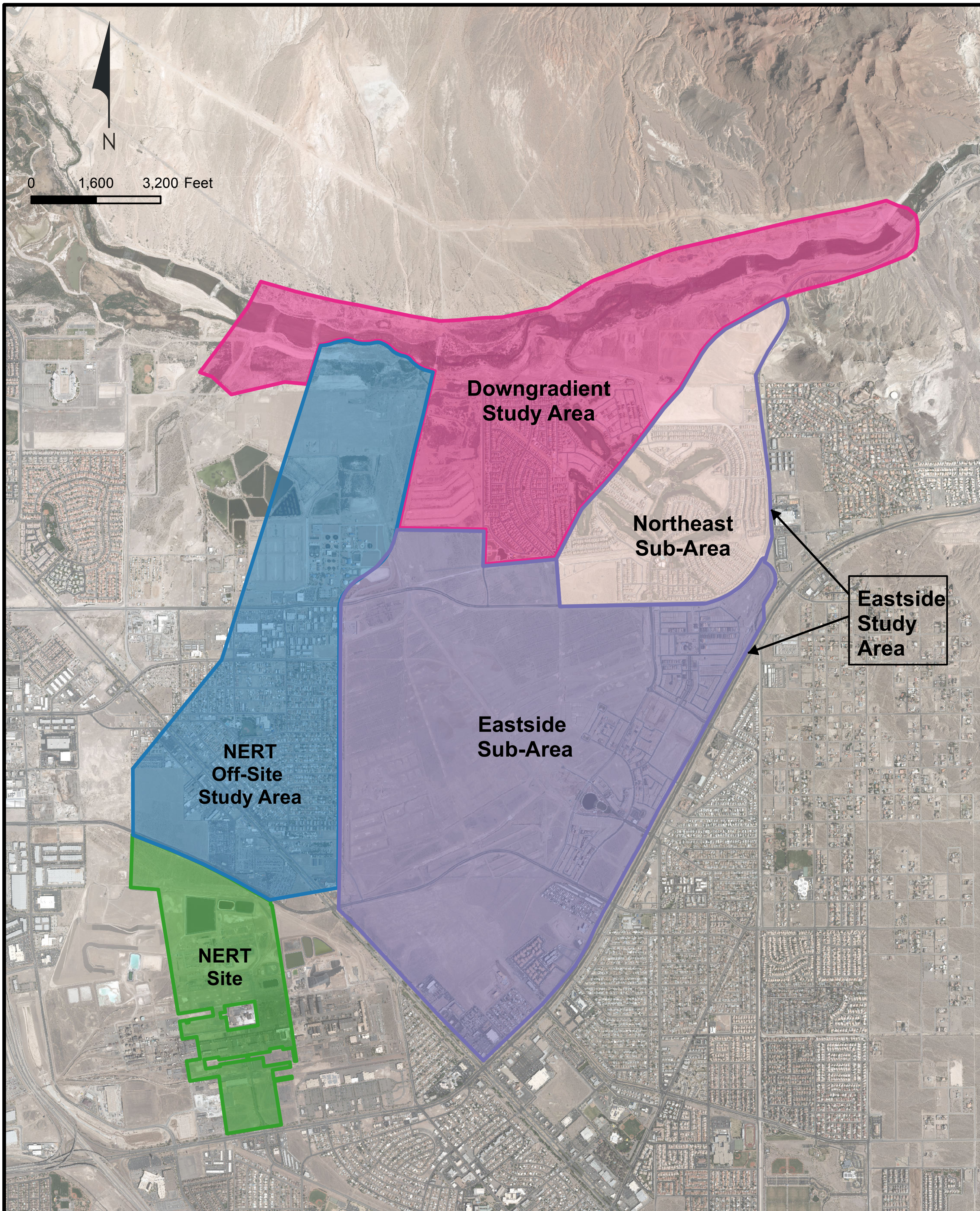
ft bgs: feet below ground surface

[1] Planned new wells are shown in bold.

[2] Monitored recovery tests will be performed during development for qualitative new well testing.

[3] Disprecancy in construction information between All Wells Database and boring log.

FIGURES



RAMBOLL ENVIRON

Remedial Investigation Study Area Overview
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **1-1**

Drafter: RS | Date: 9/29/2017 | Contract Number: 21-41400C | Approved: | Revised:

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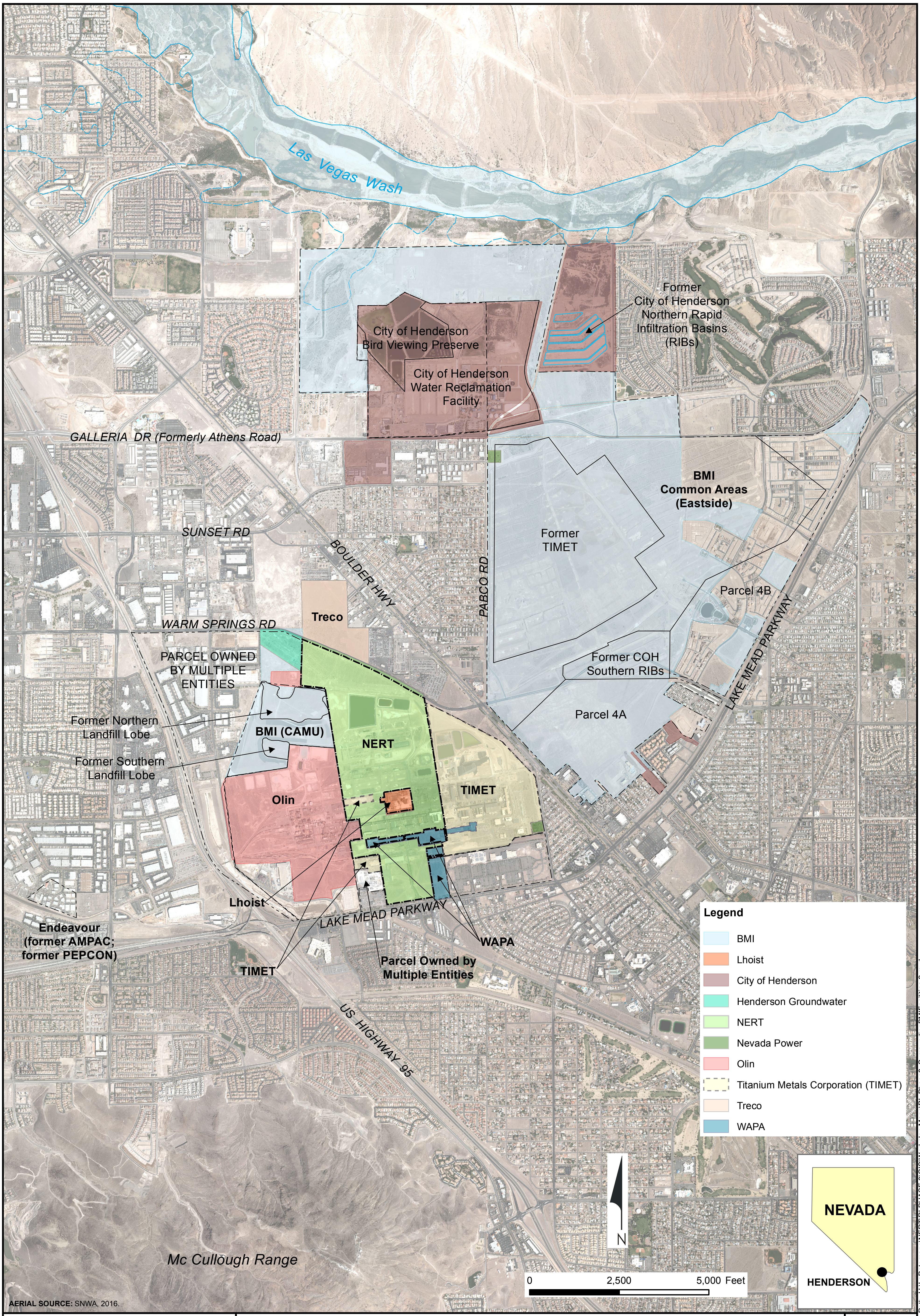

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Surroundung BMI Complex Facilities

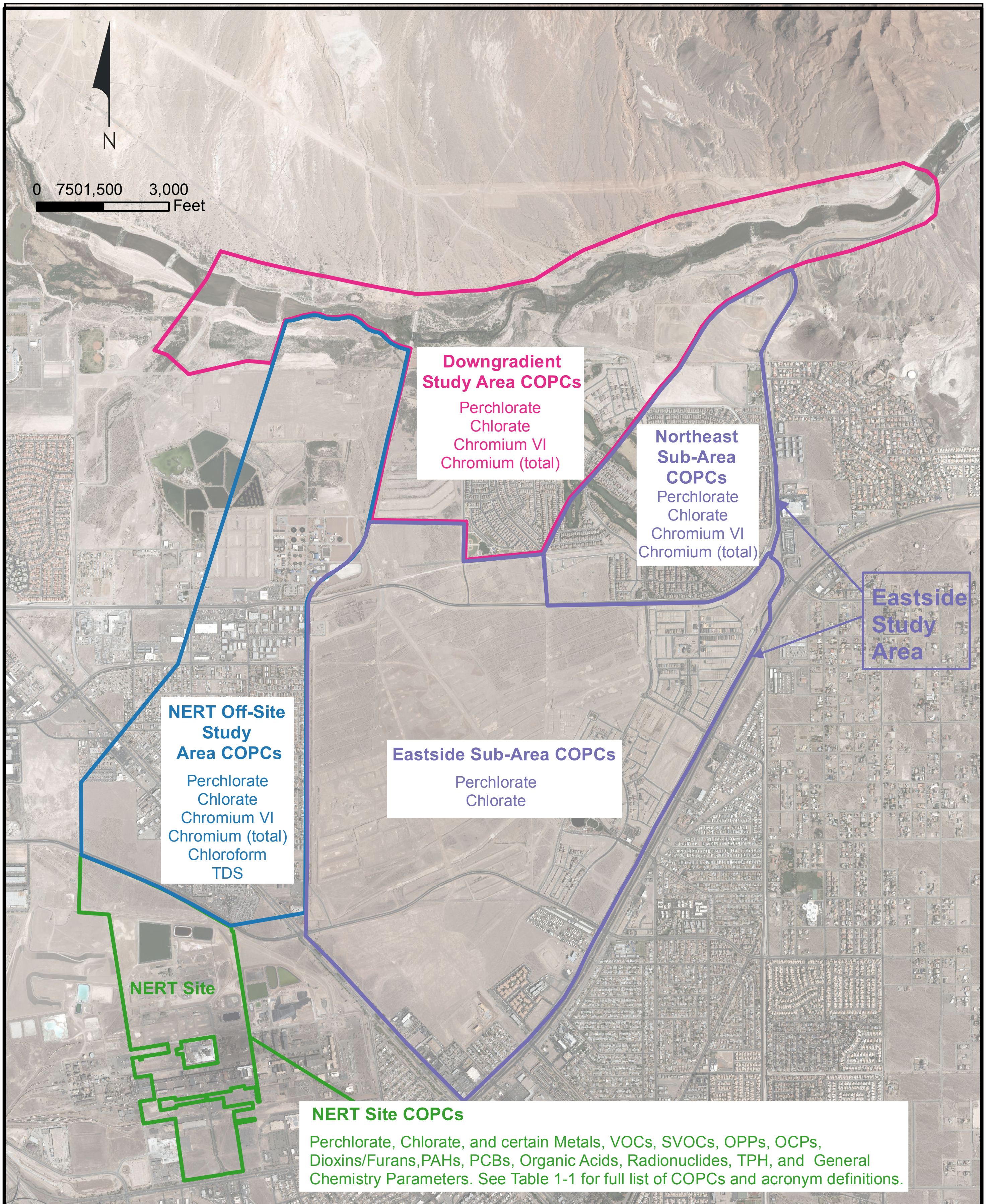
RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure

1-2

Drafter: RS	Date: 5/5/17	Contract Number: 21-41400C	Approved by:	Revised:



RAMBOLL ENVIRON

Chemicals of Potential Concern (COPCs)

RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure

1-3

Drafter: EF | Date: 10/5/2017 | Contract Number: 21-41400C | Approved: | Revised:

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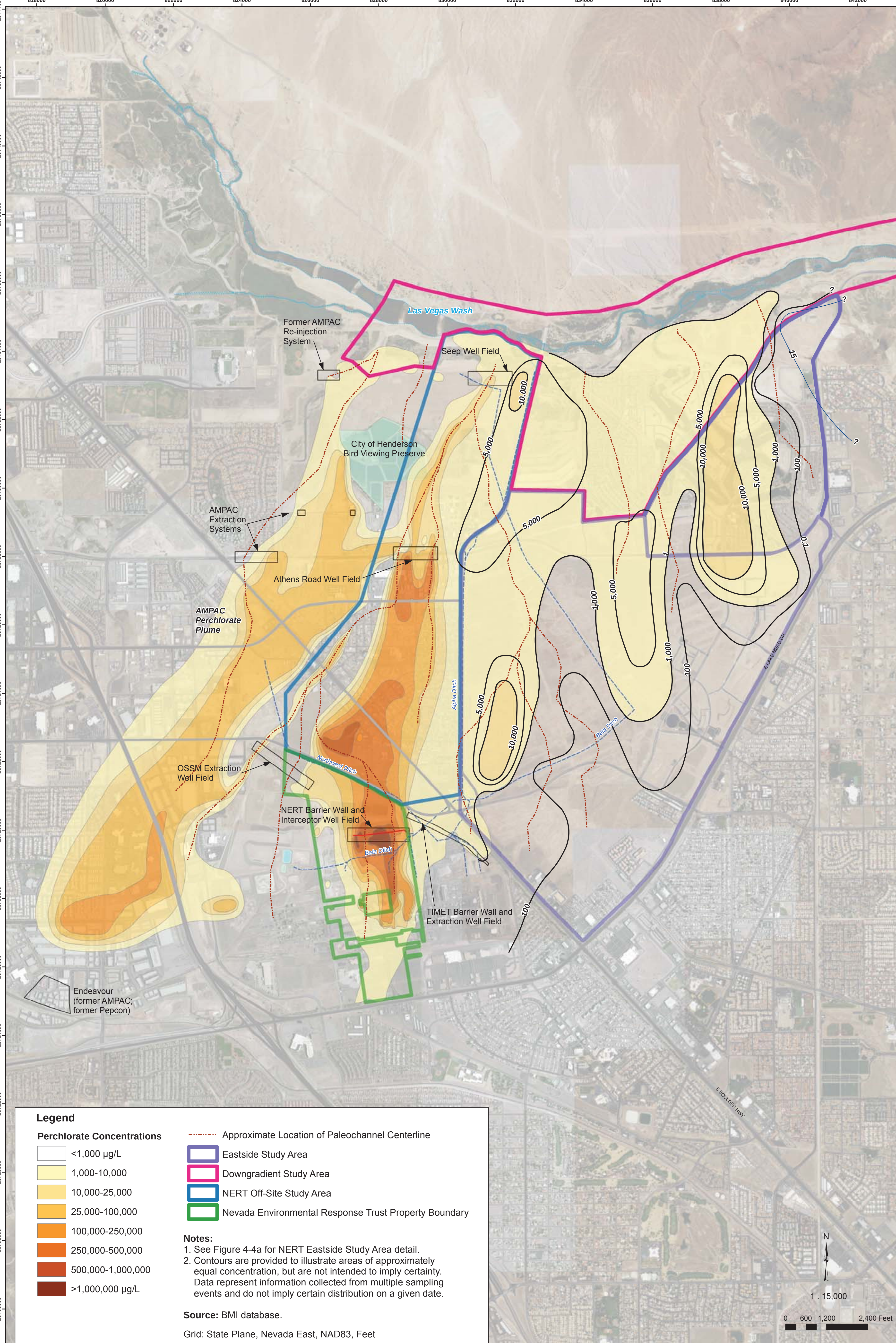

RAMBOLL ENVIRON

2015-2016 Groundwater Perchlorate Map, Shallow Water-Bearing Zone
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **1-4**

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

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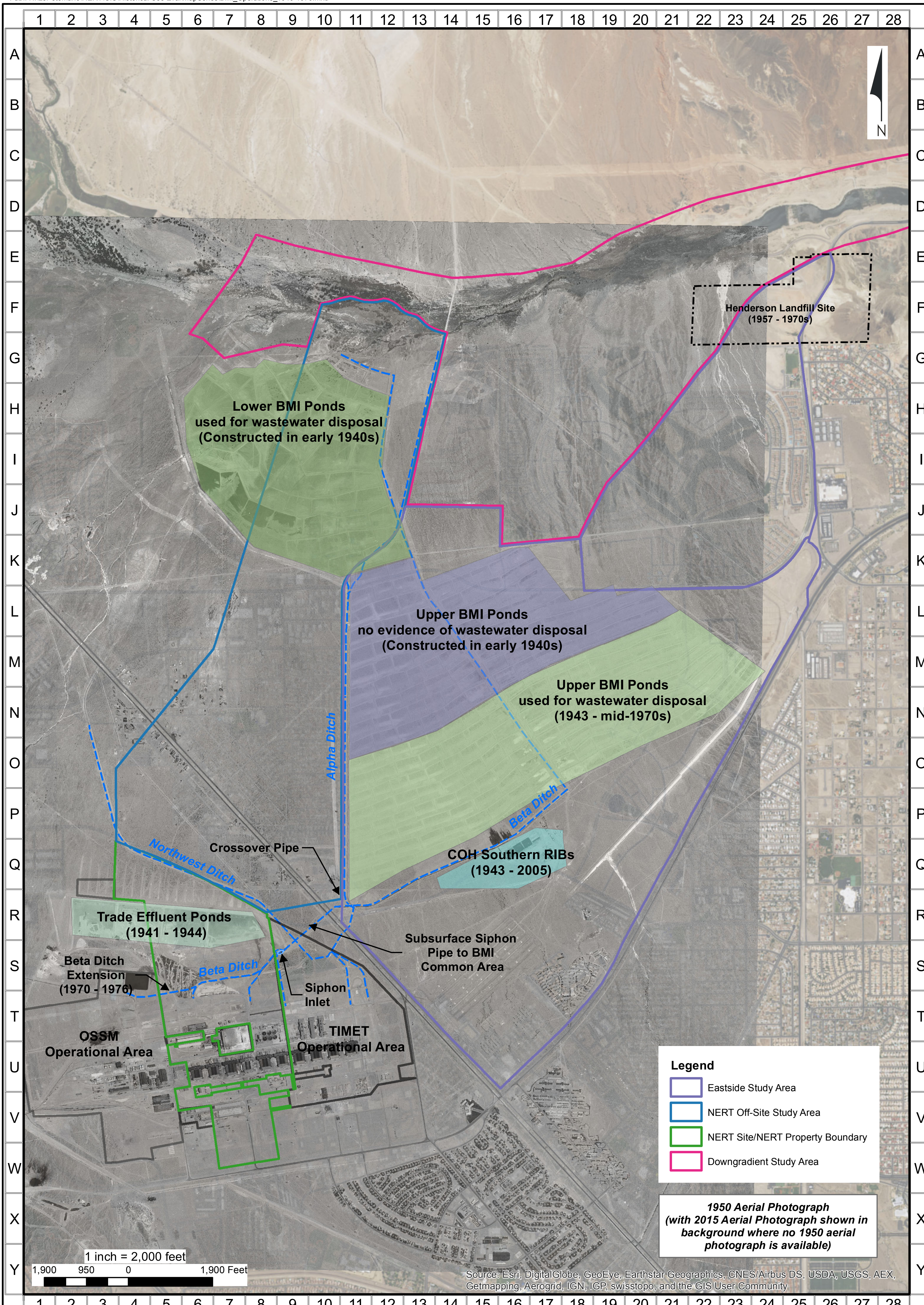

RAMBOLL ENVIRON

Historical Wastewater Ponds (1940 - 1975)
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
2-1

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

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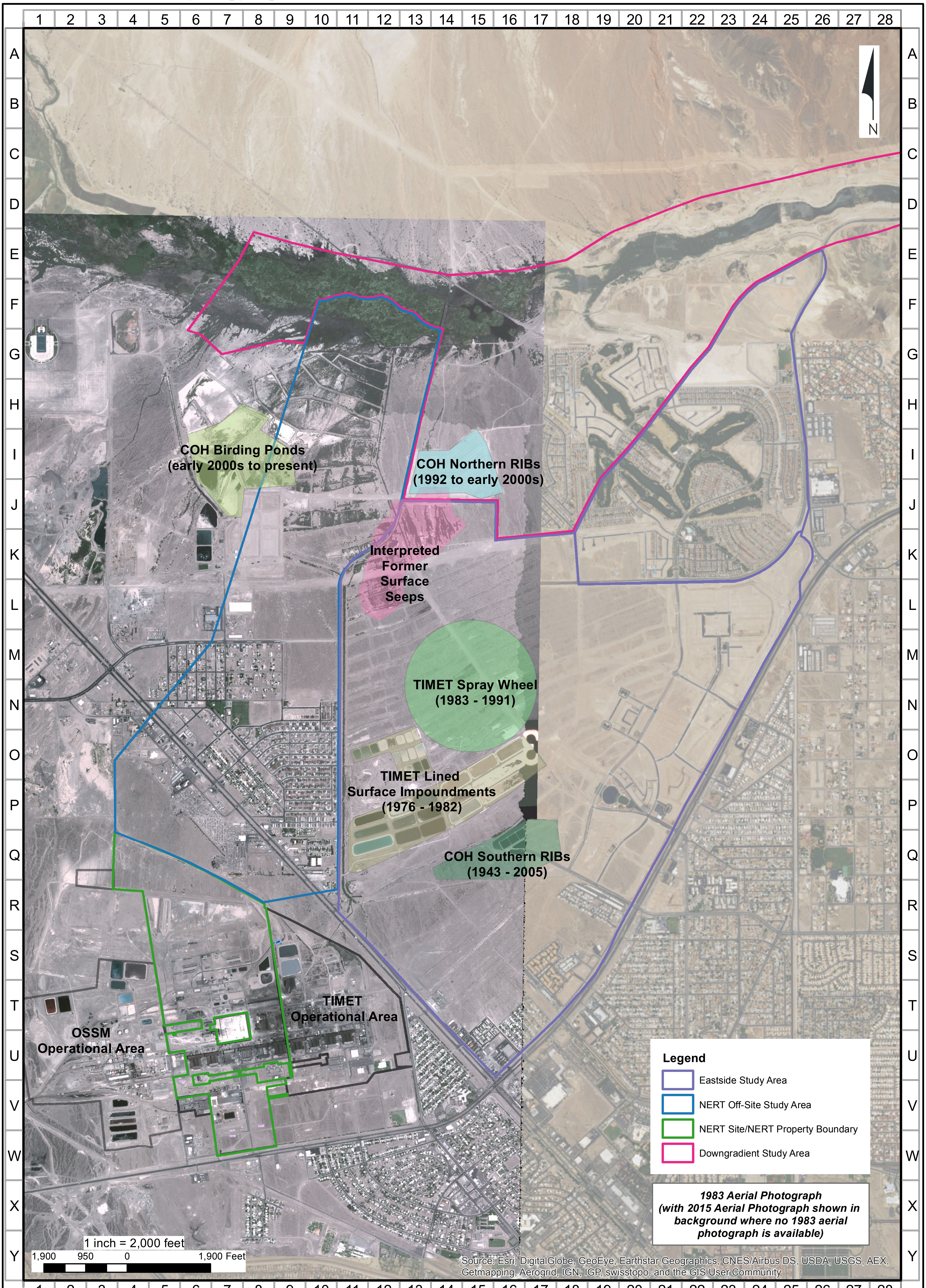
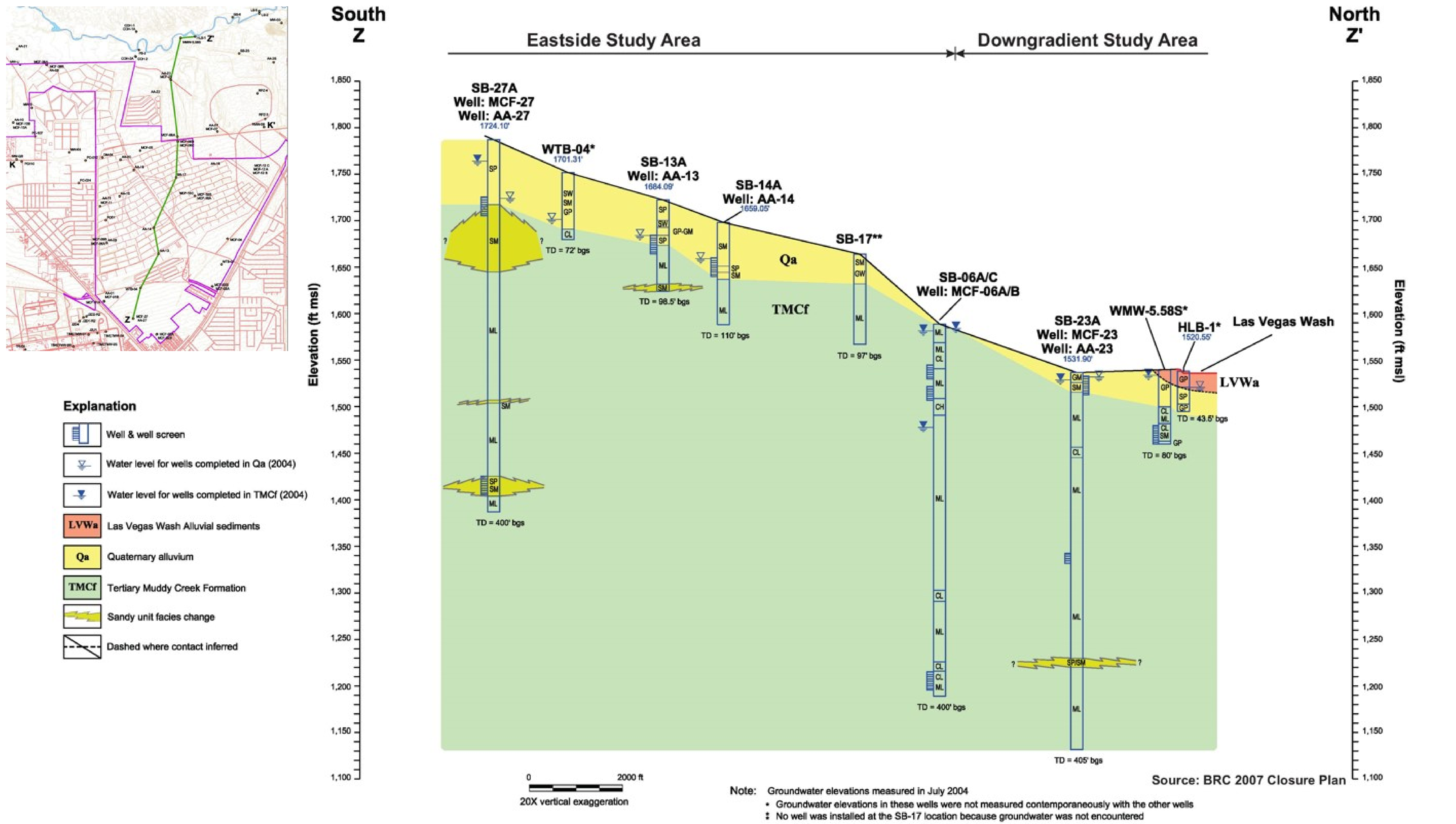


RAMBOLL ENVIRON

Historical Wastewater Ponds (1976 - Present)
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure 2-2

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:



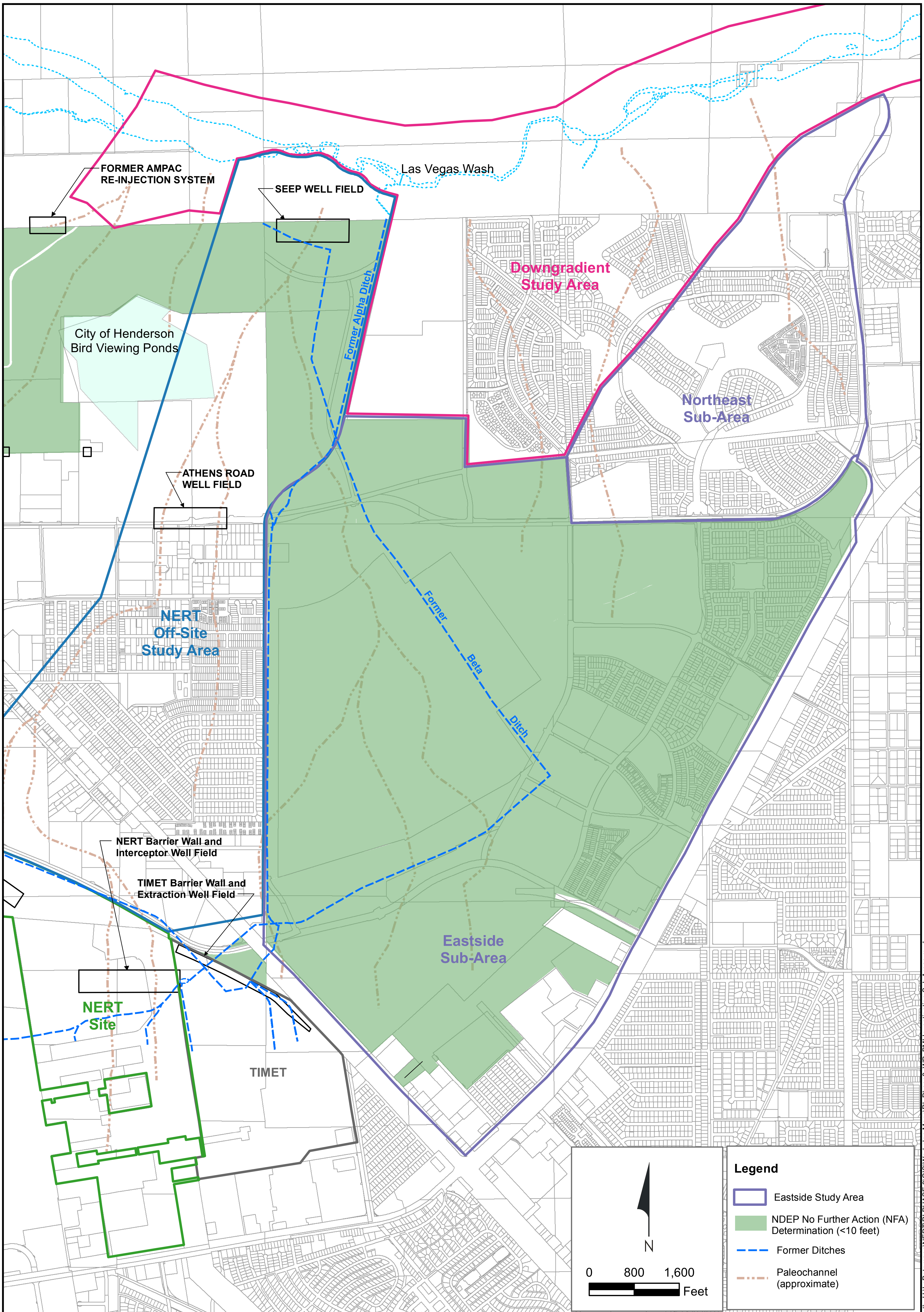
RAMBOLL ENVIRON

DRAFTED BY: KPL DATE: 5/5/17

Subsurface Cross-Section, Eastside Study Area
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
2-3

21-41400C

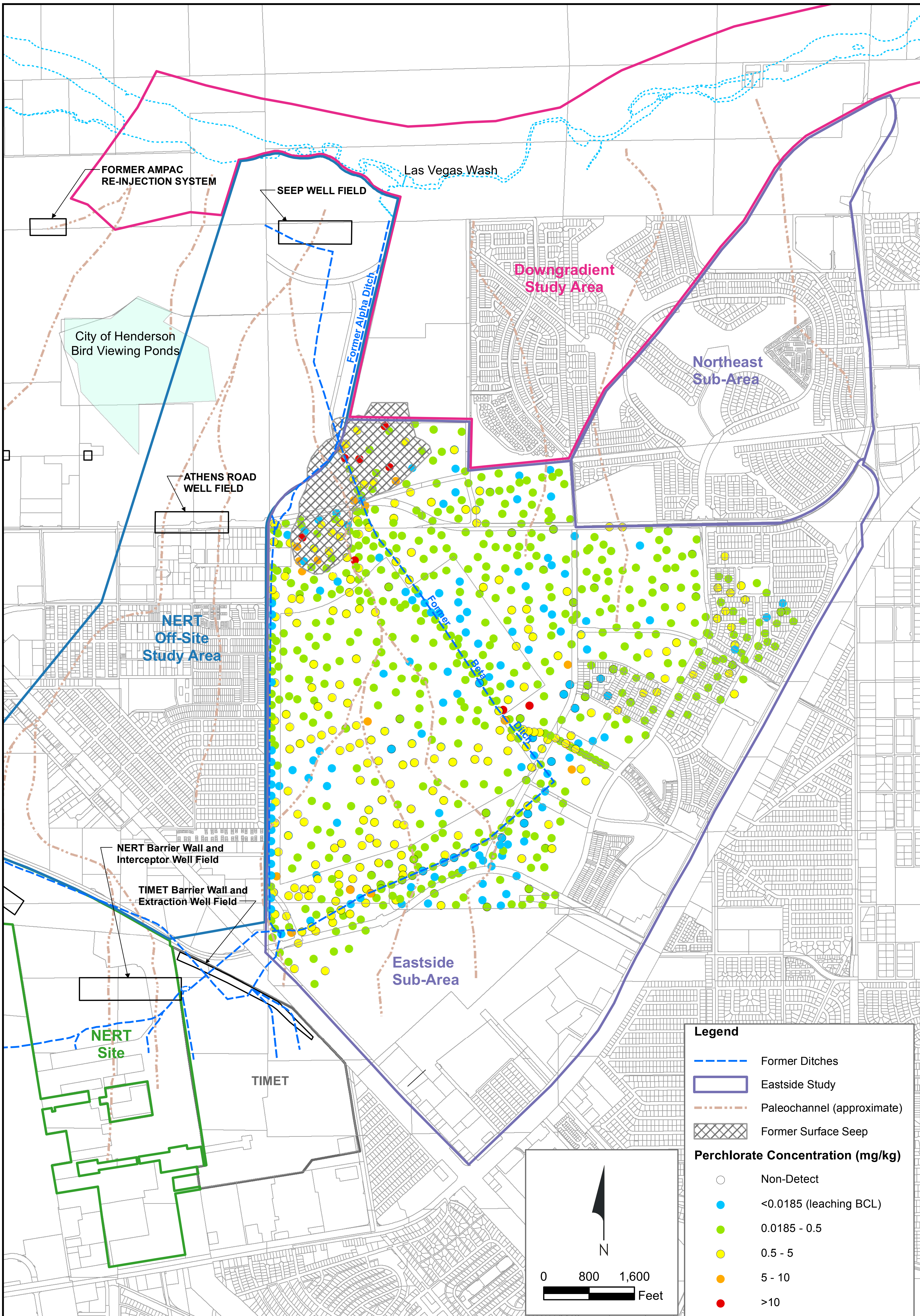


RAMBOLL ENVIRON

BMI Investigation No Further Action (NFA) Determination Areas
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
3-1

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:



Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\RI_Phase3_WP_Perchlorate_shallow_soil_depth_less_than_10_v2.mxd

RAMBOLL ENVIRON

Perchlorate Concentrations in Shallow Soil (<10 ft bgs)

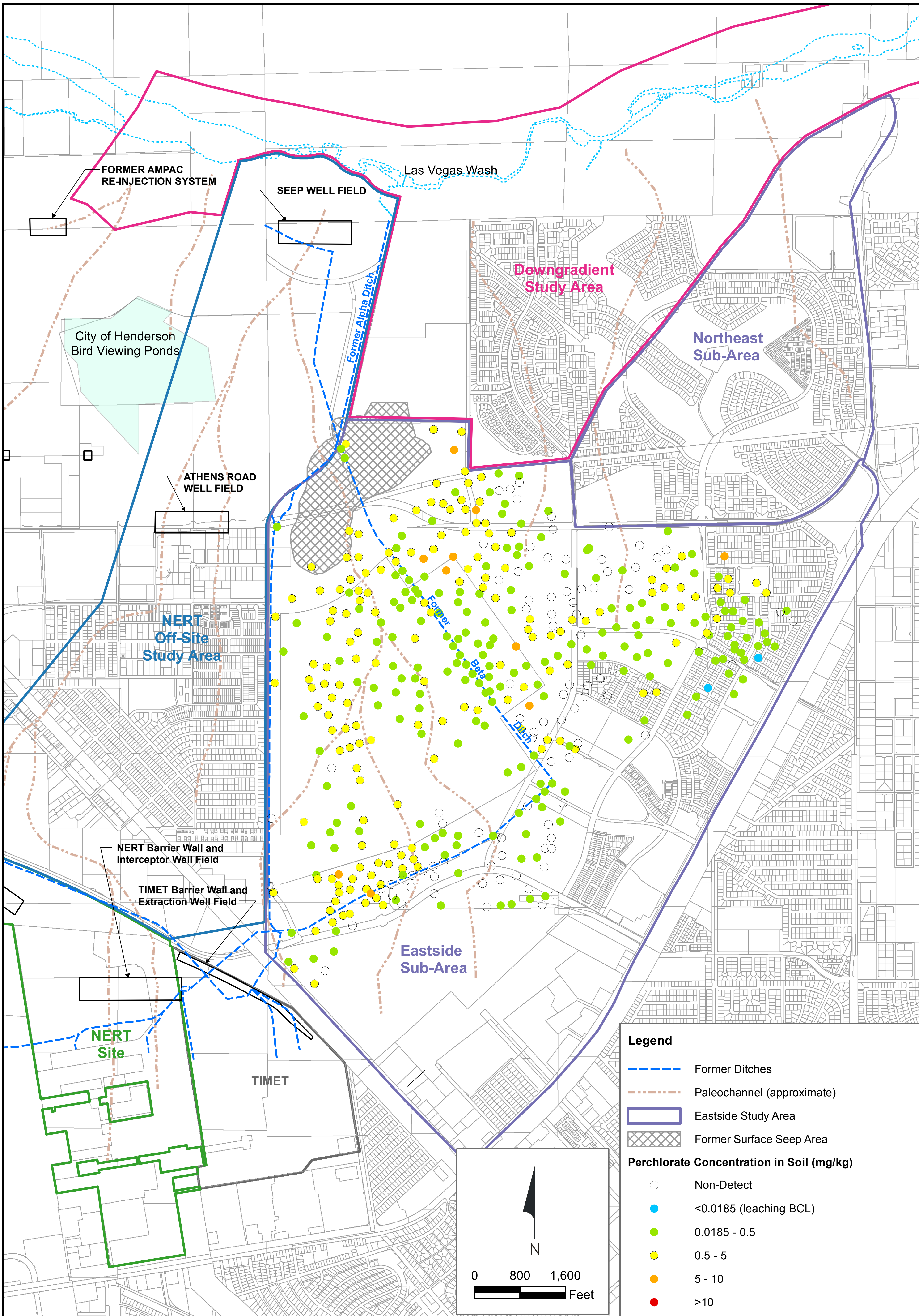
RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure

4-1a

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:



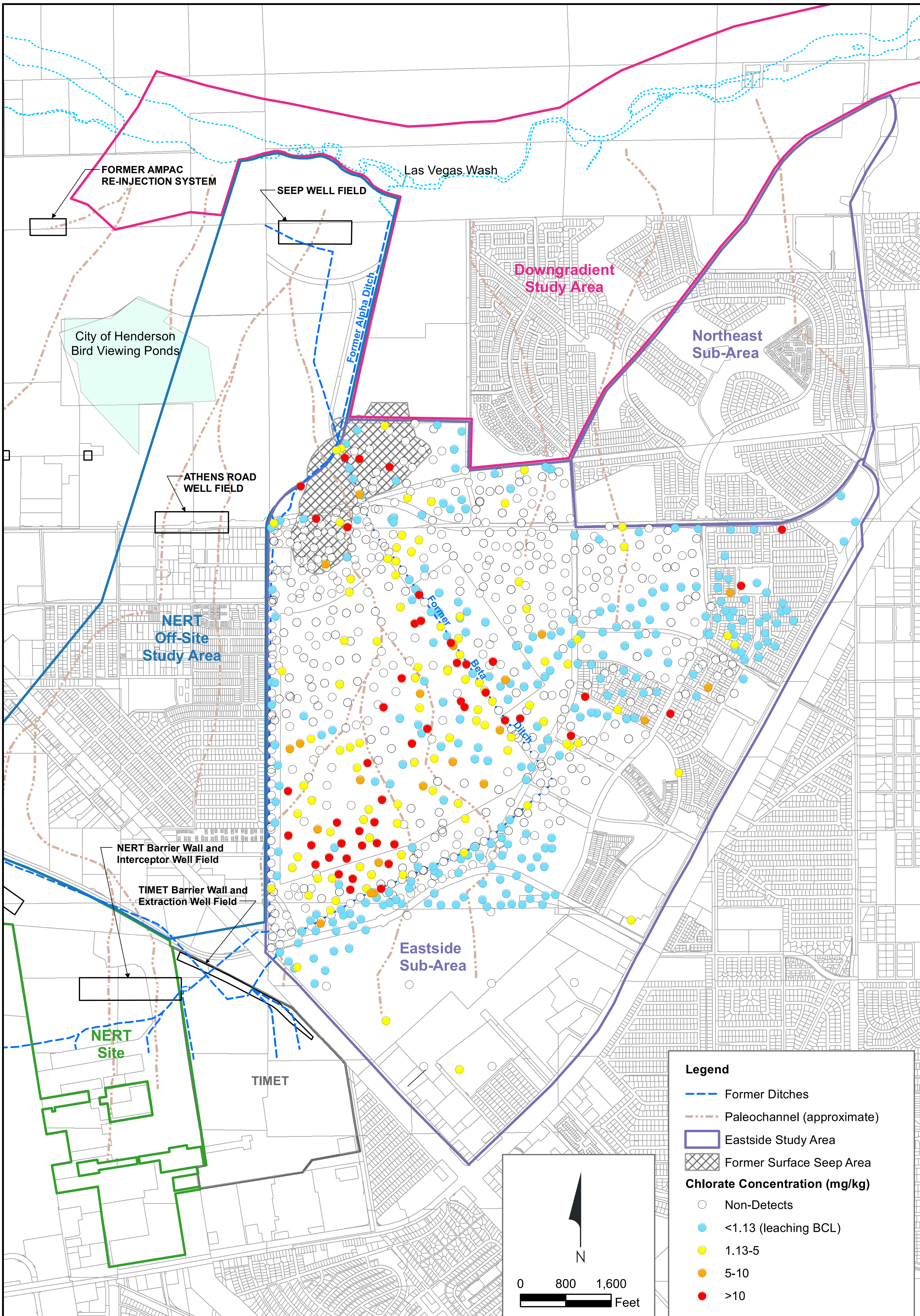
Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\RI_Phase3_WP_Perchlorate_shallow_soil_depth_MORE_THAN_10_feet_v3.mxd

RAMBOLL ENVIRON

Perchlorate Concentrations in Deeper Soil (below 10 ft bgs)
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
4-1b

Drafter: RS	Date: 5/5/17	Contract Number: 21-41400C	Approved by:	Revised:



Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\RI_Phase3_WP_Chlorate_shallow_soil_depth_less_than_10ft.mxd

RAMBOLL ENVIRON

Chlorate Concentrations in Shallow Soil (<10 ft bgs)

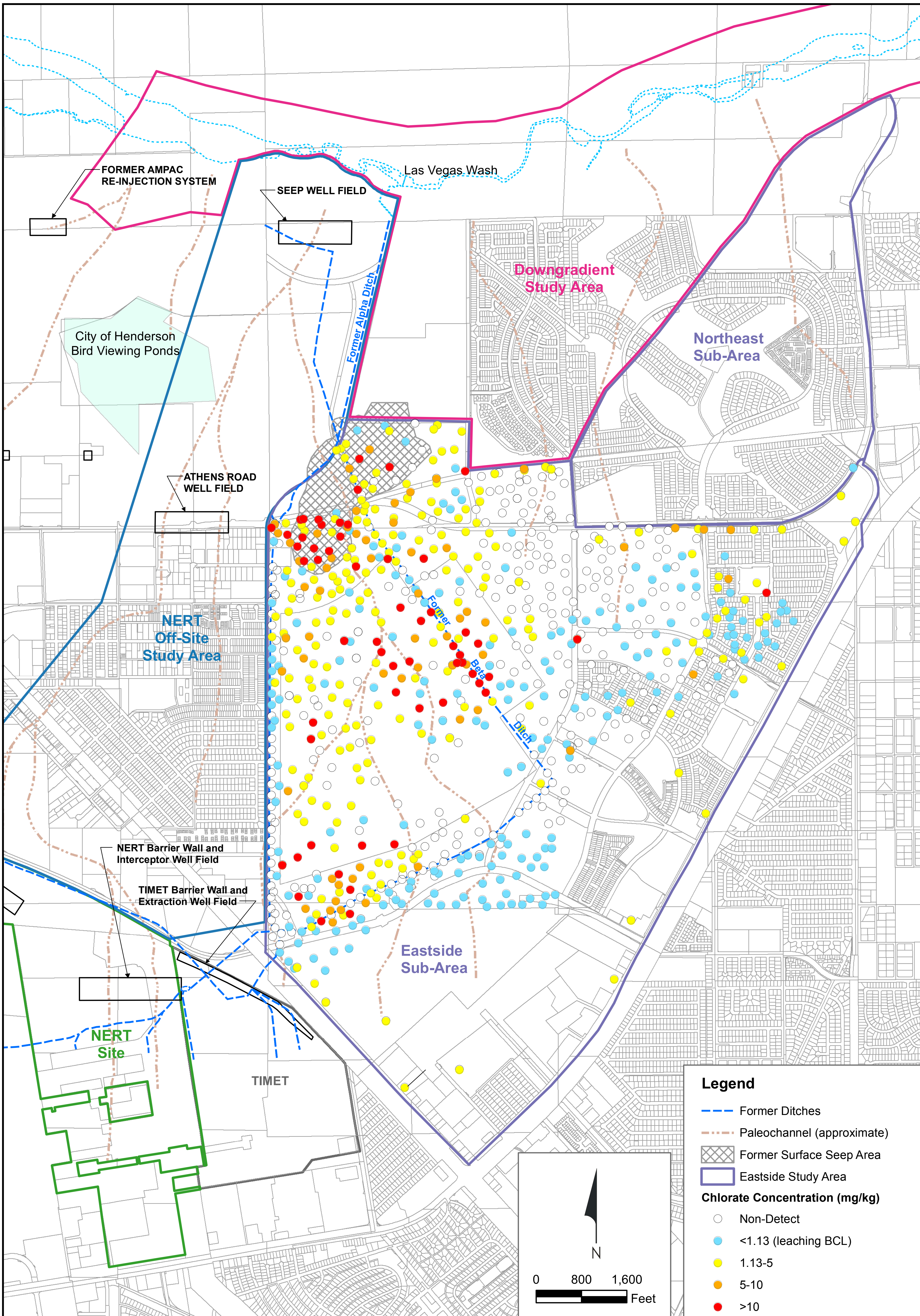
RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure

4-2a

Drafter: MV	Date: 5/5/17	Contract Number: 21-41400C	Approved by:	Revised:



Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\RI_Phase3_WP_Chlorate_shallow_soil_depth_MORE_THAN_10_feet.mxd

RAMBOLL ENVIRON

Chlorate Concentrations in Deeper Soil (below 10 ft bgs)

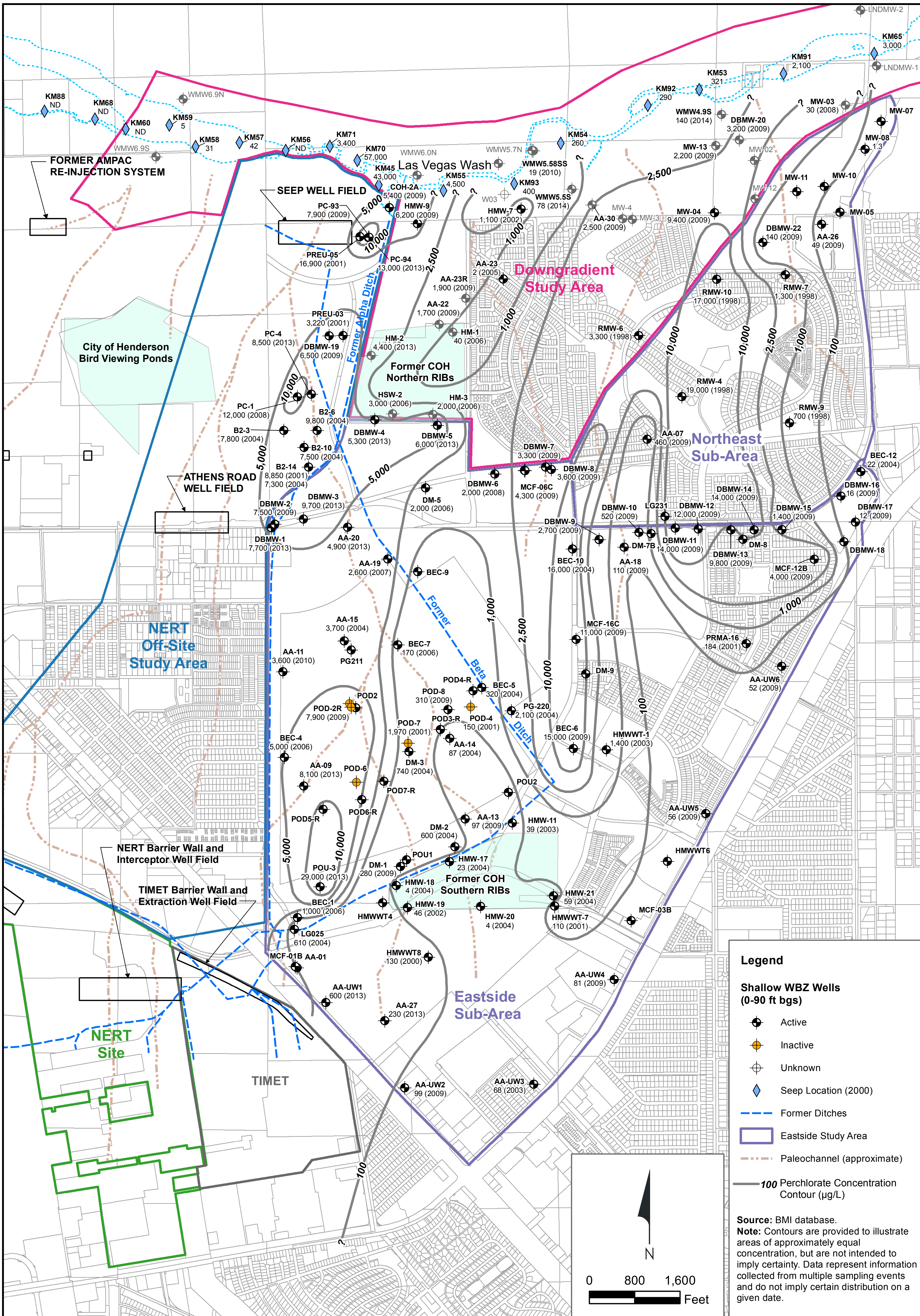
RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure

4-2b

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

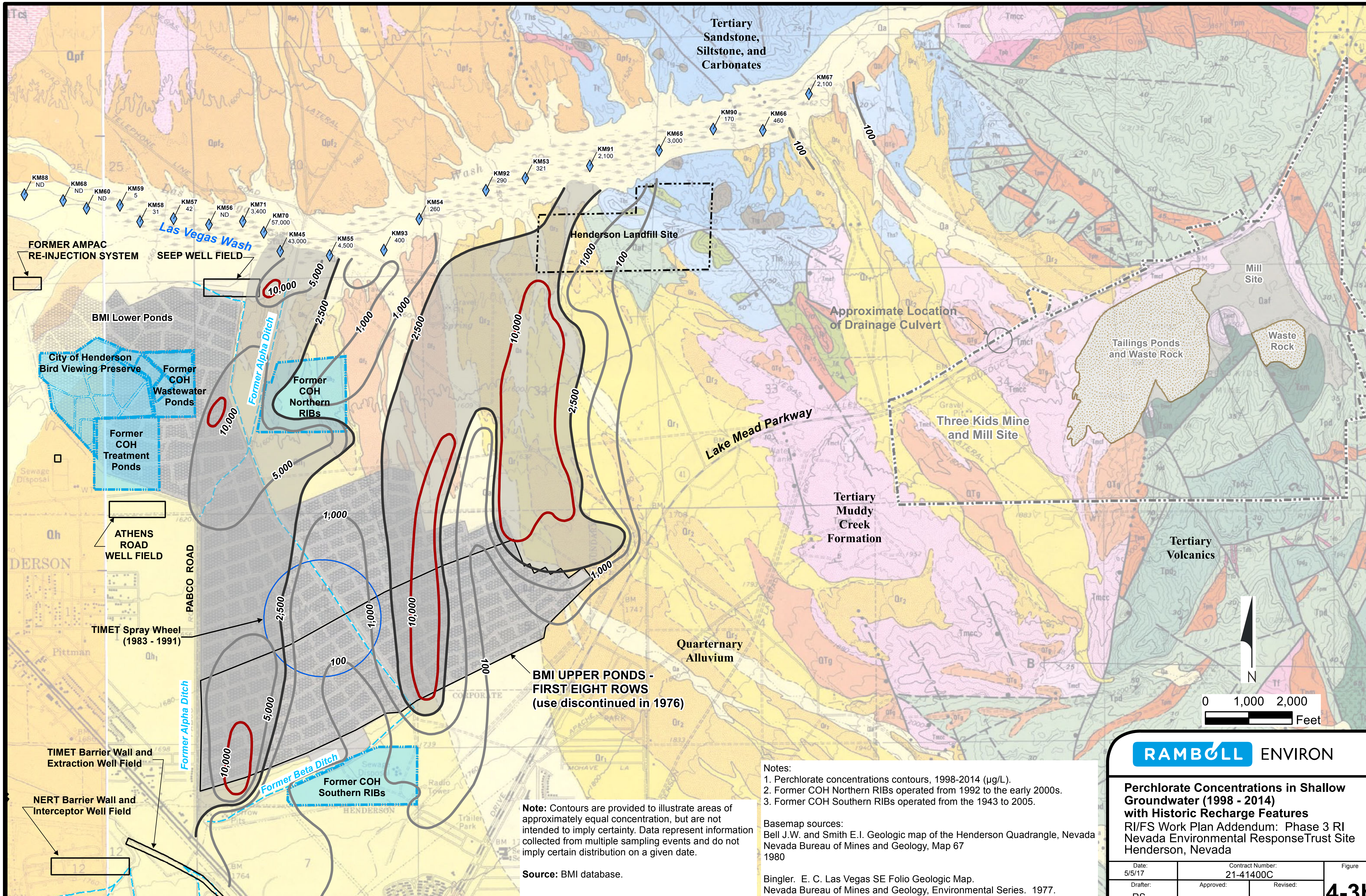


RAMBOLL ENVIRON

Perchlorate Concentrations in Shallow Groundwater, 1998-2014 (µg/L)
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **4-3a**

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:



Note: Contours are provided to illustrate areas of approximately equal concentration, but are not intended to imply certainty. Data represent information collected from multiple sampling events and do not imply certain distribution on a given date.

Source: BMI database.

Notes:
1. Perchlorate concentrations contours, 1998-2014 (µg/L).
2. Former COH Northern RIBs operated from 1992 to the early 2000s.
3. Former COH Southern RIBs operated from the 1943 to 2005.

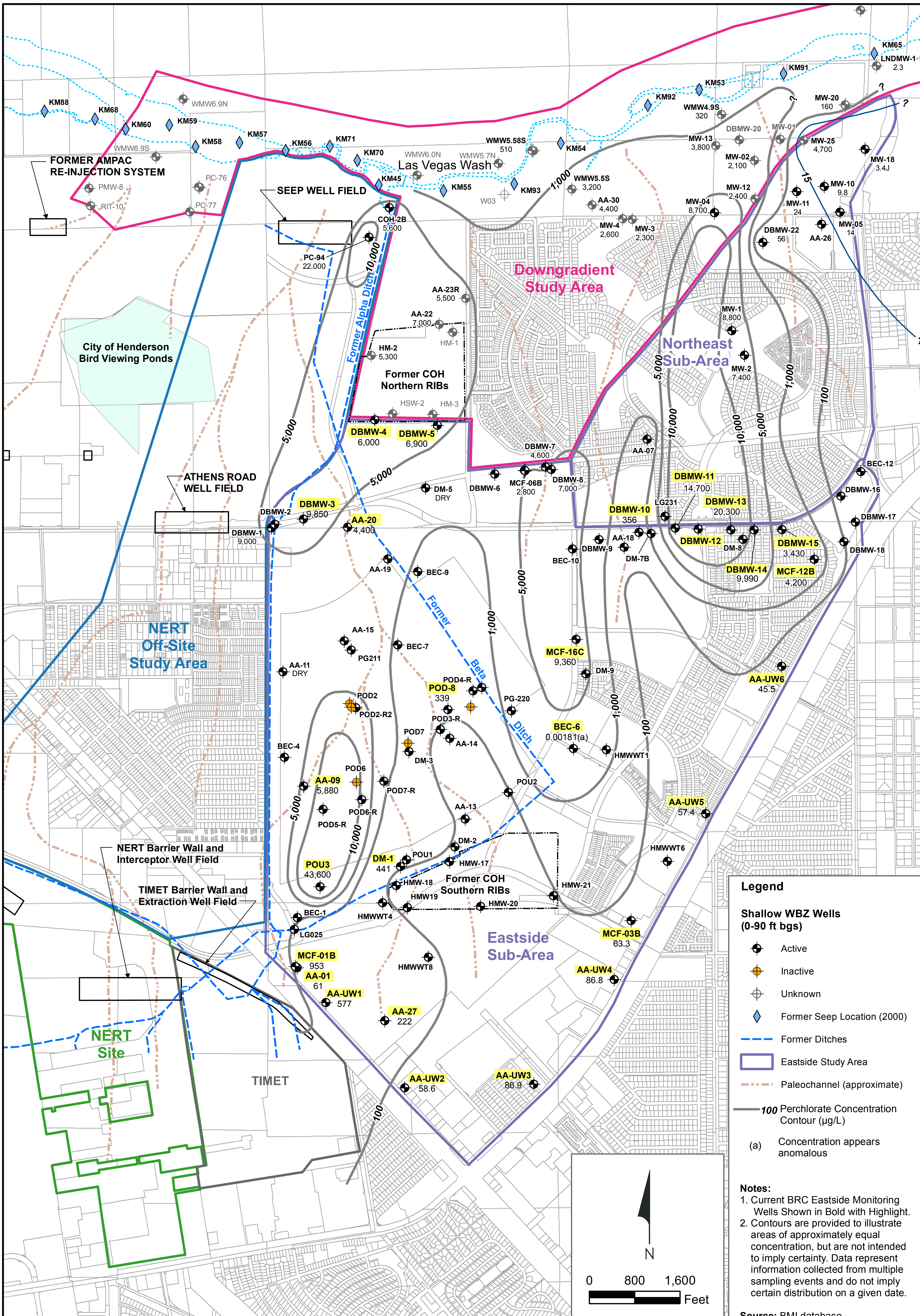
Basemap sources:
Bell J.W. and Smith E.I. Geologic map of the Henderson Quadrangle, Nevada
Nevada Bureau of Mines and Geology, Map 67
1980

Bingler. E. C. Las Vegas SE Folio Geologic Map.
Nevada Bureau of Mines and Geology, Environmental Series. 1977.

RAMBOLL ENVIRON

Perchlorate Concentrations in Shallow Groundwater (1998 - 2014) with Historic Recharge Features
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental ResponseTrust Site
Henderson, Nevada

Date: 5/5/17	Contract Number: 21-41400C		Figure
Drafter: RS	Approved:	Revised:	4-3b



RAMBOLL ENVIRON

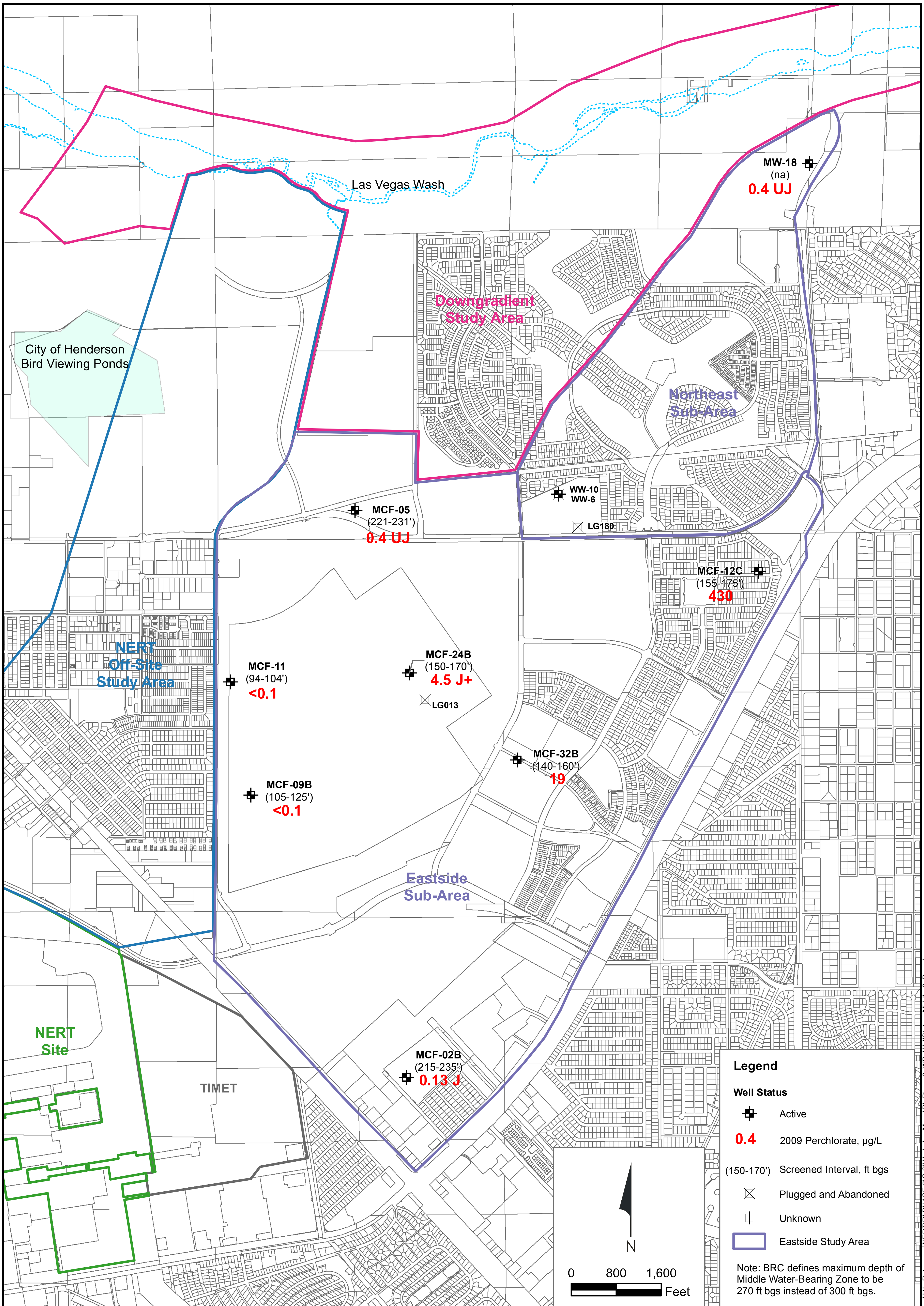
2015-2016 Perchlorate Concentrations in Shallow Groundwater (µg/L)

RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **4-4a**

Drafter: RS	Date: 5/5/17	Contract Number: 21-41400C	Approved by:	Revised:



RAMBOLL ENVIRON

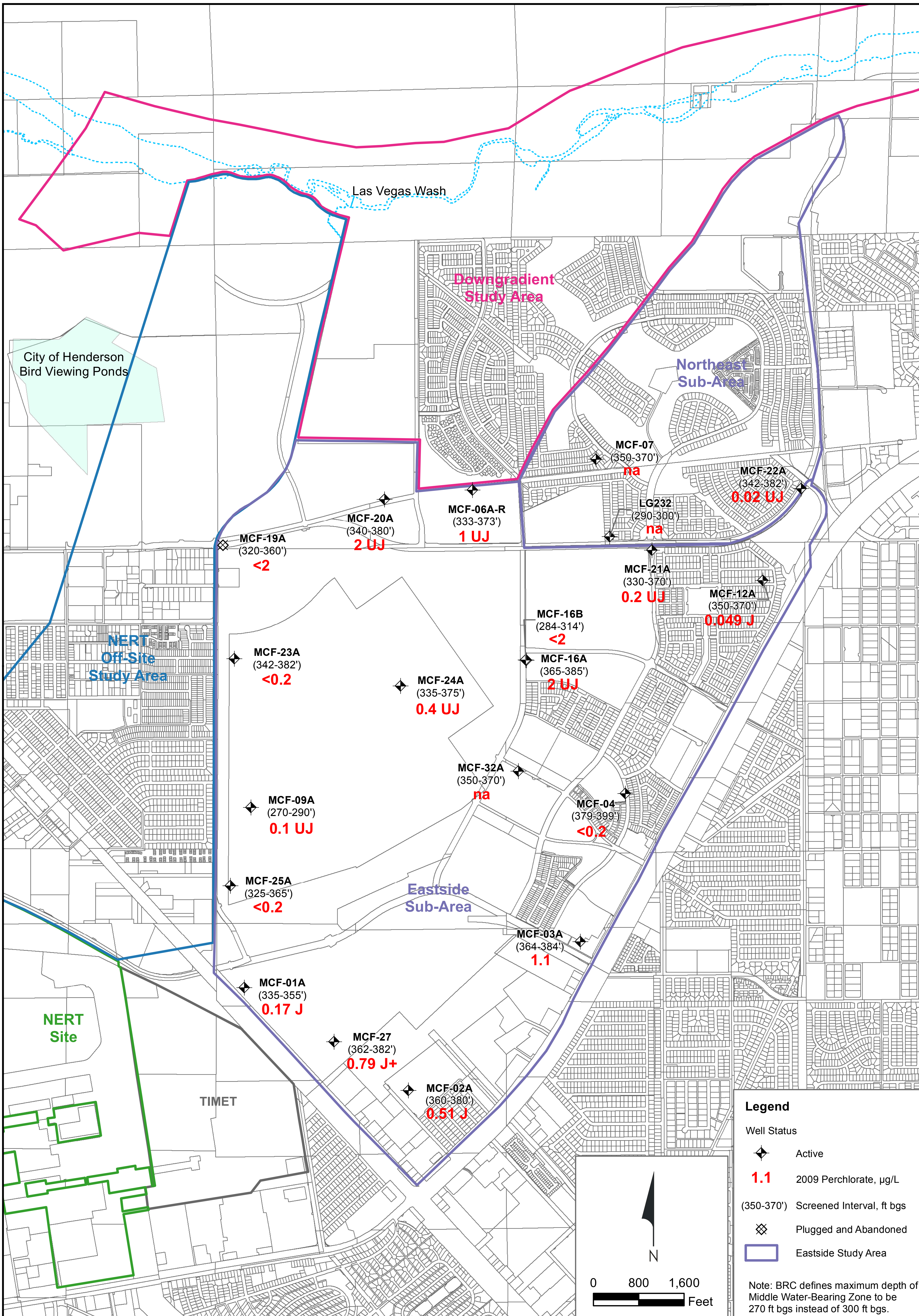
2009 Perchlorate Concentrations in Middle Water-Bearing Zone Wells

RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **4-4b**

Drafter: RS	Date: 5/5/17	Contract Number: 21-41400C	Approved by:	Revised:

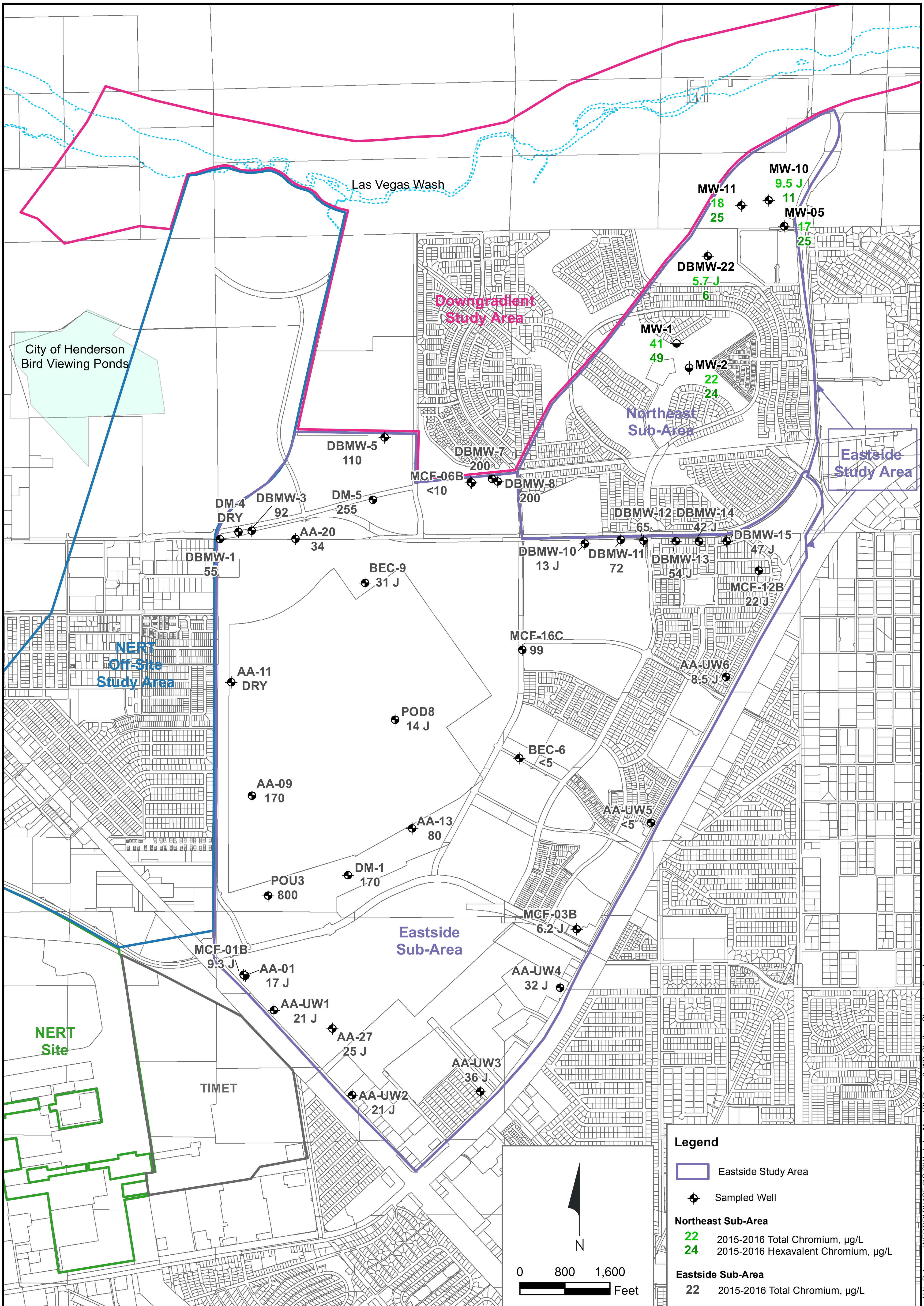


RAMBOLL ENVIRON

2009 Perchlorate Concentrations in Deep Water-Bearing Zone Wells
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
4-4c

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

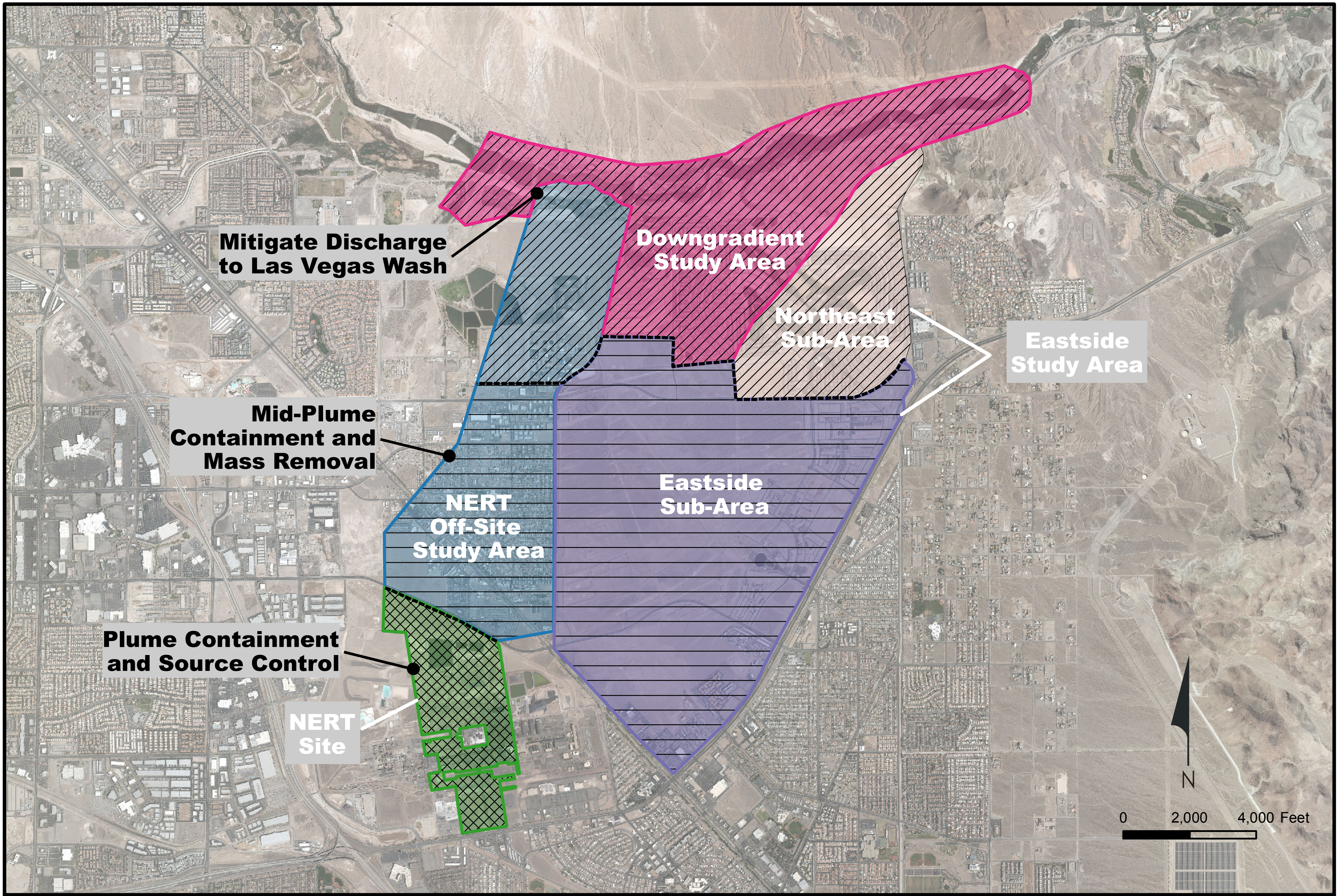


RAMBOLL ENVIRON

2014-2016 Total Chromium Concentrations in Shallow Groundwater
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
4-5

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:



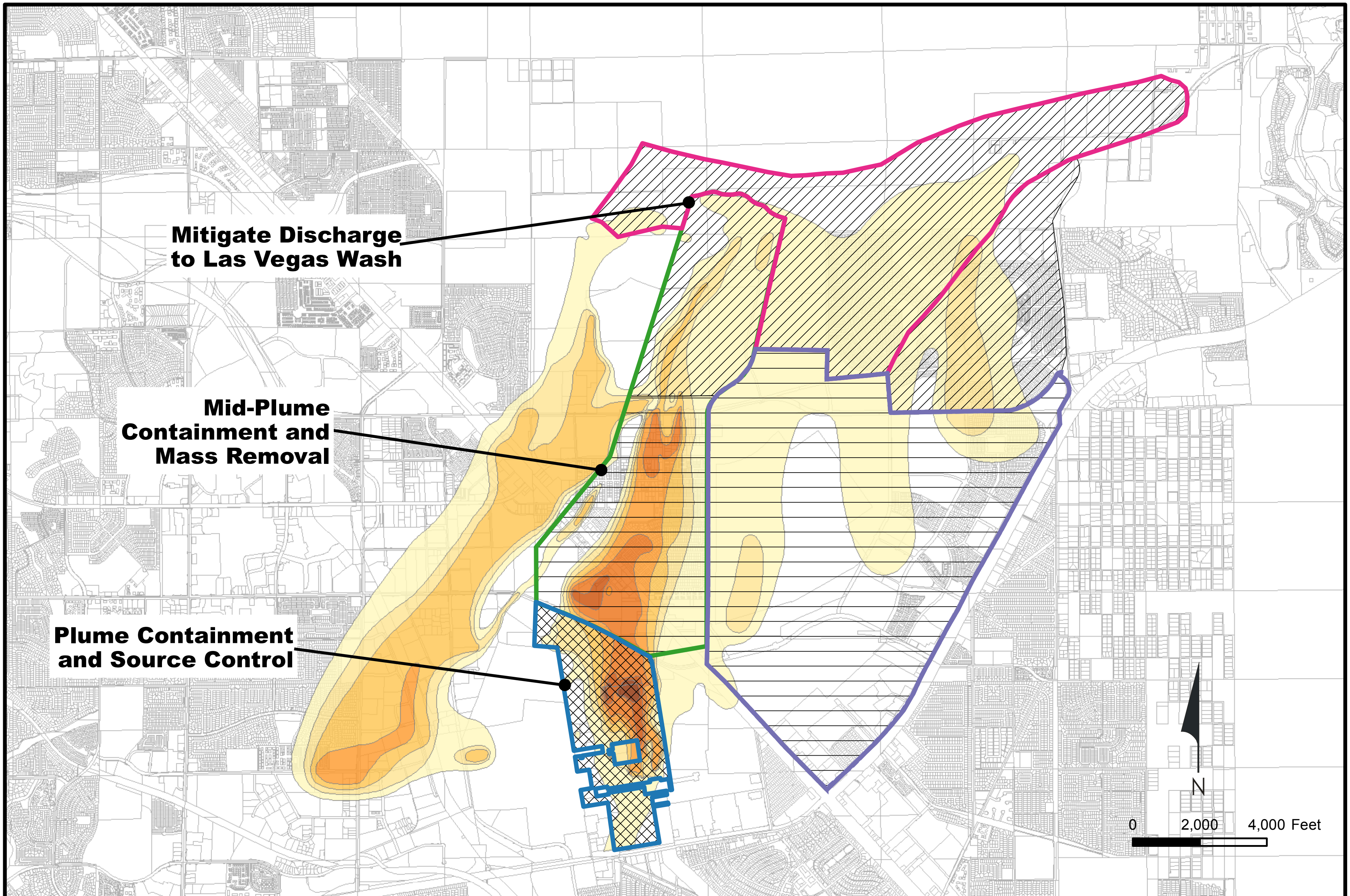
RAMBOLL ENVIRON

Remedial Action Objectives for the NERT RI Study Area
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
5-1

Drafter: RS | Date: 10/4/2017 | Contract Number: 21-41400C | Approved: | Revised:

Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\Fig 5-1.mxd



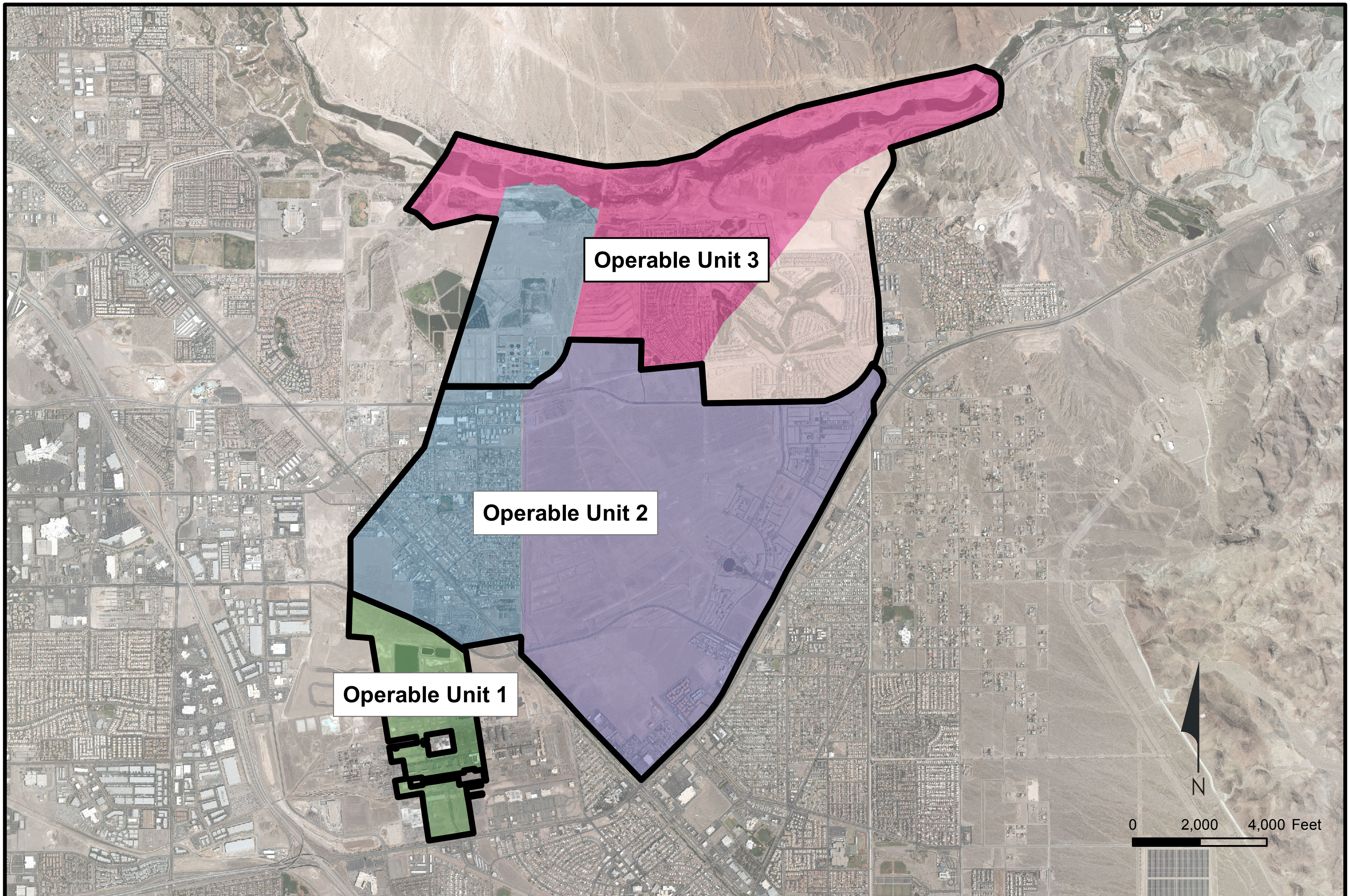
RAMBOLL ENVIRON

Remedial Action Objectives Showing Perchlorate Plume
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **5-2**

Drafter: RS	Date: 5/6/2017	Contract Number: 21-41400C	Approved:	Revised:

Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\Fig 5-2.mxd



RAMBOLL ENVIRON

Proposed Operable Units

RI/FS Work Plan Addendum: Phase 3 RI

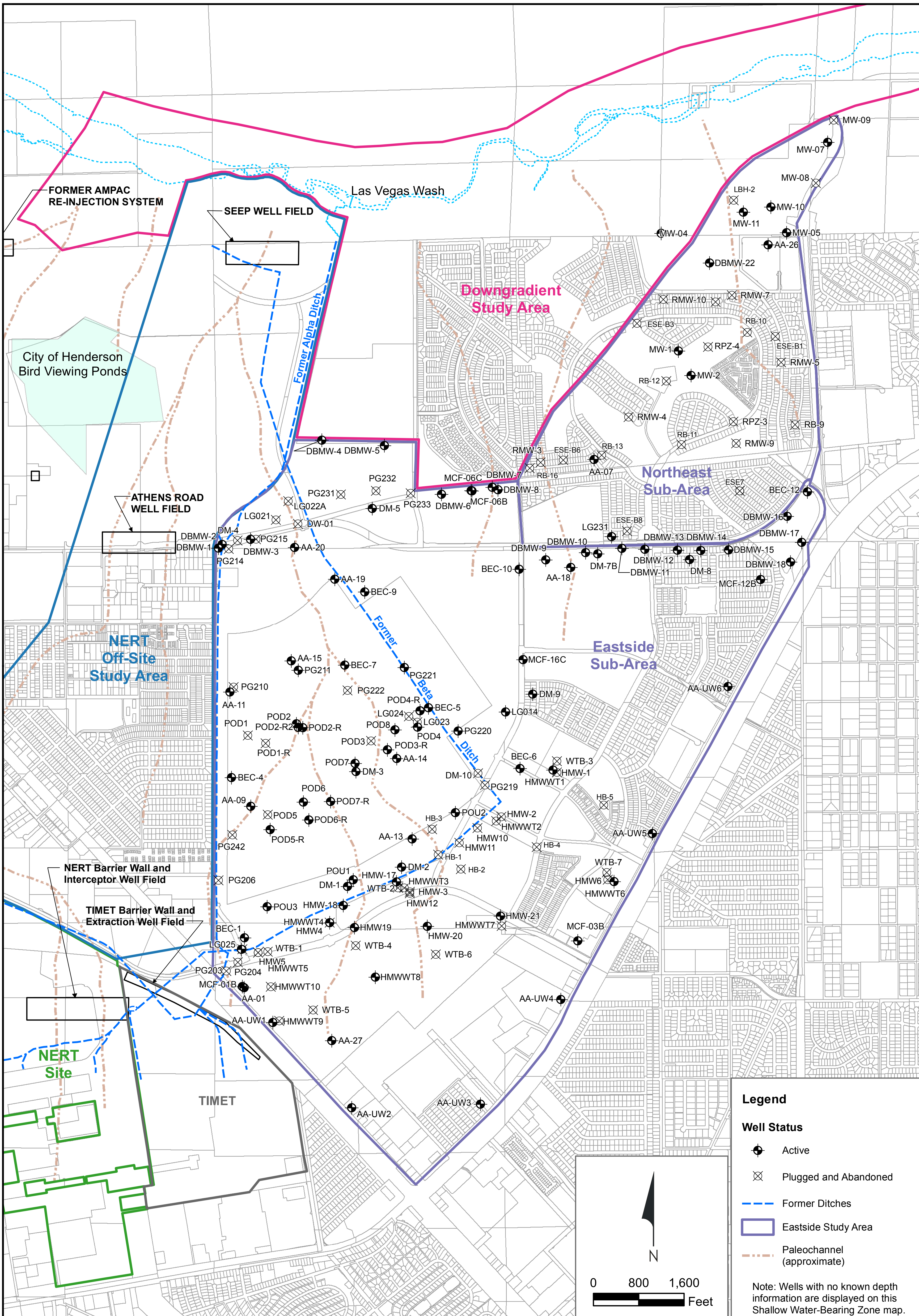
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure

5-3

Drafter: RS Date: 9/29/2017 Contract Number: 21-41400C Approved: Revised:

Path: H:\LePetomane\NERT\RI PHASE 3\GIS\Workplan Maps\Fig 5-3.mxd



RAMBOLL ENVIRON

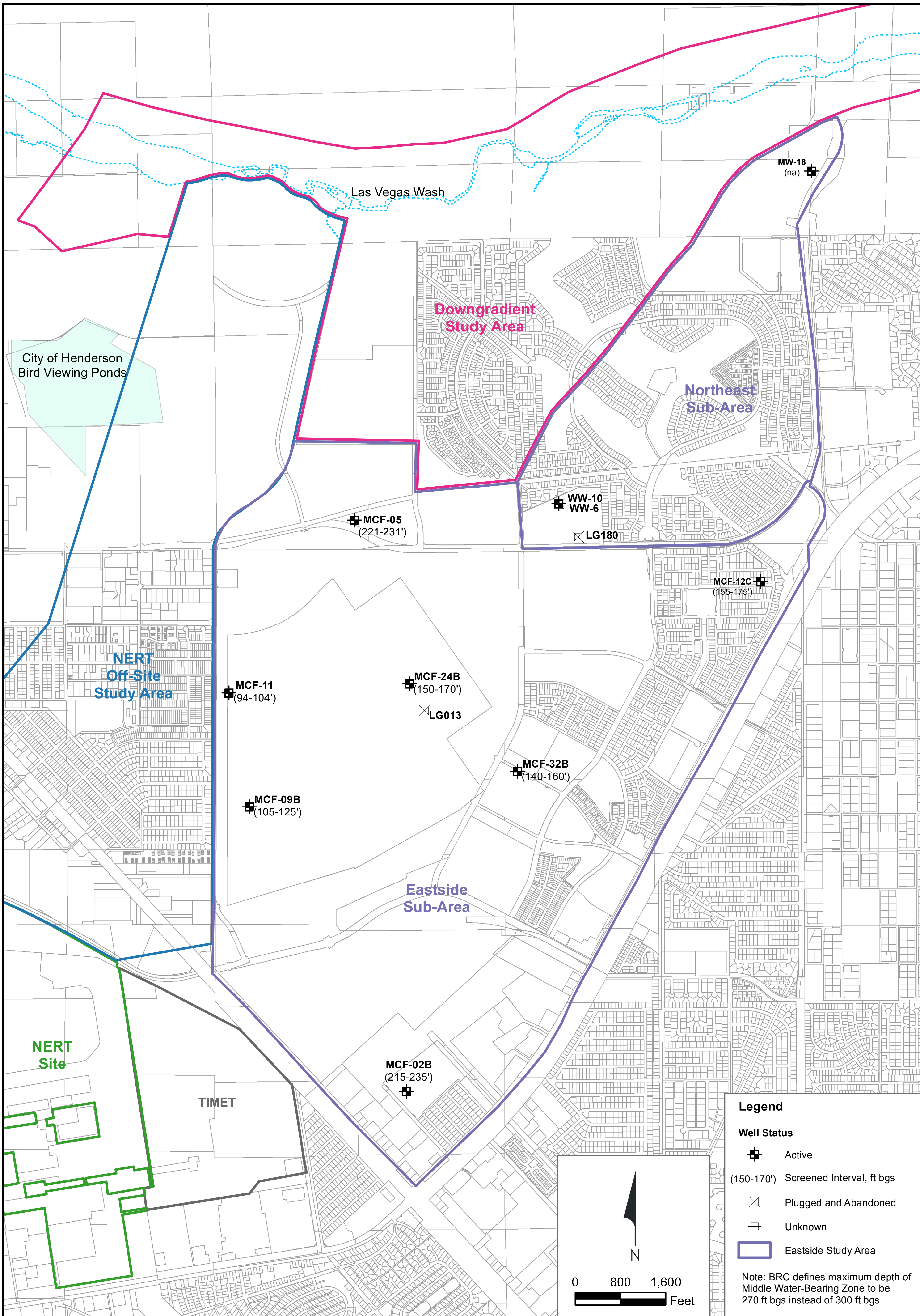
Monitoring Well Locations, Shallow Water-Bearing Zone (0-90 ft bgs)

RI/FS Work Plan Addendum: Phase 3 RI

Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **6-1a**

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

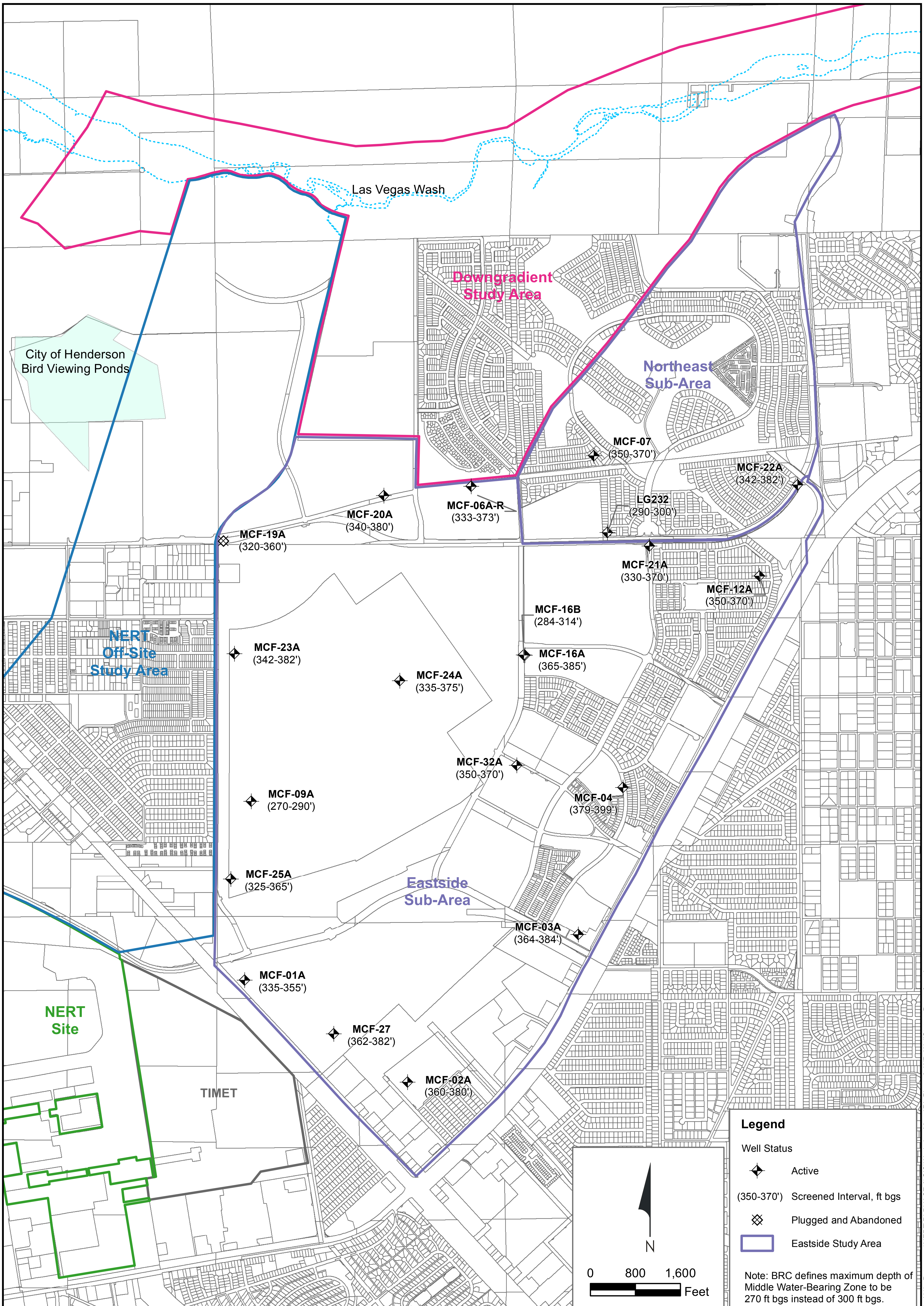


RAMBOLL ENVIRON

Monitoring Well Locations, Middle Water-Bearing Zone (90-270 ft bgs)
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
6-1b

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

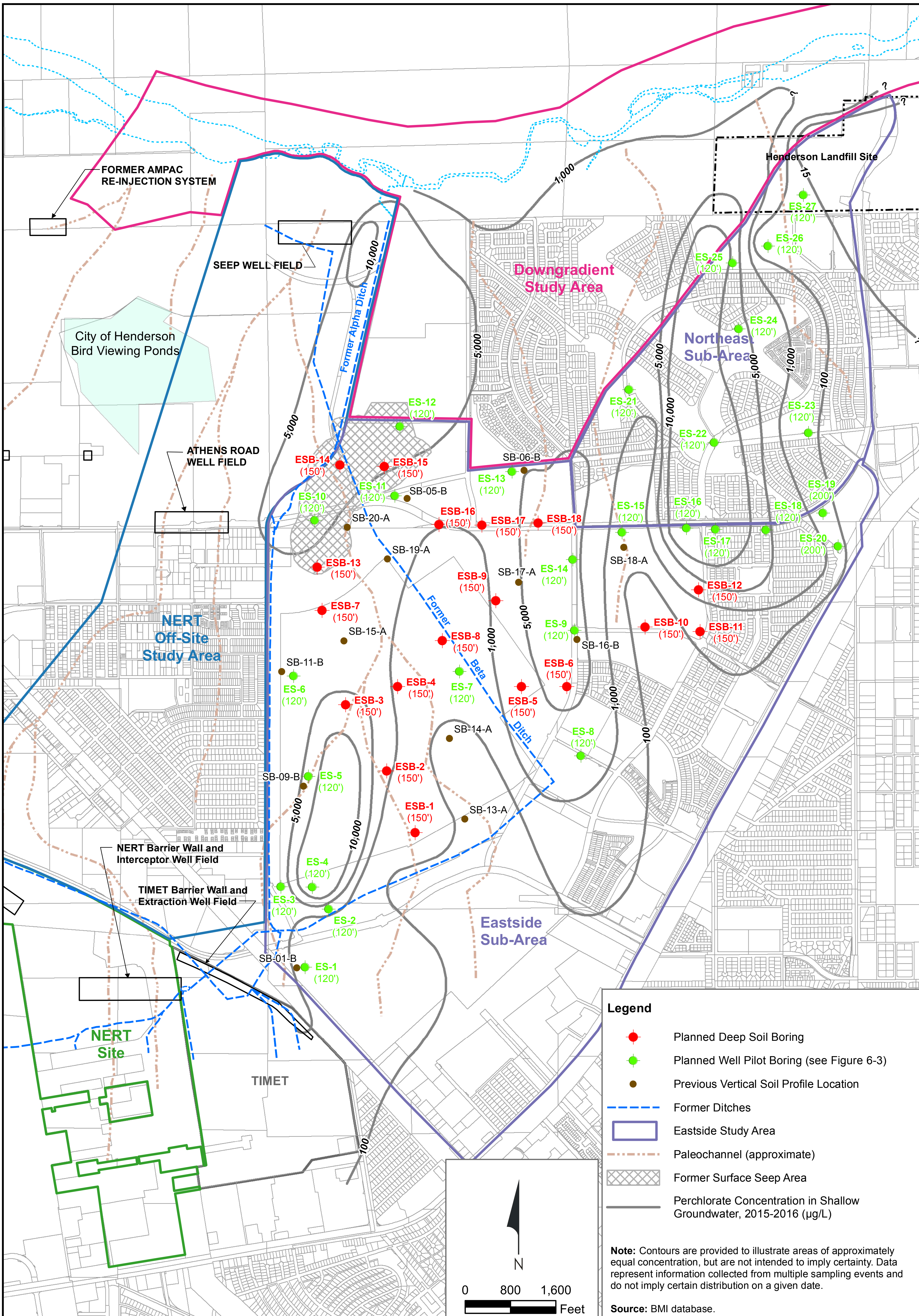


RAMBOLL ENVIRON

Monitoring Well Locations, Deep Water-Bearing Zone (>270 ft bgs)
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
6-1c

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

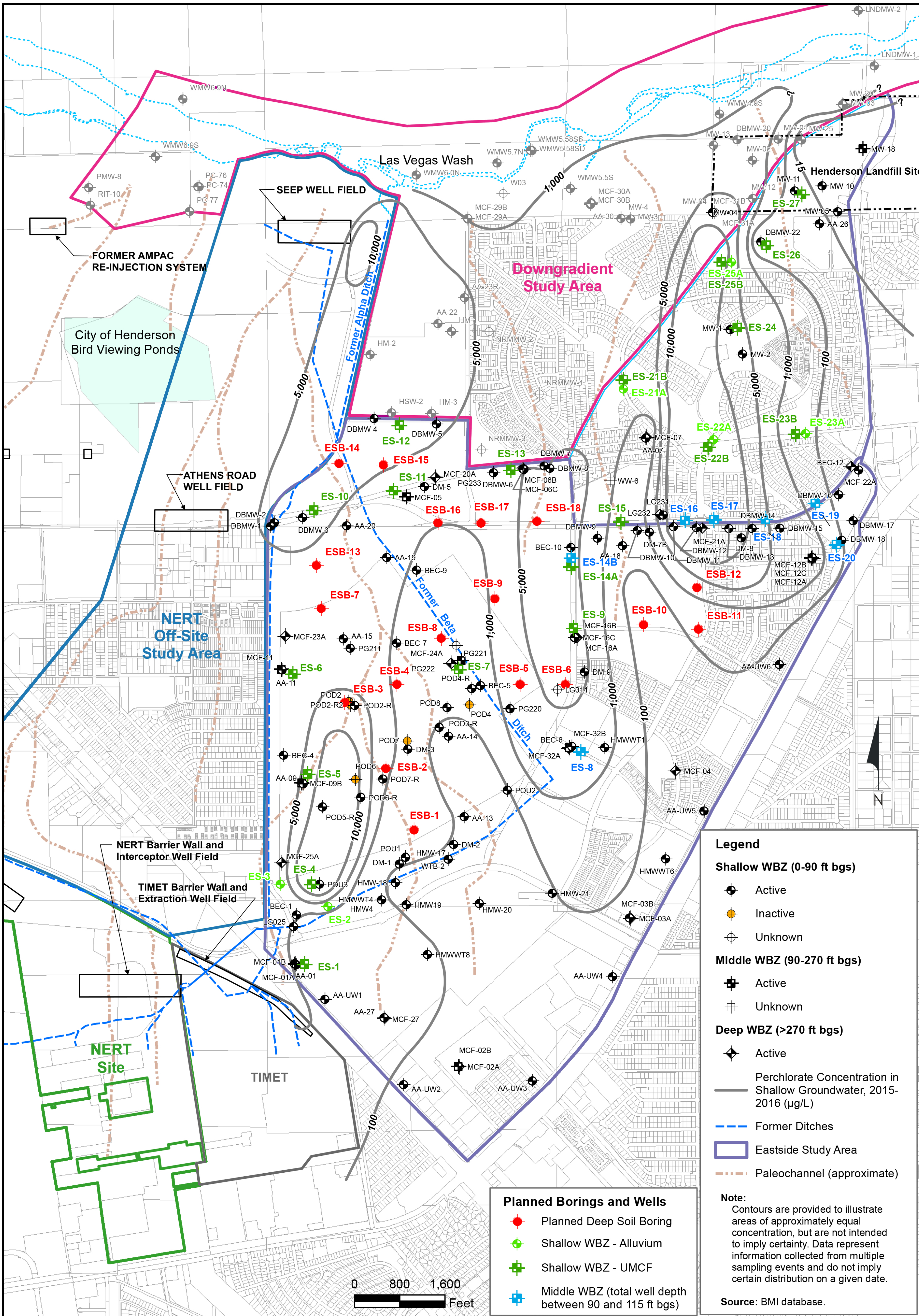


RAMBOLL ENVIRON

Planned Investigation Locations
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **6-2**

Drafter: RS | DATE: 10/4/2017 | Contract Number: 21-41400C | Approved by: | Revised:

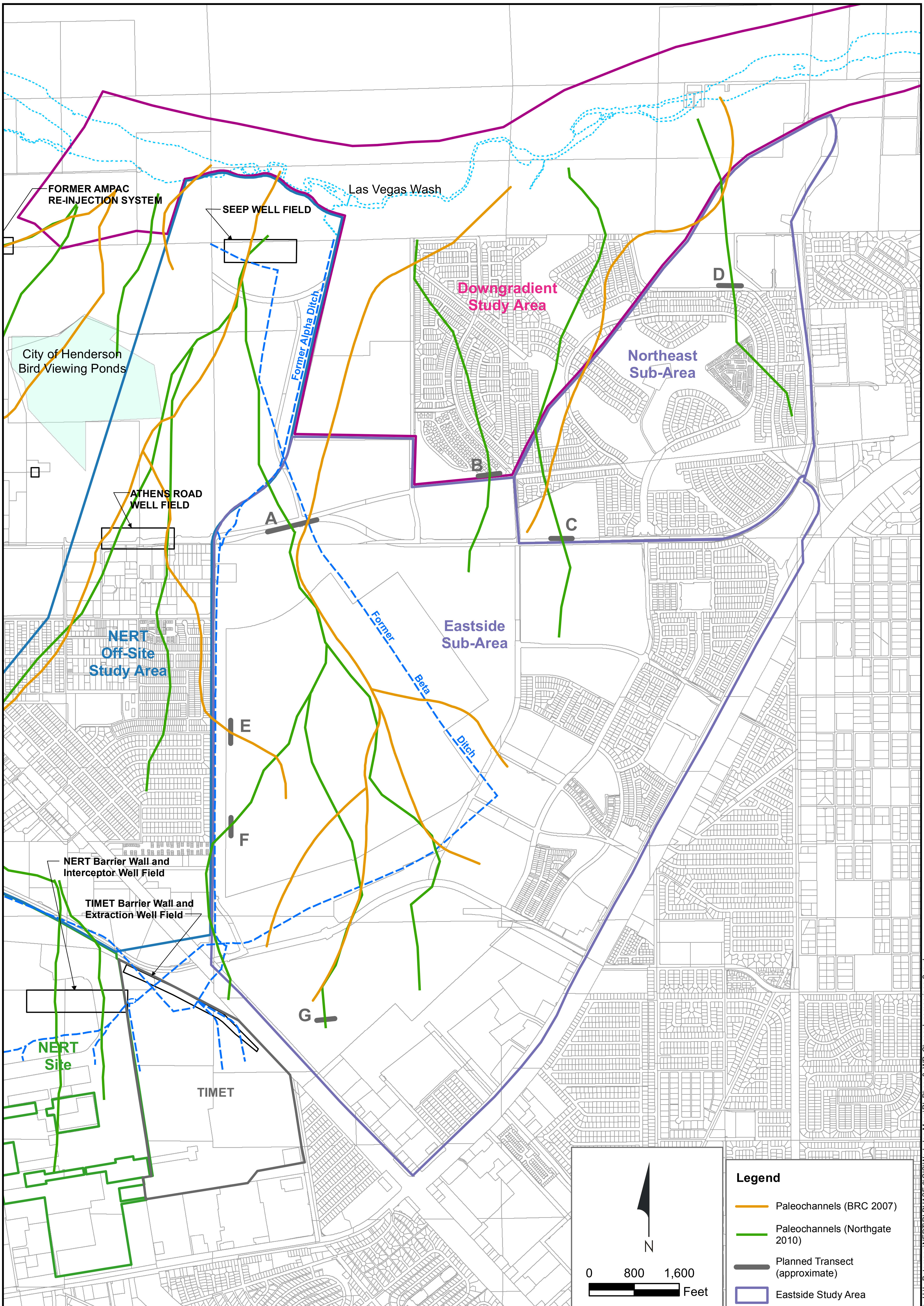


RAMBOLL ENVIRON

Planned Boring and Monitoring Well Locations
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure
6-3

Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:



RAMBOLL ENVIRON

Paleochannel Interpretations
RI/FS Work Plan Addendum: Phase 3 RI
Nevada Environmental Response Trust Site; Henderson, Nevada

Figure **6-4**

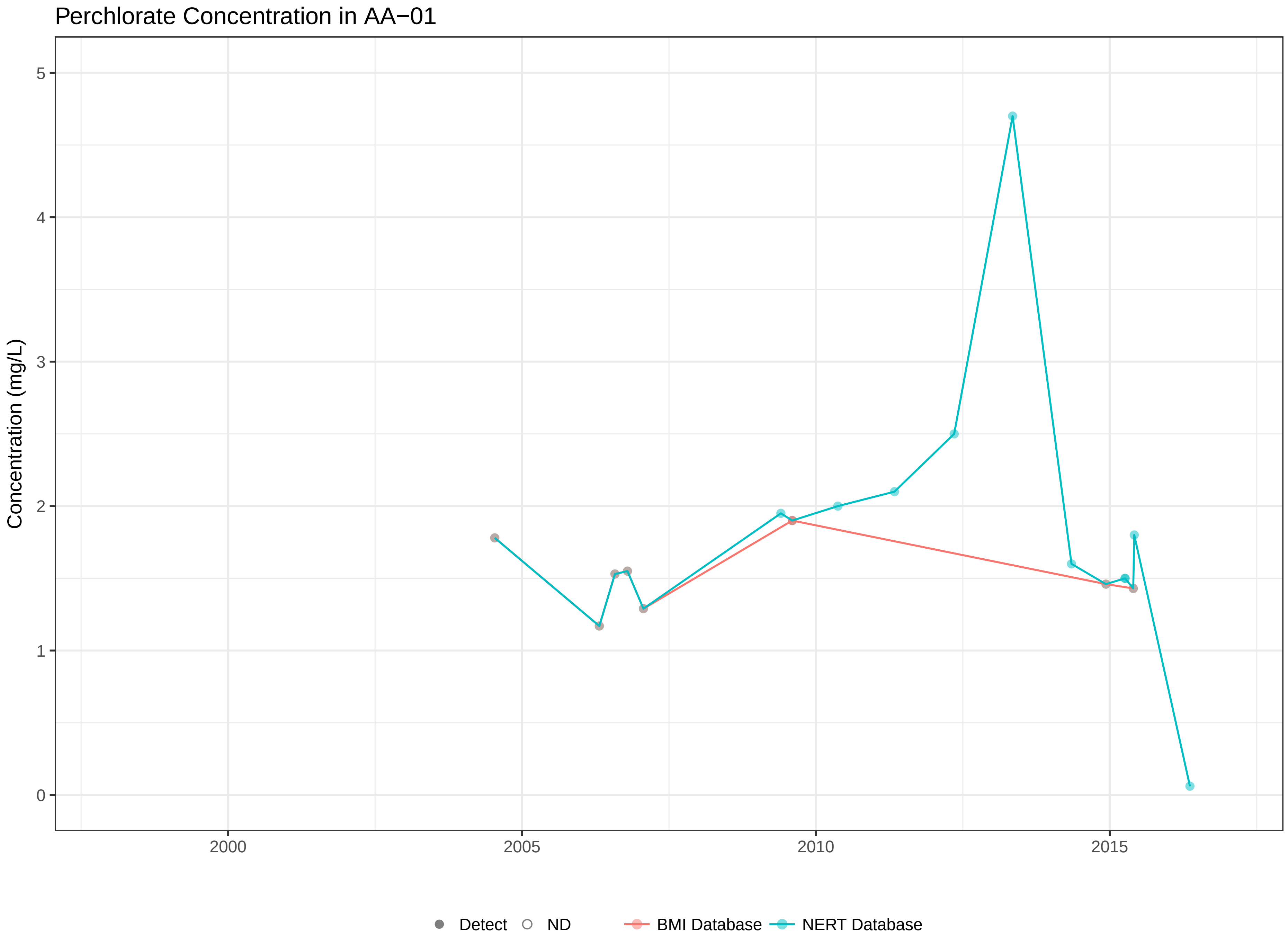
Drafter: RS | Date: 5/5/17 | Contract Number: 21-41400C | Approved by: | Revised:

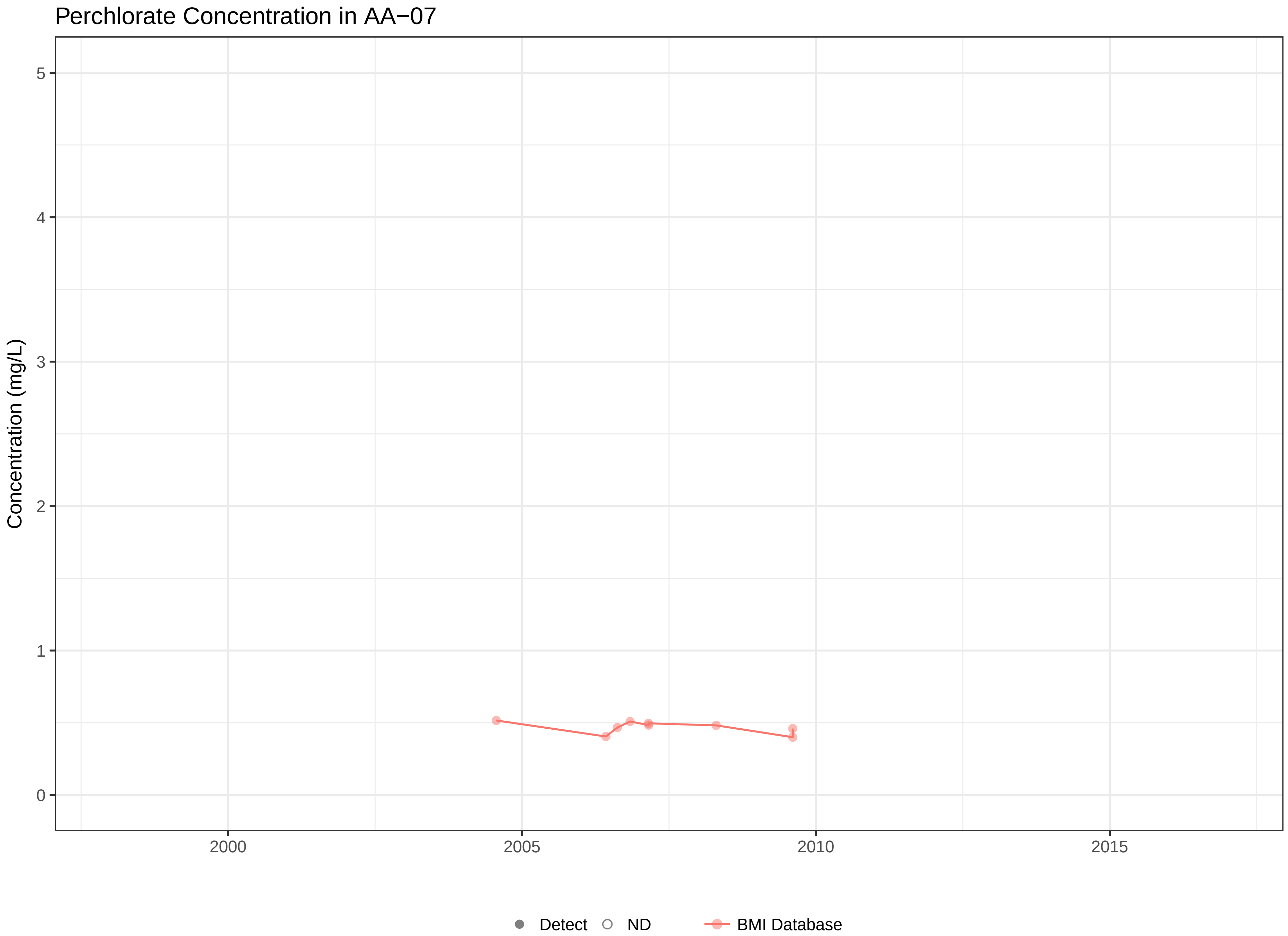
APPENDICES

APPENDIX A

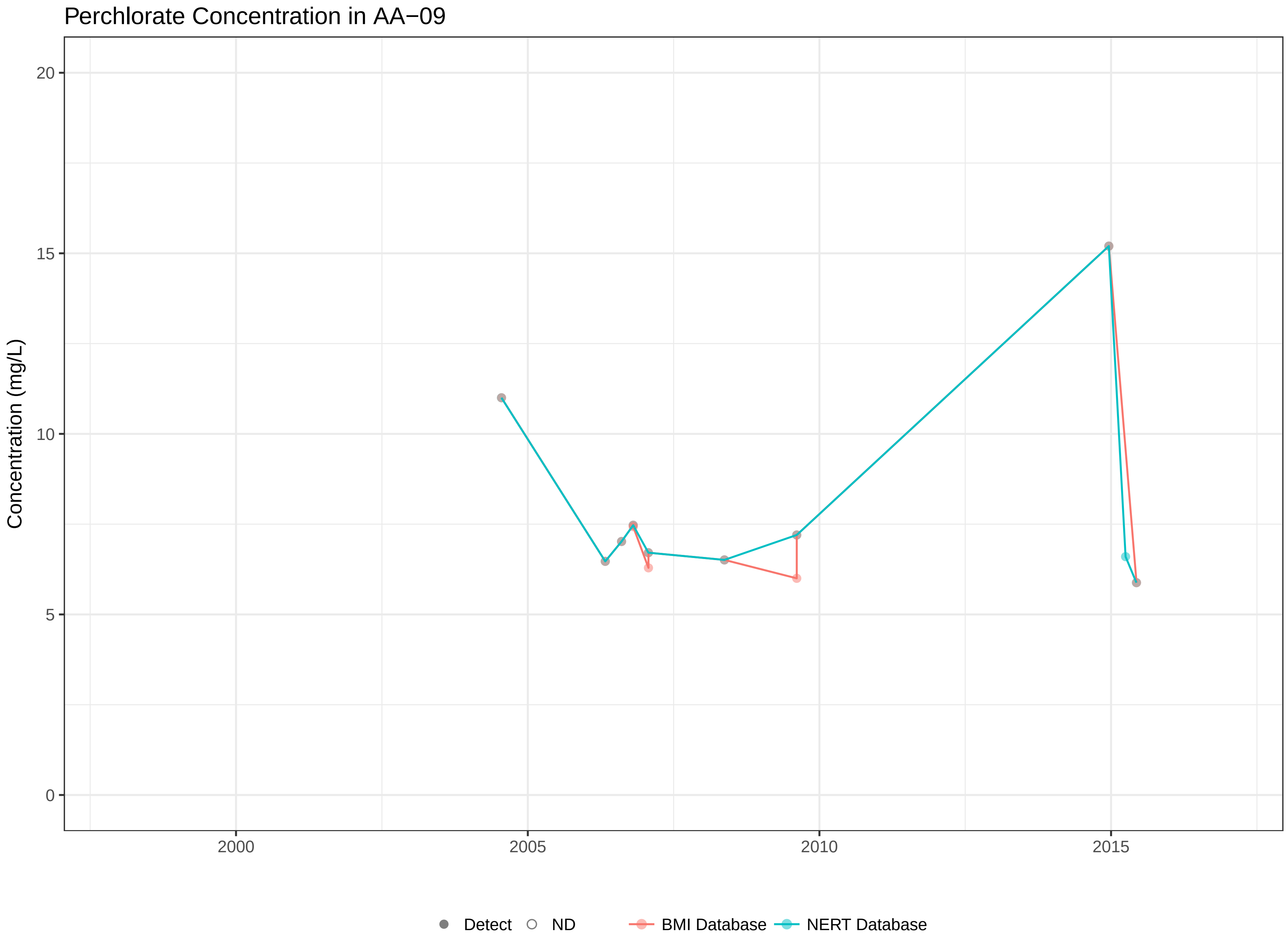
EASTSIDE SUB-AREA PERCHLORATE AND CHLORATE GROUNDWATER MONITORING DATA (1995-2016)

(*Provided in electronic format on CD*)

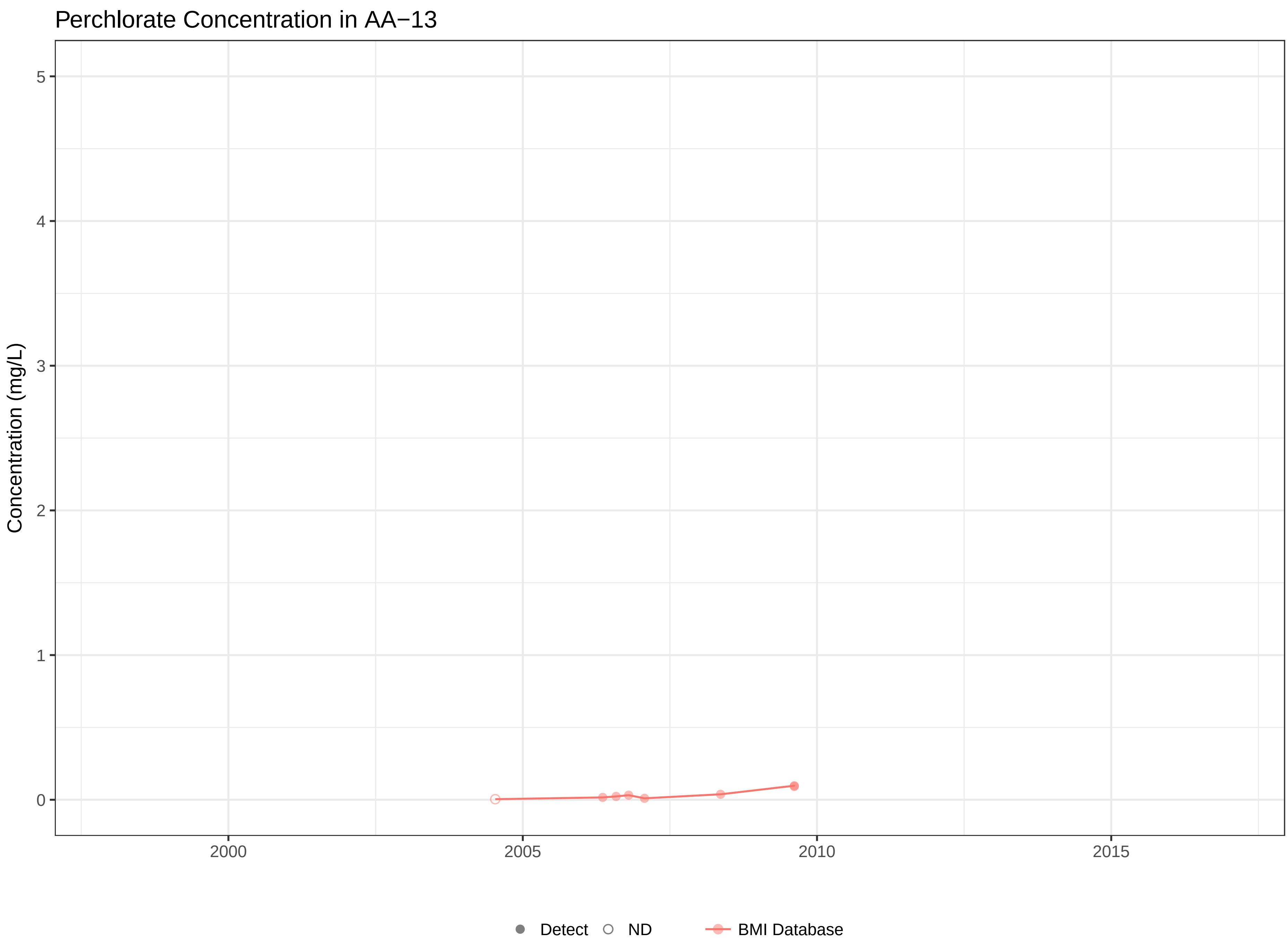

Perchlorate Concentration in AA−01
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



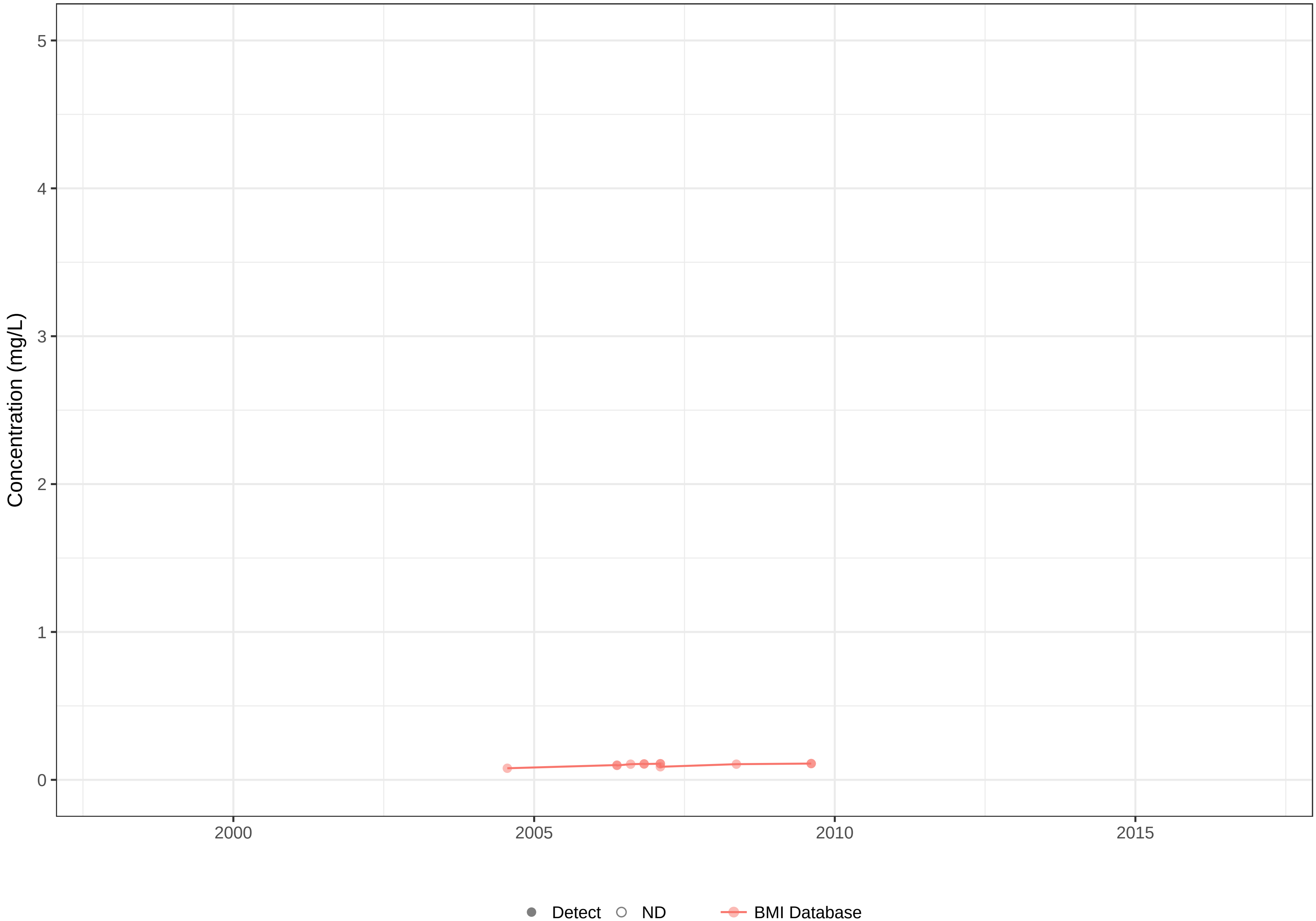
Perchlorate Concentration in AA−07
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

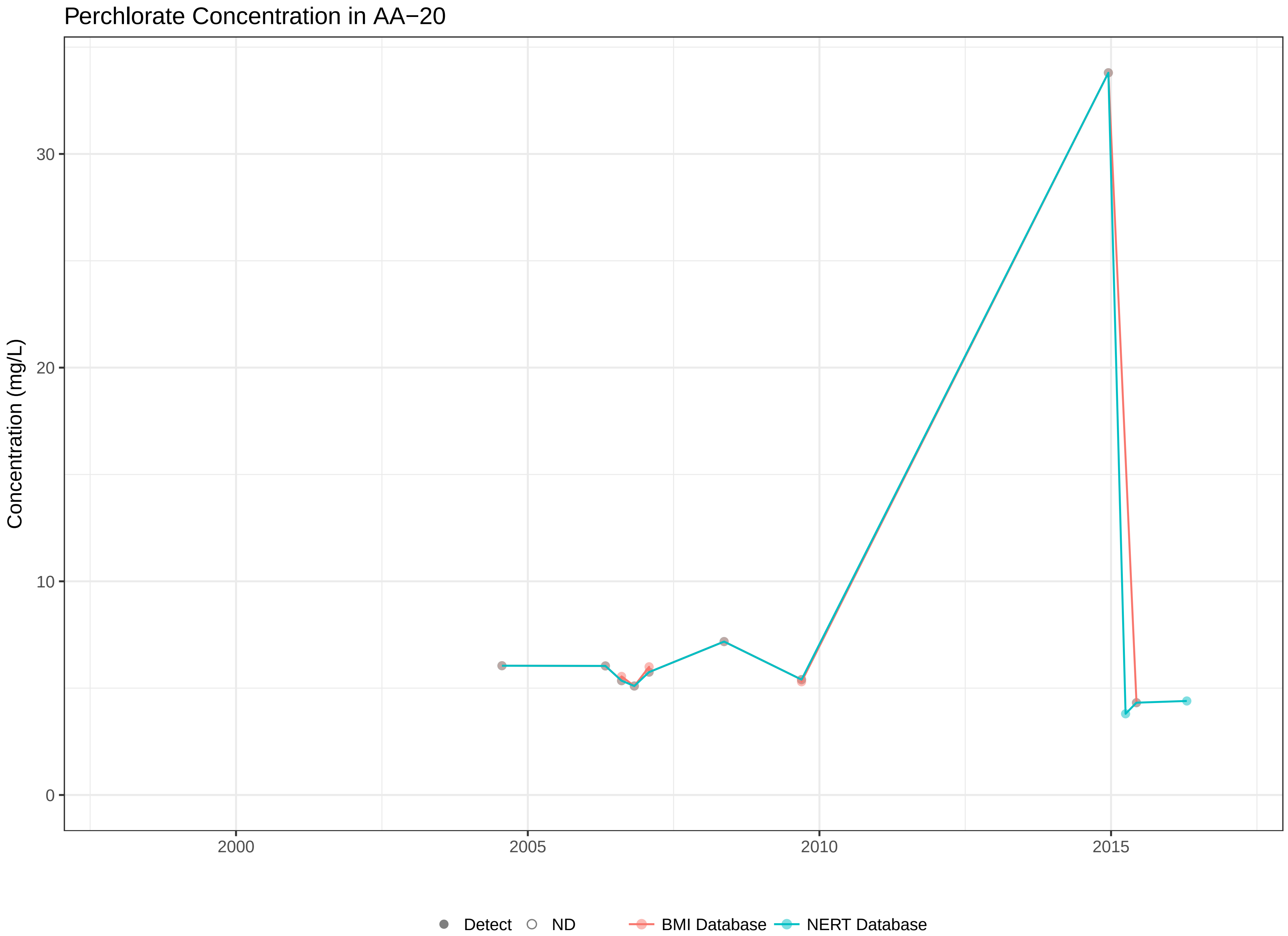


Perchlorate Concentration in AA−09
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

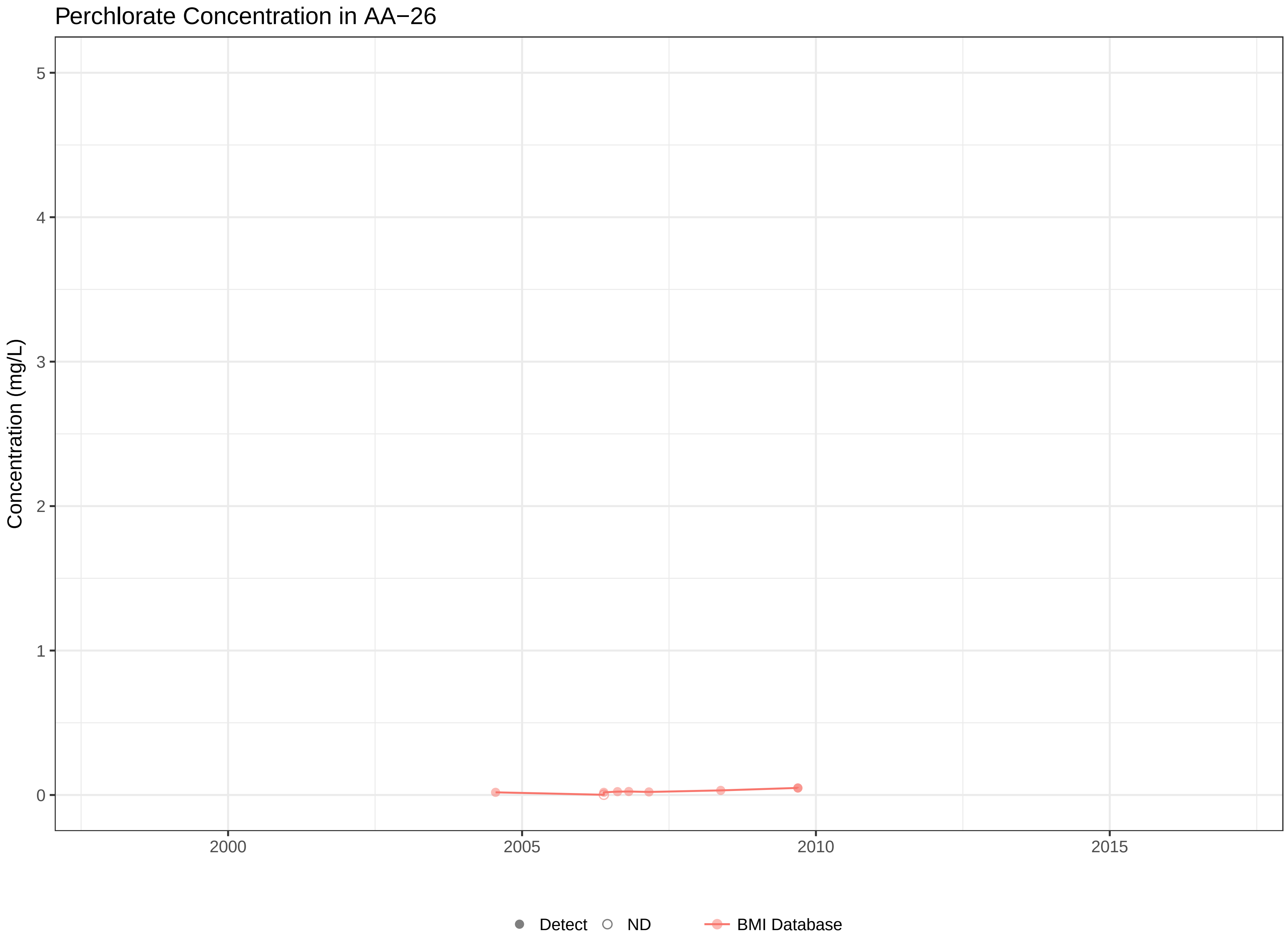

Perchlorate Concentration in AA−13
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

Perchlorate Concentration in AA−18

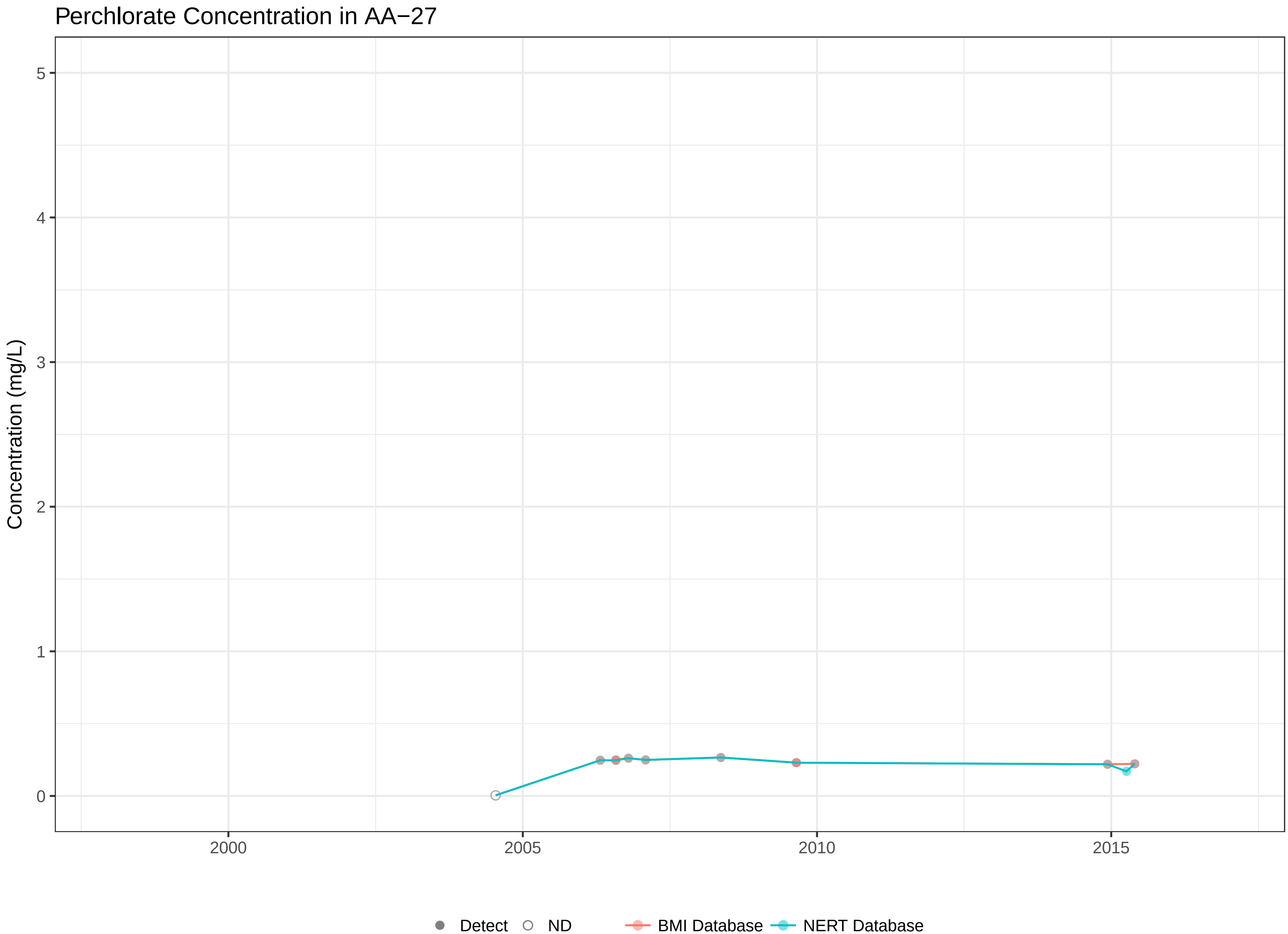




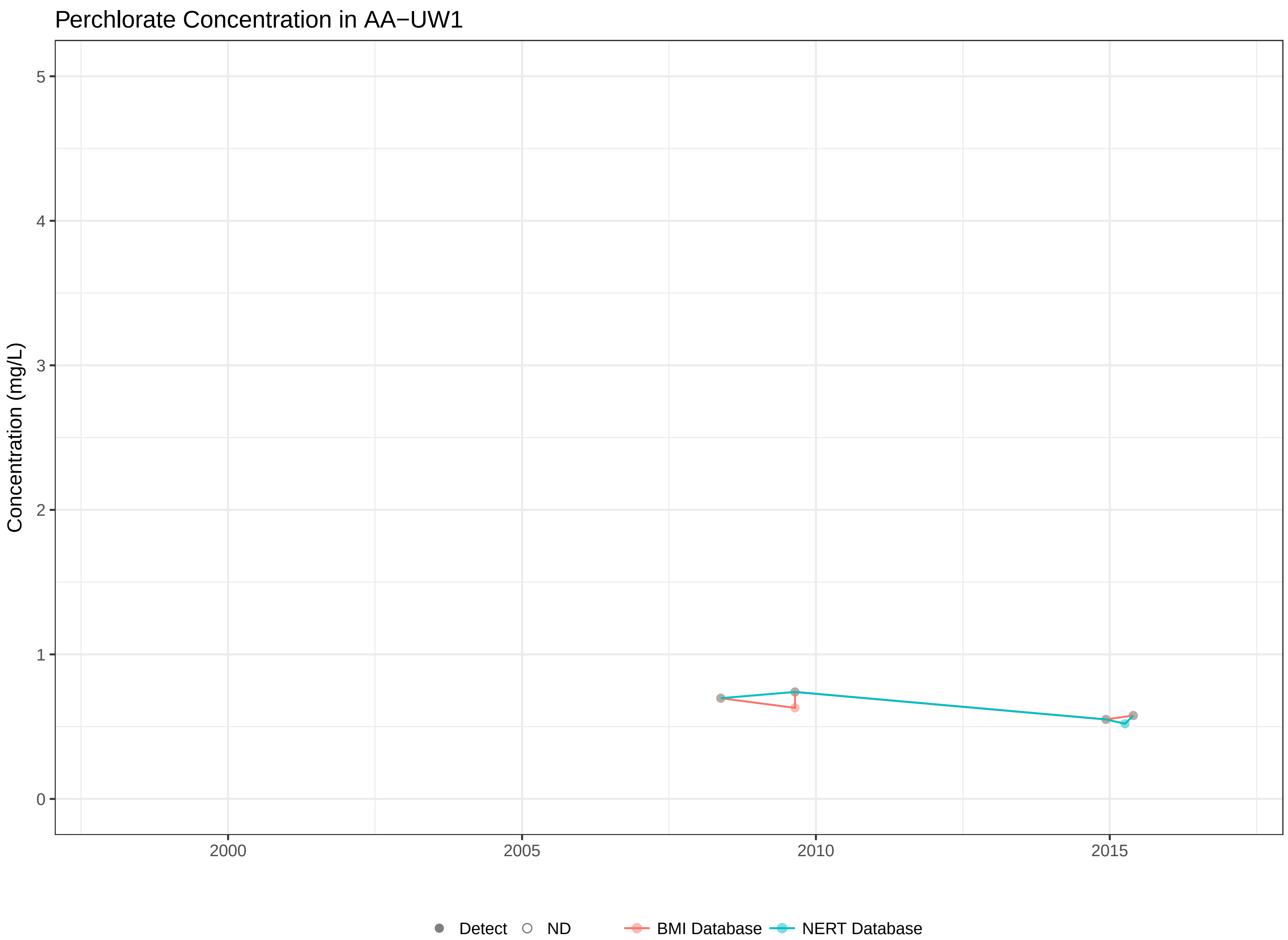
Perchlorate Concentration in AA−20
Concentration (mg/L)
0
10
20
30
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

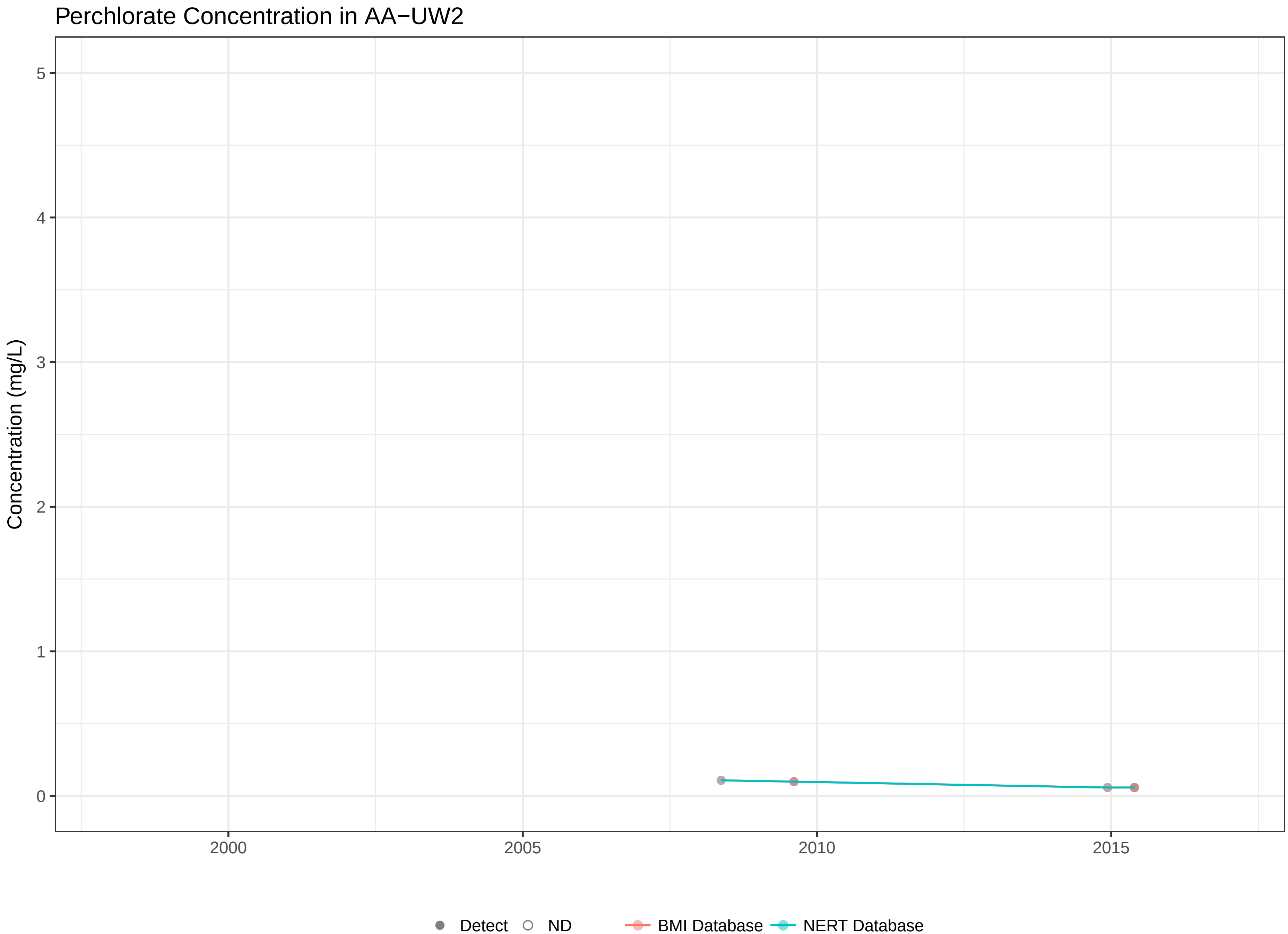


Perchlorate Concentration in AA−26
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

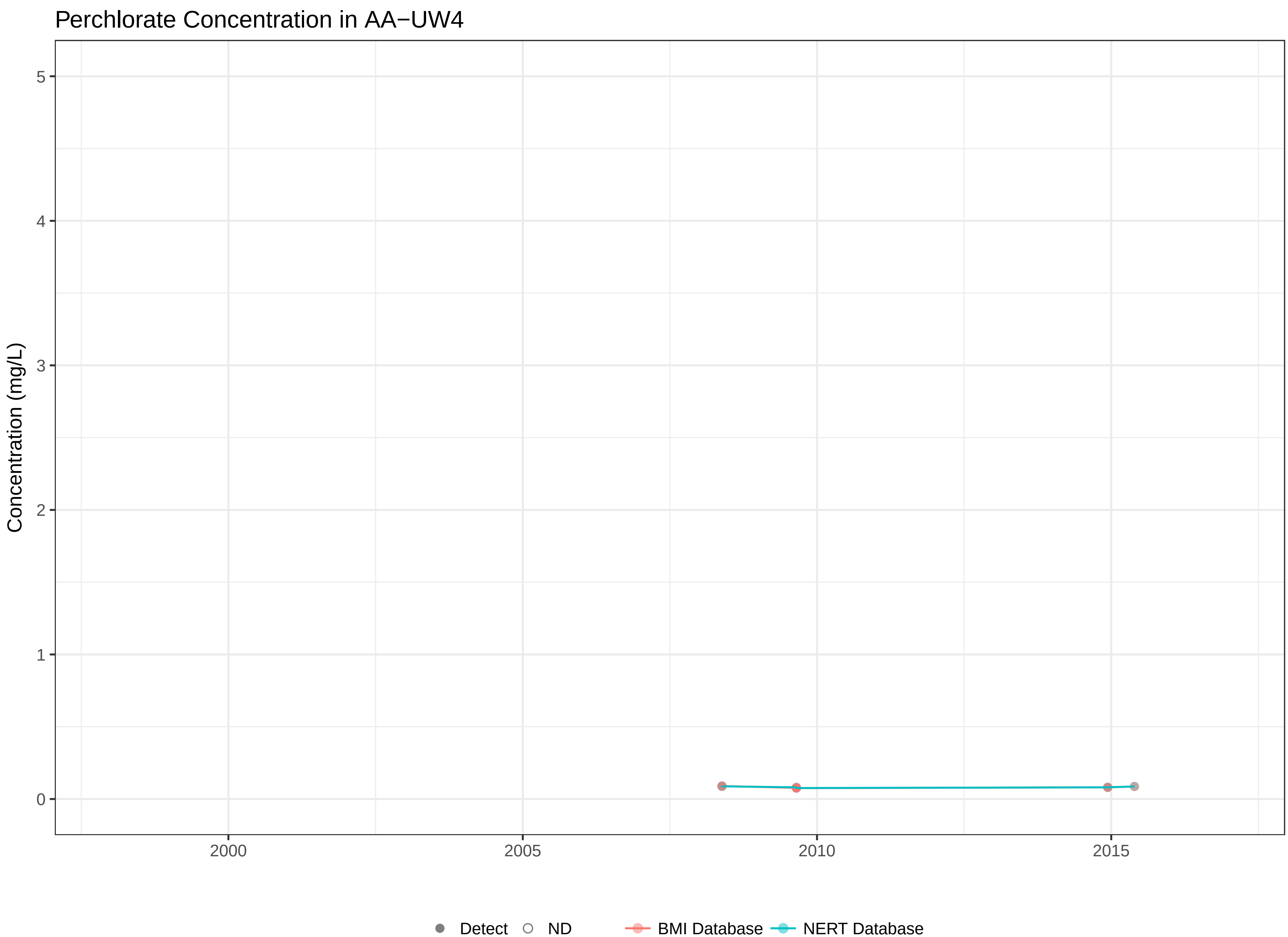


Perchlorate Concentration in AA−27
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

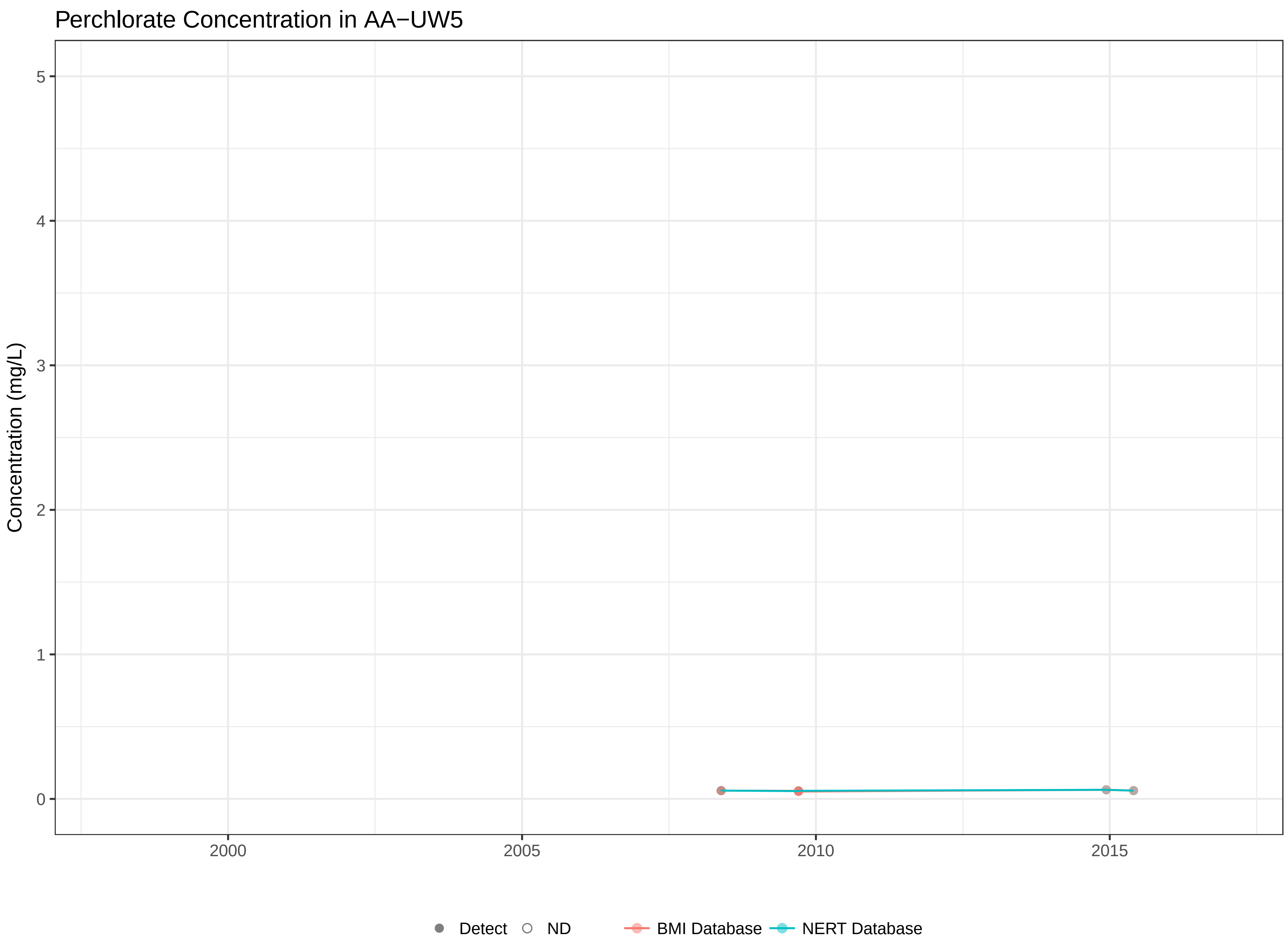

Perchlorate Concentration in AA−UW1
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



Perchlorate Concentration in AA−UW2
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

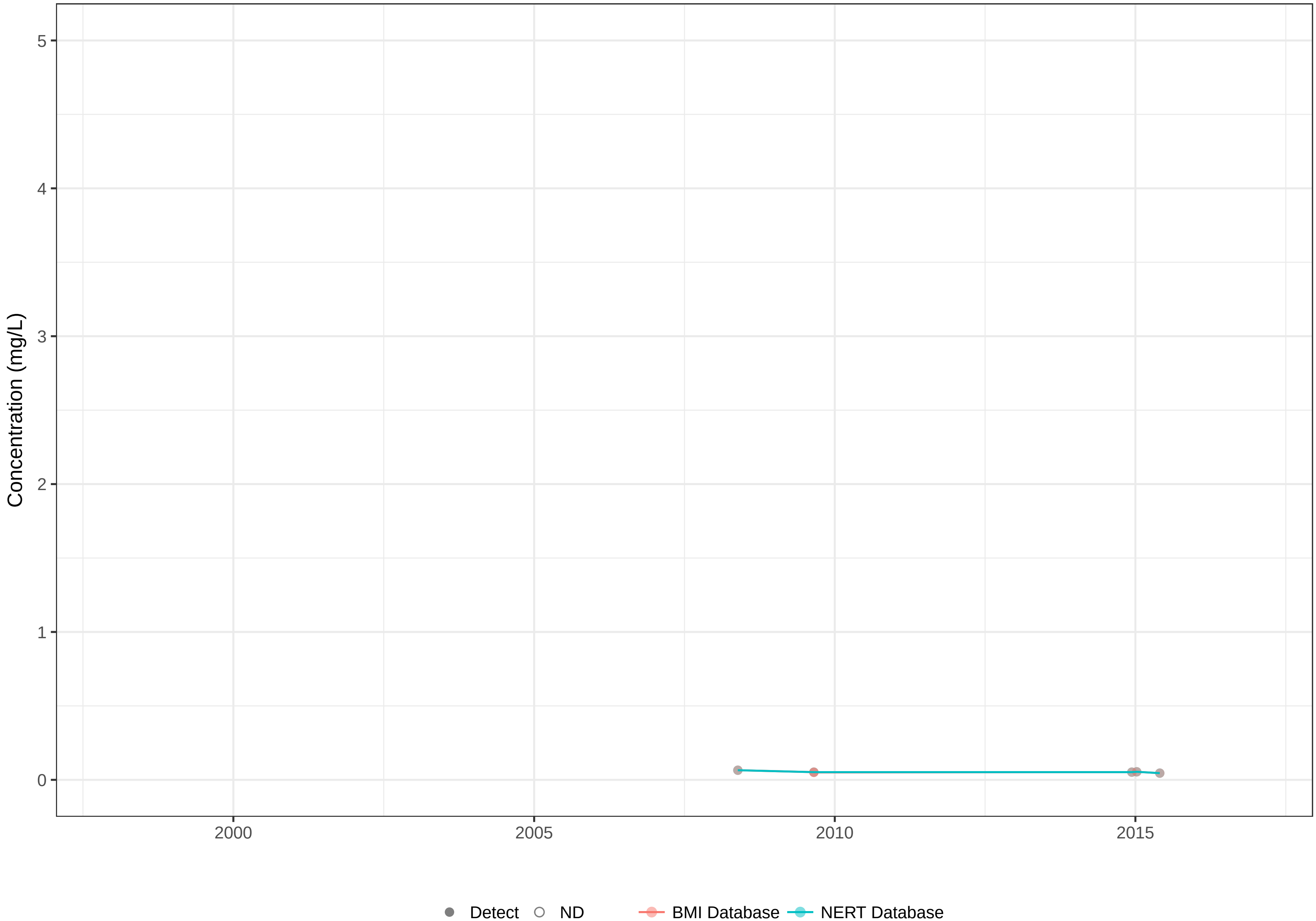


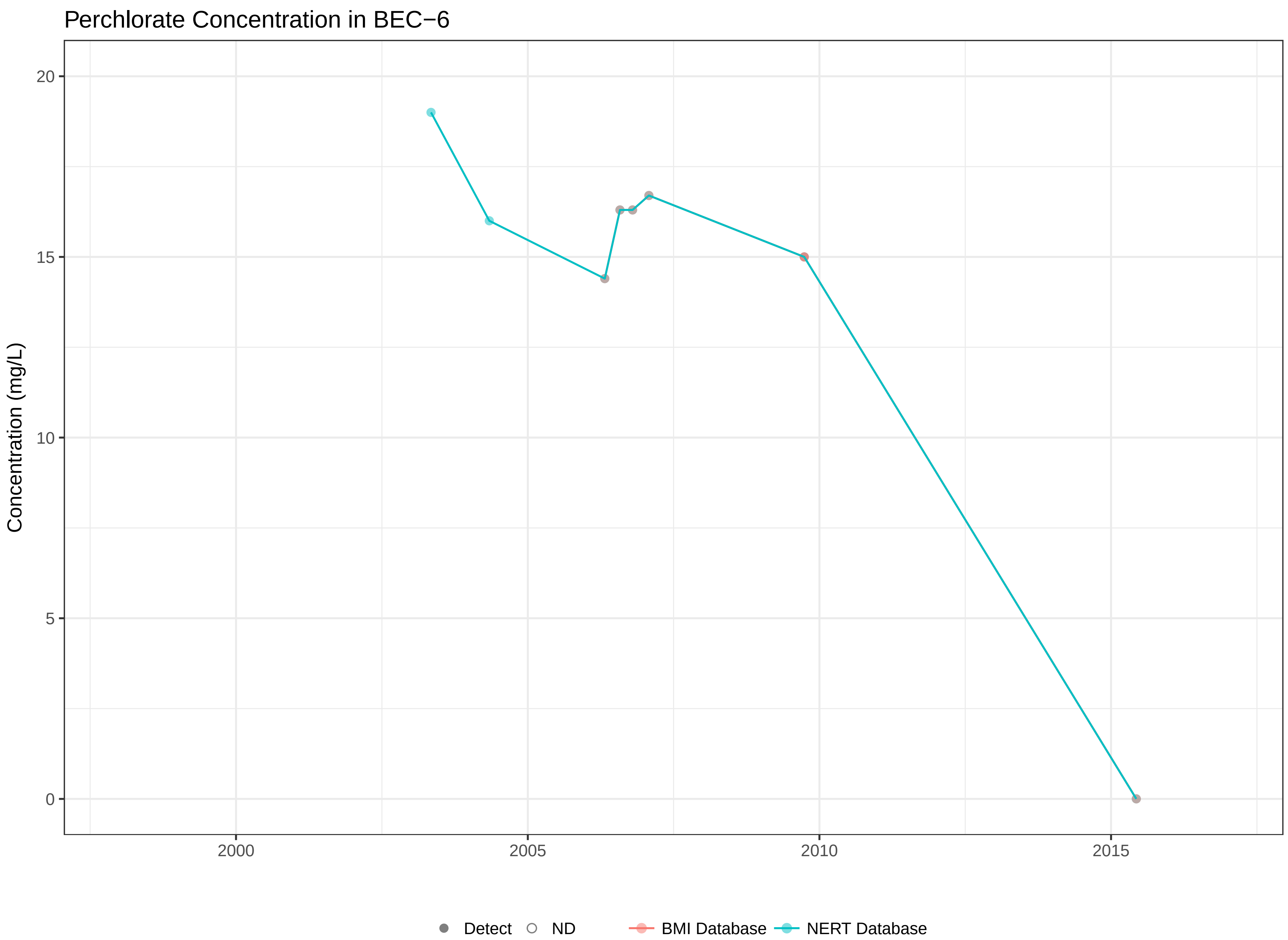
Perchlorate Concentration in AA−UW4
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



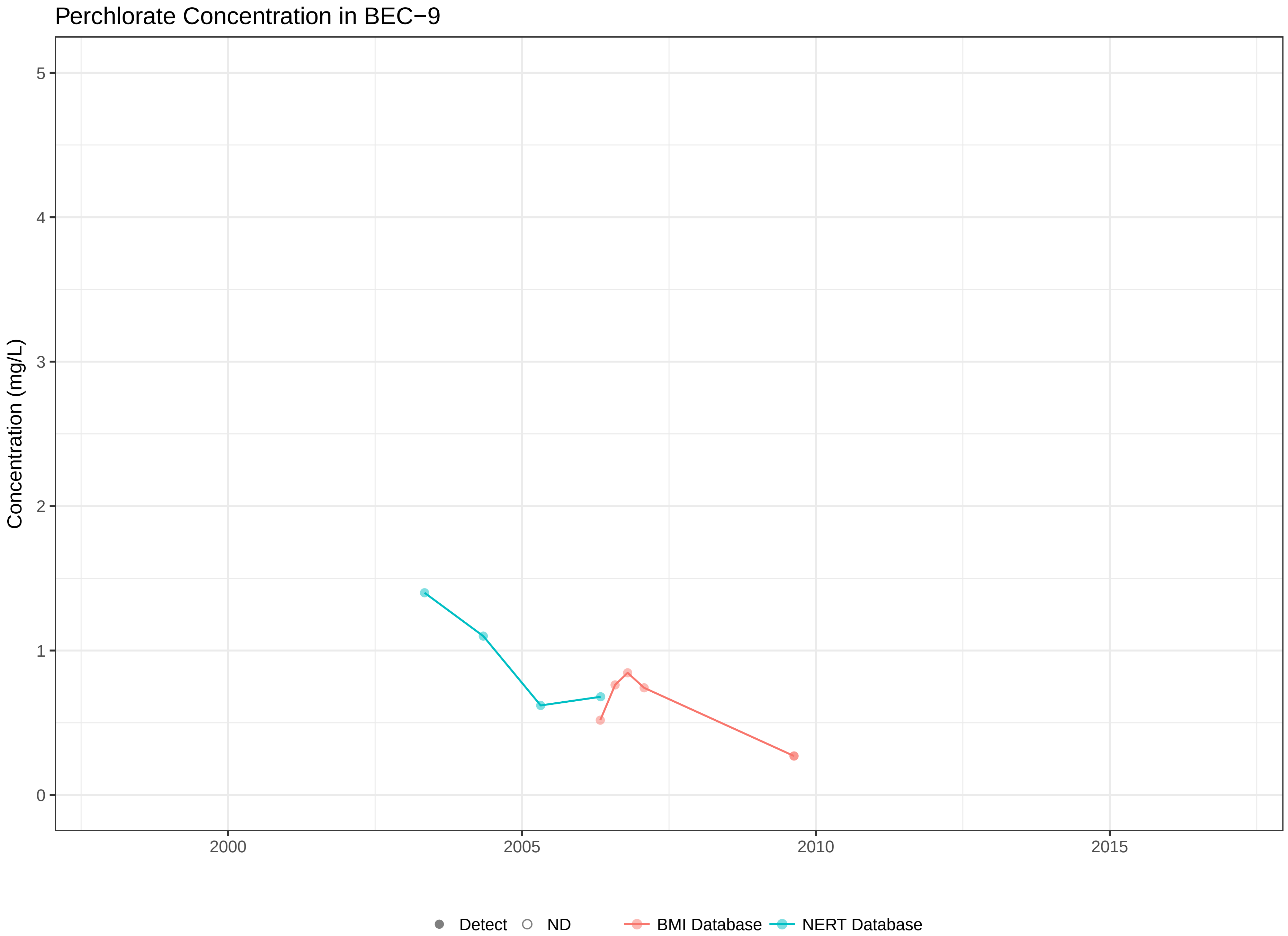
Perchlorate Concentration in AA−UW5
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

Perchlorate Concentration in AA−UW6



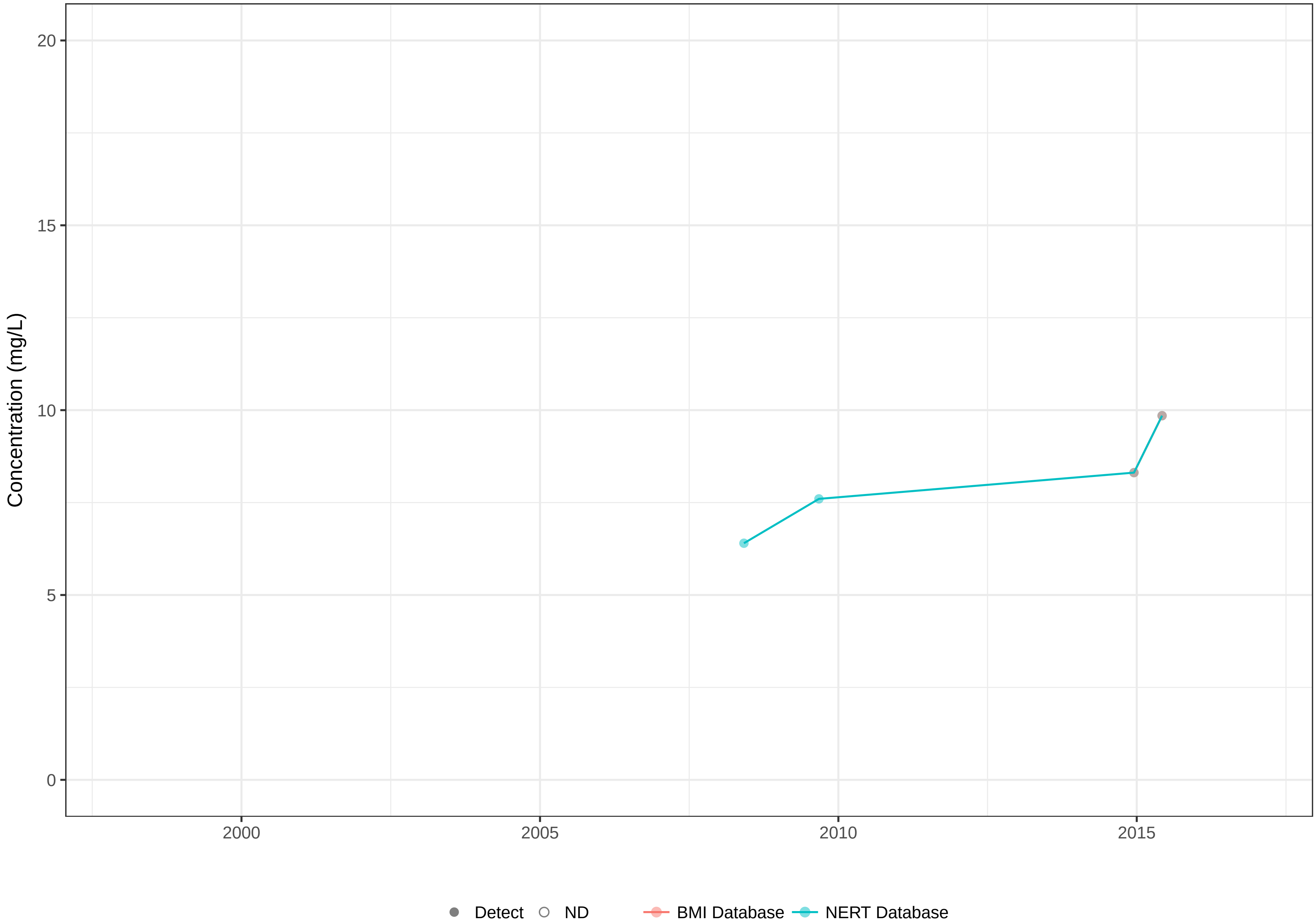


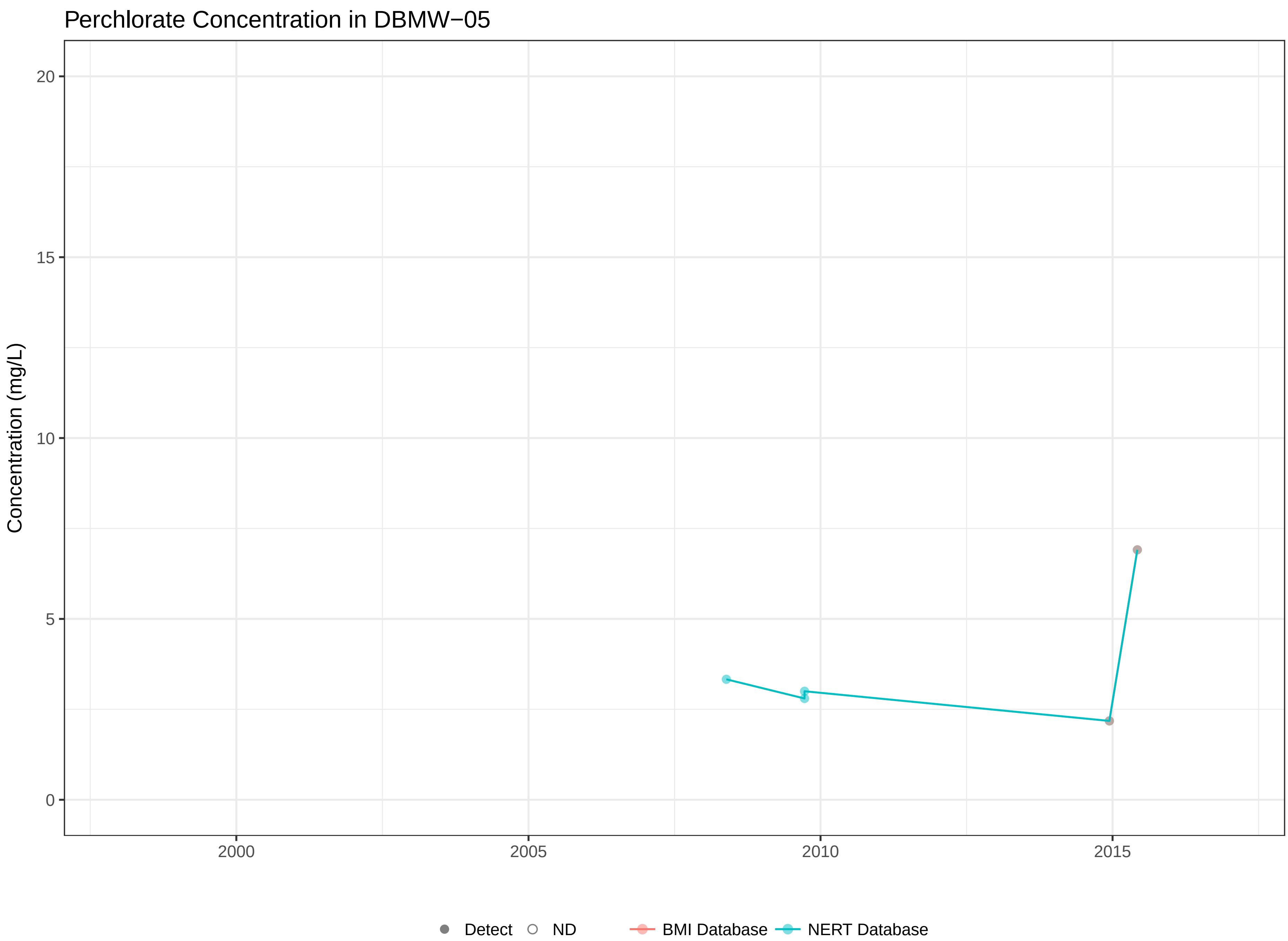
Perchlorate Concentration in BEC−6
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



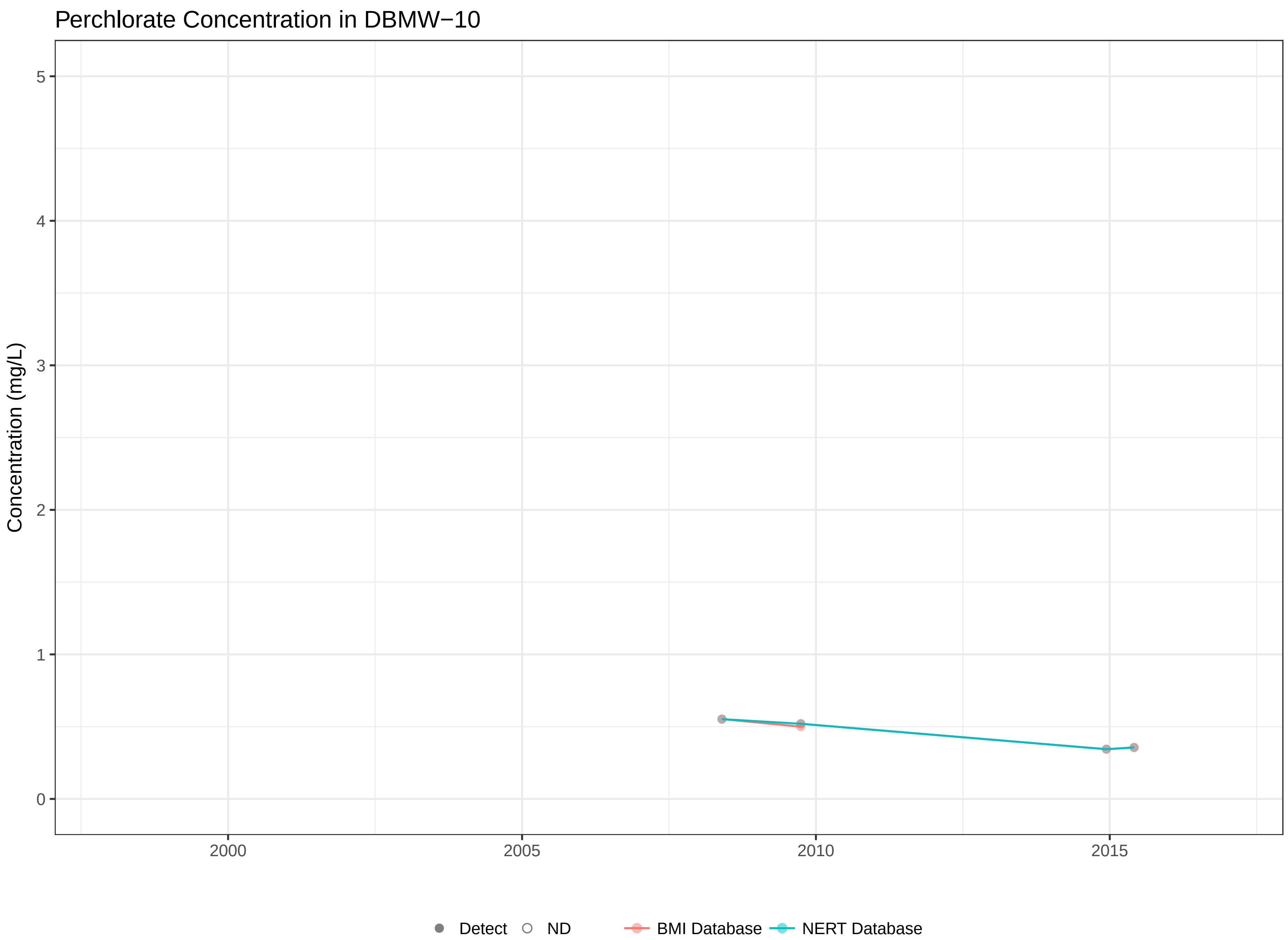
Perchlorate Concentration in BEC−9
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

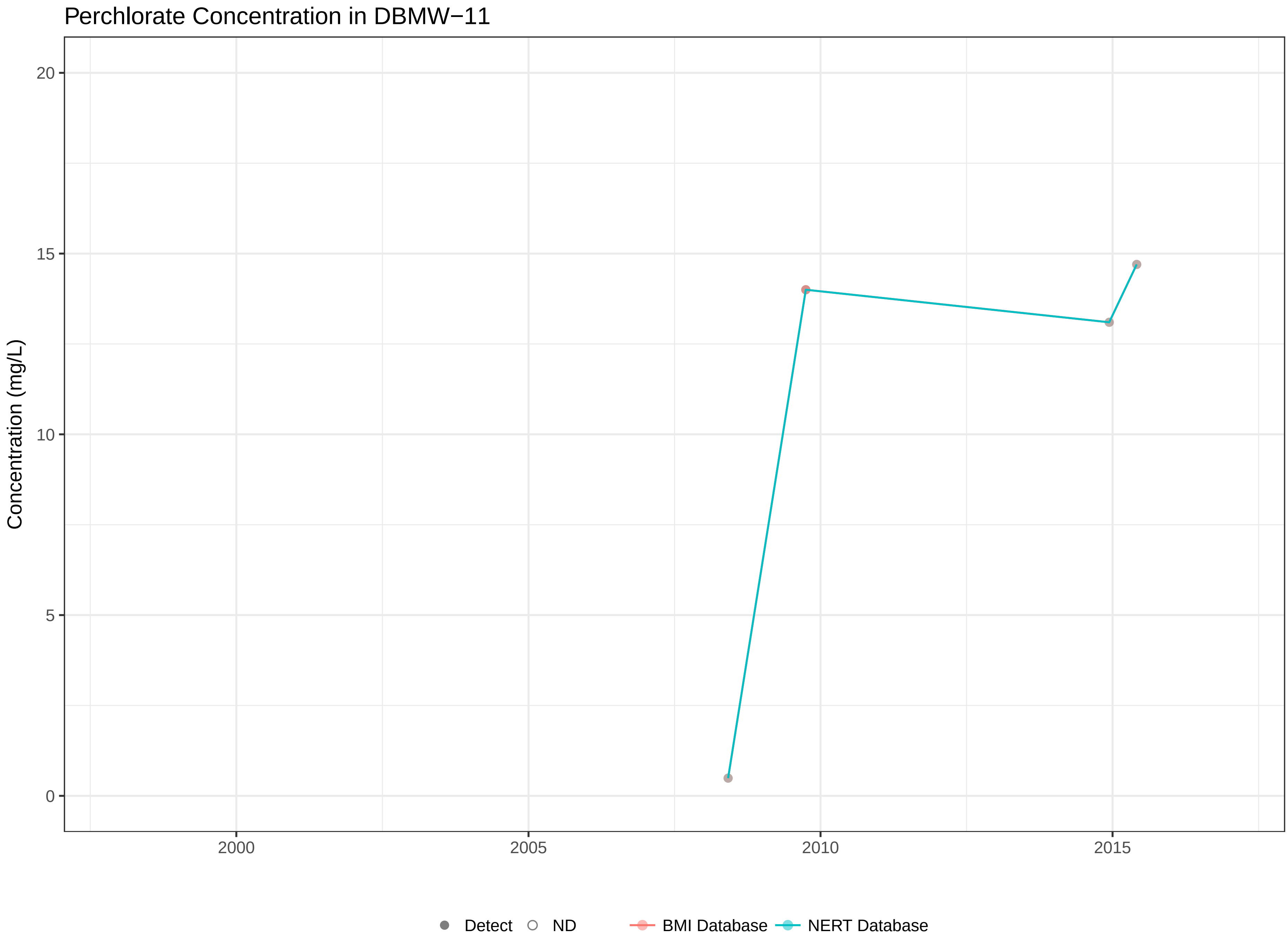
Perchlorate Concentration in DBMW−03



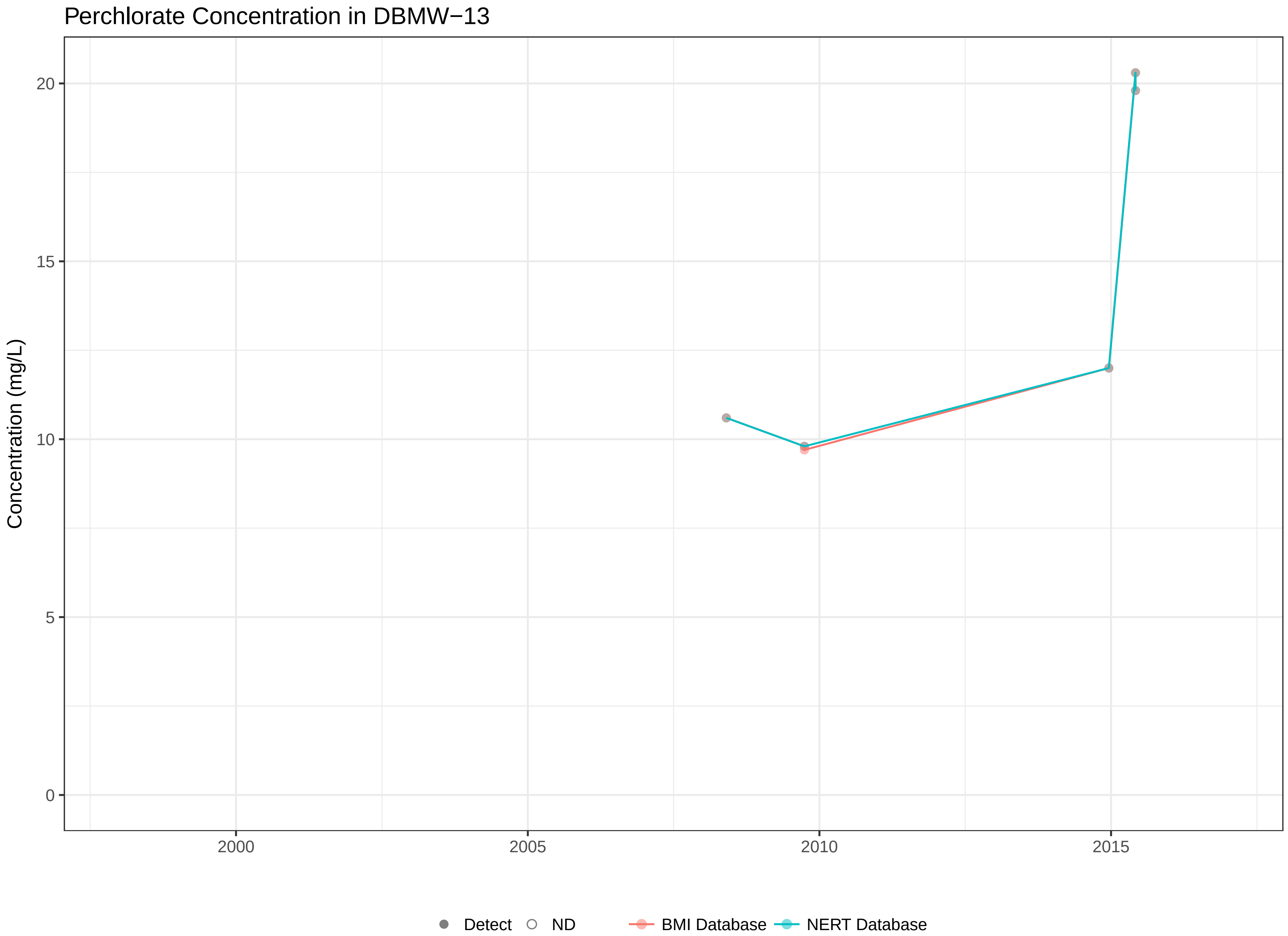


Perchlorate Concentration in DBMW−05
Concentration (mg/L)
0
5
10
15
20
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

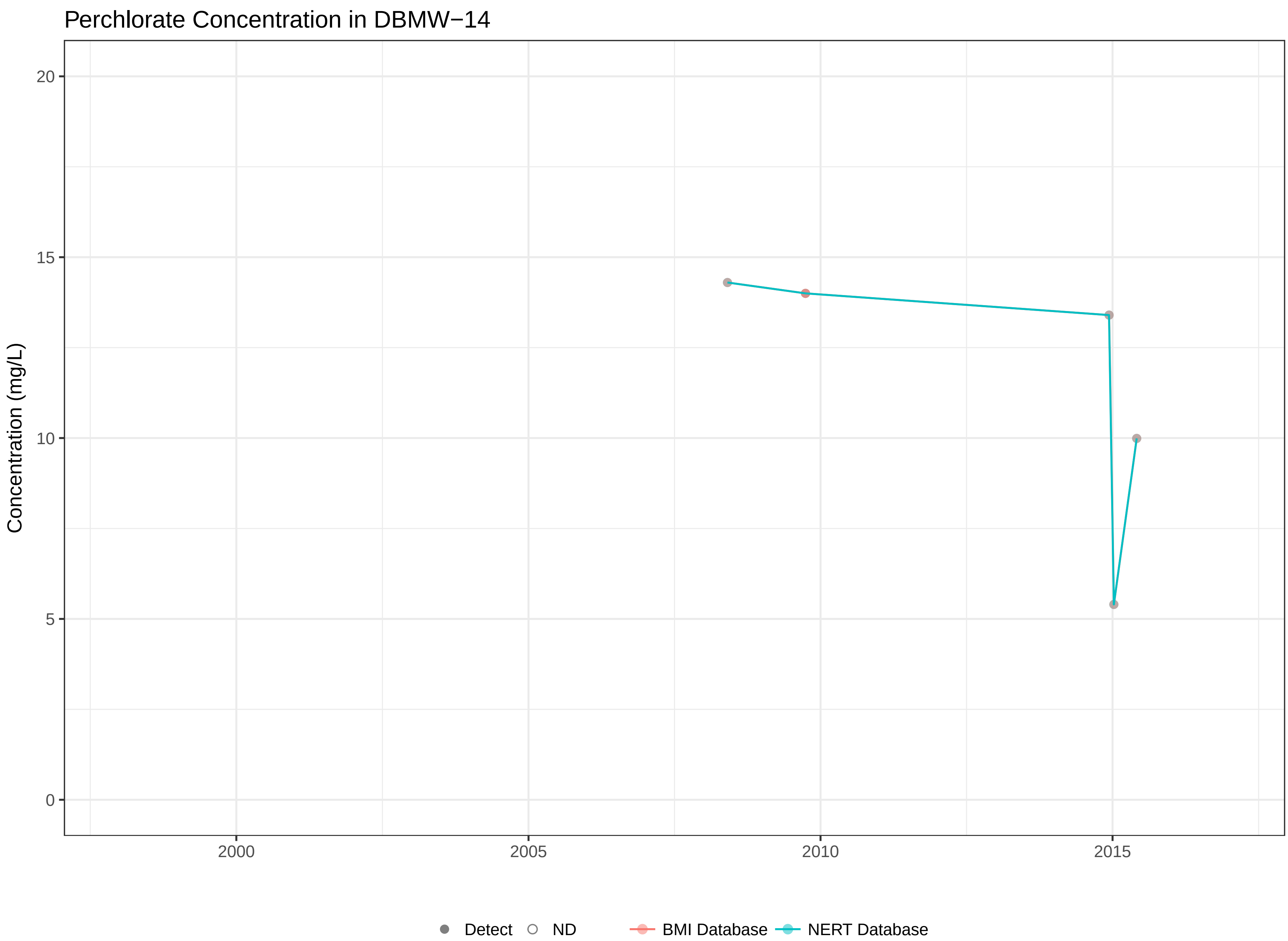

Perchlorate Concentration in DBMW−10
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



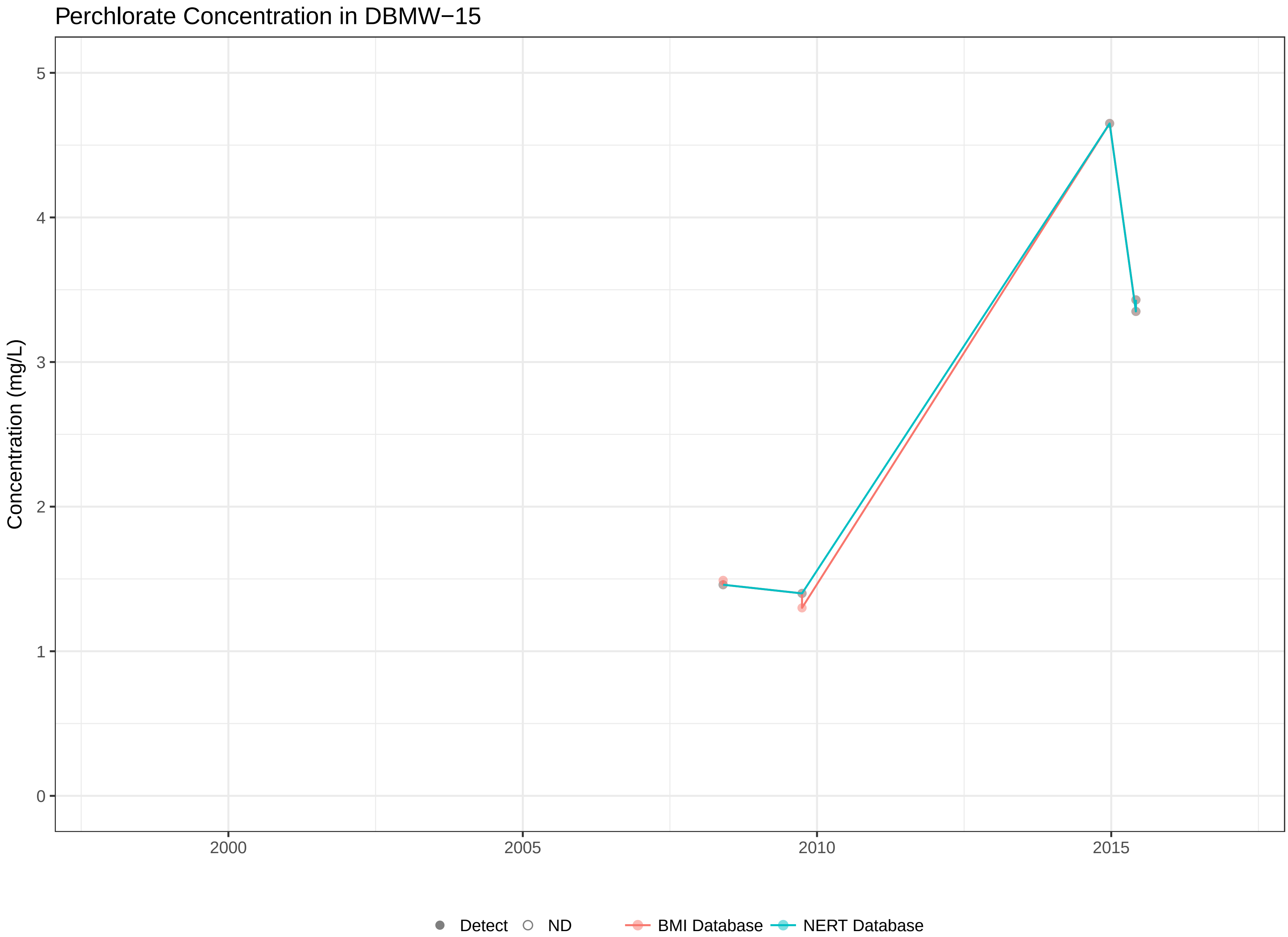
Perchlorate Concentration in DBMW−11
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



Perchlorate Concentration in DBMW−13
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

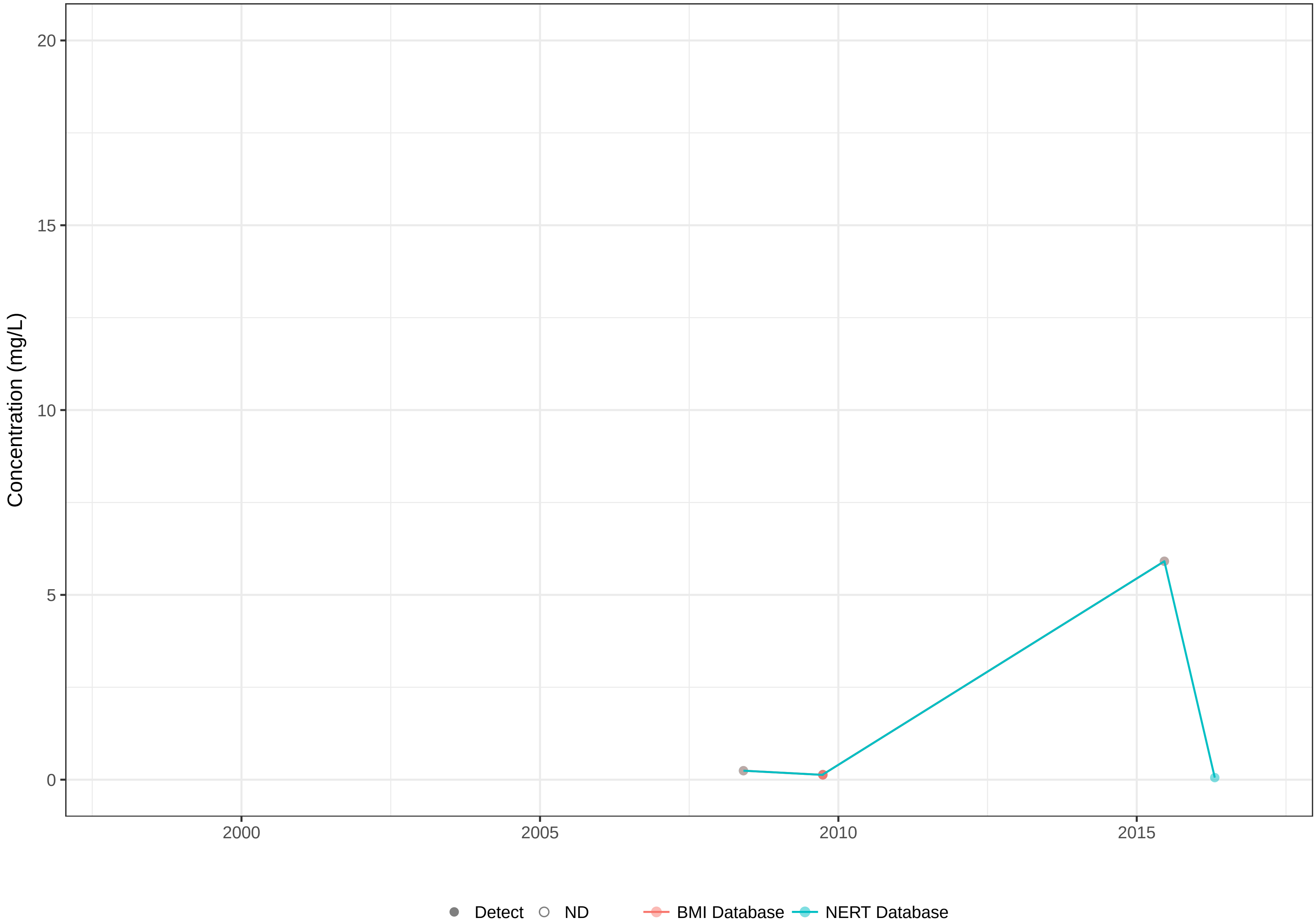


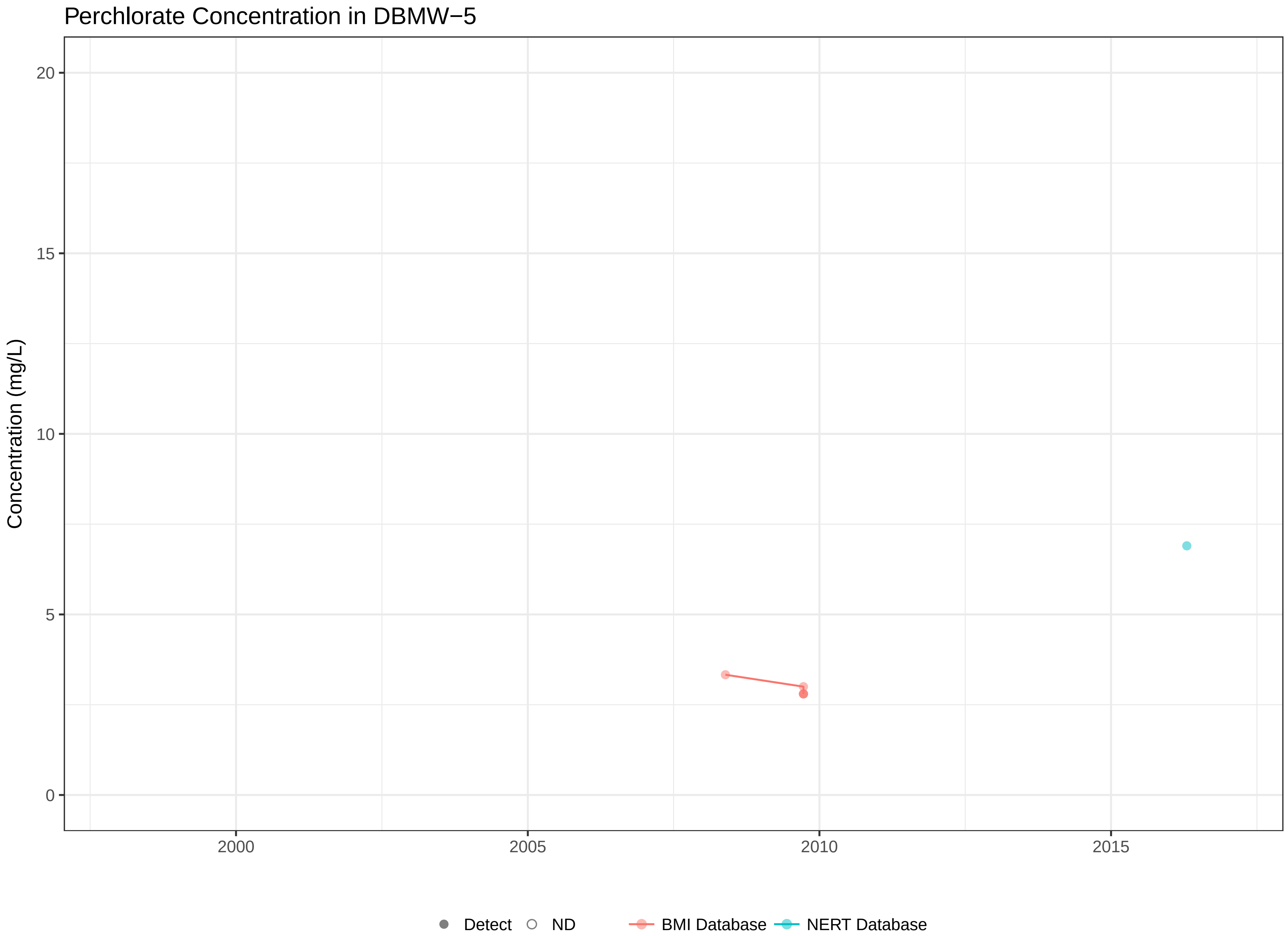
Perchlorate Concentration in DBMW−14
Concentration (mg/L)
0
5
10
15
20
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



Perchlorate Concentration in DBMW−15
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

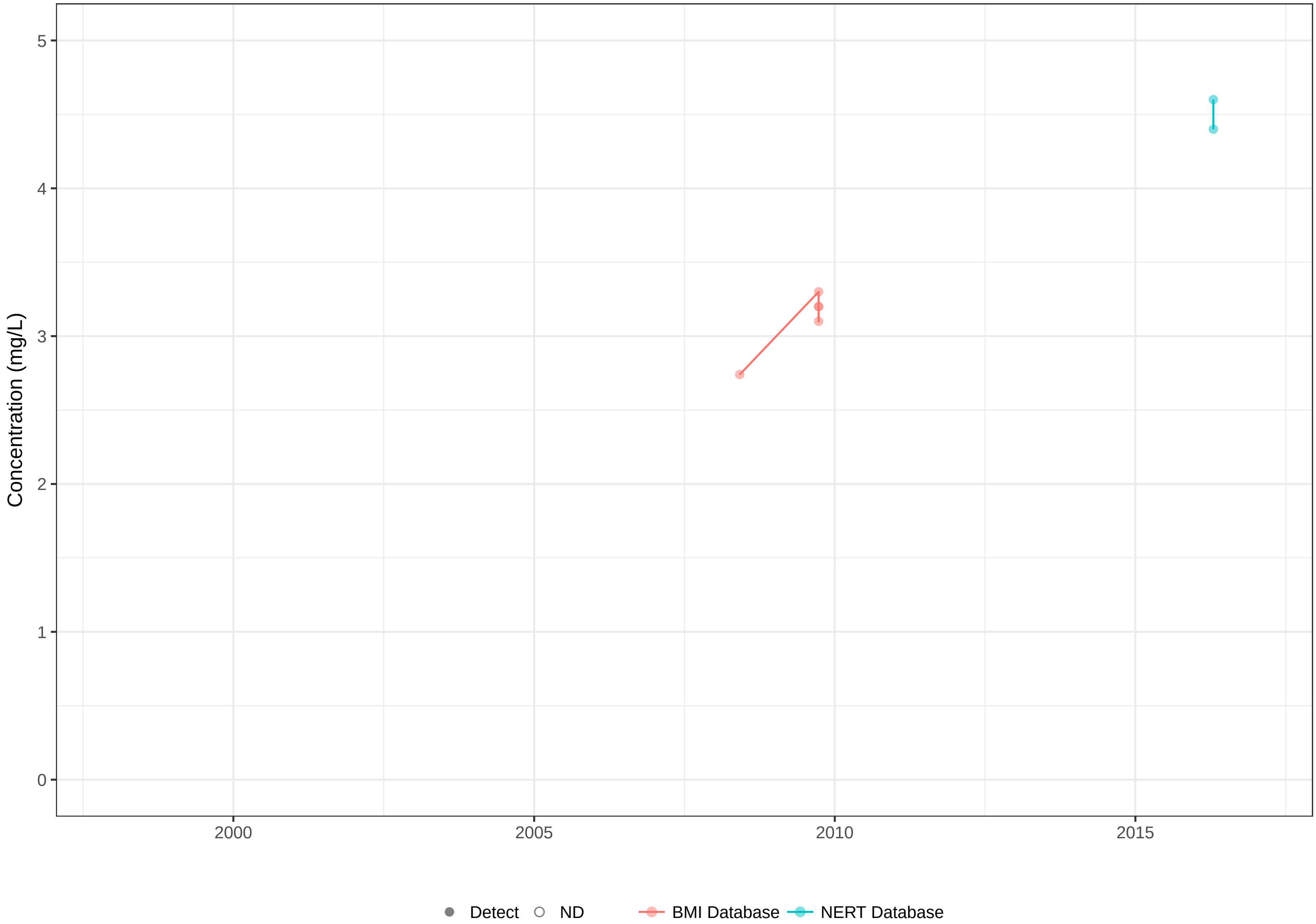
Perchlorate Concentration in DBMW−22

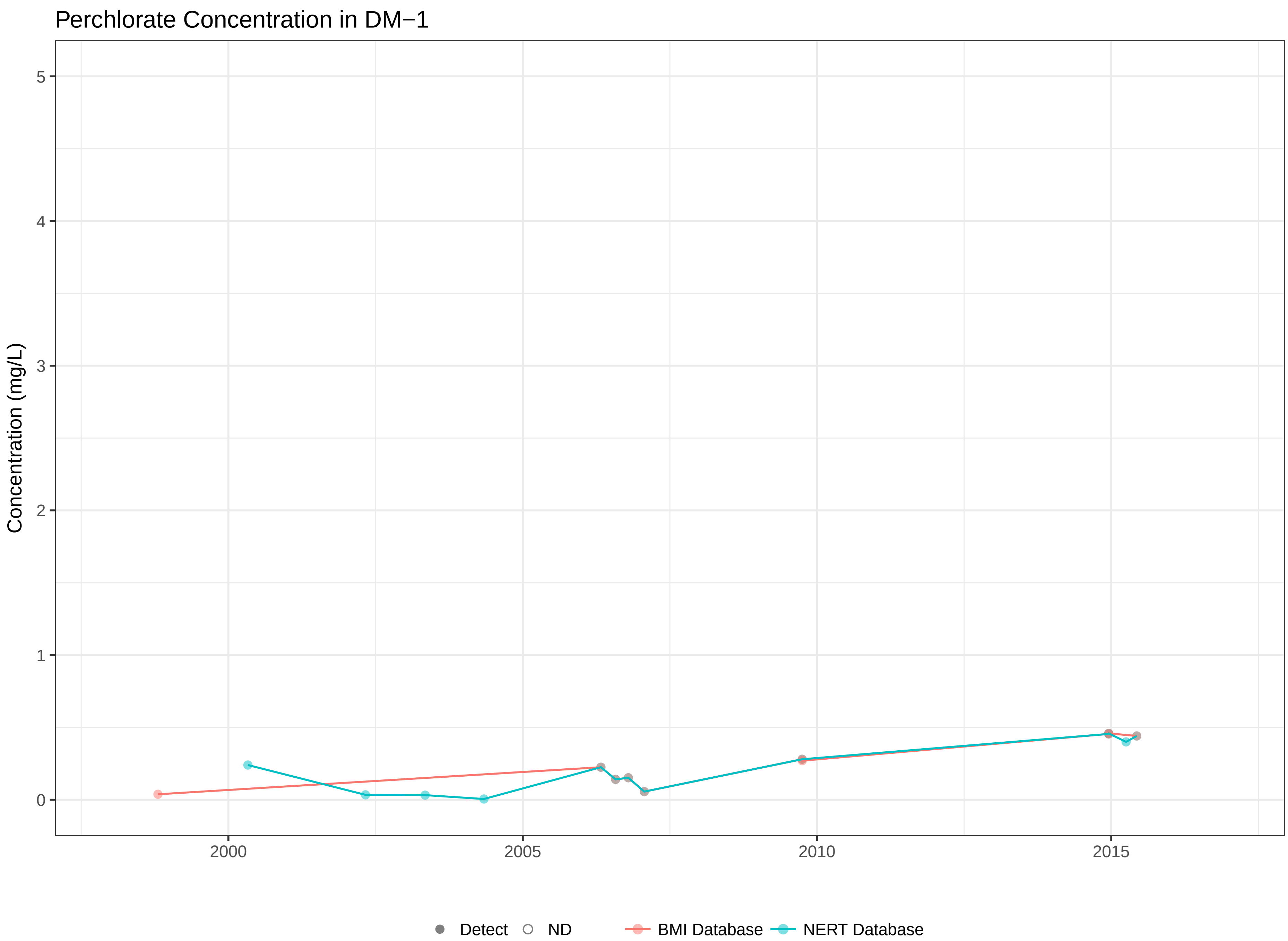




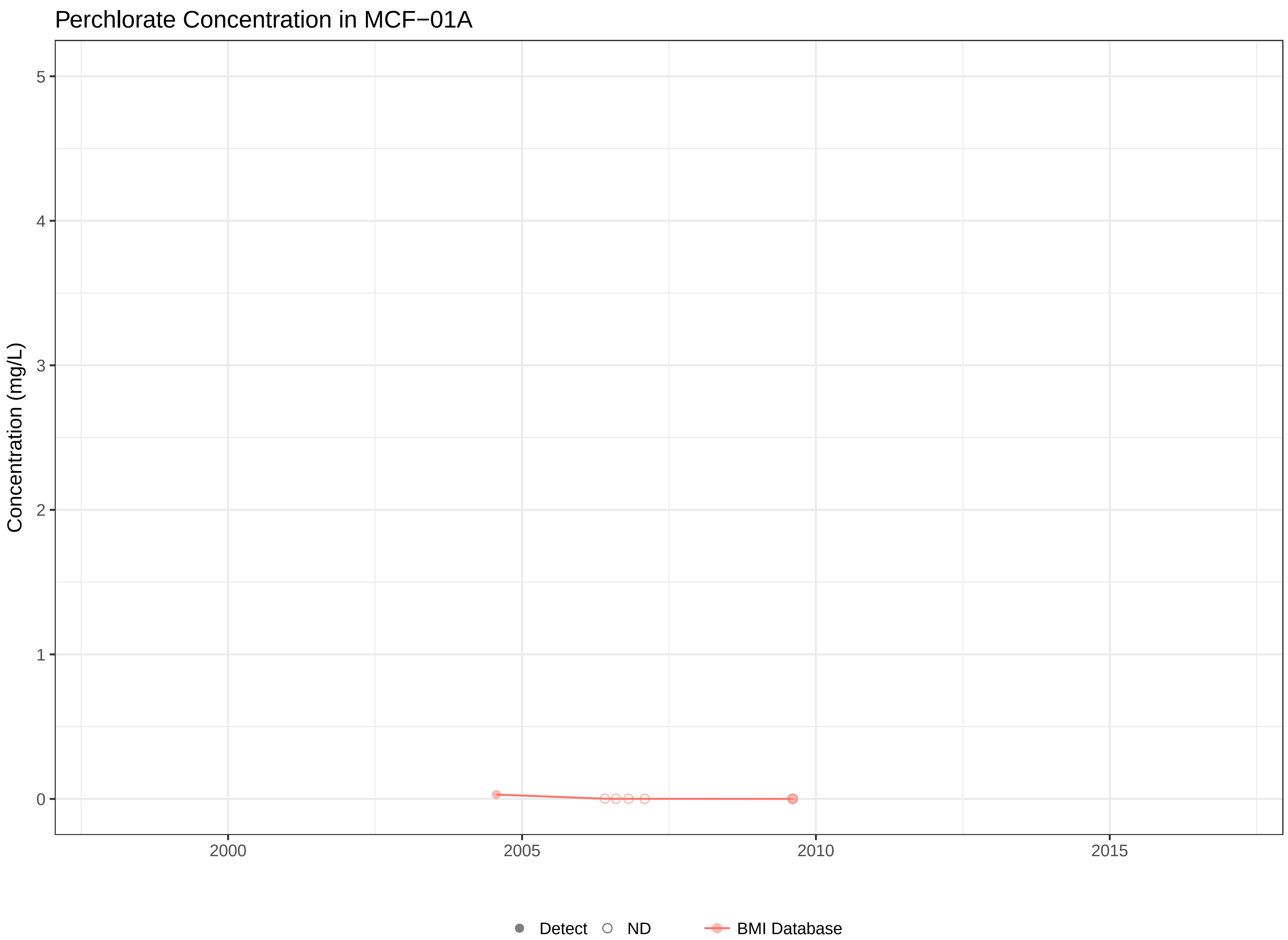
Perchlorate Concentration in DBMW−5
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

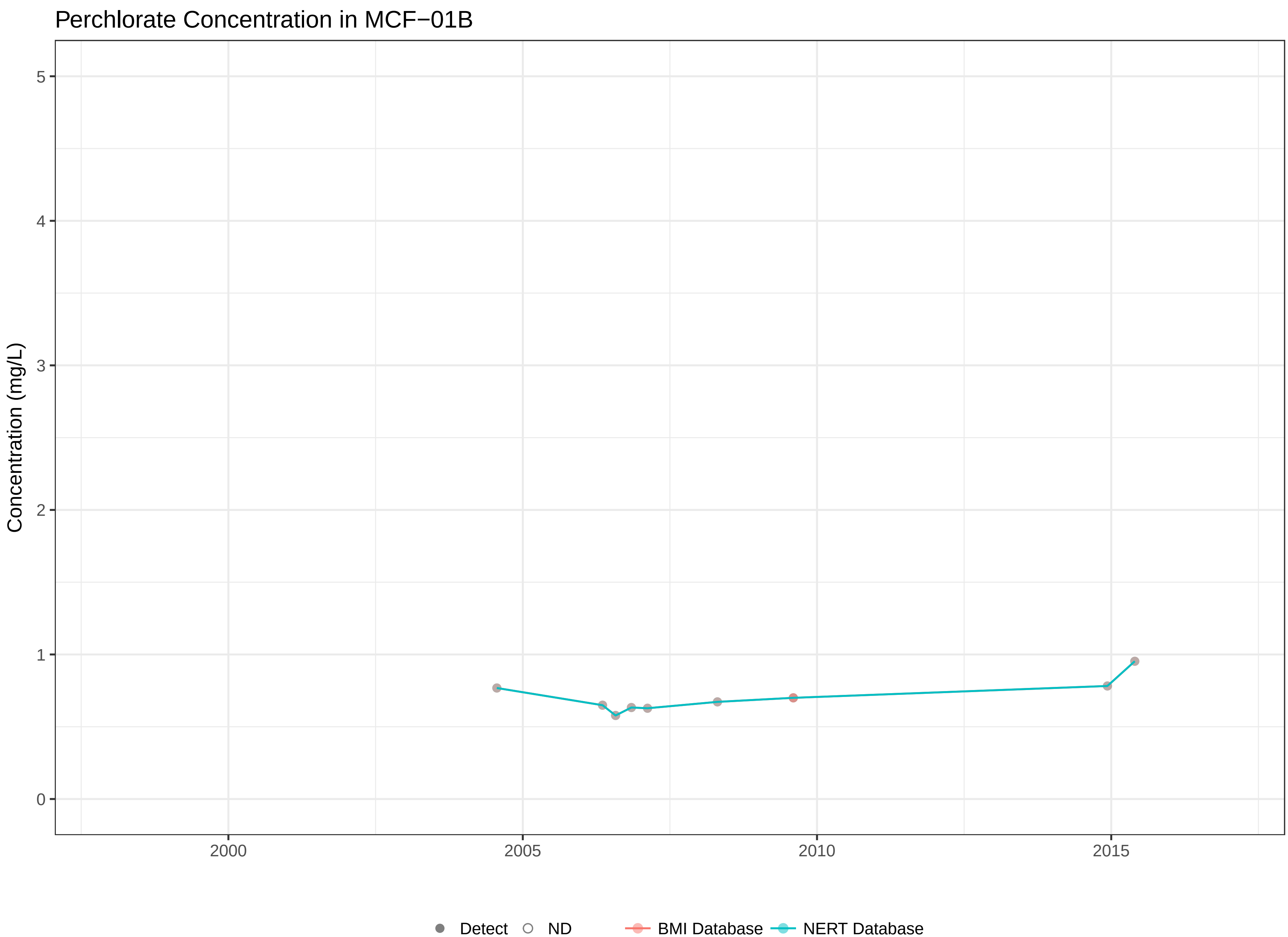
Perchlorate Concentration in DBMW−7



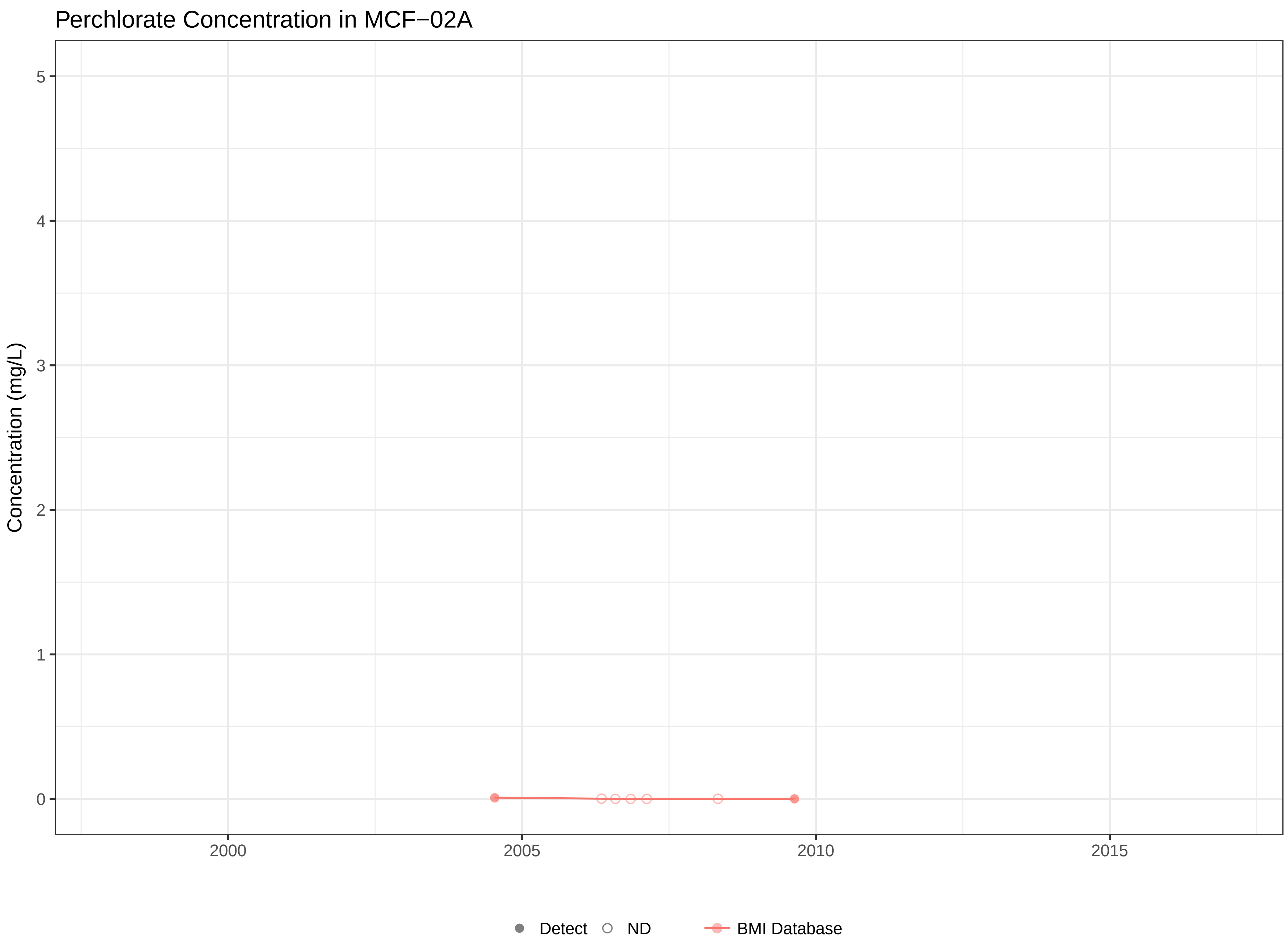


Perchlorate Concentration in DM−1
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

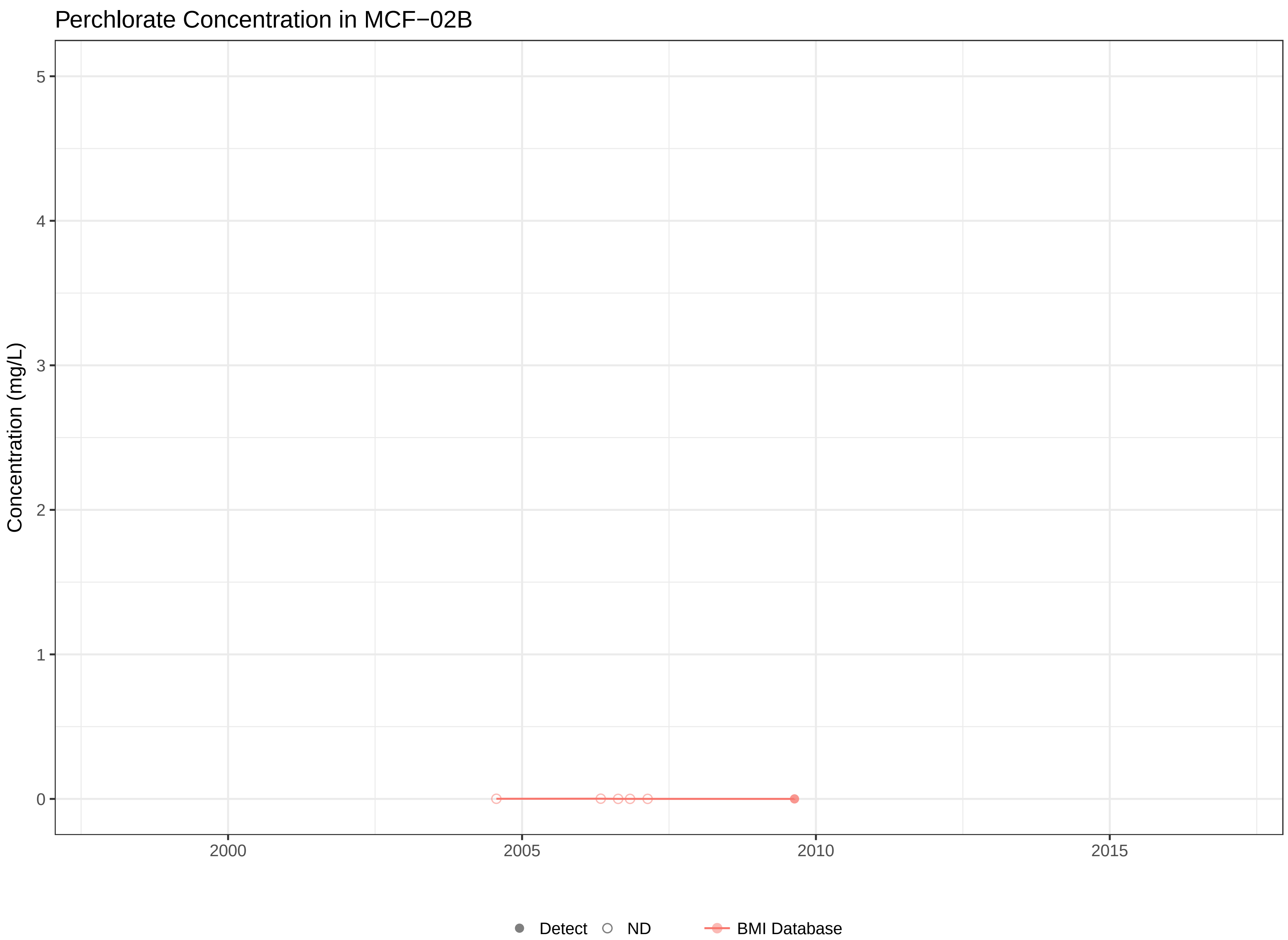

Perchlorate Concentration in MCF−01A
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database



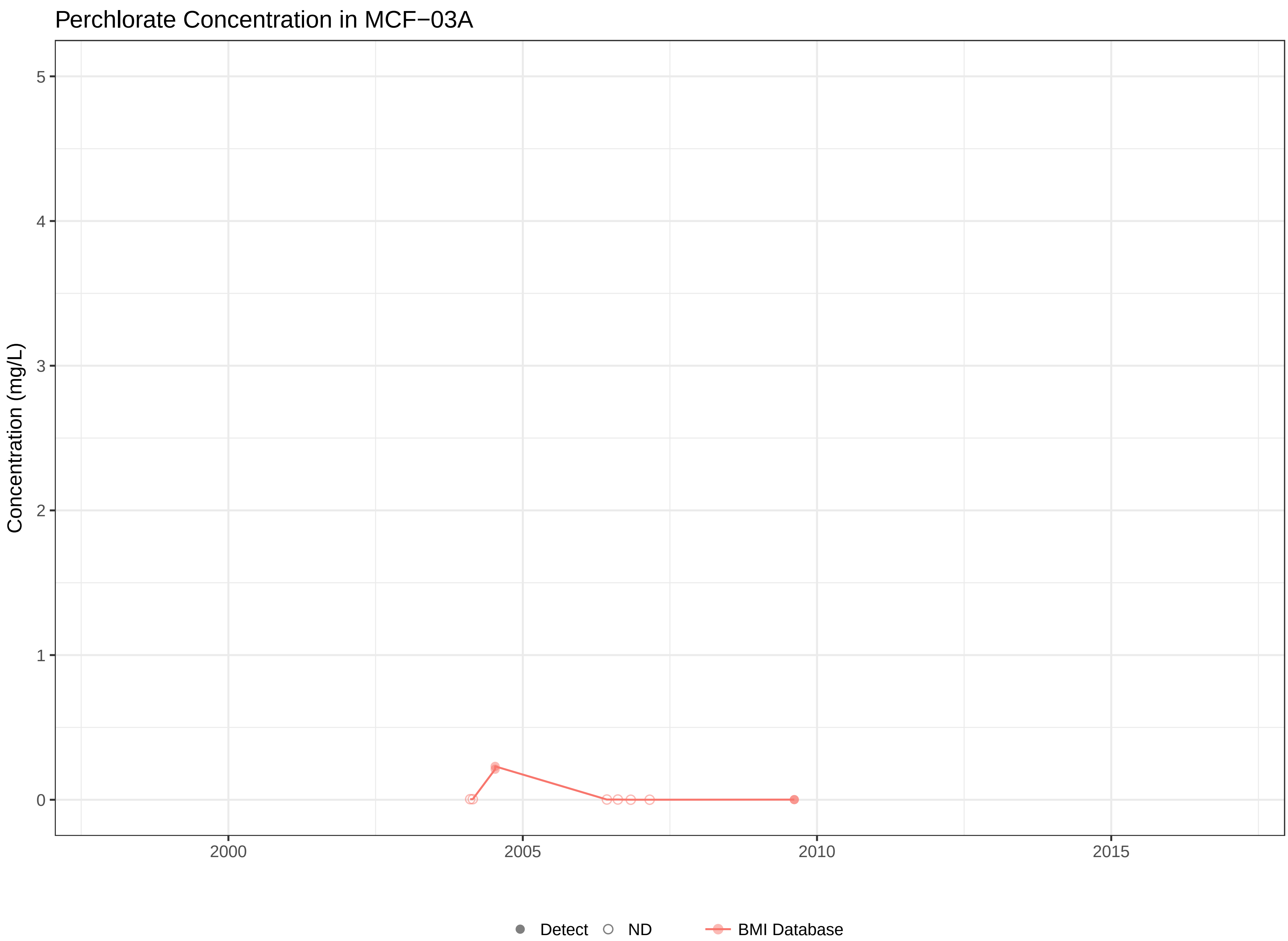
Perchlorate Concentration in MCF−01B
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

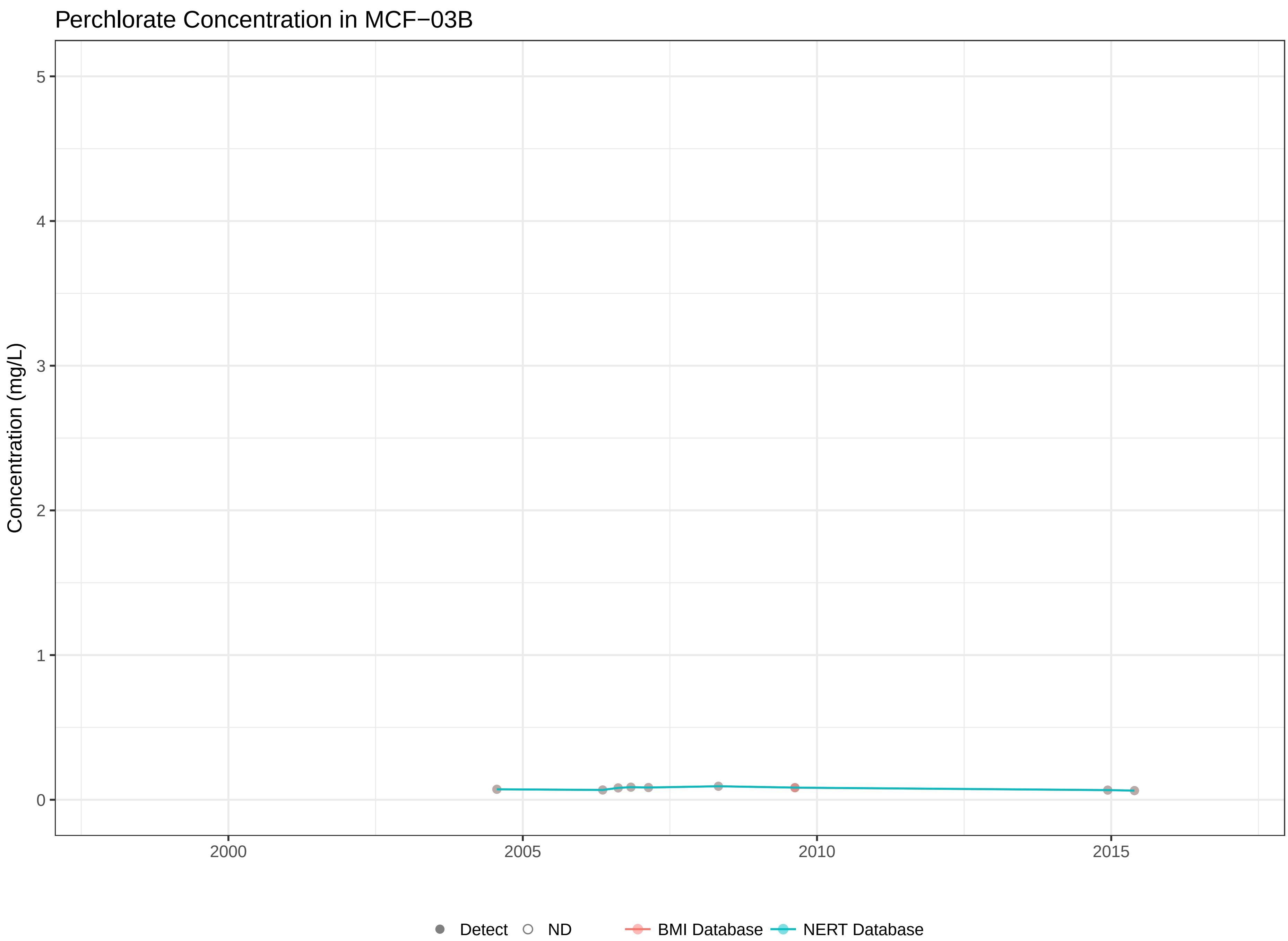


Perchlorate Concentration in MCF−02A
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

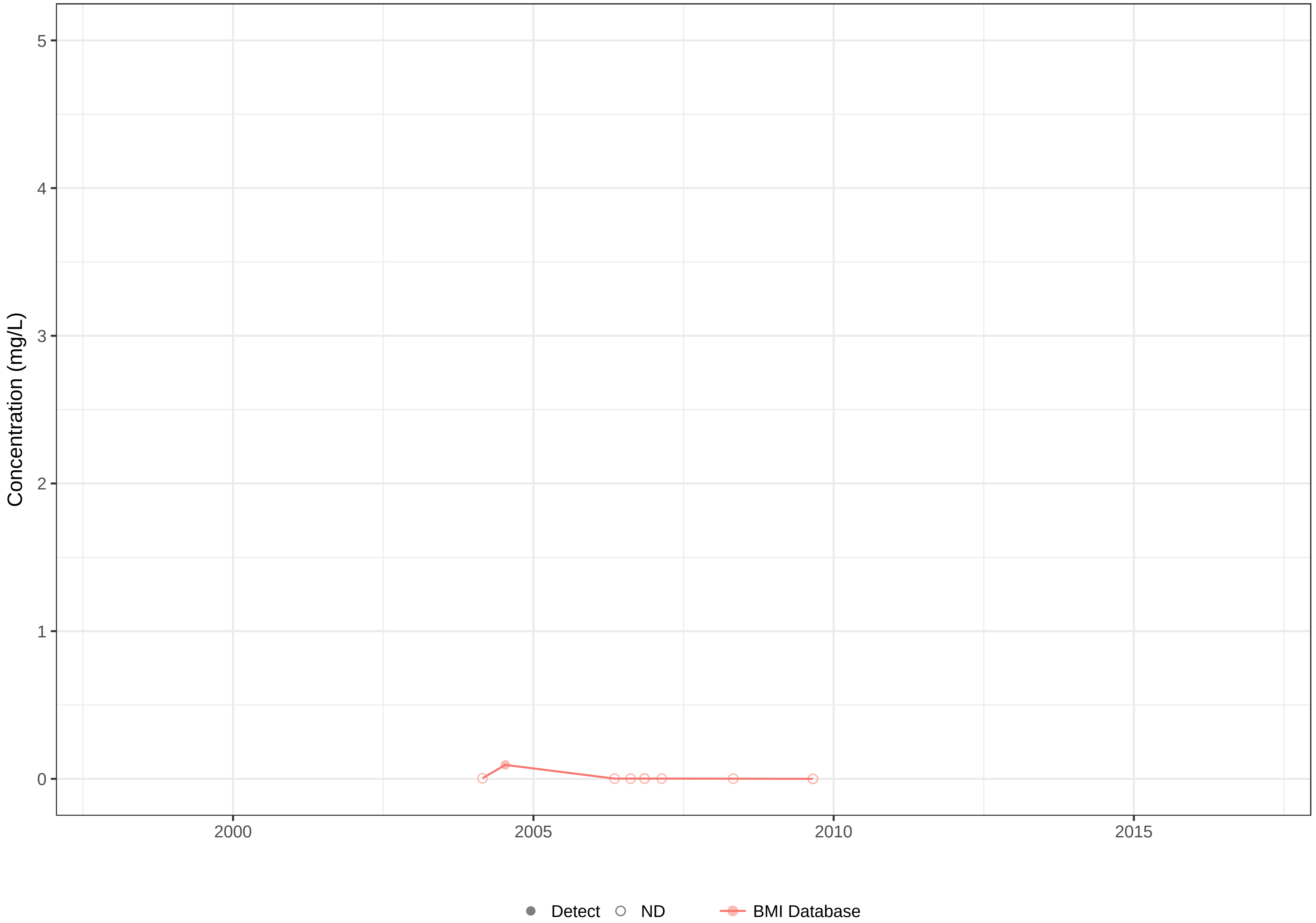


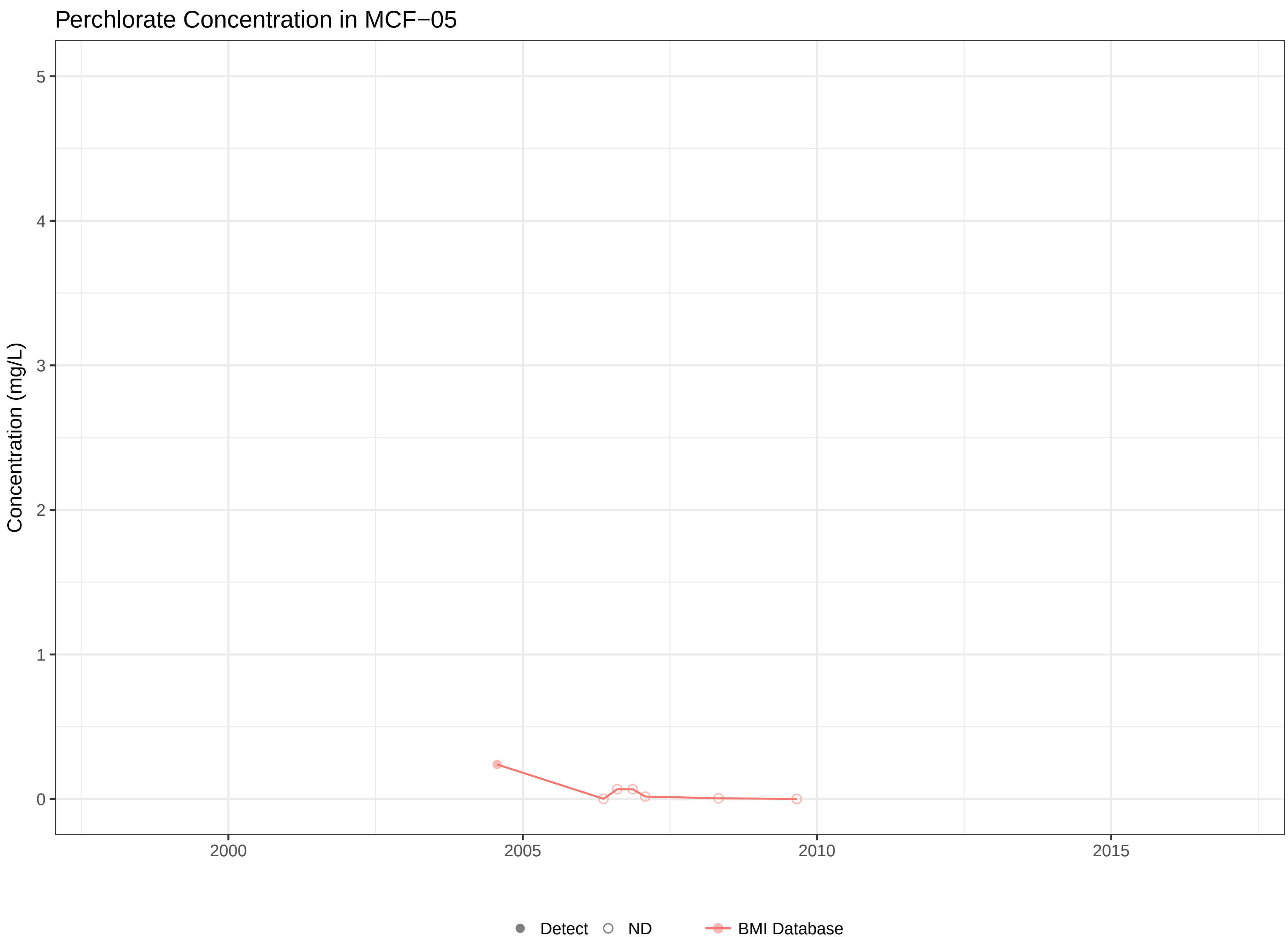
Perchlorate Concentration in MCF−02B
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database


Perchlorate Concentration in MCF−03A
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database


Perchlorate Concentration in MCF−03B
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

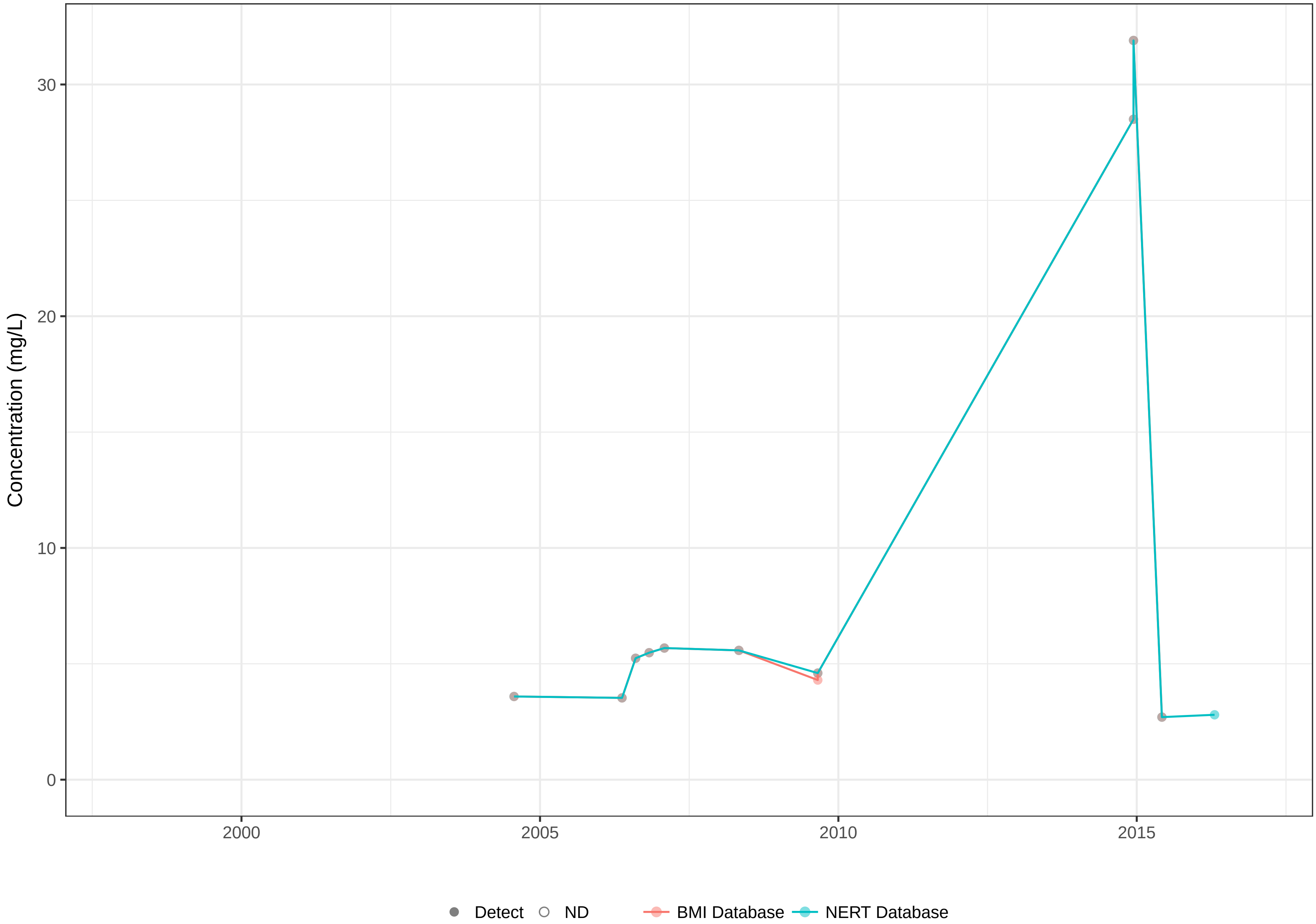
Perchlorate Concentration in MCF−04



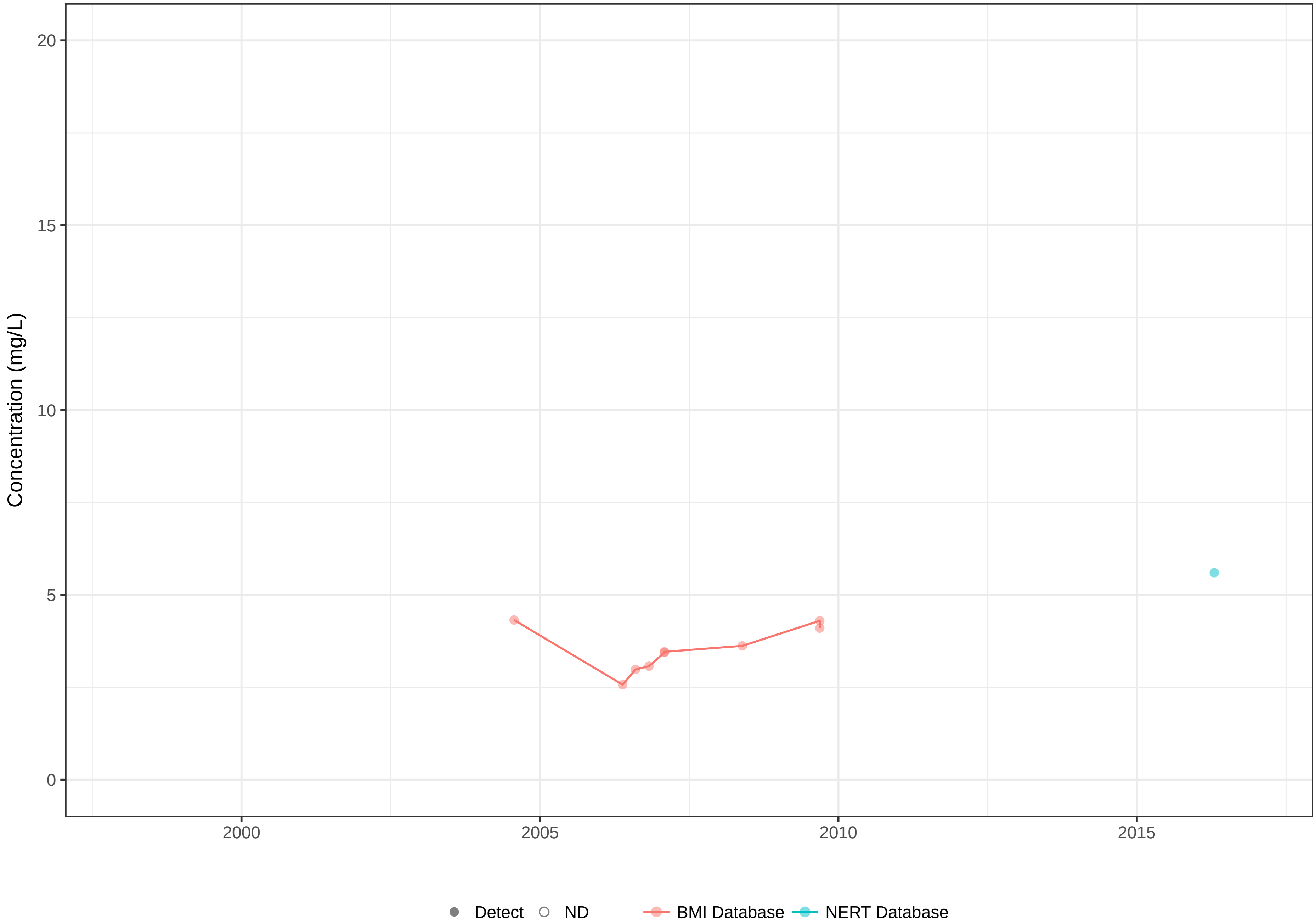


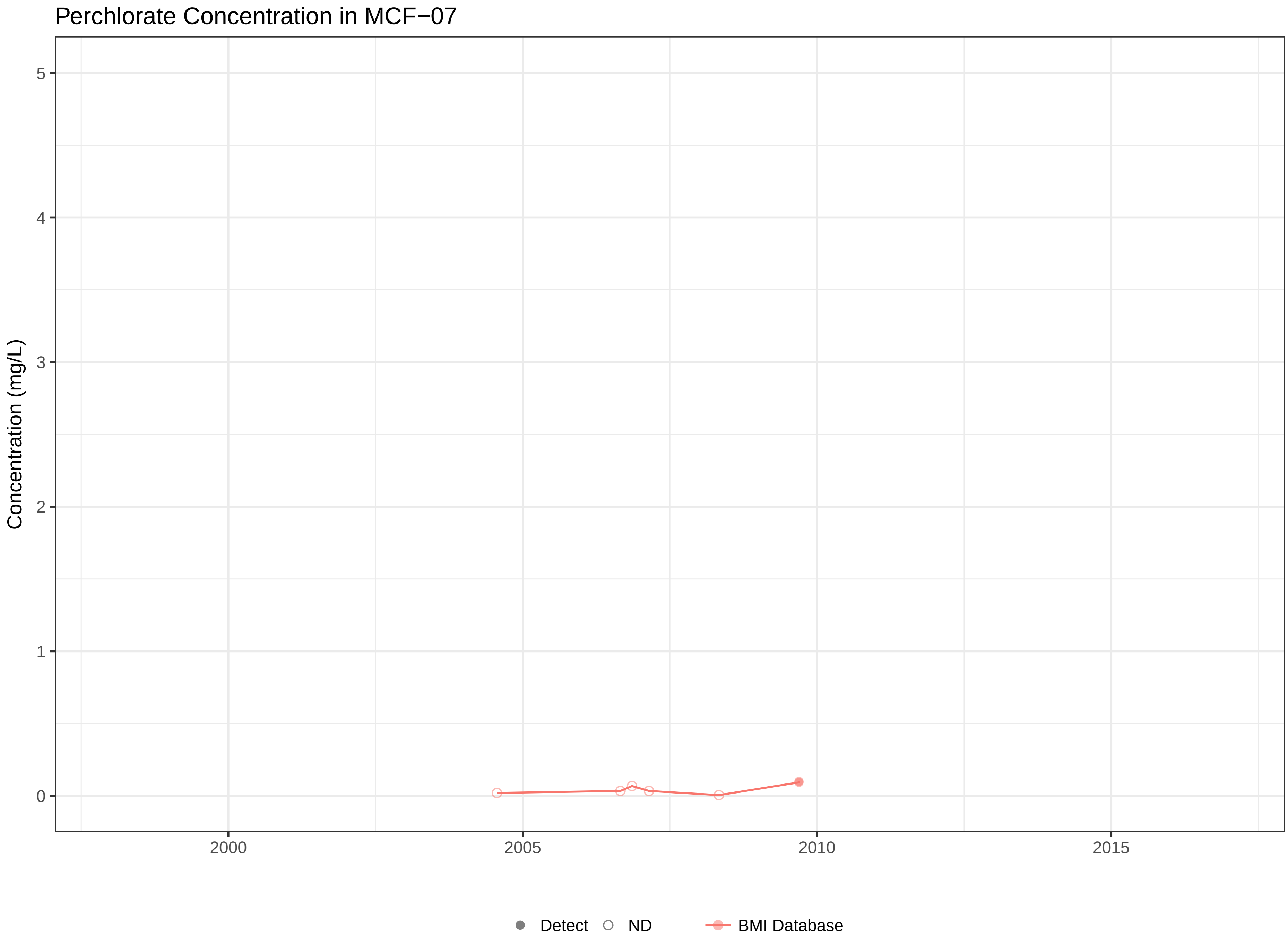
Perchlorate Concentration in MCF−05
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database

Perchlorate Concentration in MCF−06B

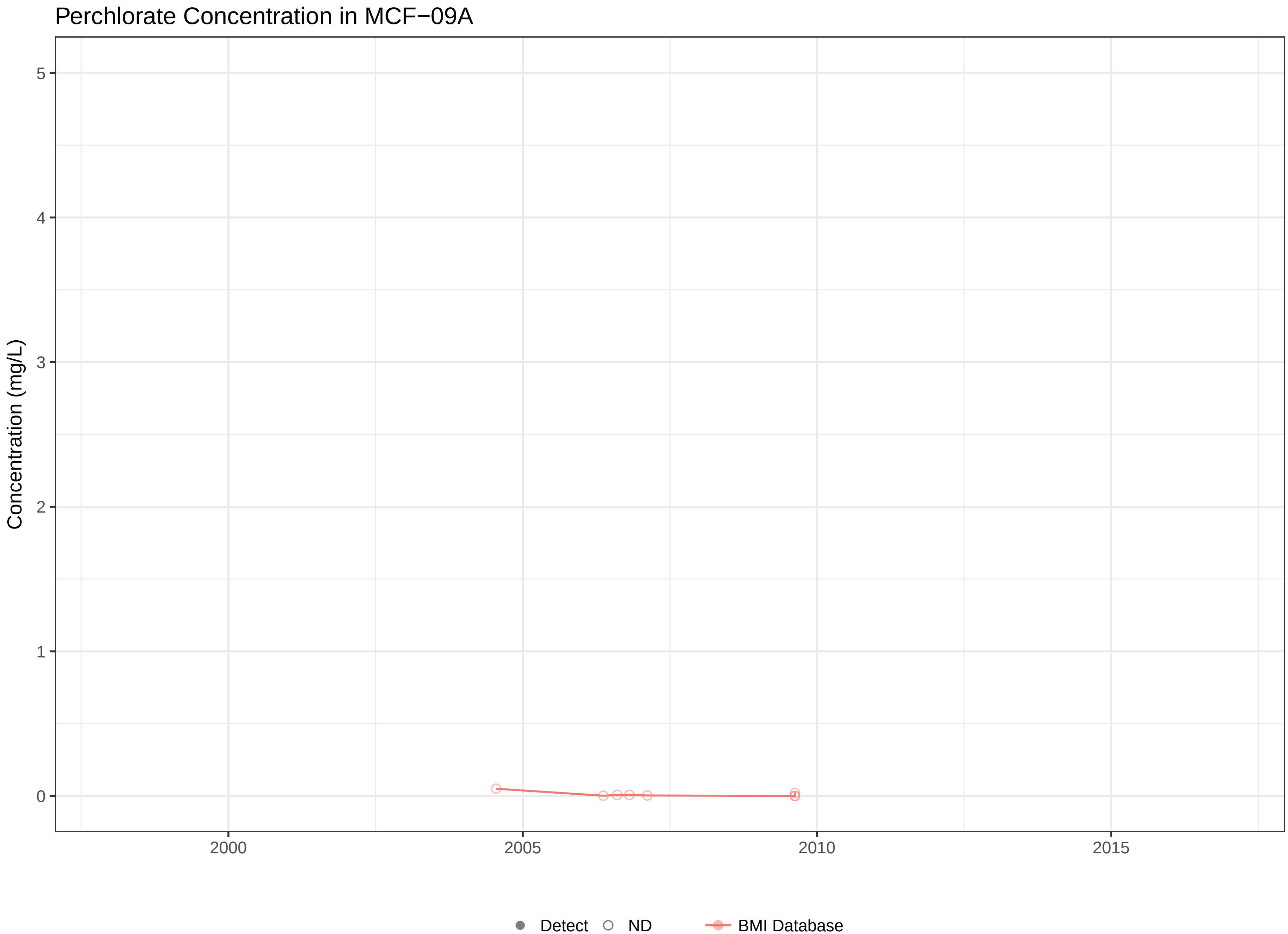


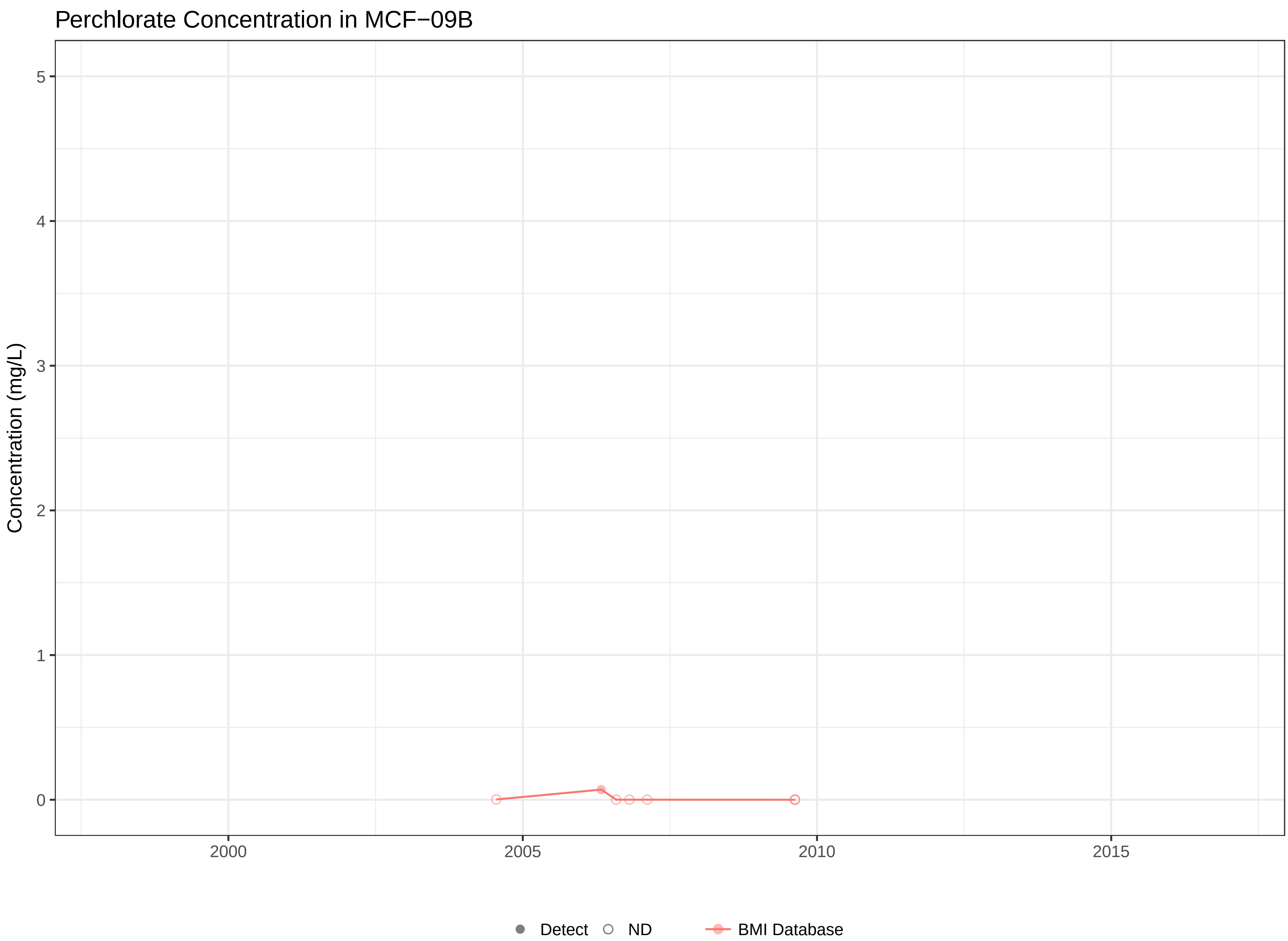
Perchlorate Concentration in MCF−06C



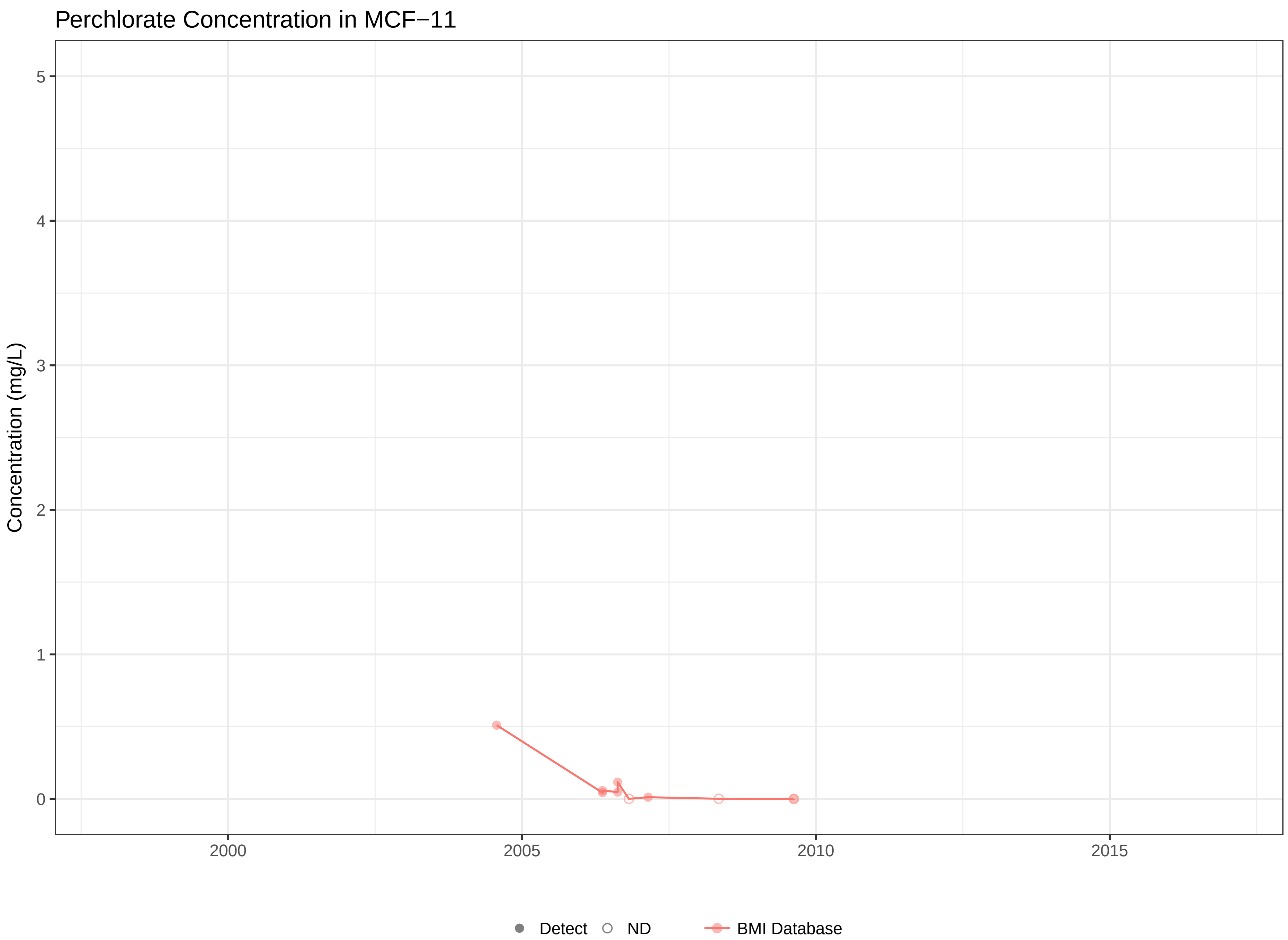


Perchlorate Concentration in MCF−07
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database

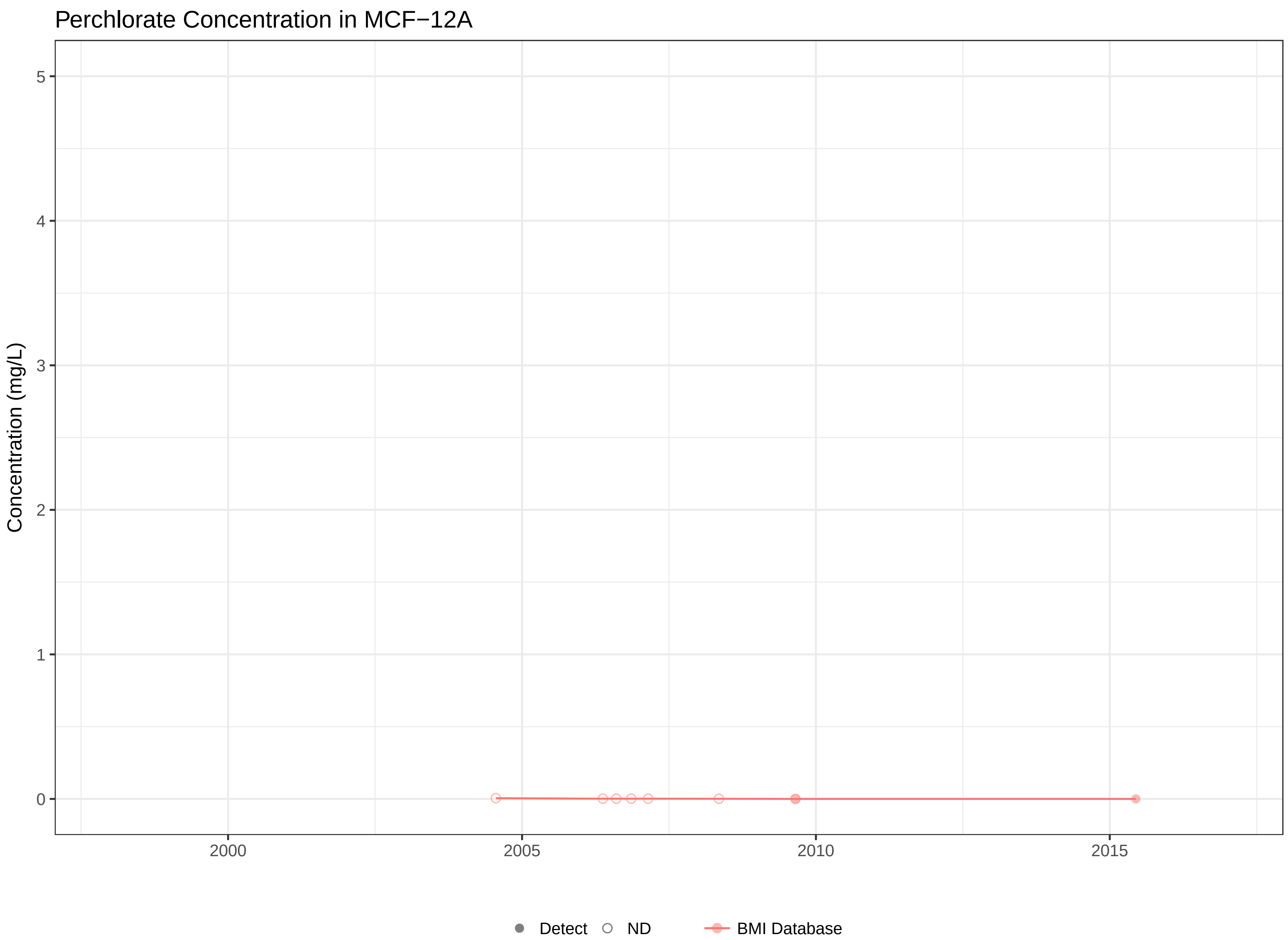

Perchlorate Concentration in MCF−09A
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

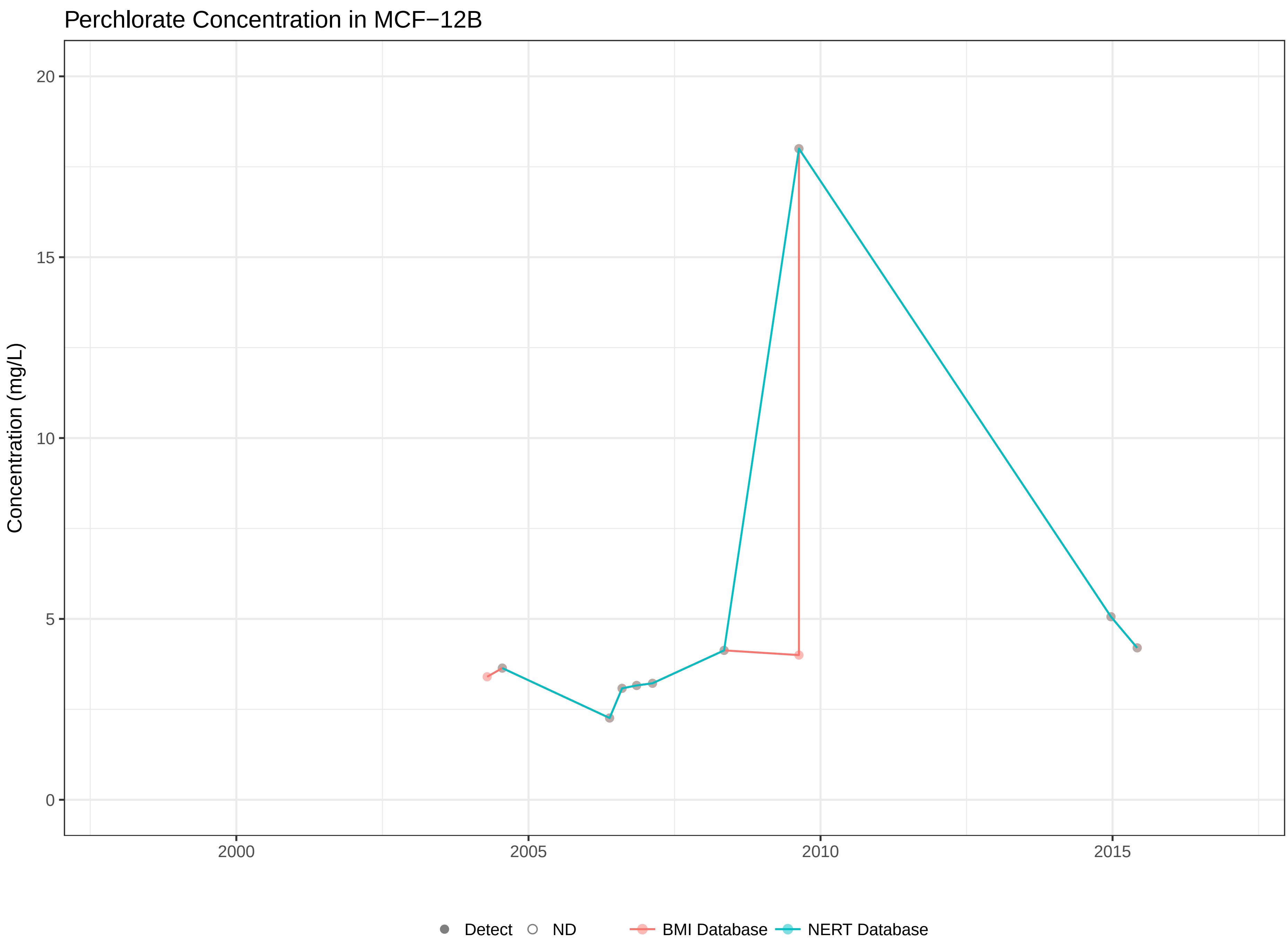


Perchlorate Concentration in MCF−09B
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

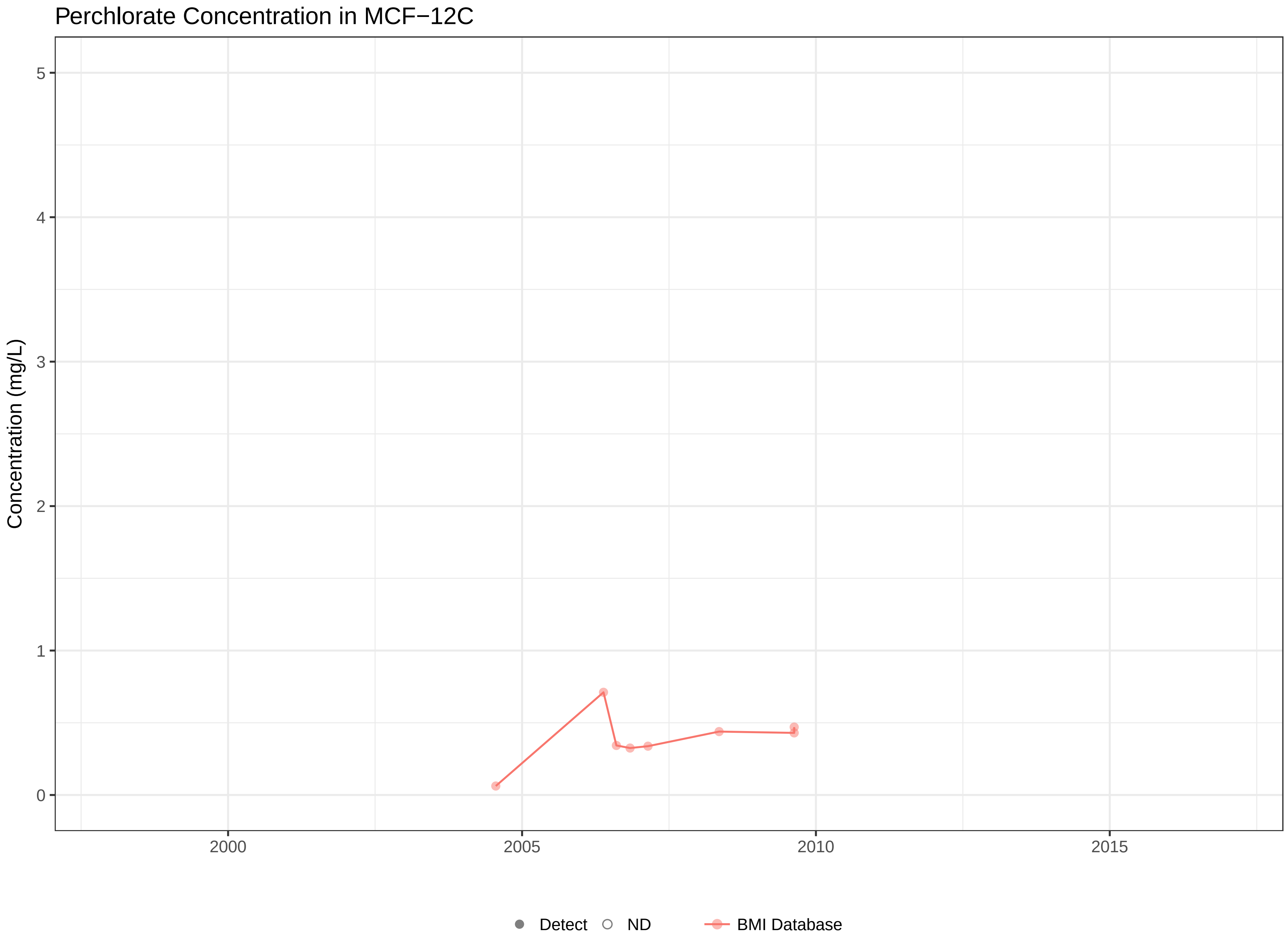


Perchlorate Concentration in MCF−11
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

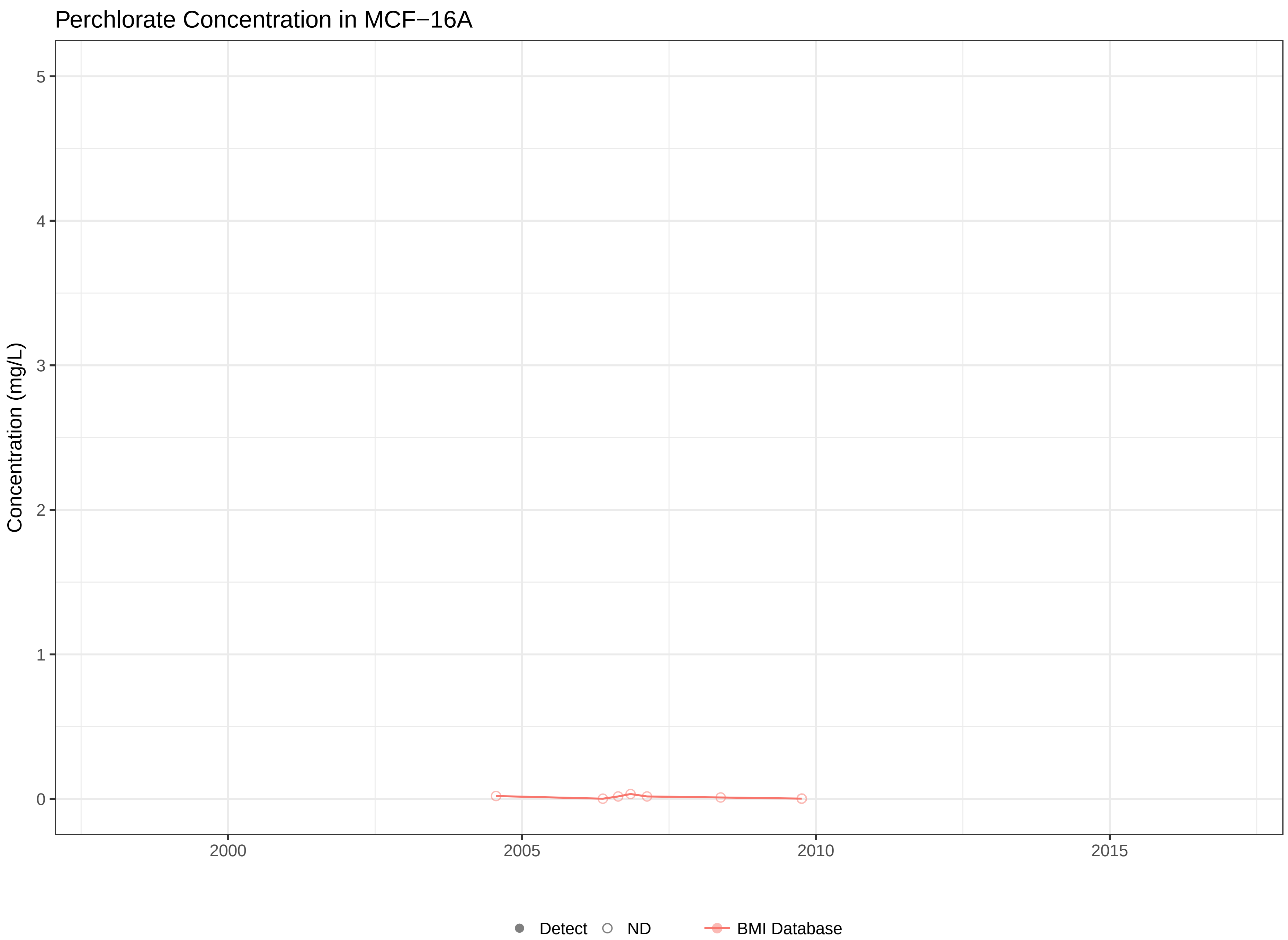

Perchlorate Concentration in MCF−12A
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database

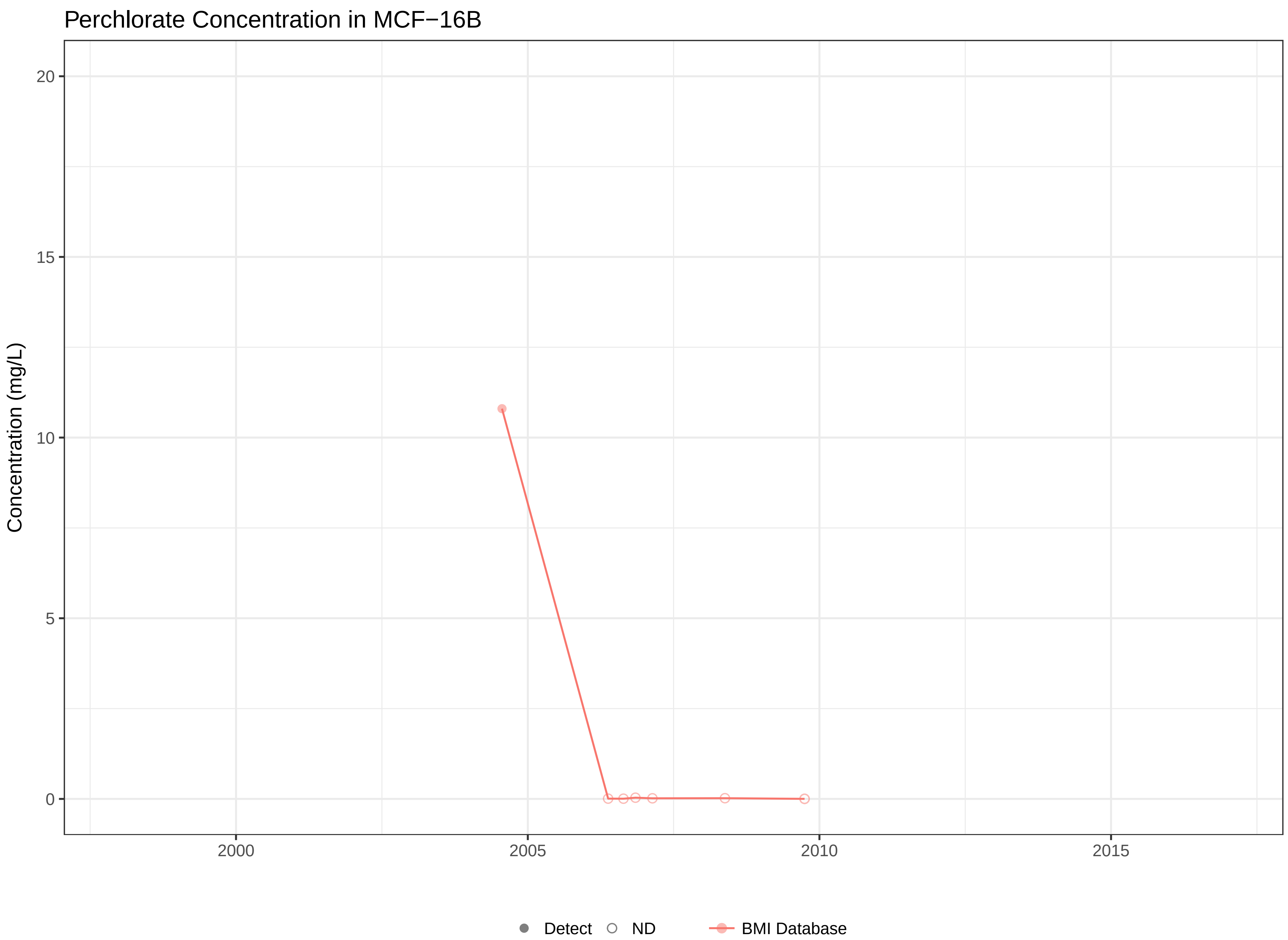


Perchlorate Concentration in MCF−12B
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

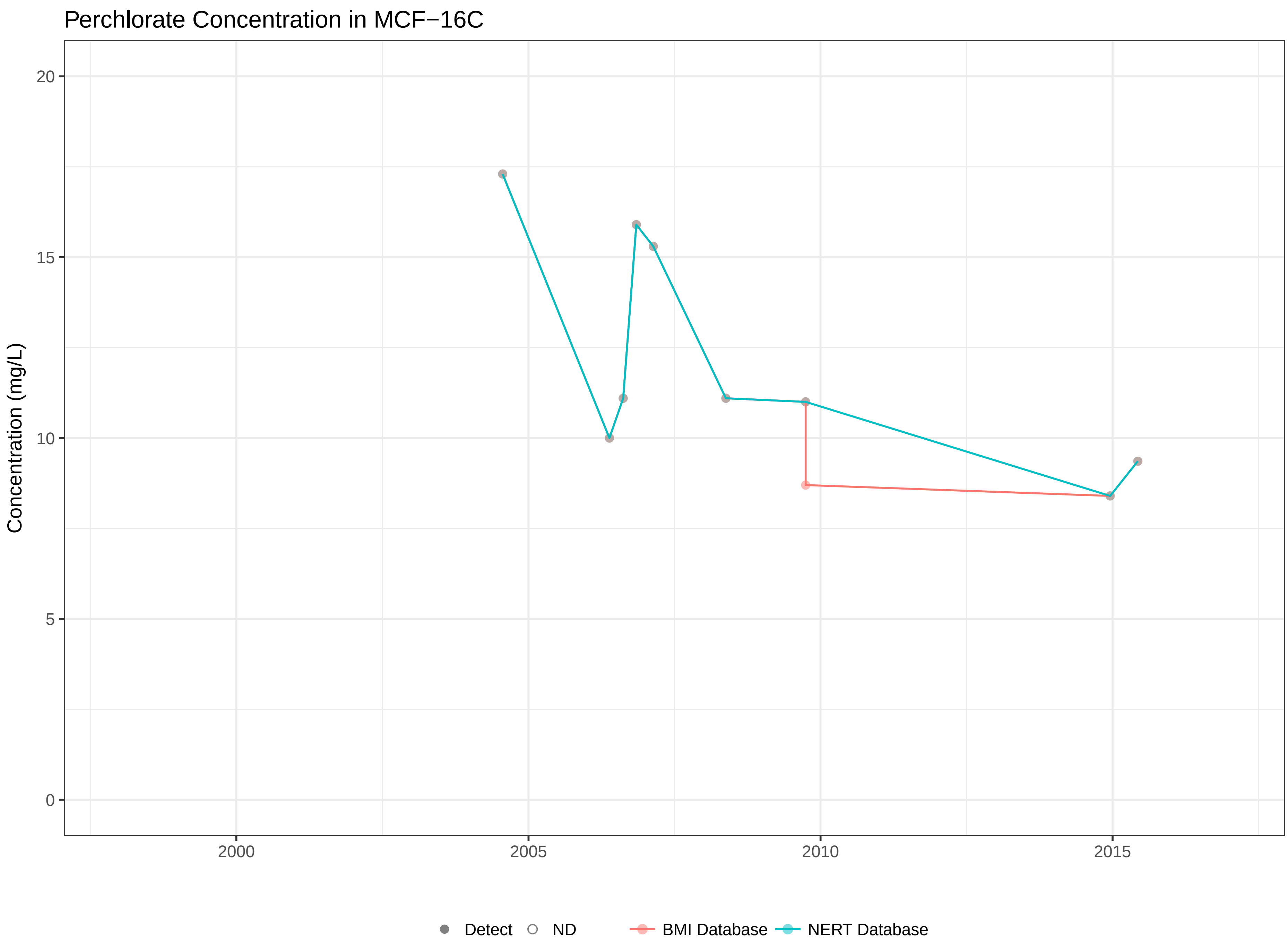


Perchlorate Concentration in MCF−12C
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database

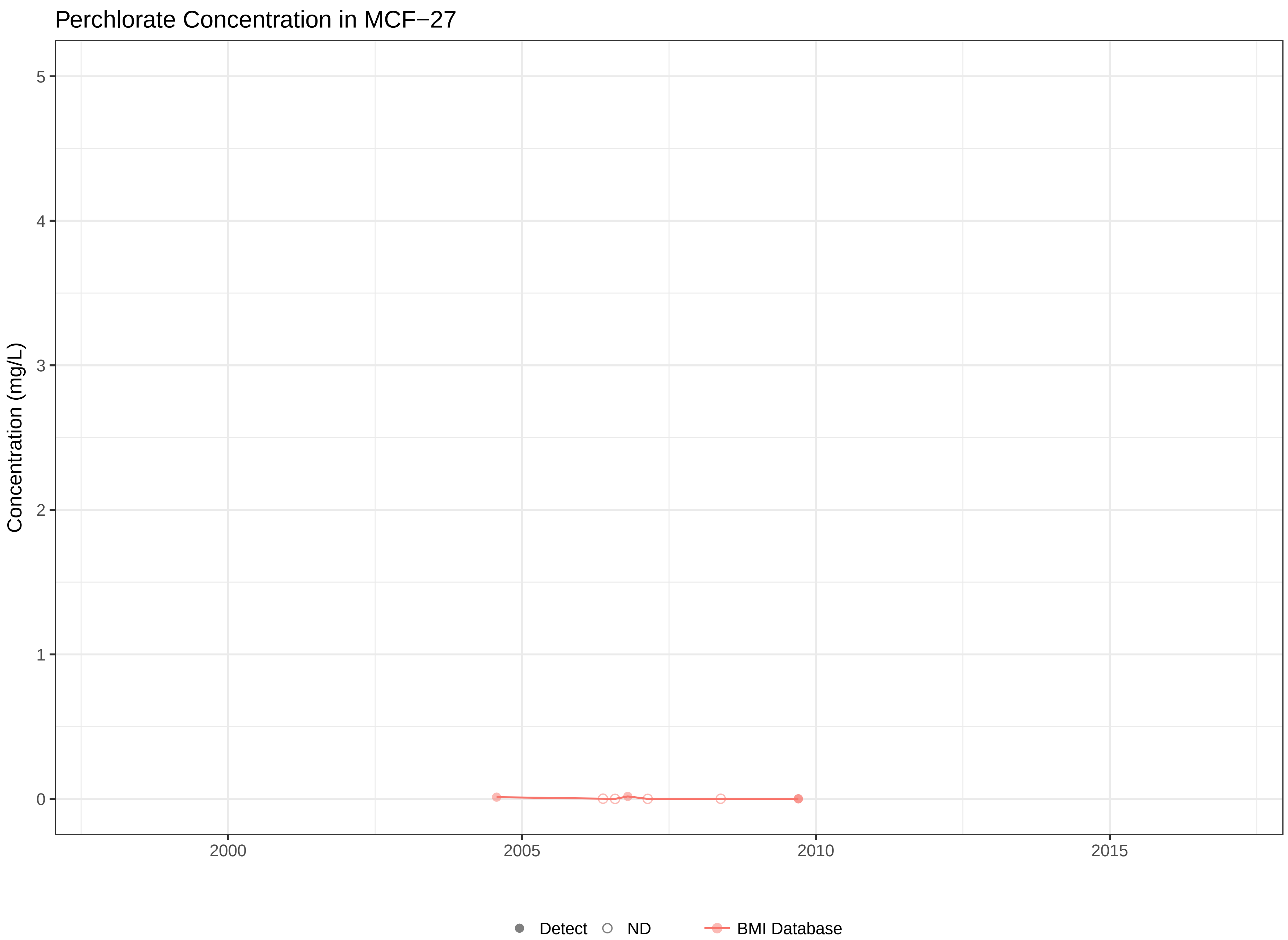

Perchlorate Concentration in MCF−16A
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database



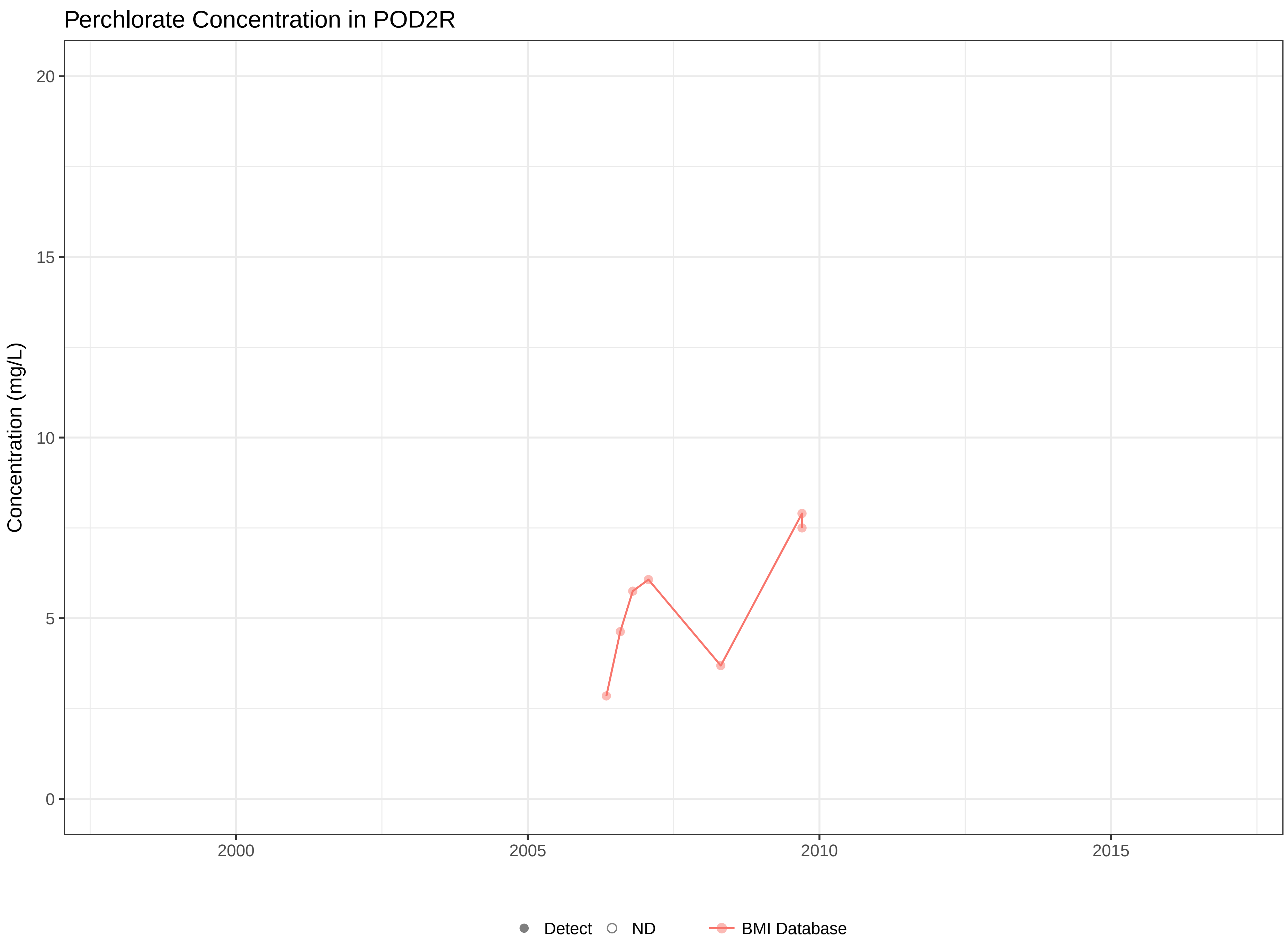
Perchlorate Concentration in MCF−16B
Concentration (mg/L)
20
15
10
5
0
2000
2005
2010
2015
Detect
ND
BMI Database

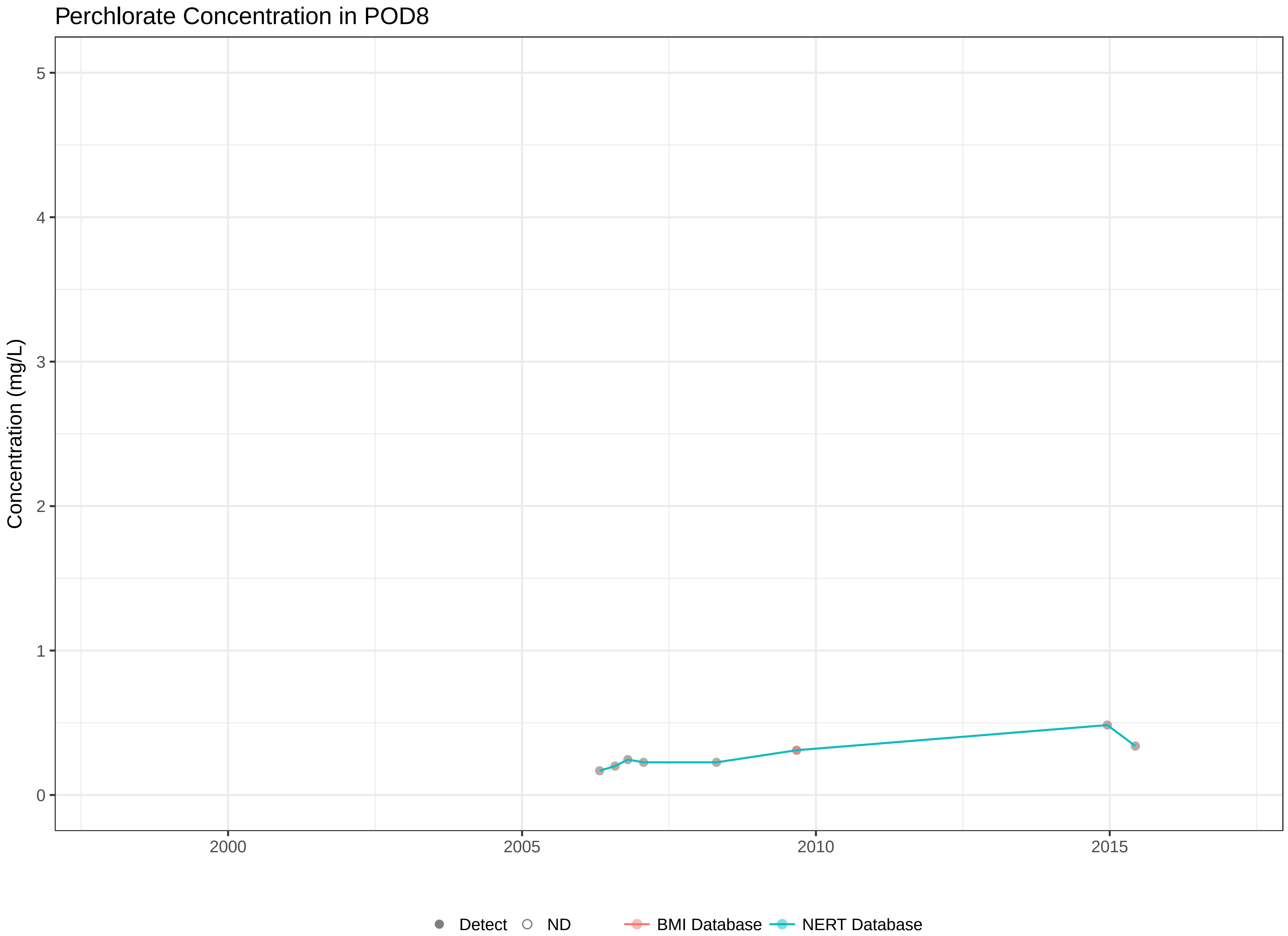


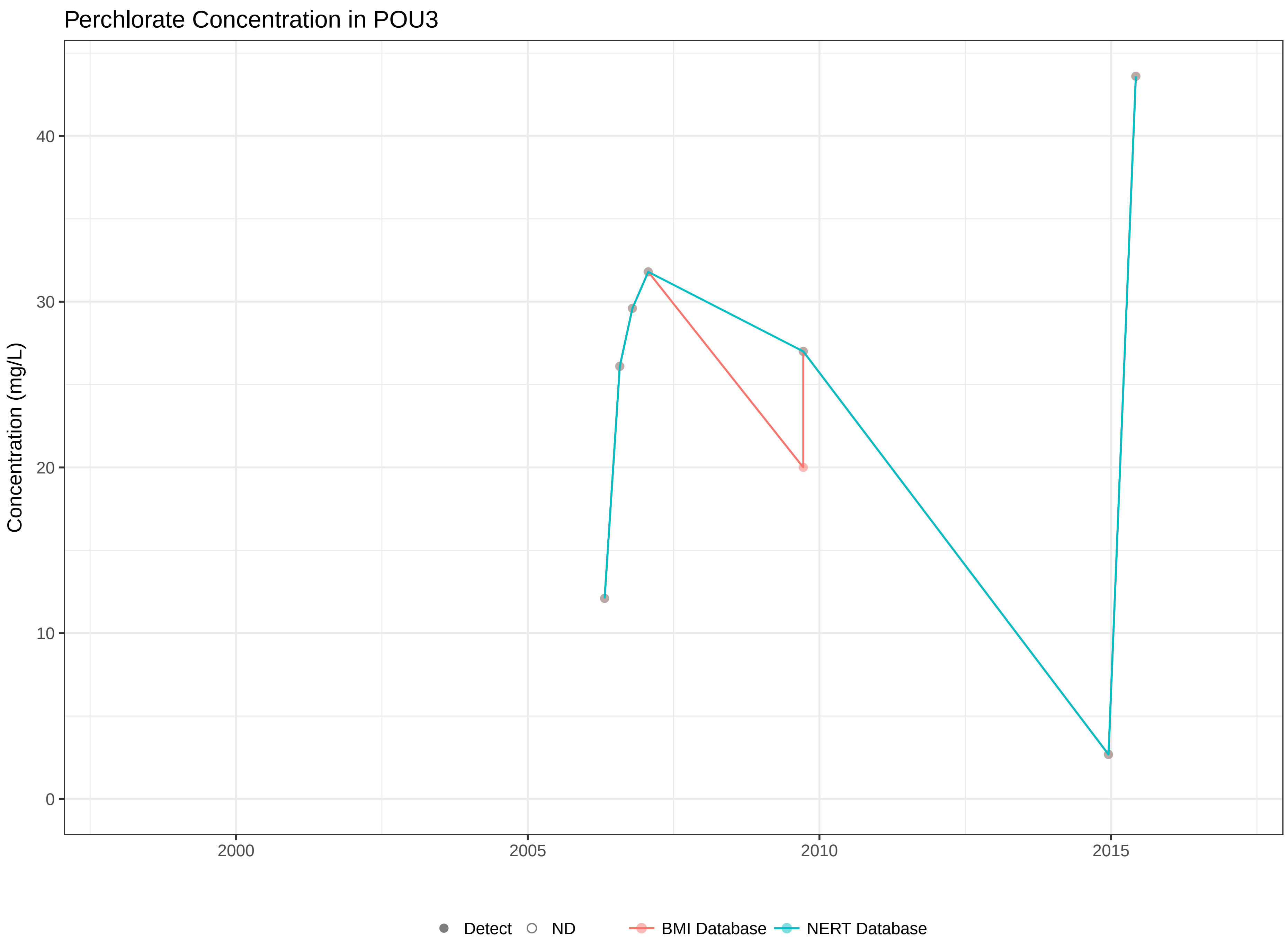
Perchlorate Concentration in MCF−16C
Concentration (mg/L)
0
5
10
15
20
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



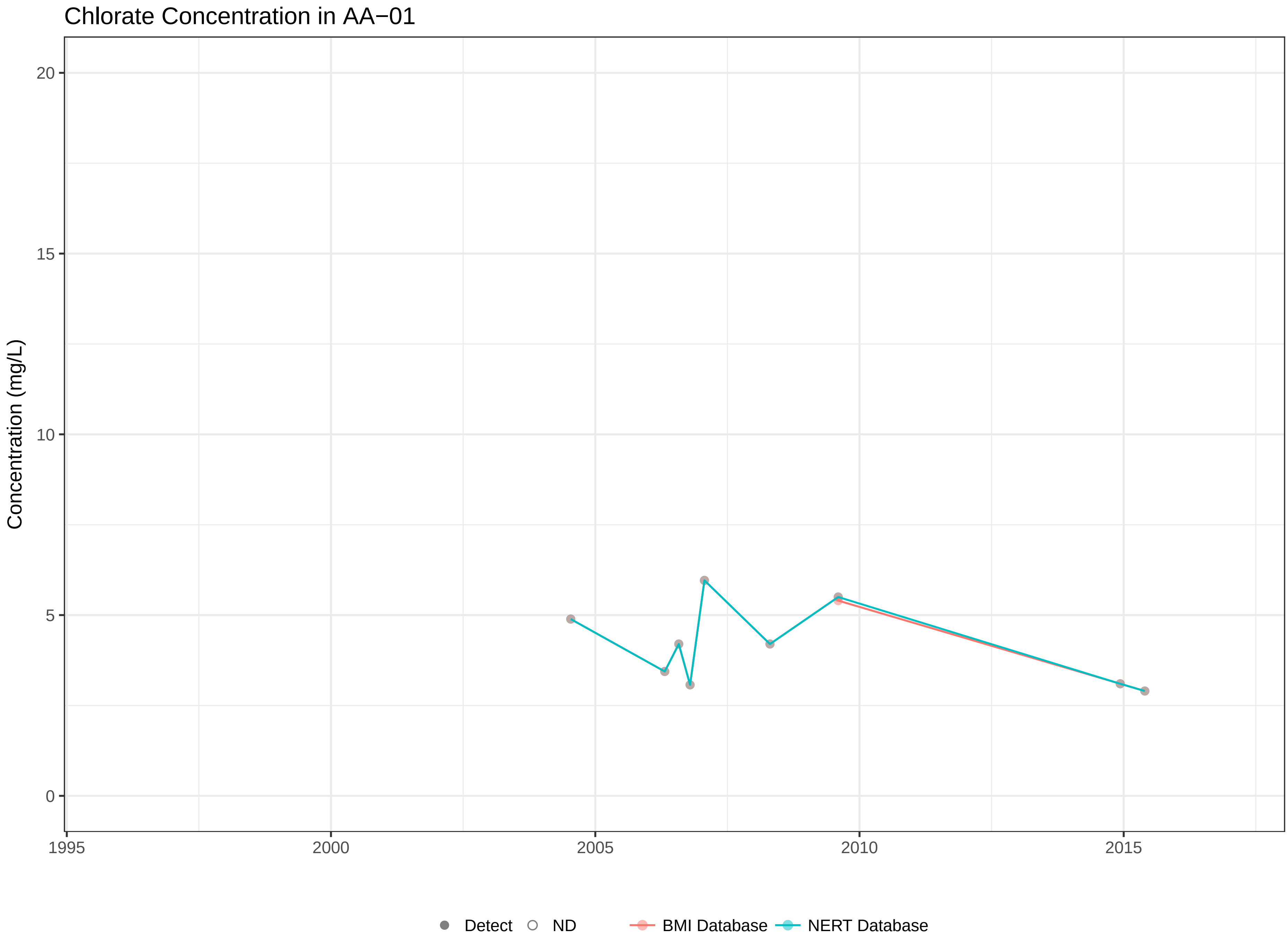
Perchlorate Concentration in MCF−27
Concentration (mg/L)
0
1
2
3
4
5
2000
2005
2010
2015
Detect
ND
BMI Database


Perchlorate Concentration in POD2R
Concentration (mg/L)
0
5
10
15
20
2000
2005
2010
2015
Detect
ND
BMI Database

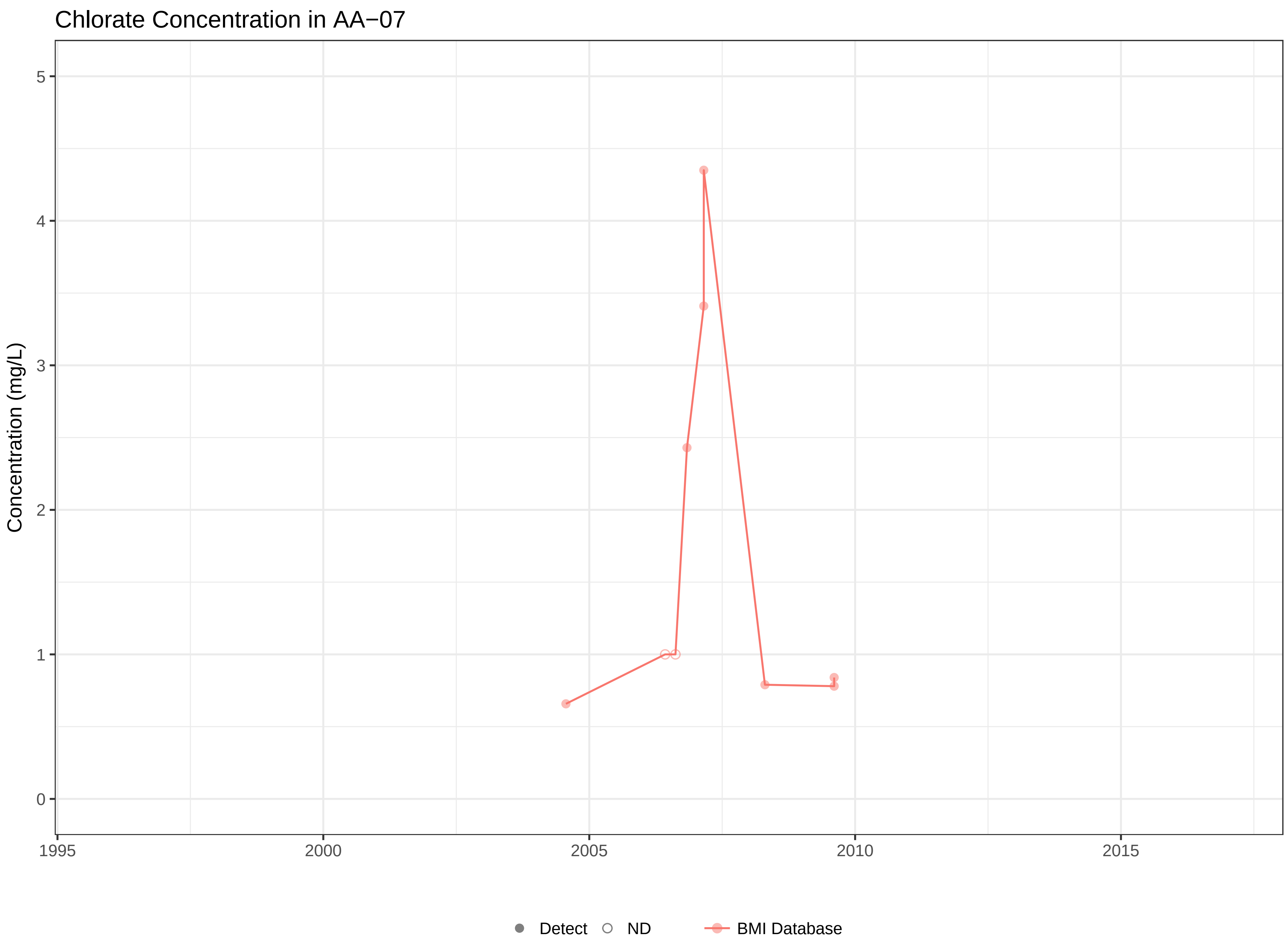

Perchlorate Concentration in POD8
Concentration (mg/L)
5
4
3
2
1
0
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



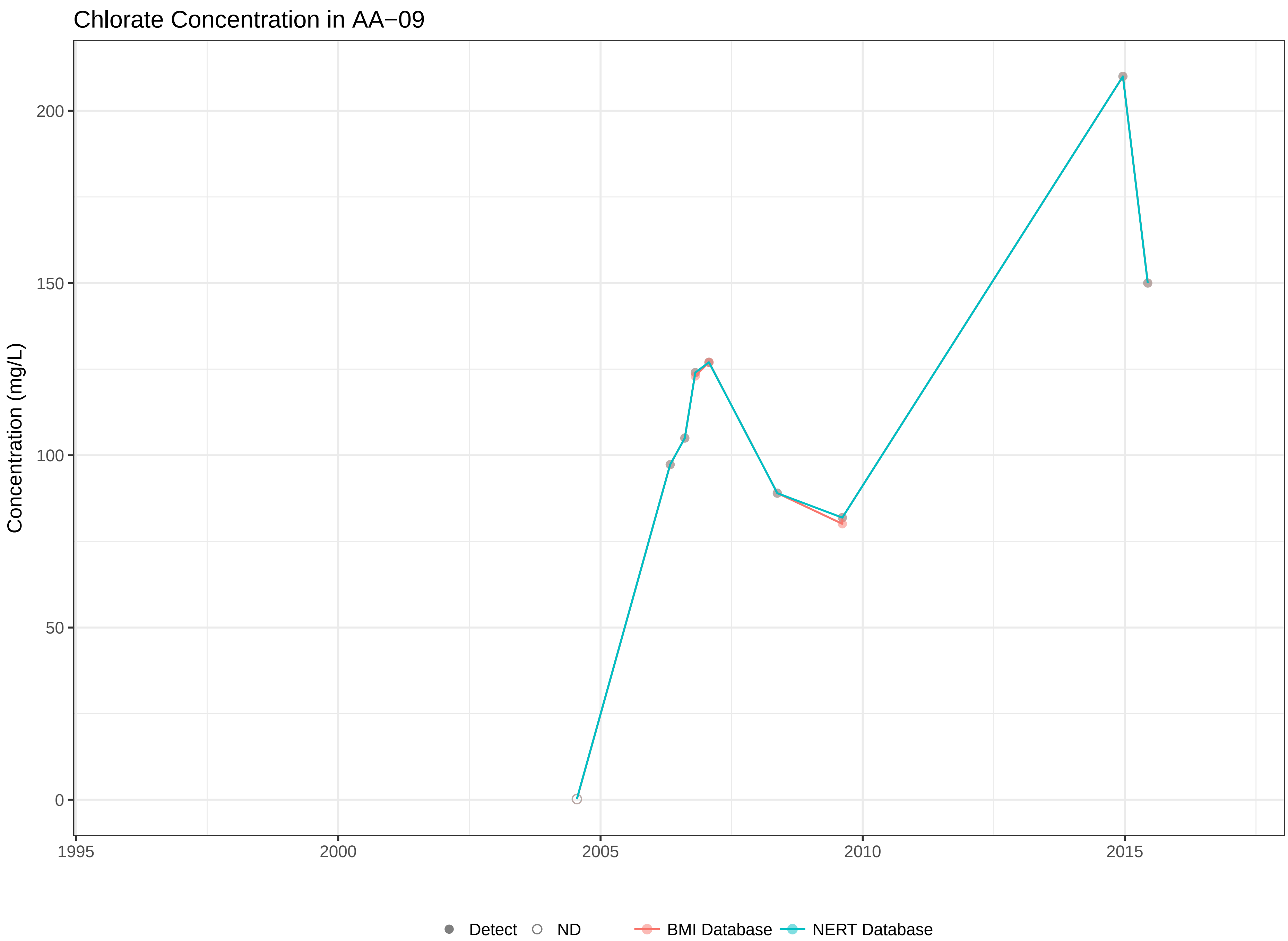
Perchlorate Concentration in POU3
Concentration (mg/L)
0
10
20
30
40
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



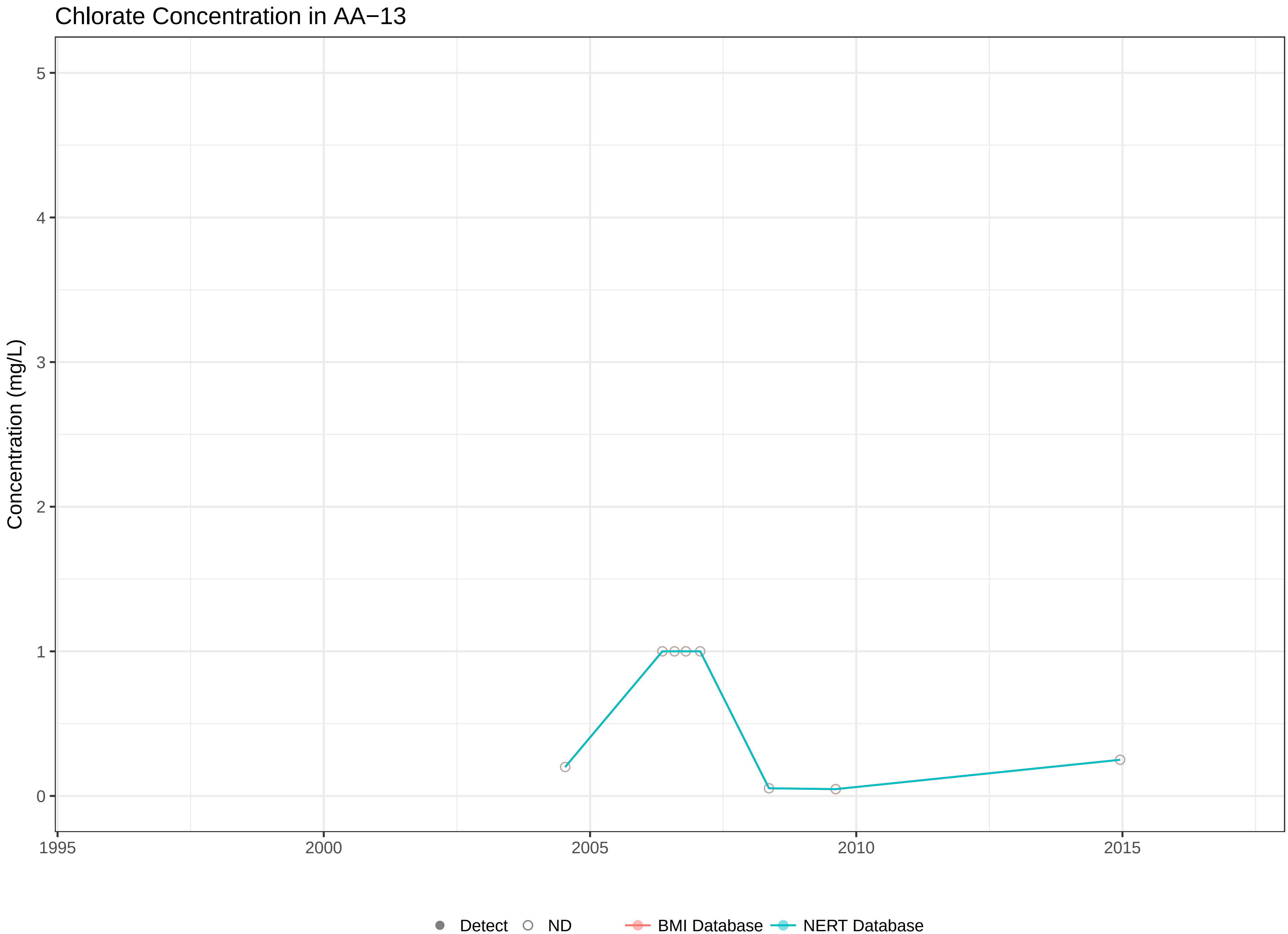
Chlorate Concentration in AA−01
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



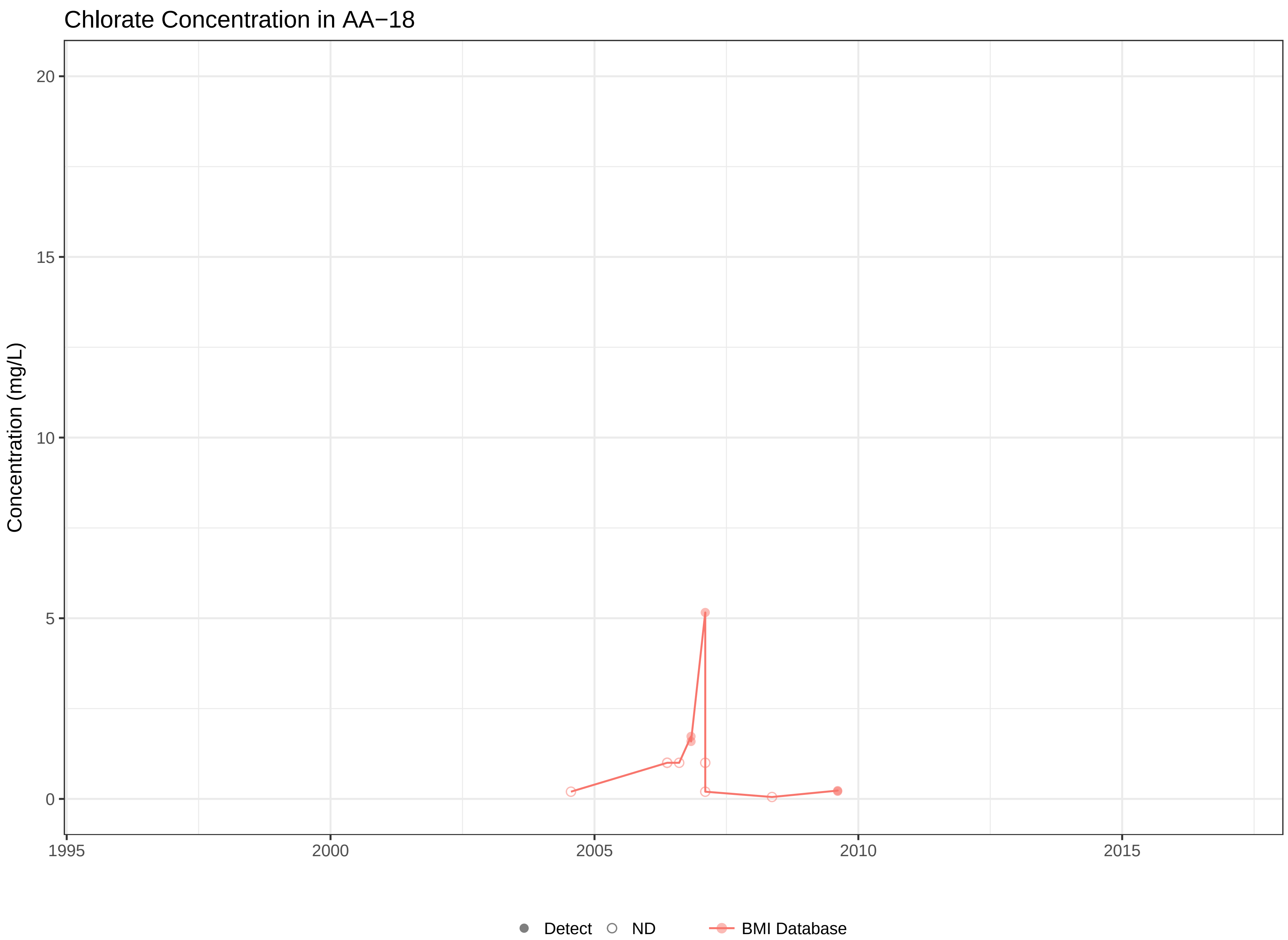
Chlorate Concentration in AA−07
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database



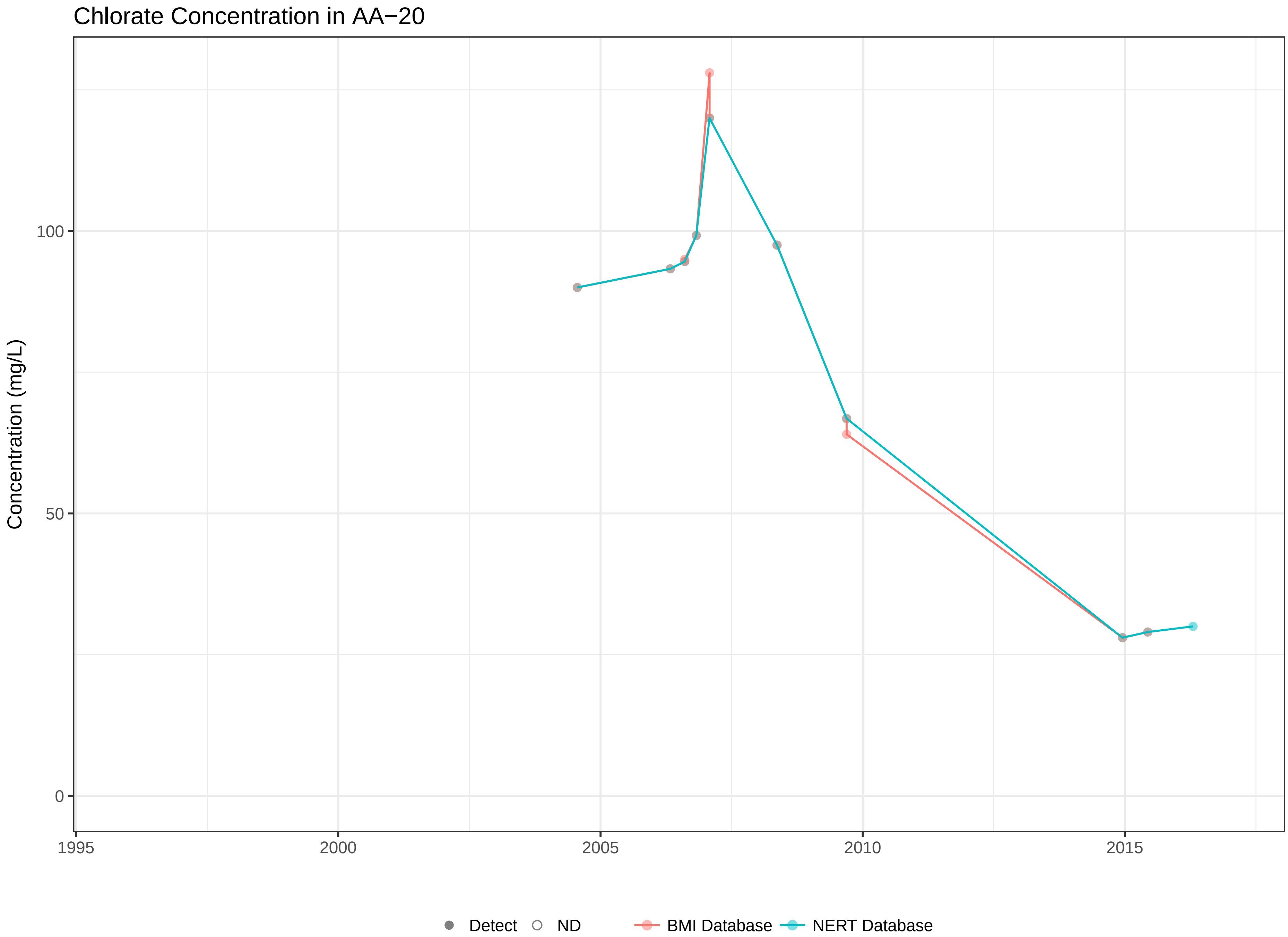
Chlorate Concentration in AA−09
Concentration (mg/L)
200
150
100
50
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



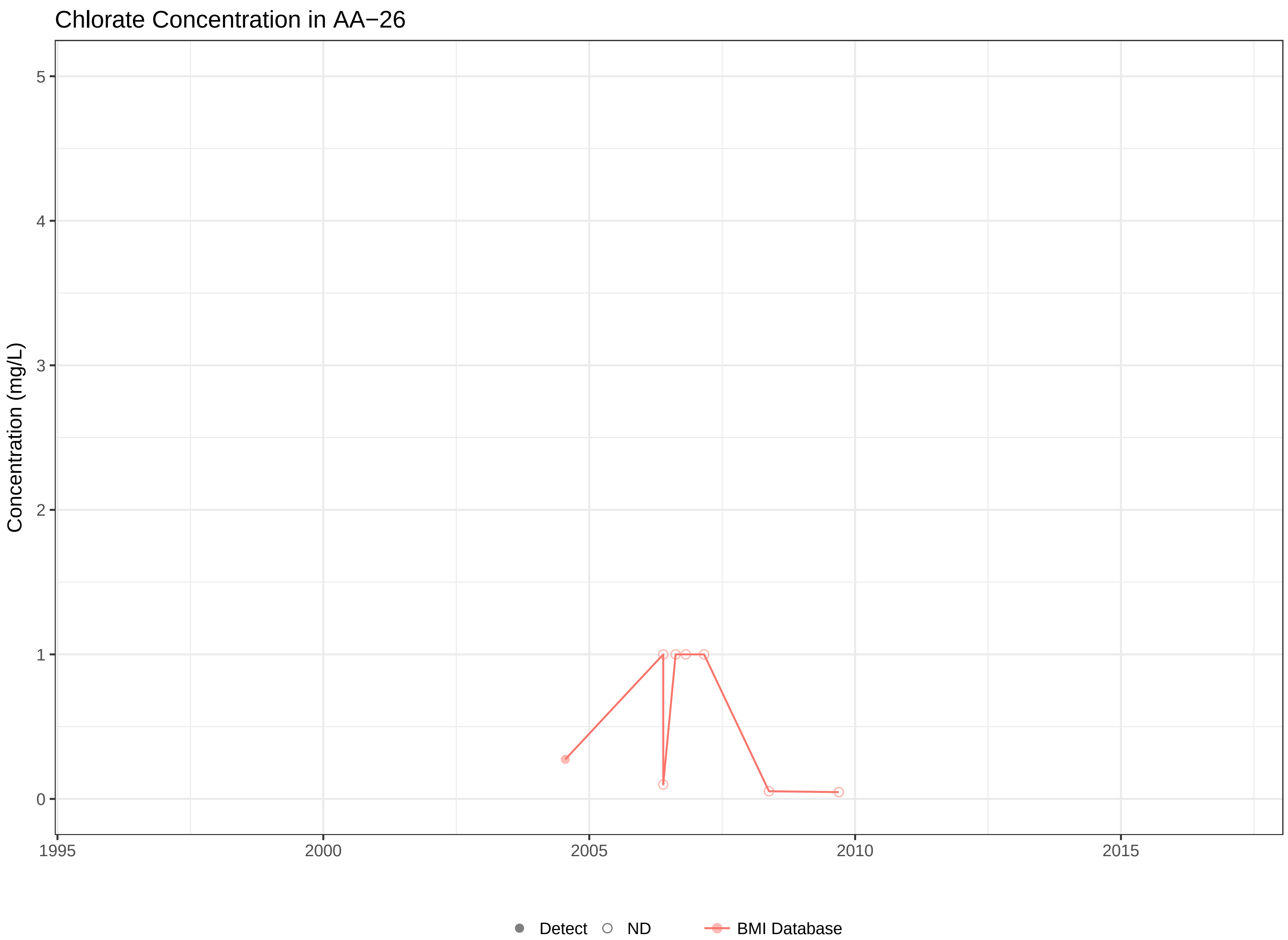
Chlorate Concentration in AA−13
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



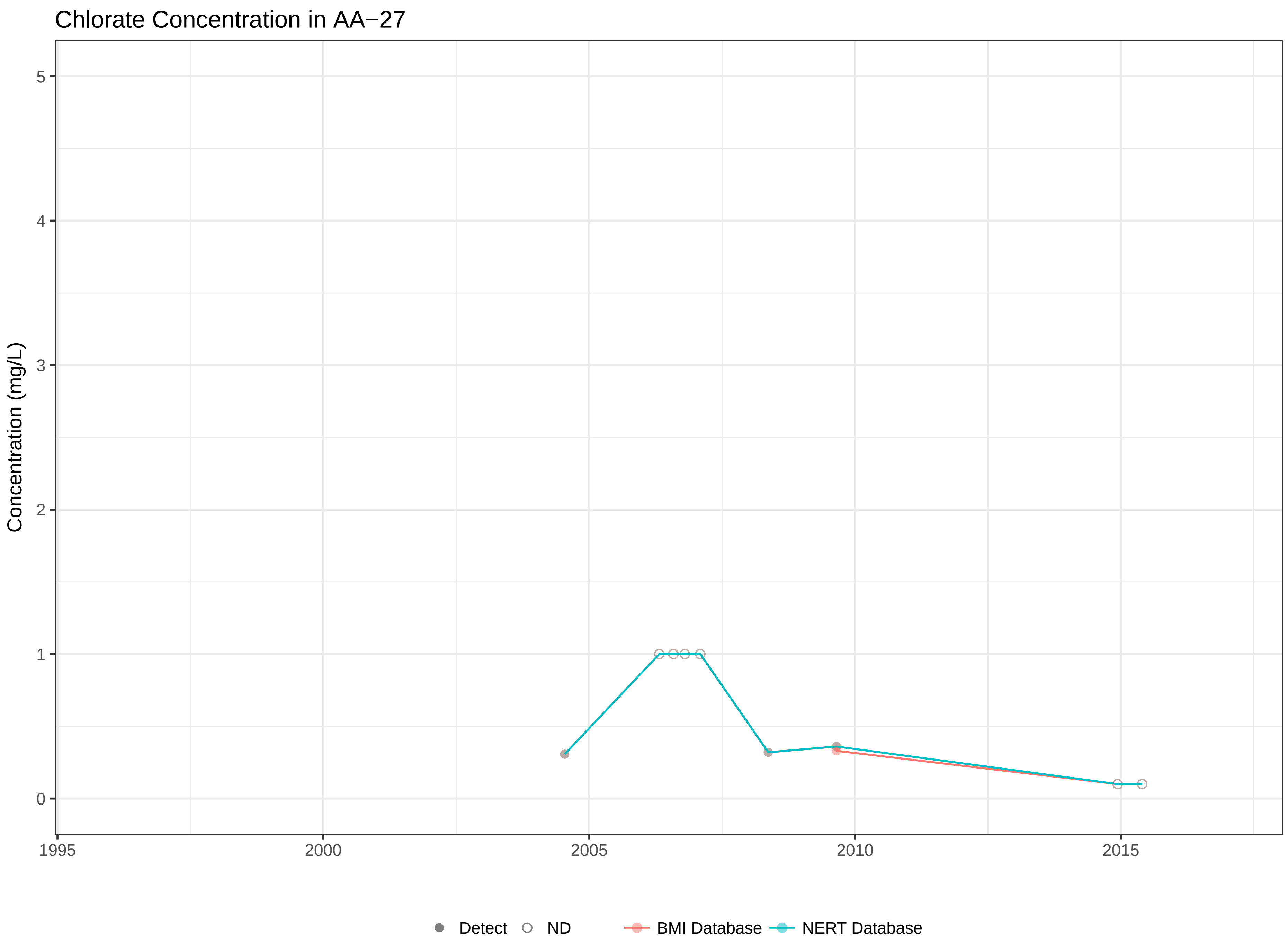
Chlorate Concentration in AA−18
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database



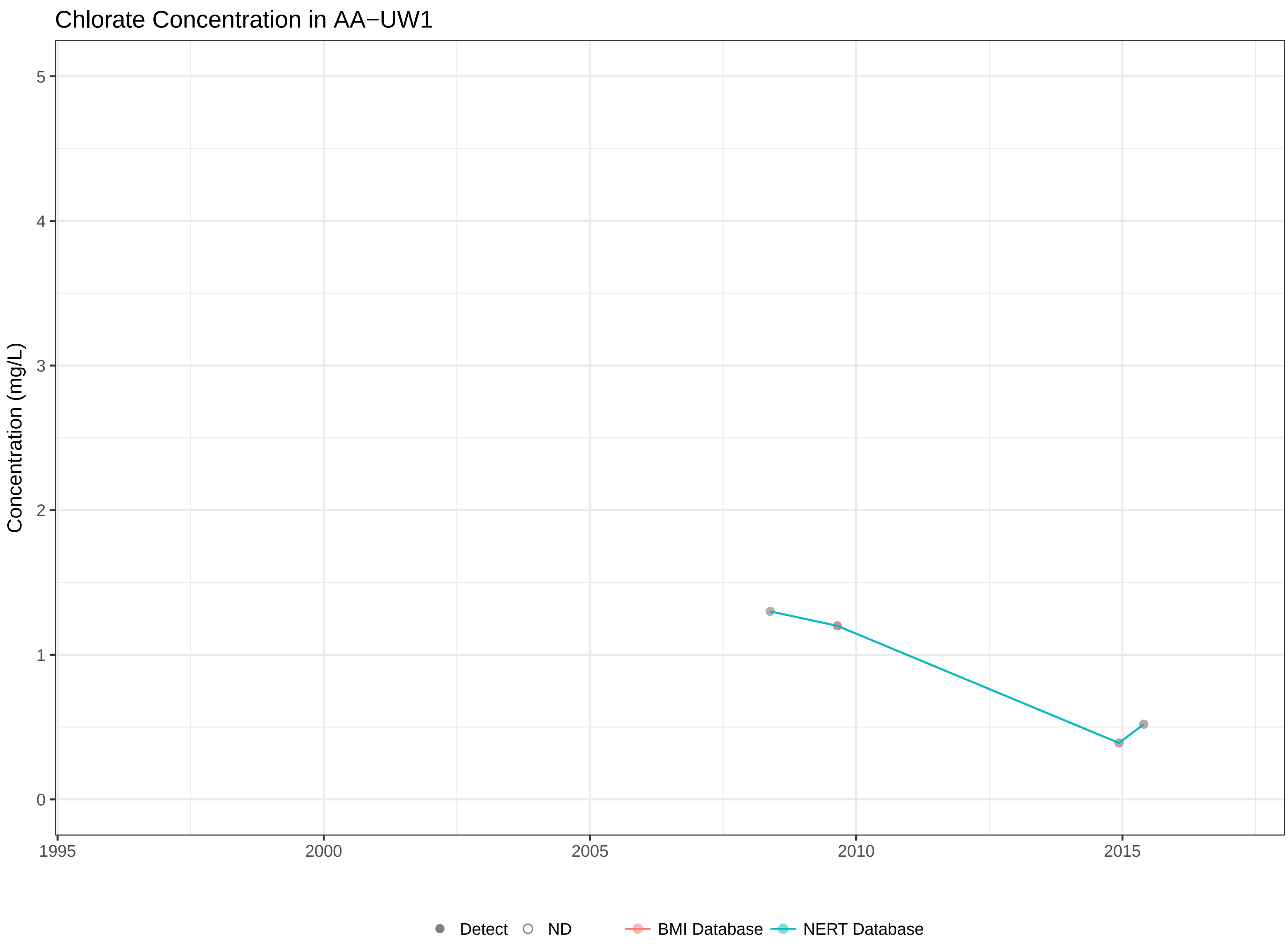
Chlorate Concentration in AA−20
Concentration (mg/L)
100
50
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

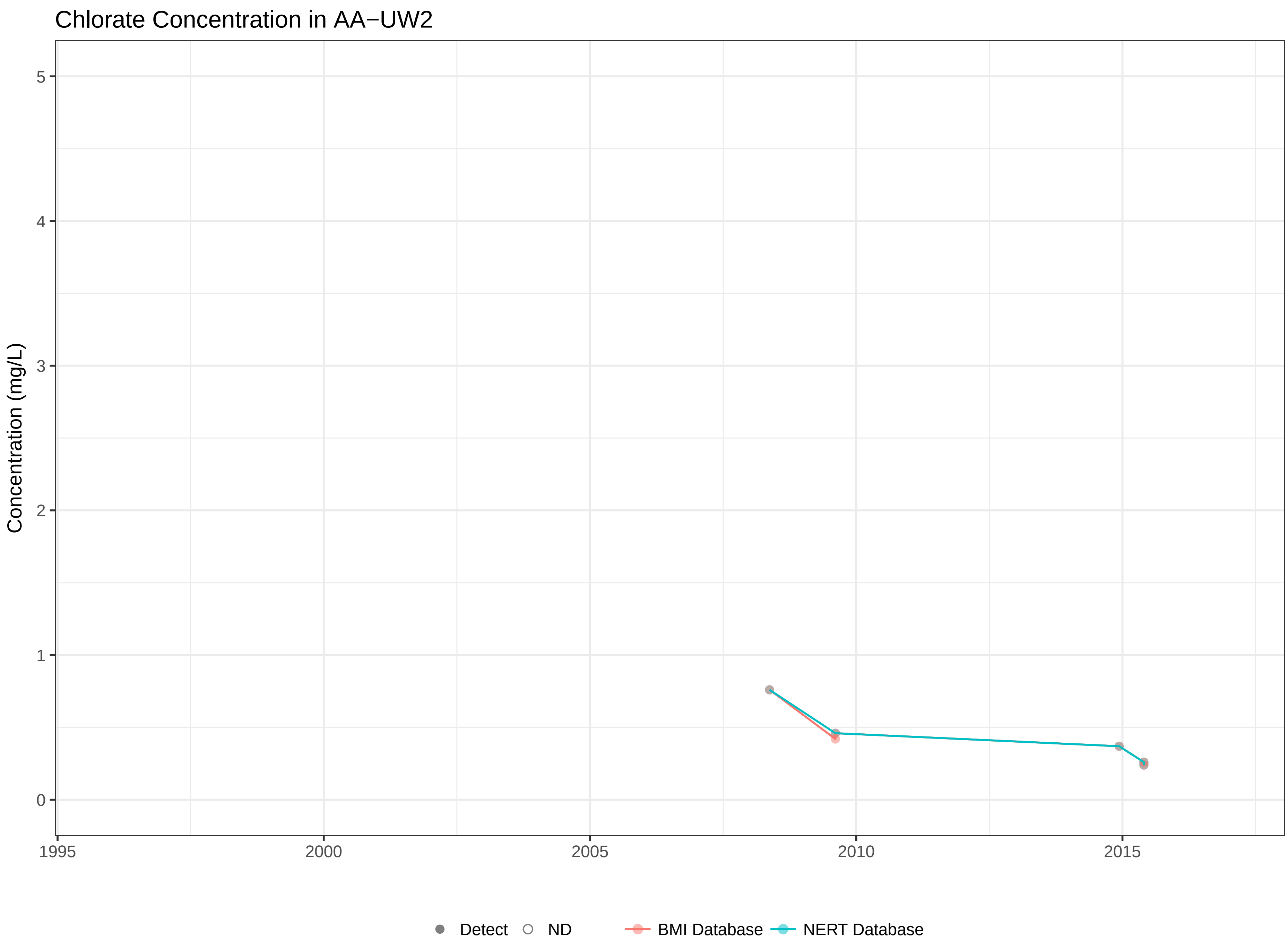


Chlorate Concentration in AA−26
Concentration (mg/L)
5
4
3
2
1
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database

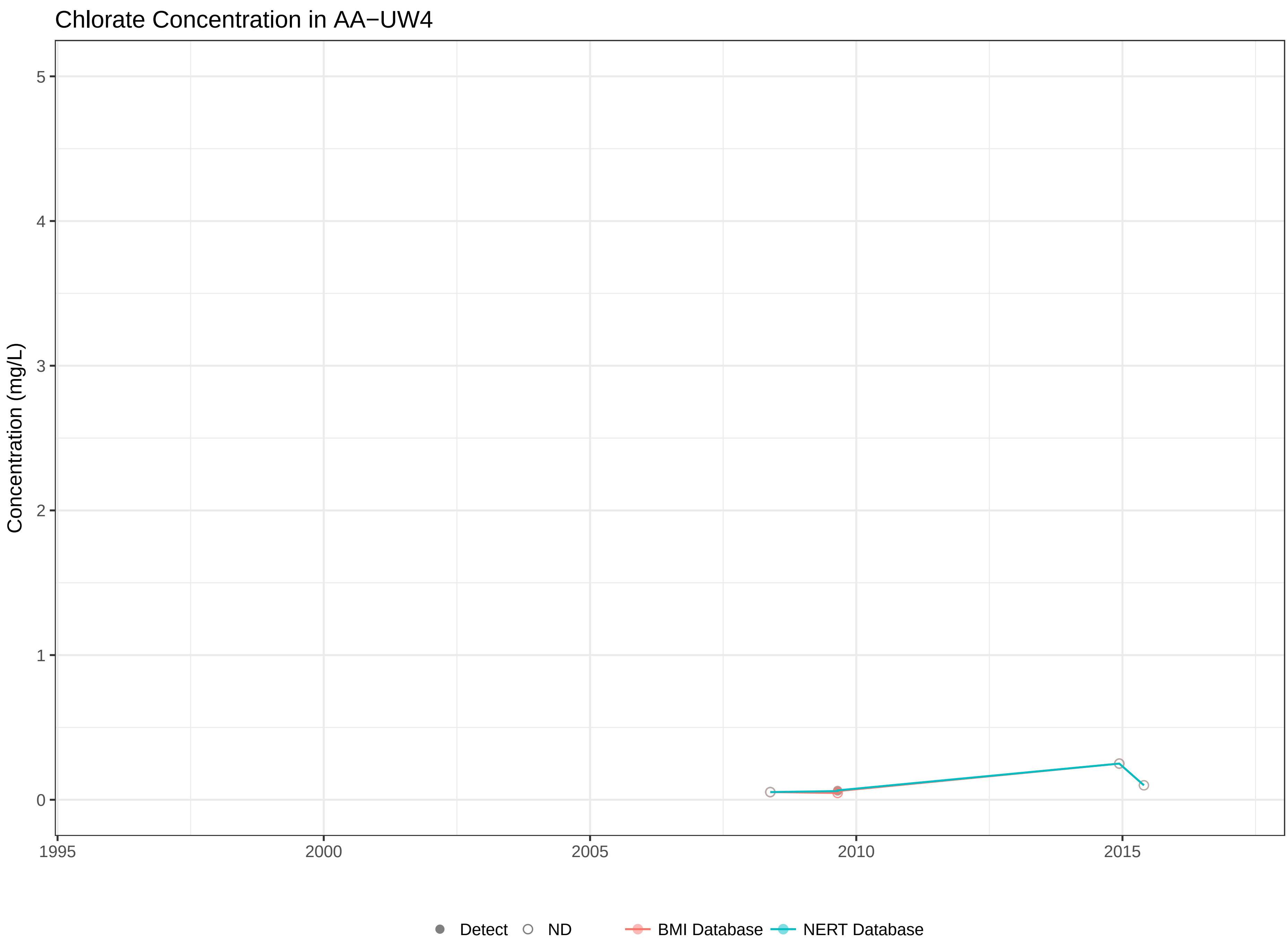


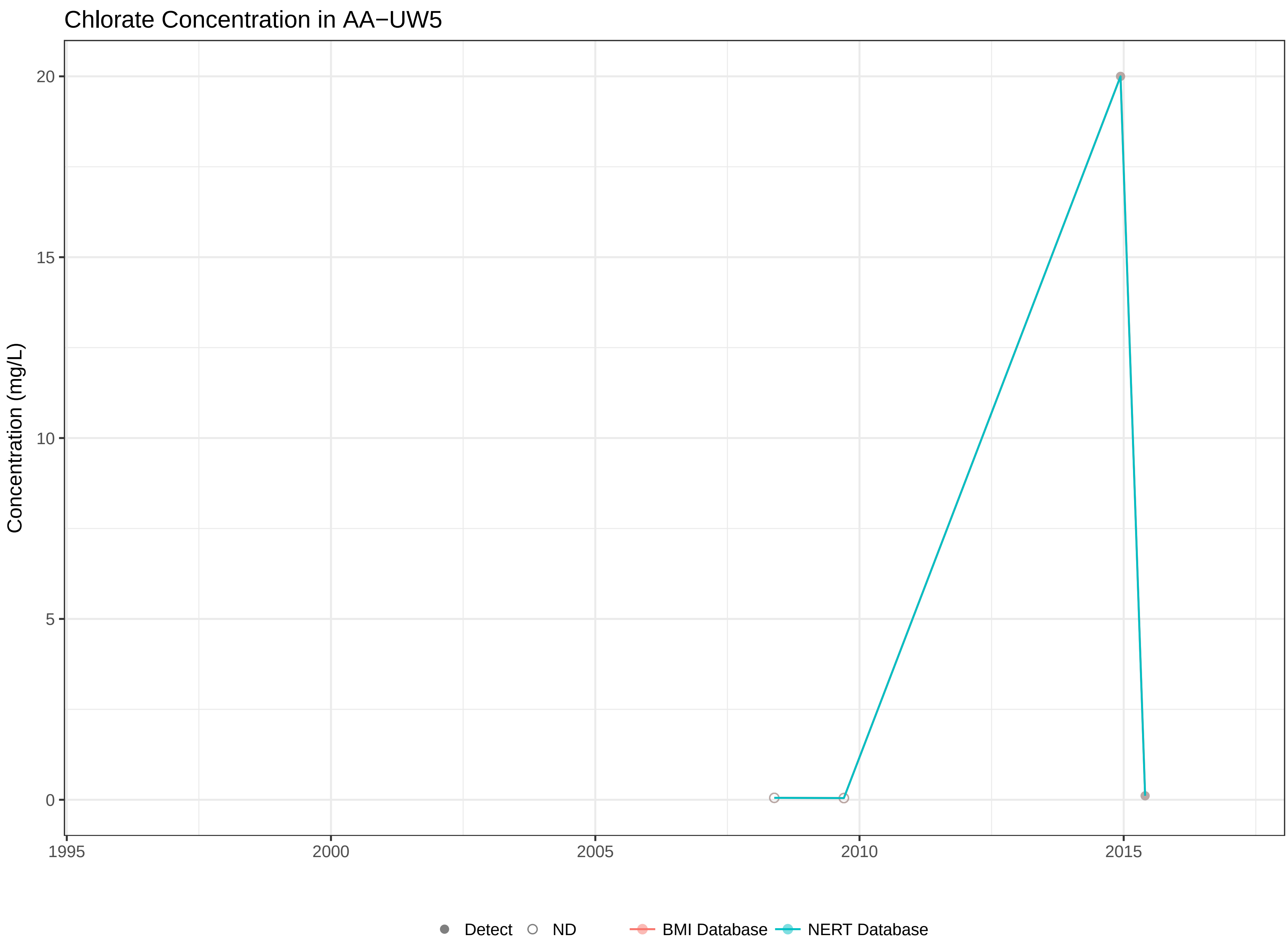
Chlorate Concentration in AA−27
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database


Chlorate Concentration in AA−UW1
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

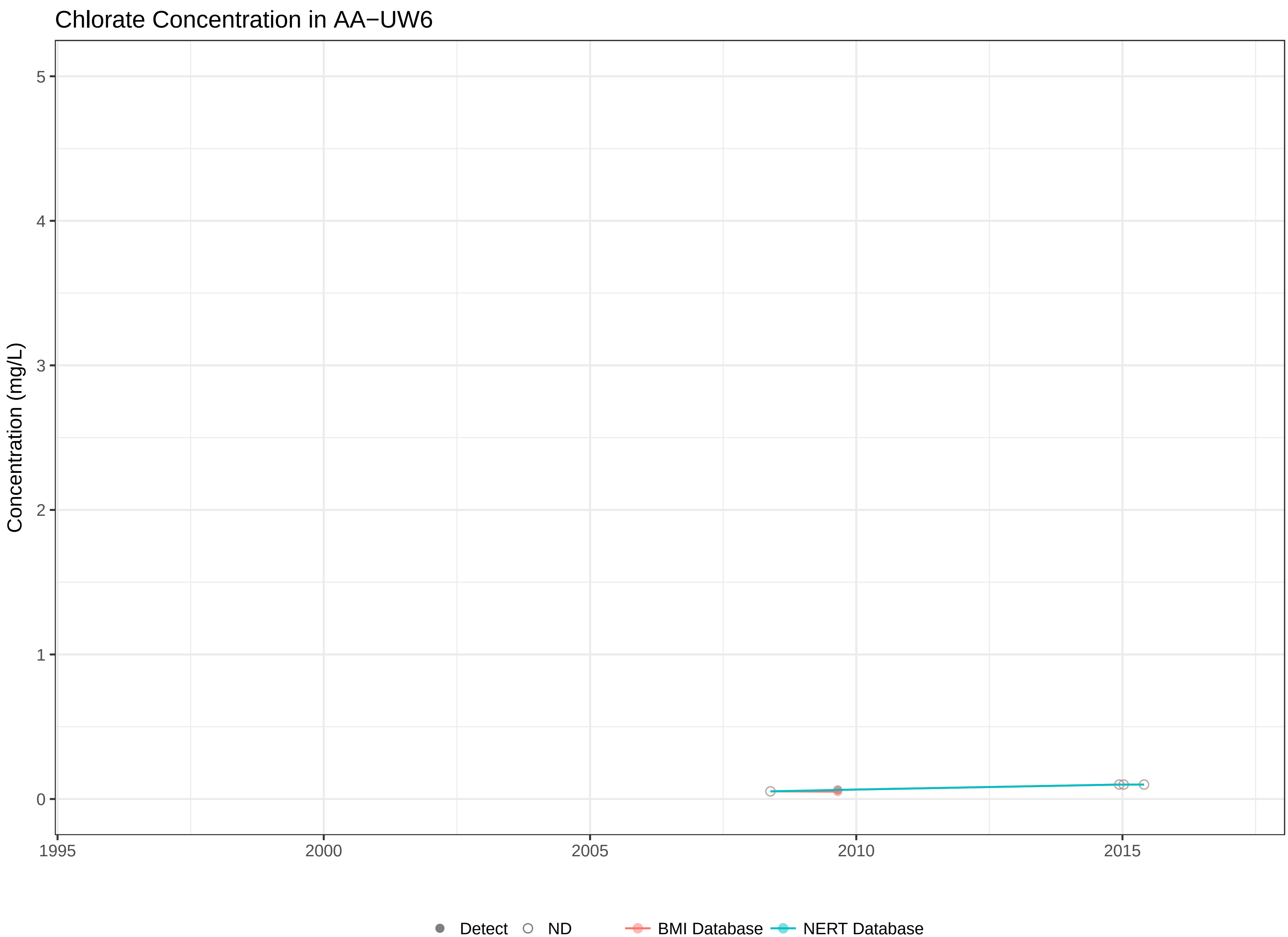


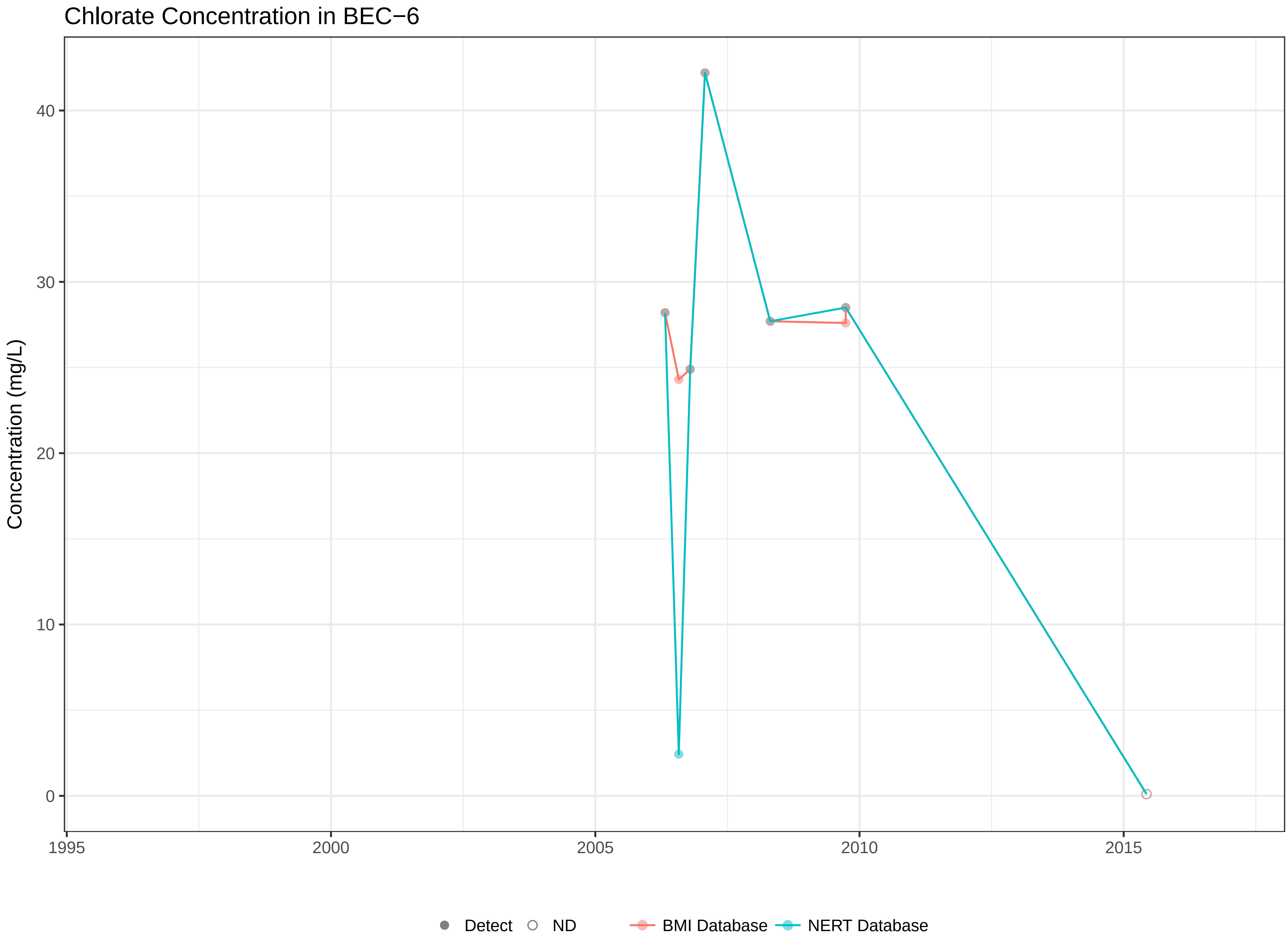
Chlorate Concentration in AA−UW2
Concentration (mg/L)
5
4
3
2
1
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database


Chlorate Concentration in AA−UW4
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

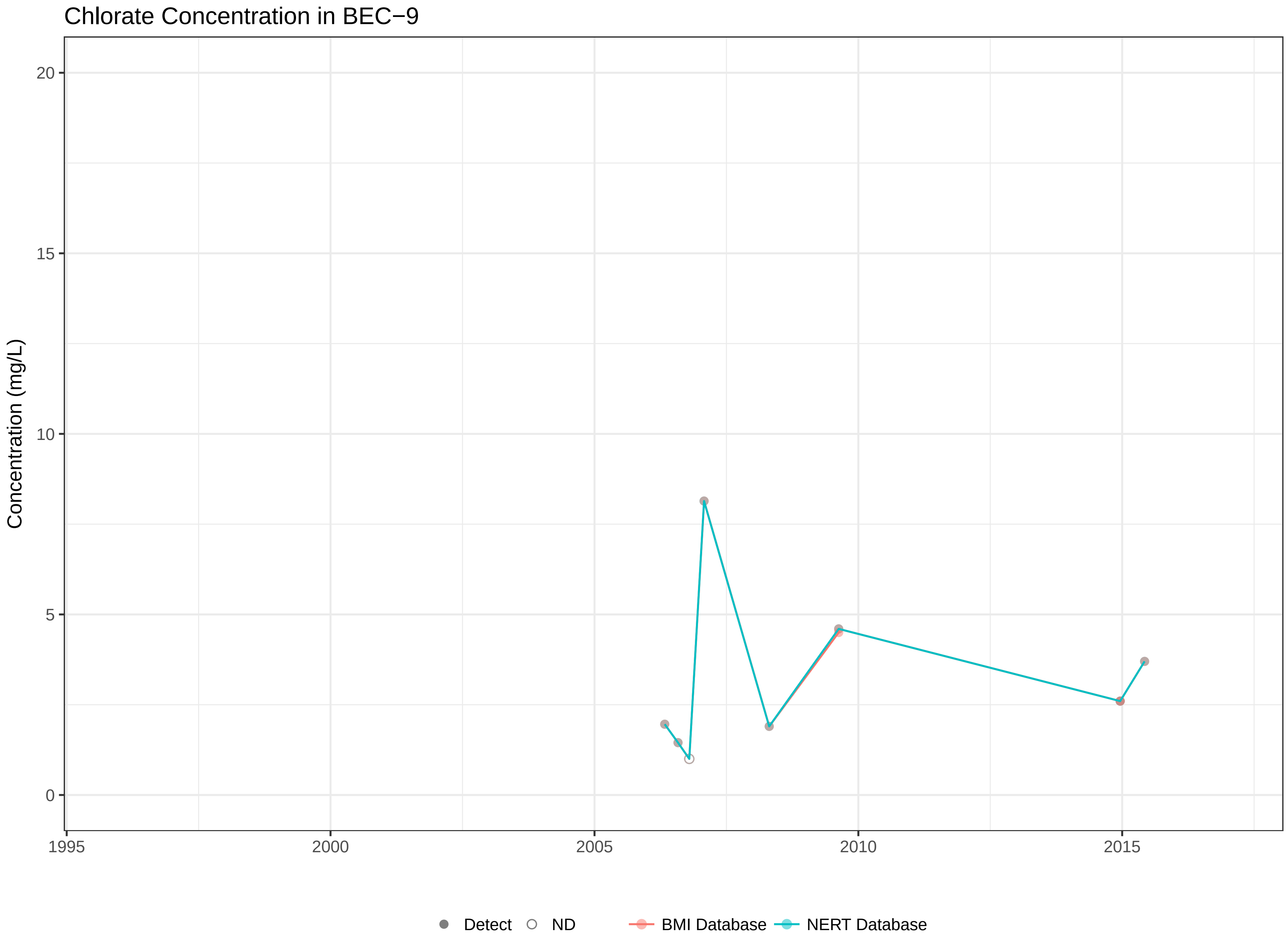


Chlorate Concentration in AA−UW5
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

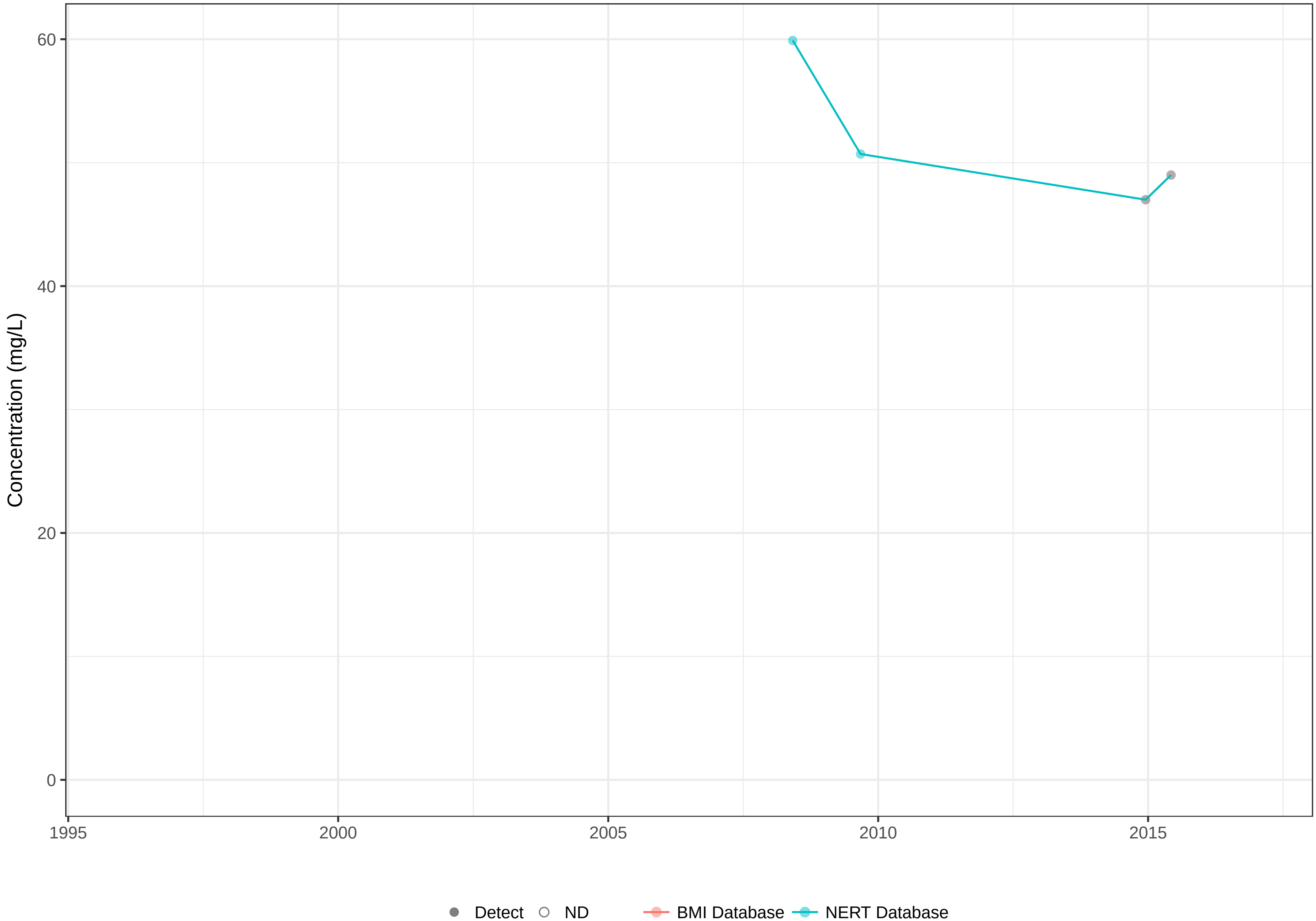

Chlorate Concentration in AA−UW6
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



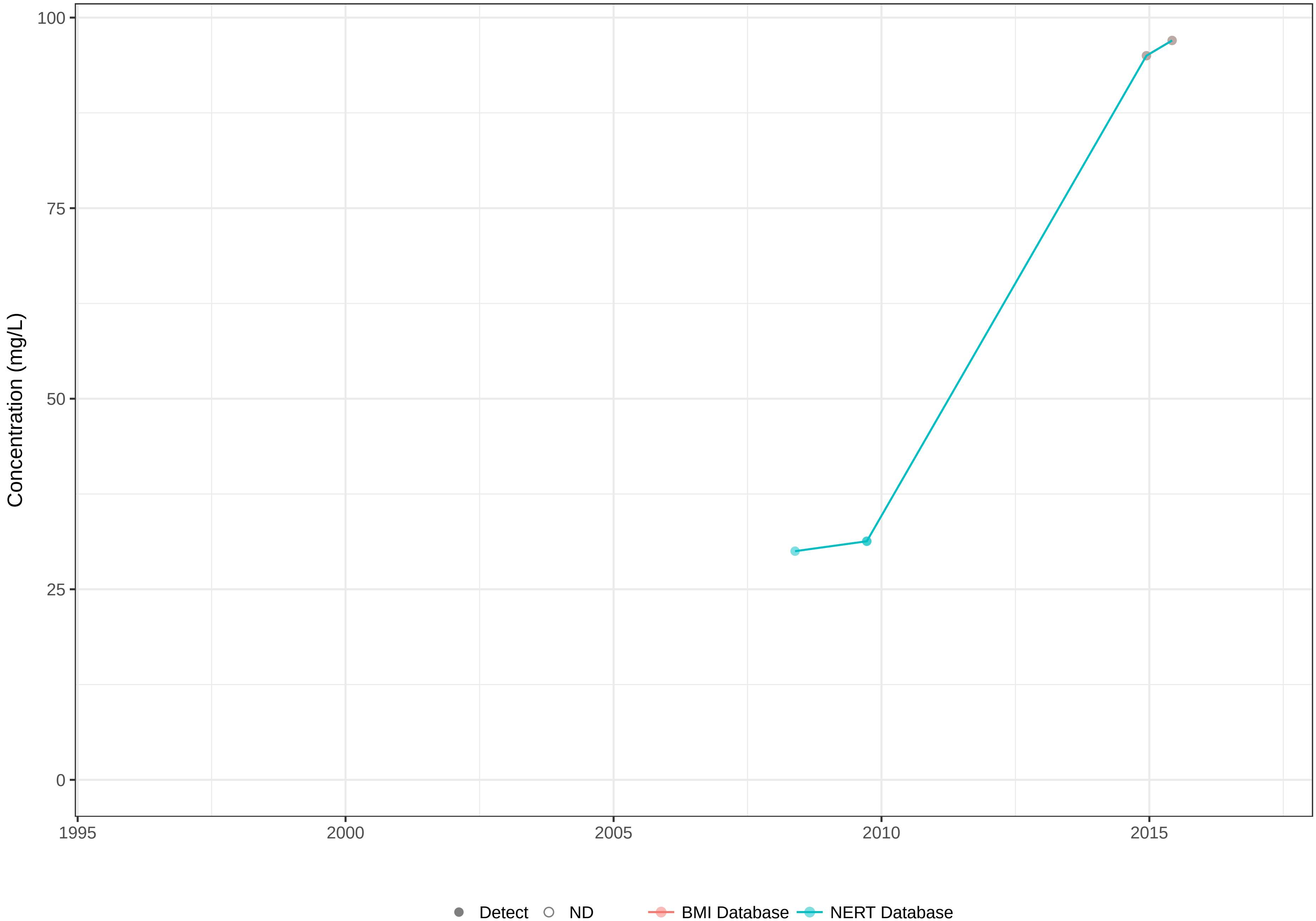
Chlorate Concentration in BEC−6
Concentration (mg/L)
0
10
20
30
40
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database


Chlorate Concentration in BEC−9
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

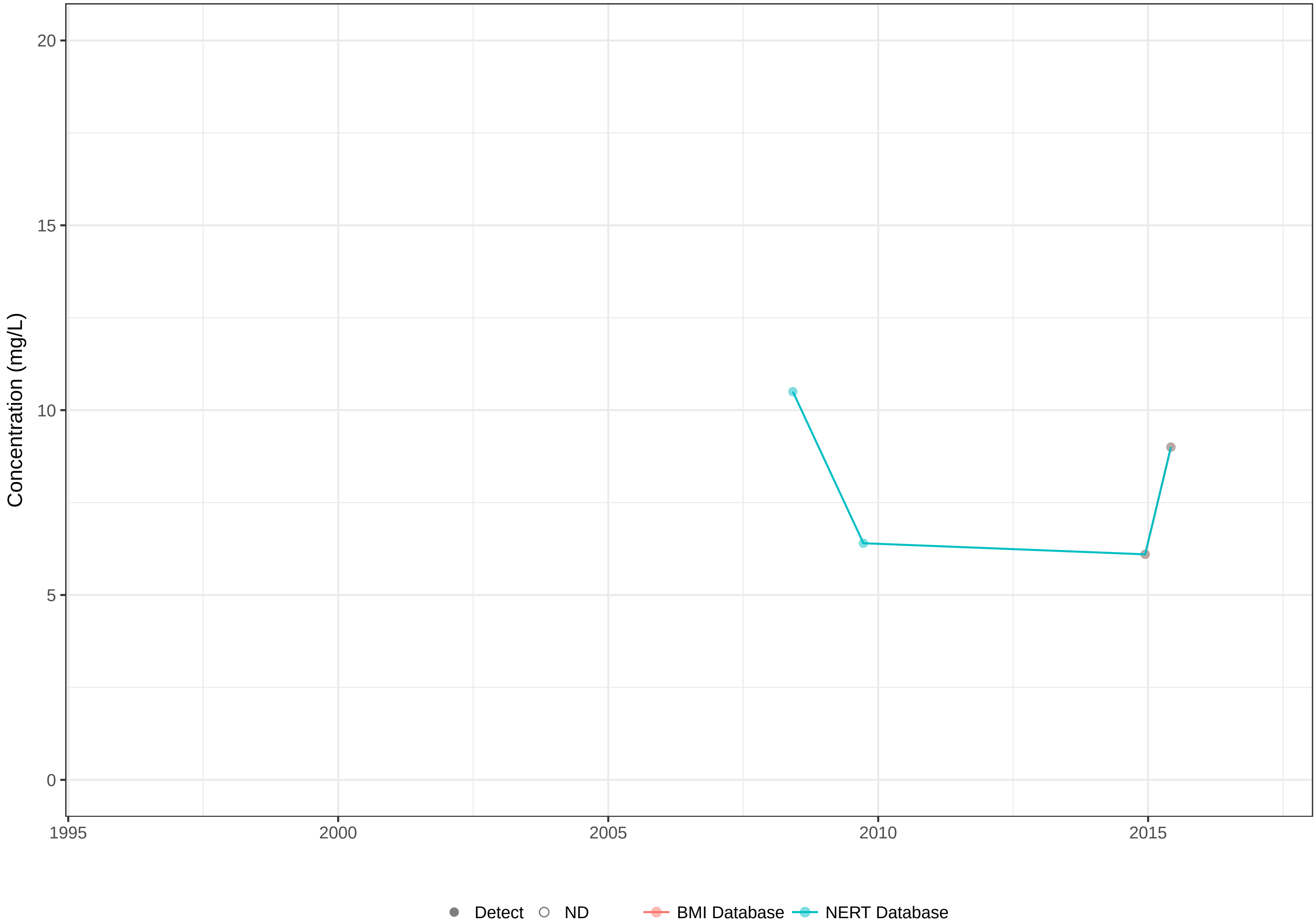
Chlorate Concentration in DBMW−03

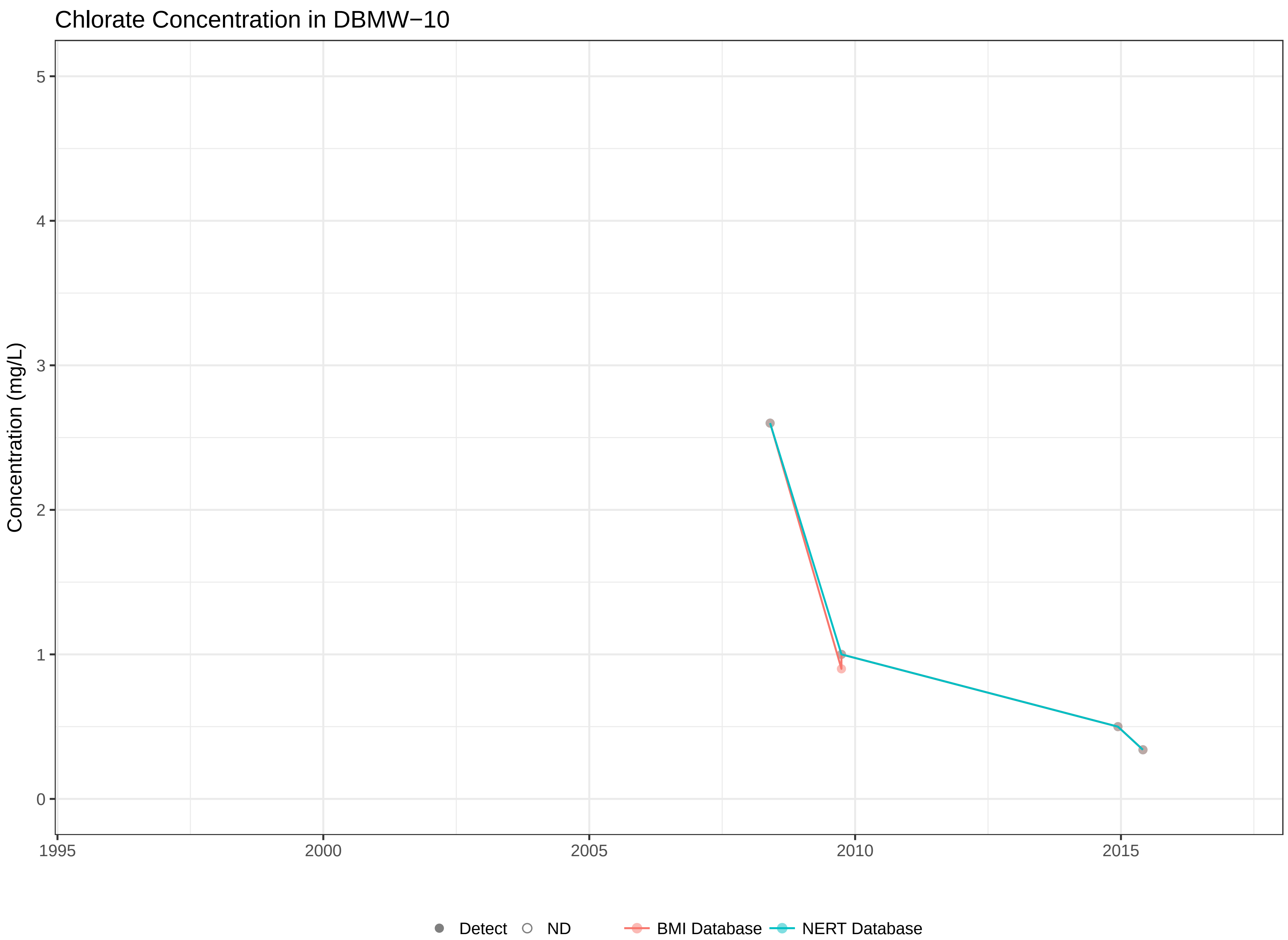


Chlorate Concentration in DBMW−05

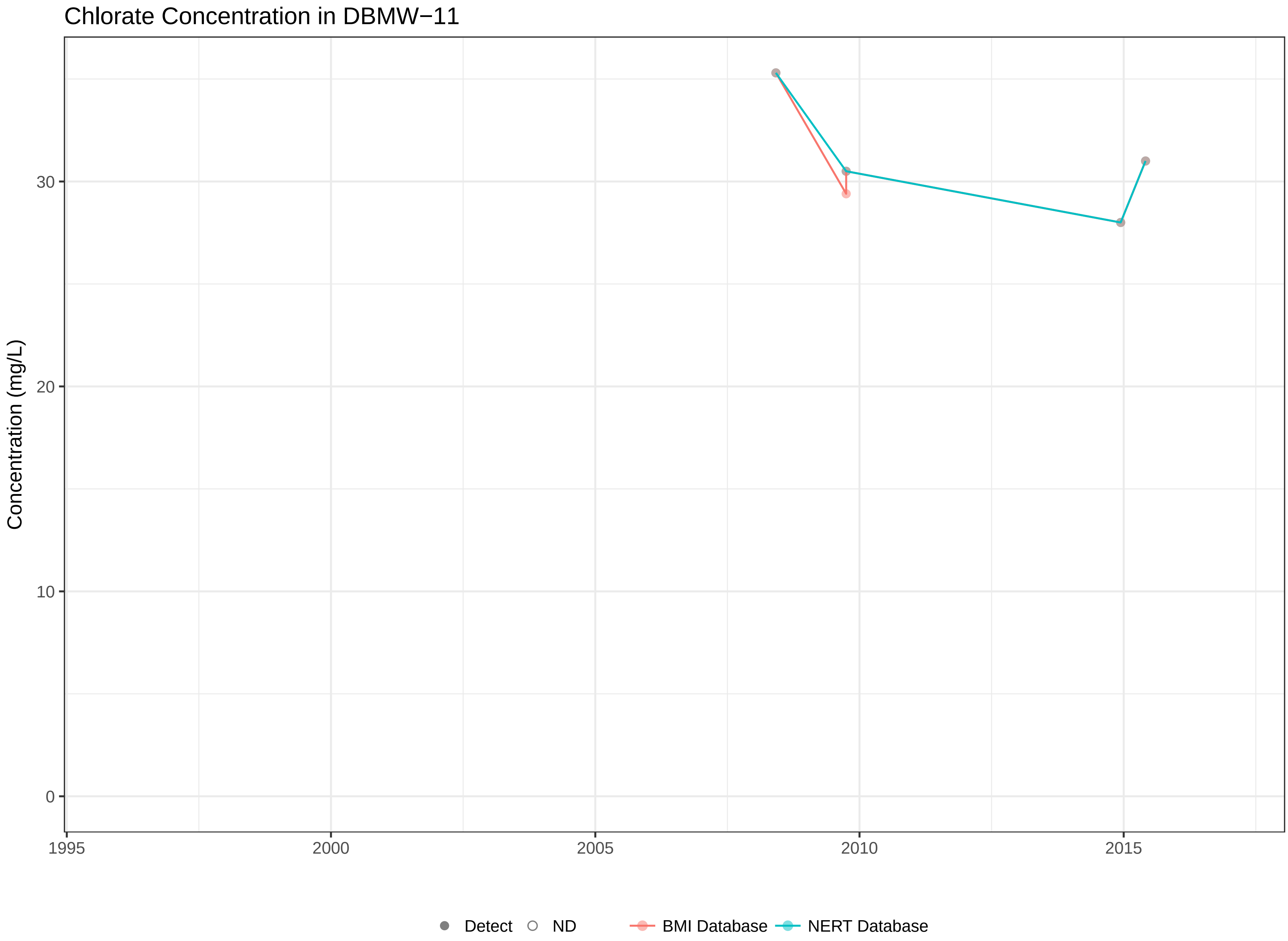


Chlorate Concentration in DBMW−08

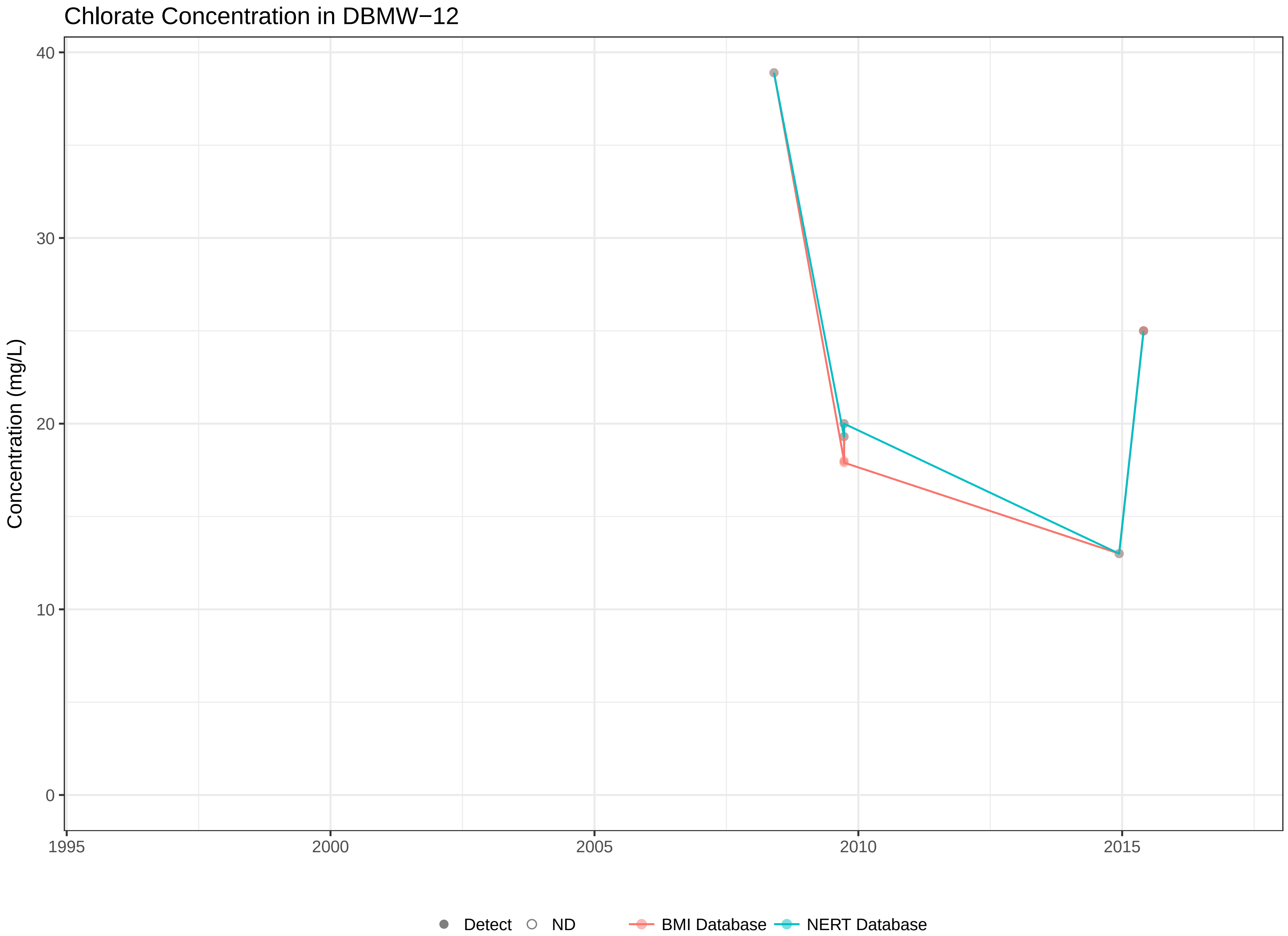




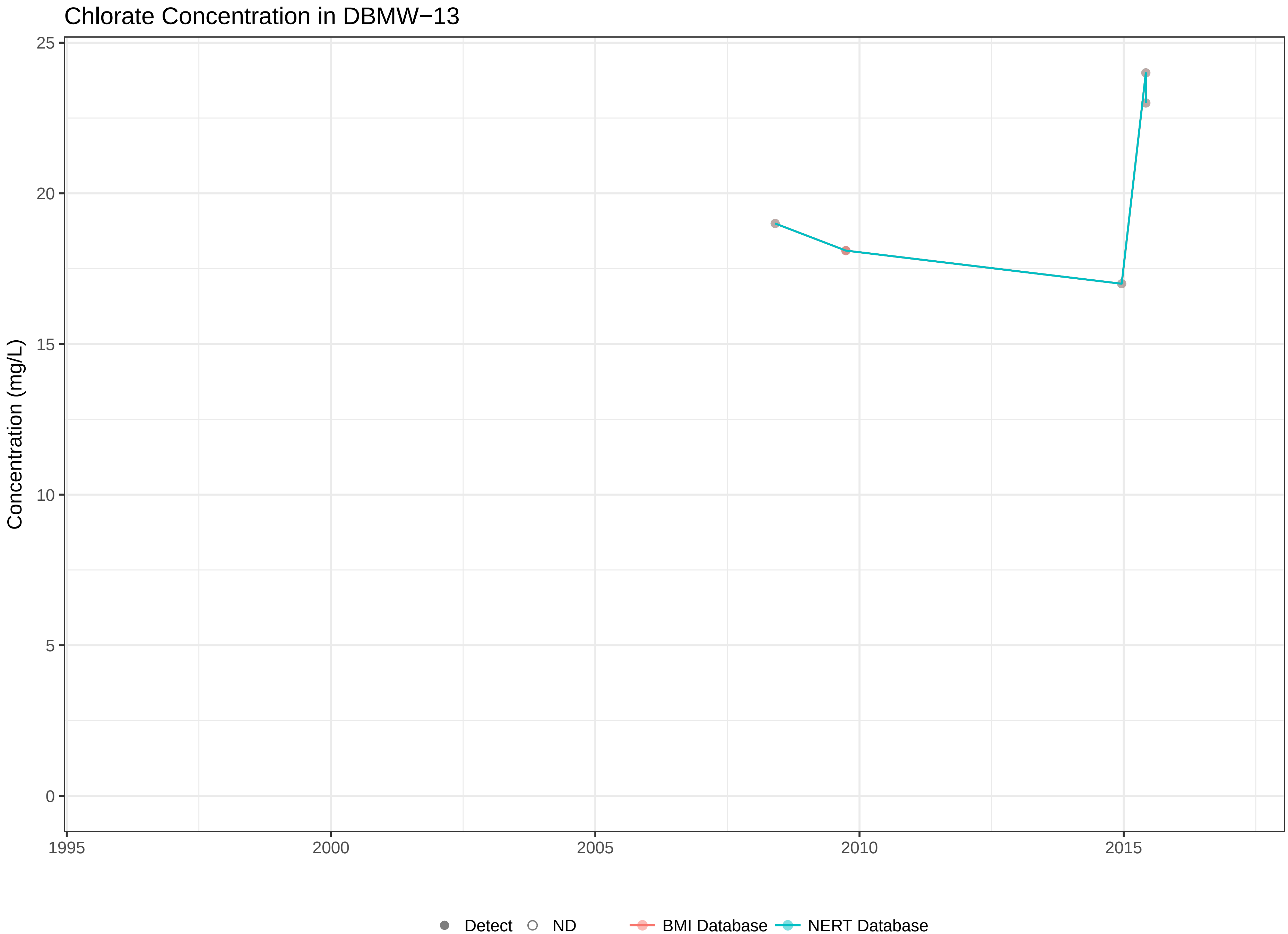
Chlorate Concentration in DBMW−10
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



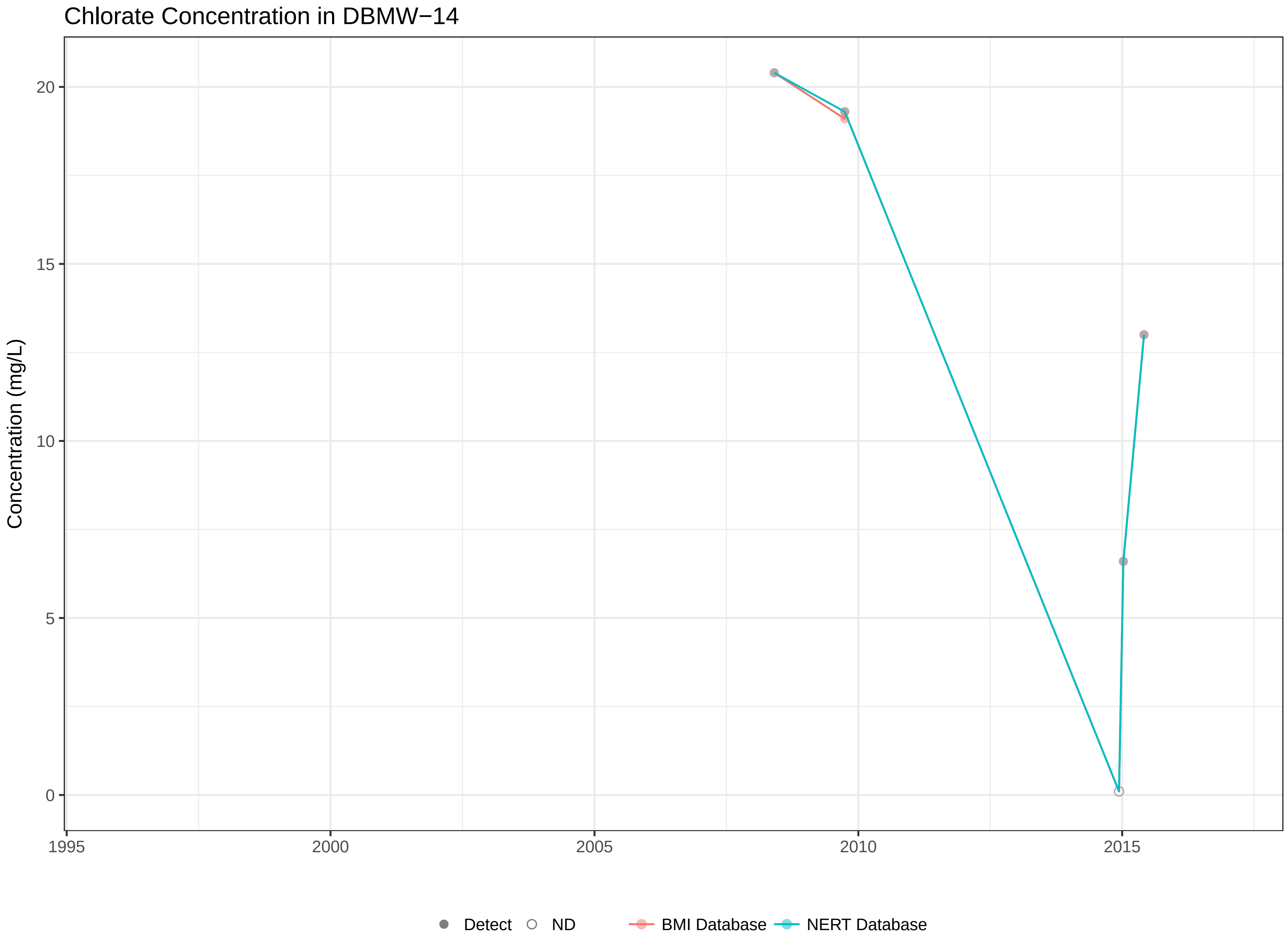
Chlorate Concentration in DBMW−11
Concentration (mg/L)
0
10
20
30
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



Chlorate Concentration in DBMW−12
Concentration (mg/L)
40
30
20
10
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

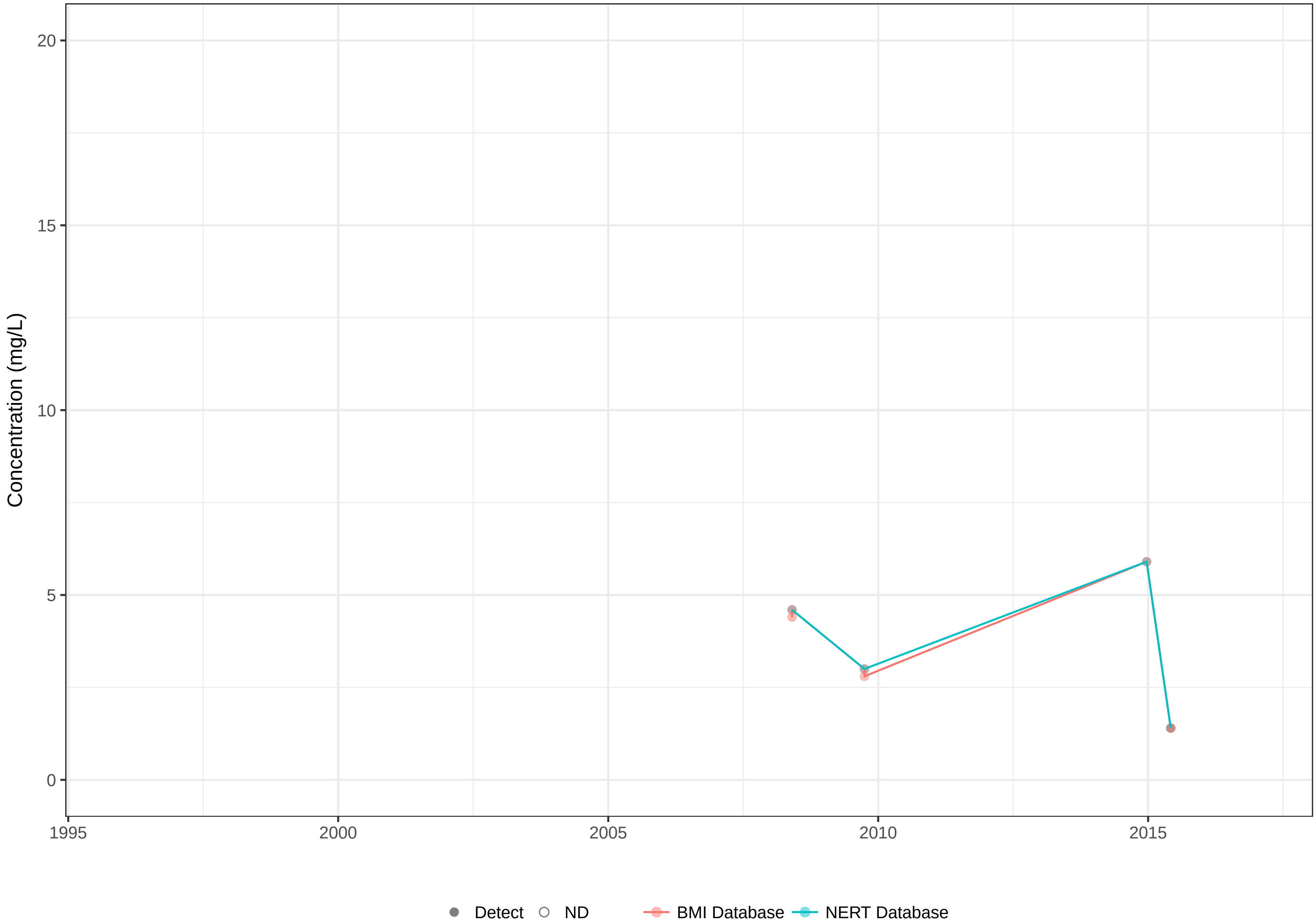


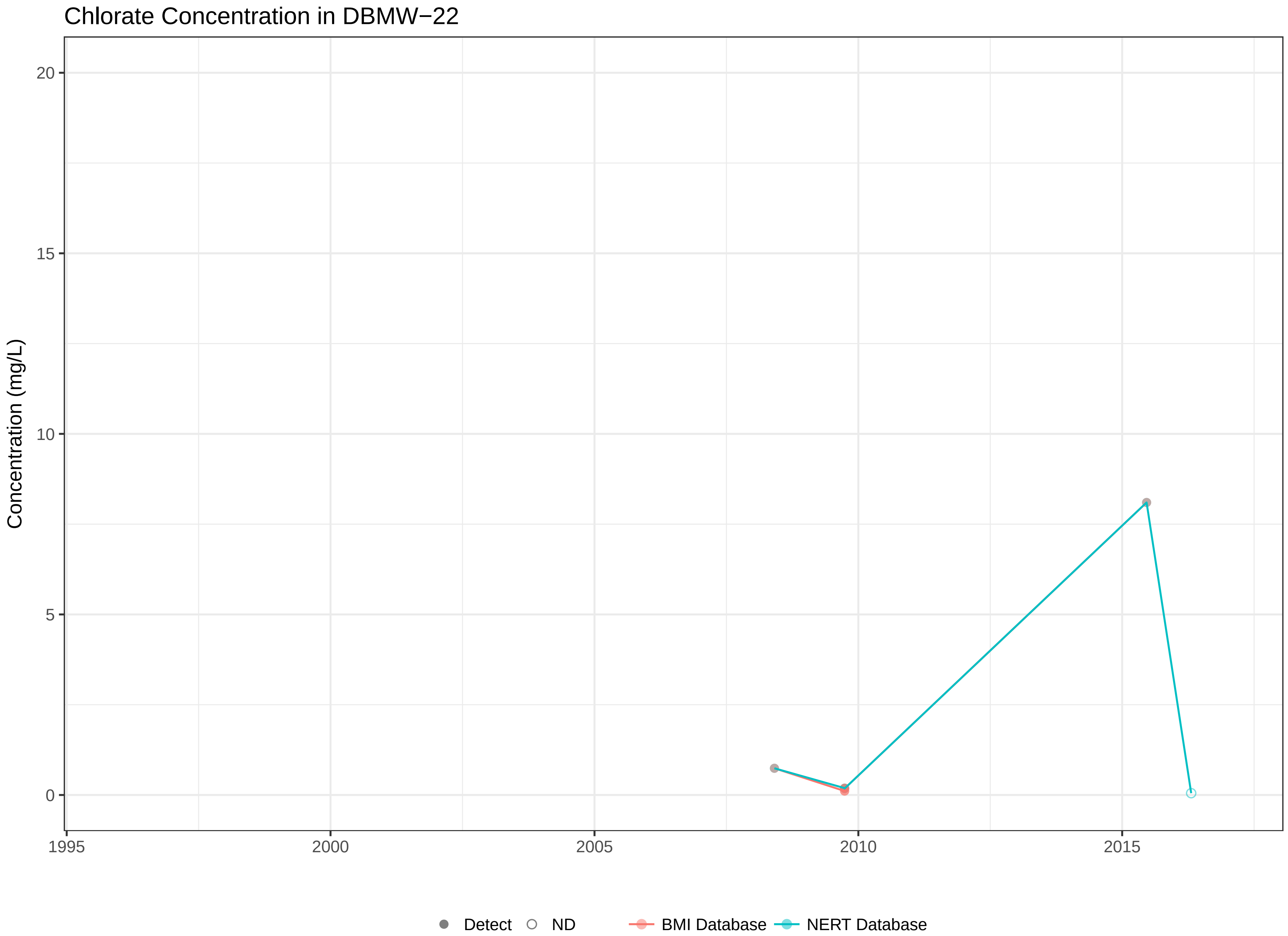
Chlorate Concentration in DBMW−13
Concentration (mg/L)
25
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



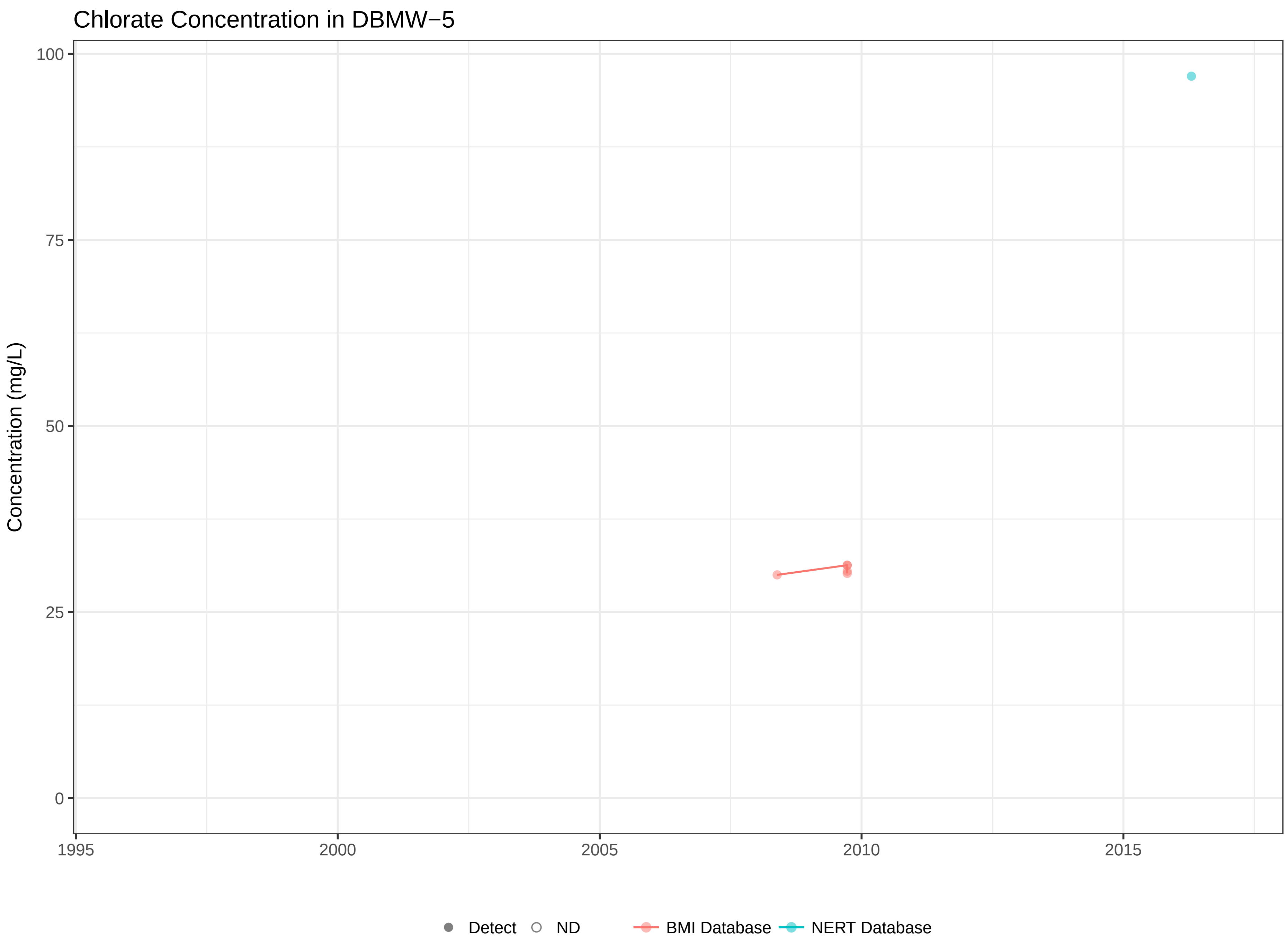
Chlorate Concentration in DBMW−14
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

Chlorate Concentration in DBMW−15

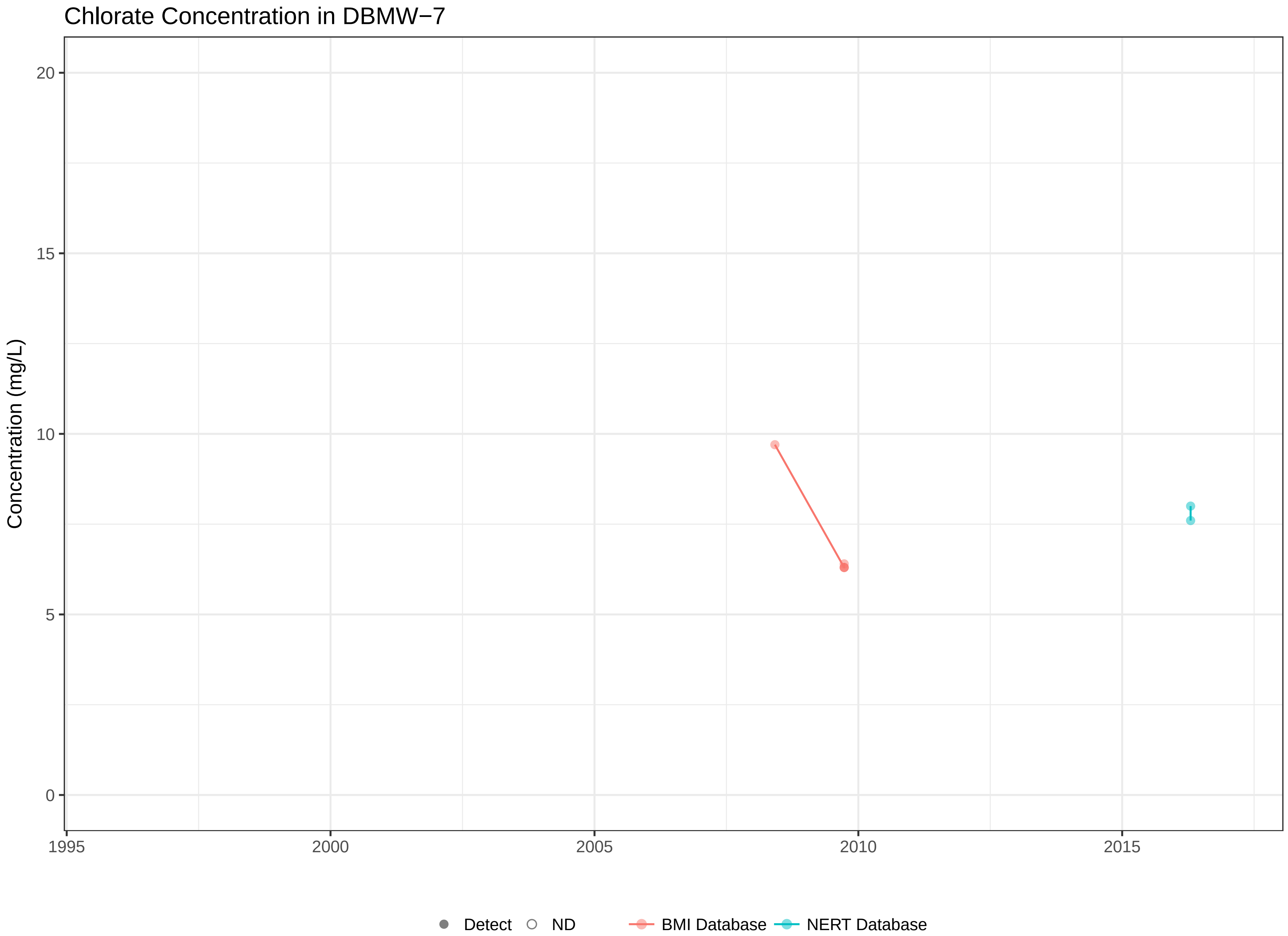


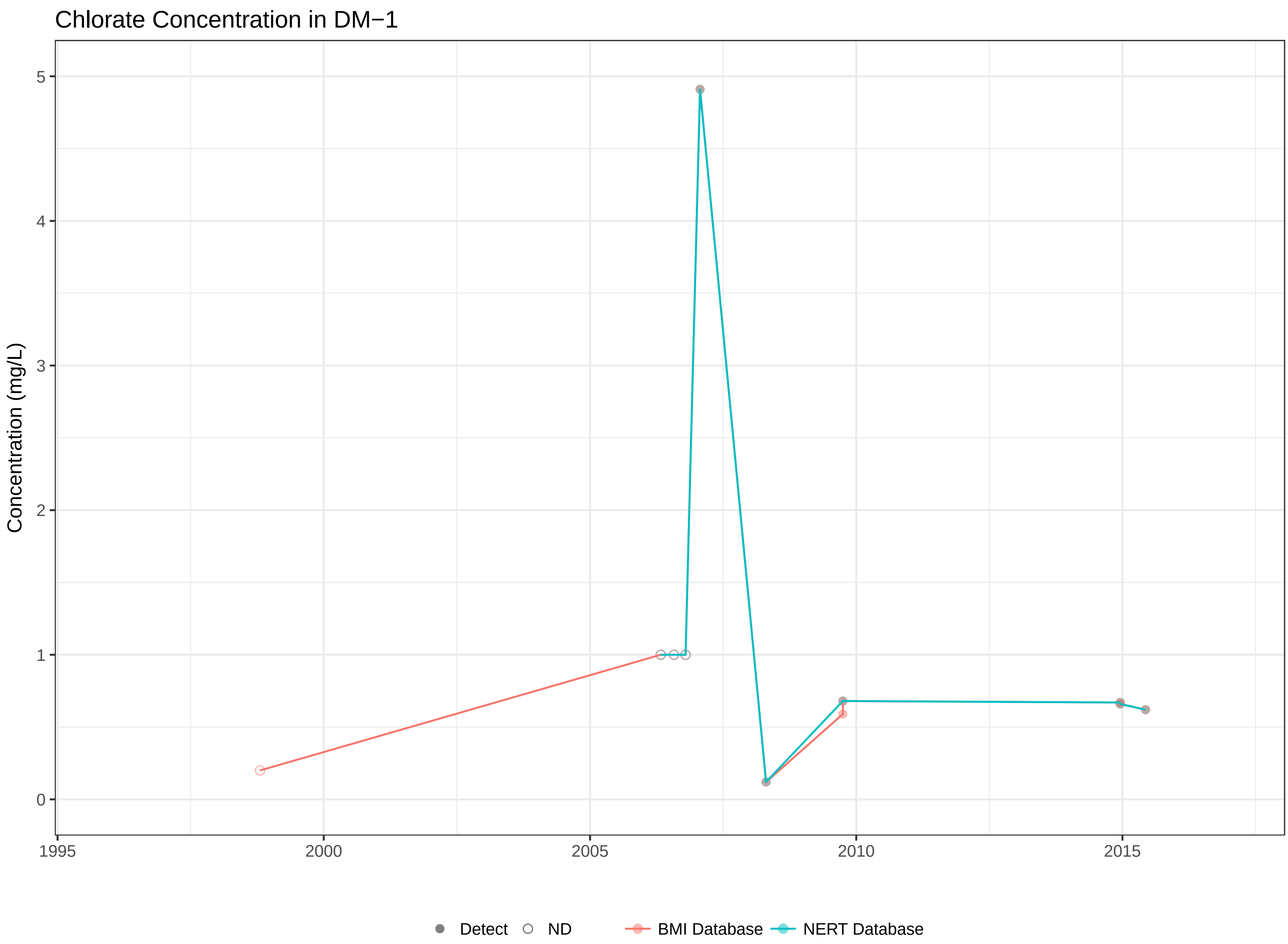


Chlorate Concentration in DBMW−22
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

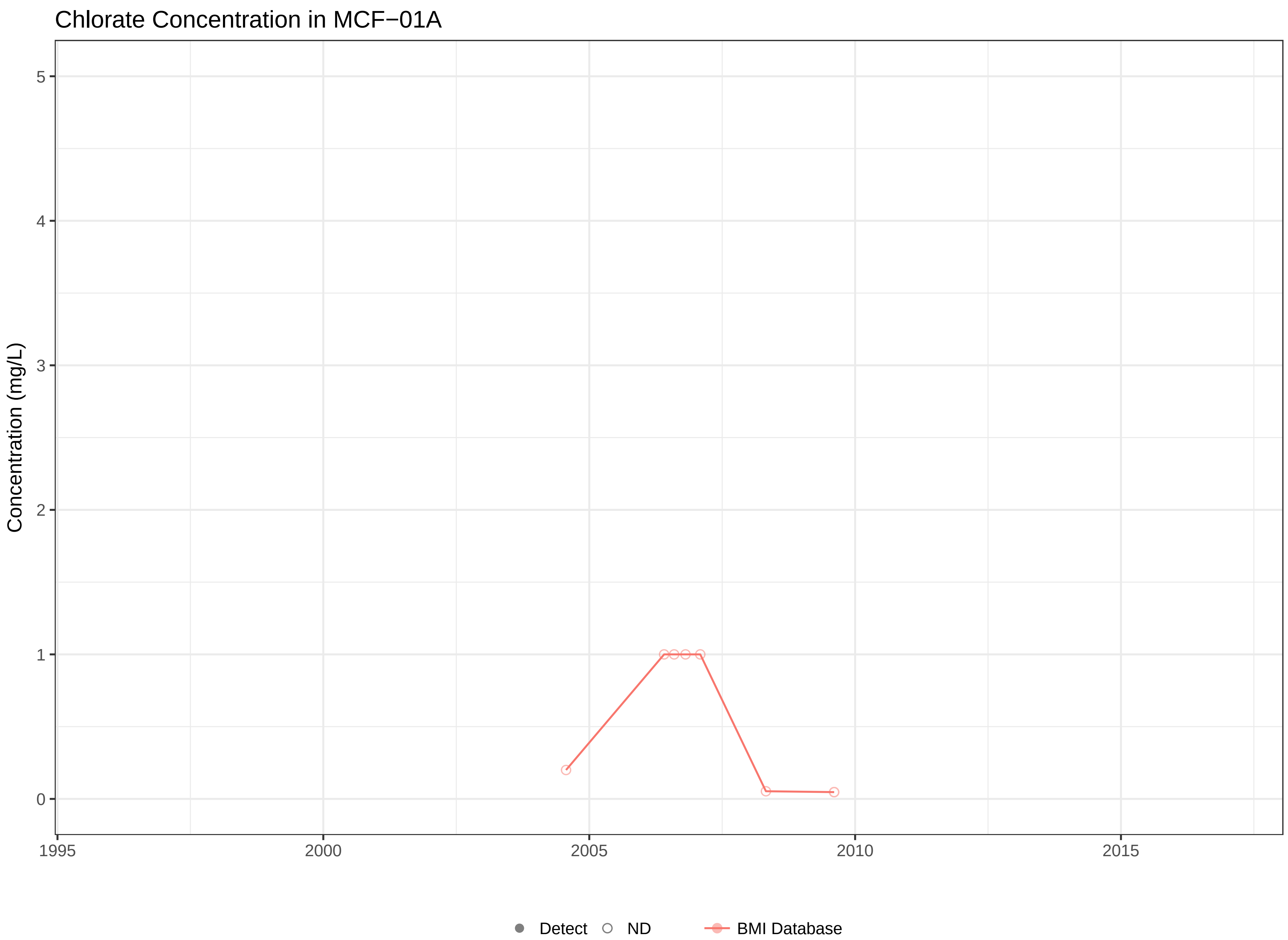


Chlorate Concentration in DBMW−5
Concentration (mg/L)
100
75
50
25
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

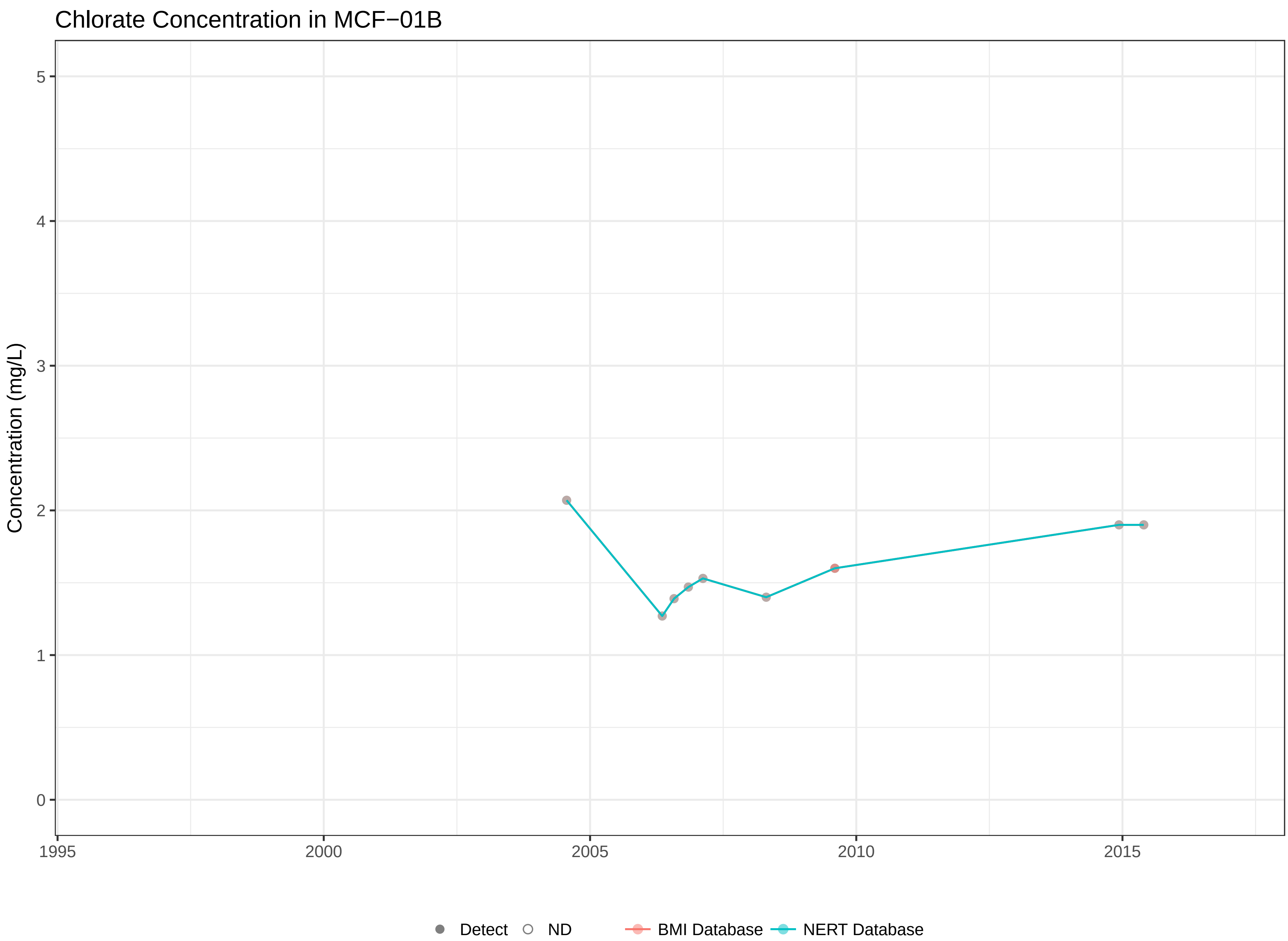

Chlorate Concentration in DBMW−7
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



Chlorate Concentration in DM−1
Concentration (mg/L)
5
4
3
2
1
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

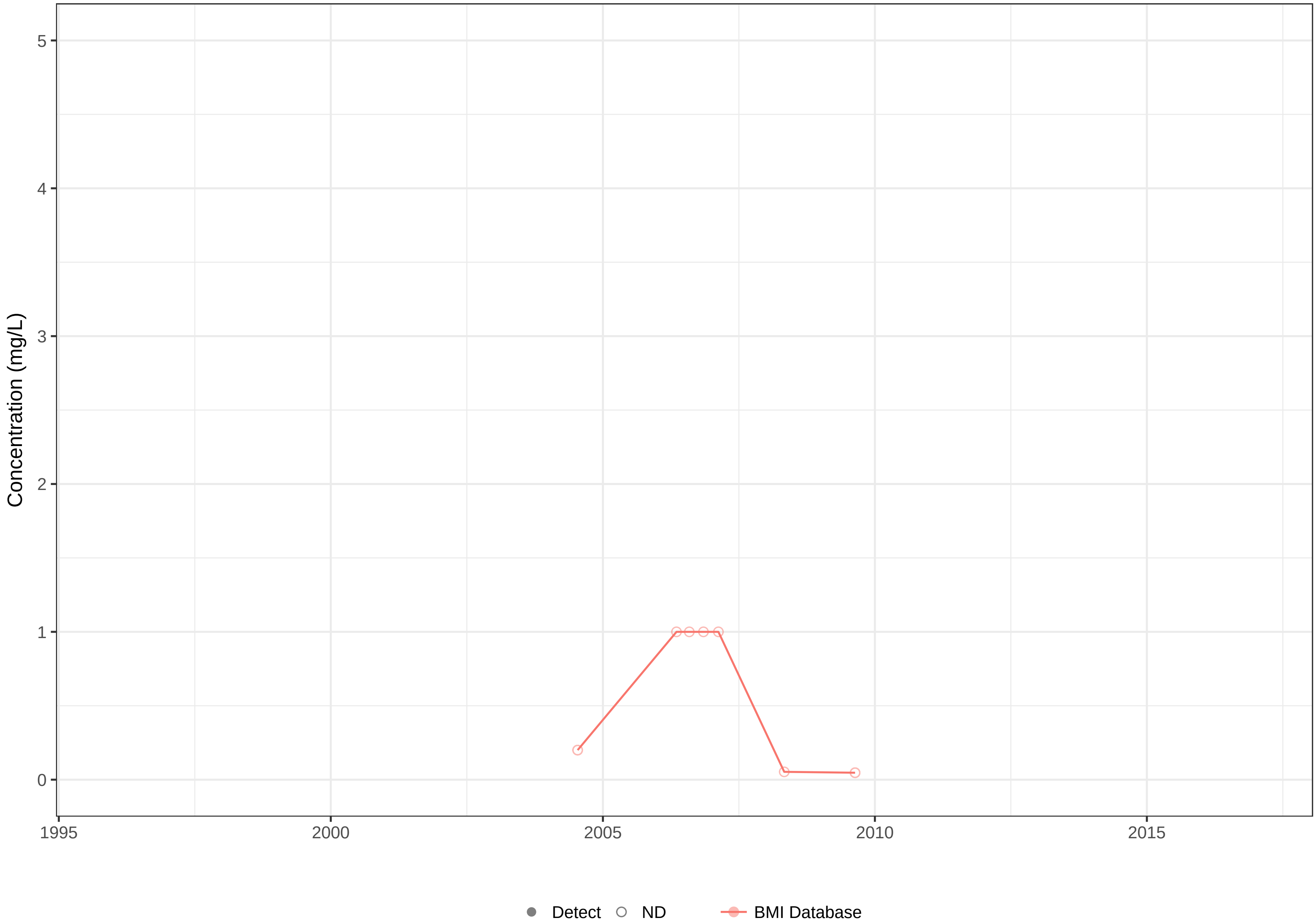


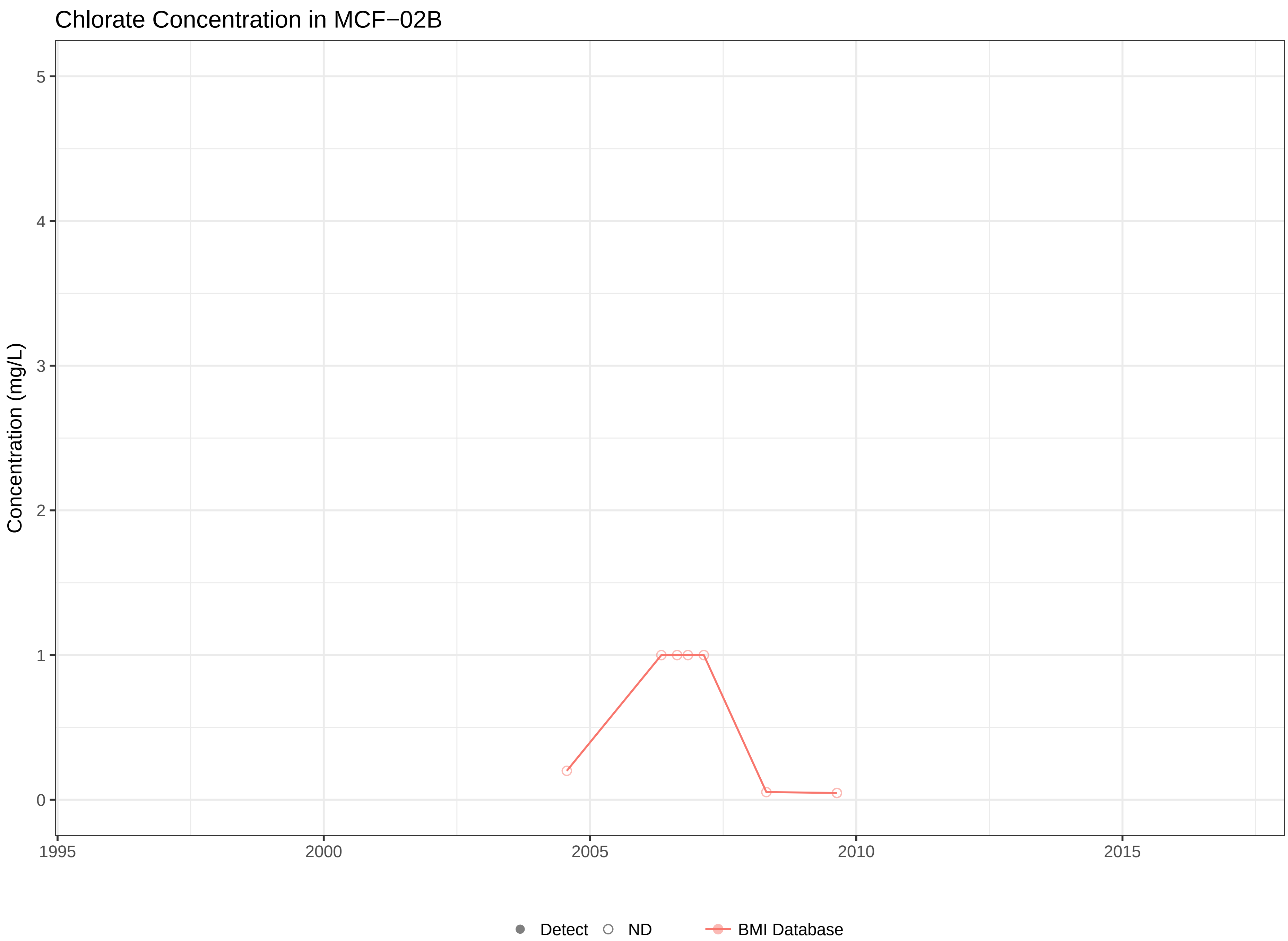
Chlorate Concentration in MCF−01A
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database



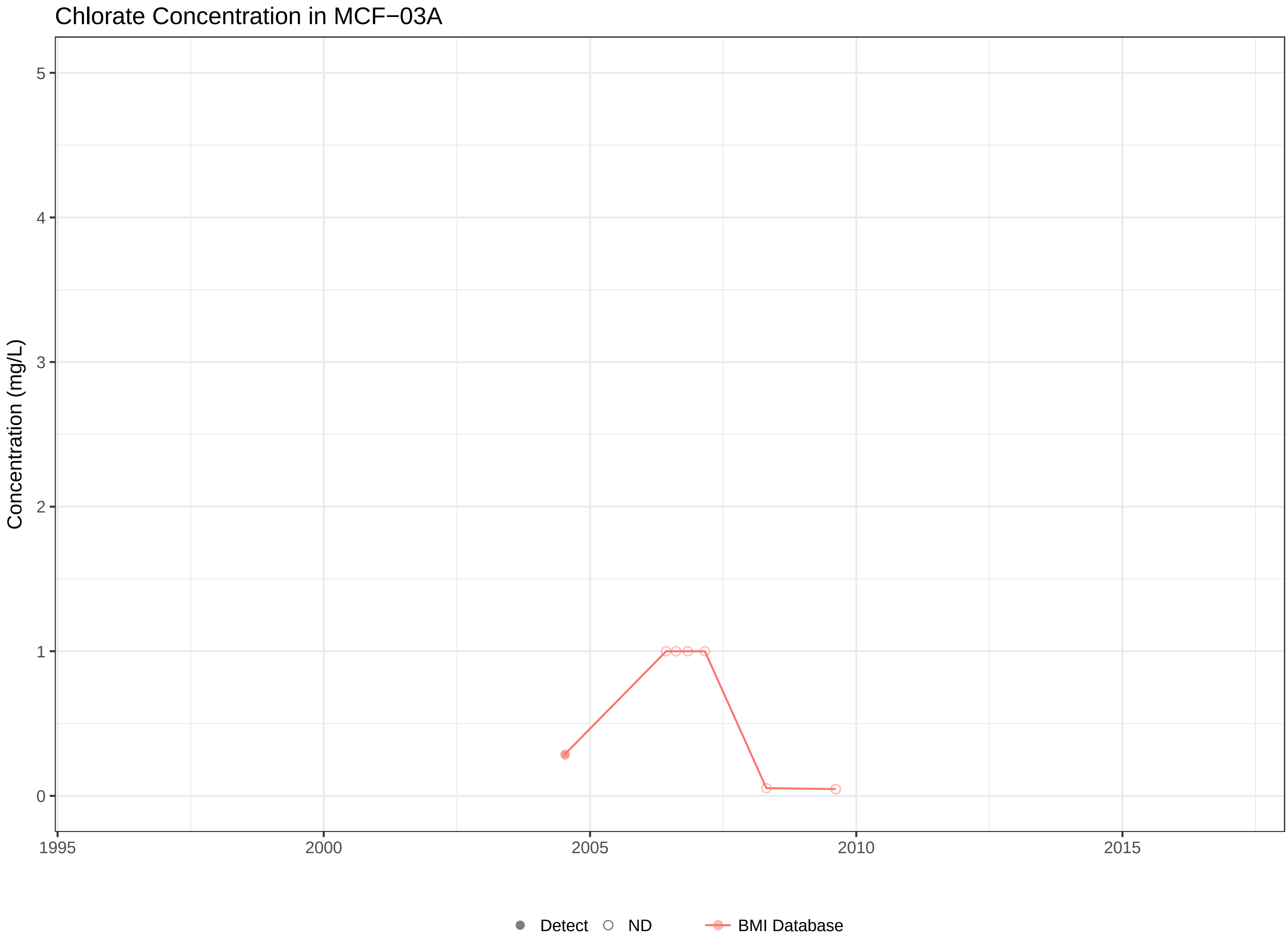
Chlorate Concentration in MCF−01B
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

Chlorate Concentration in MCF−02A



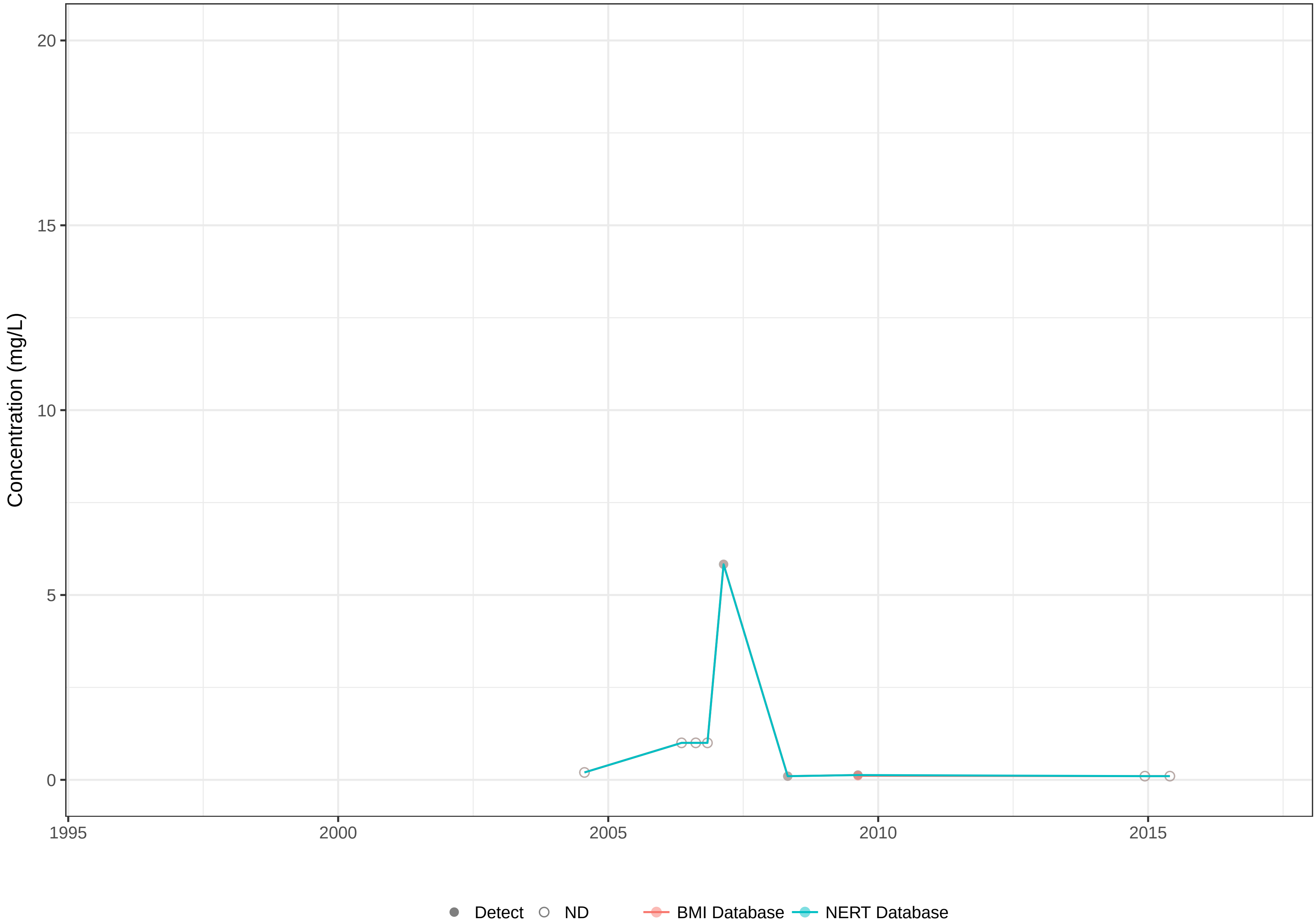


Chlorate Concentration in MCF−02B
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database

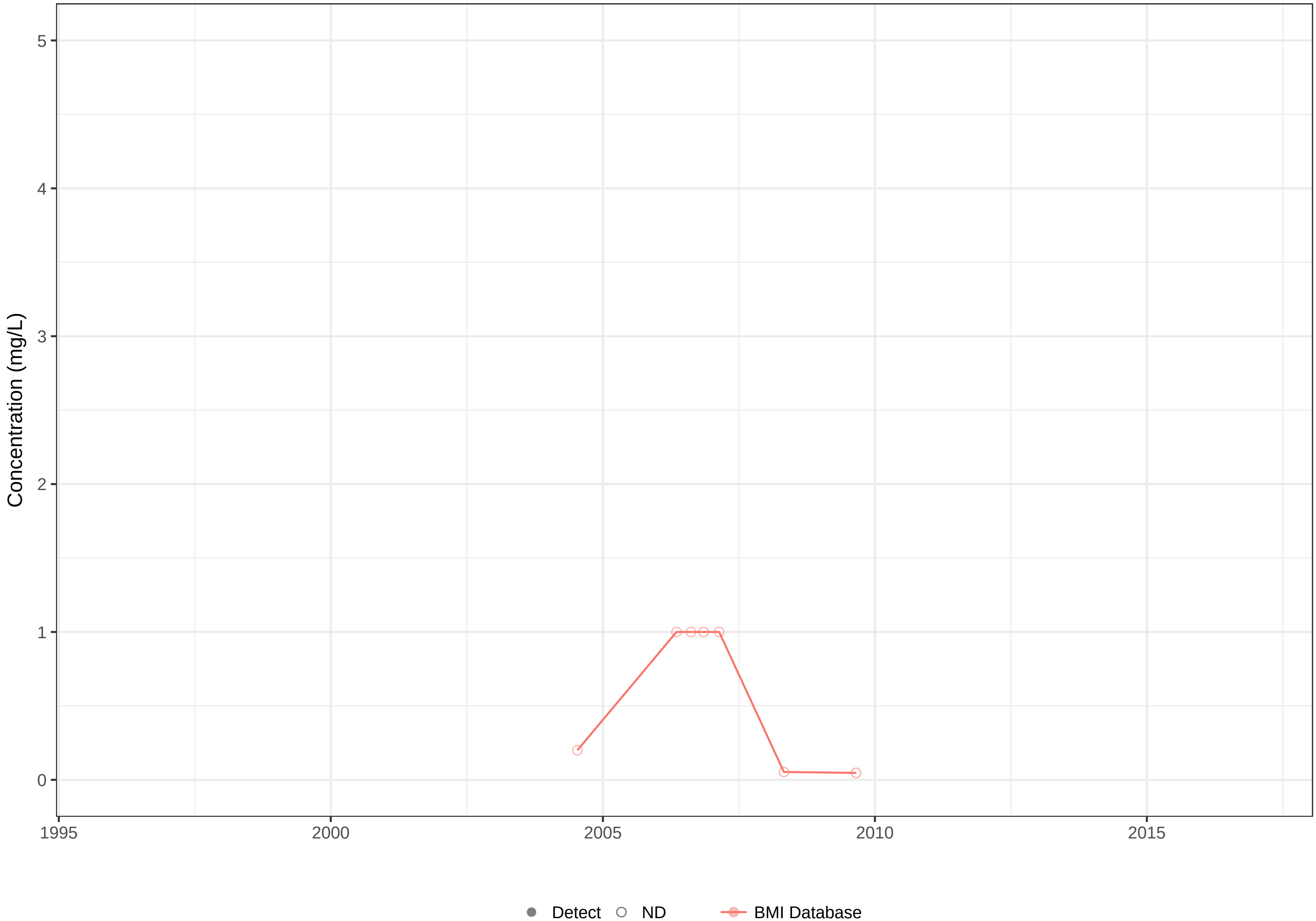


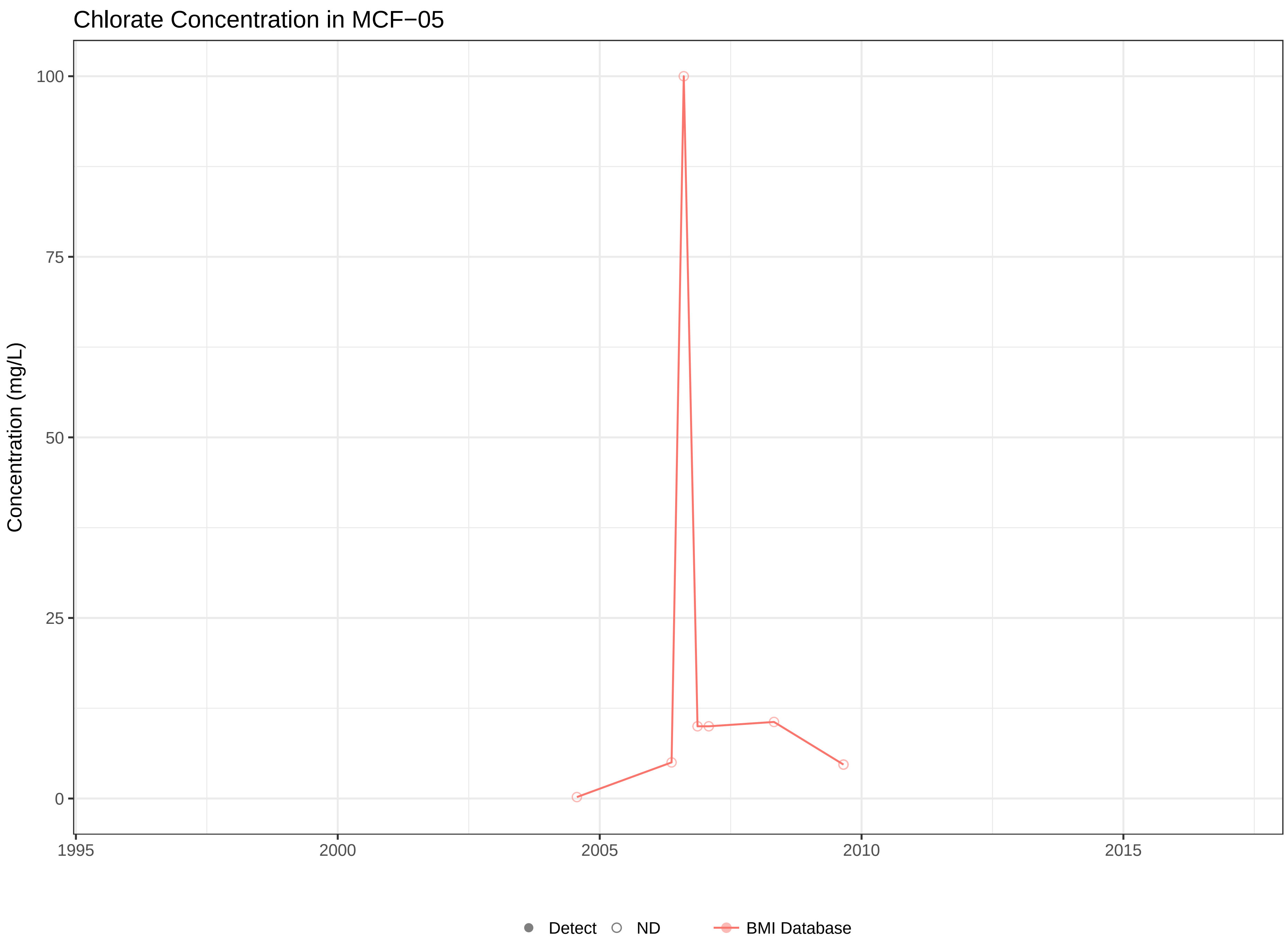
Chlorate Concentration in MCF−03A
Concentration (mg/L)
5
4
3
2
1
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database

Chlorate Concentration in MCF−03B

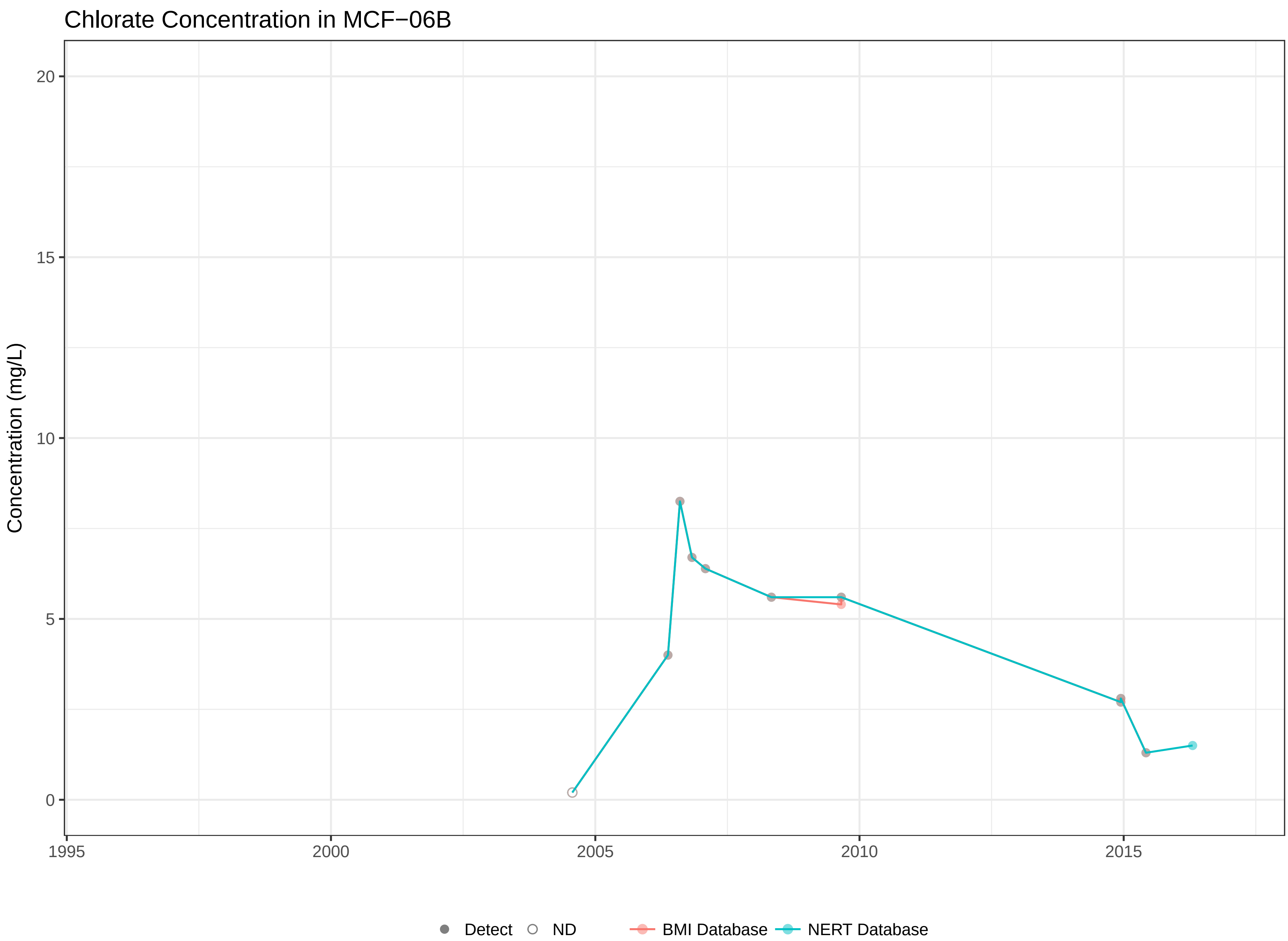


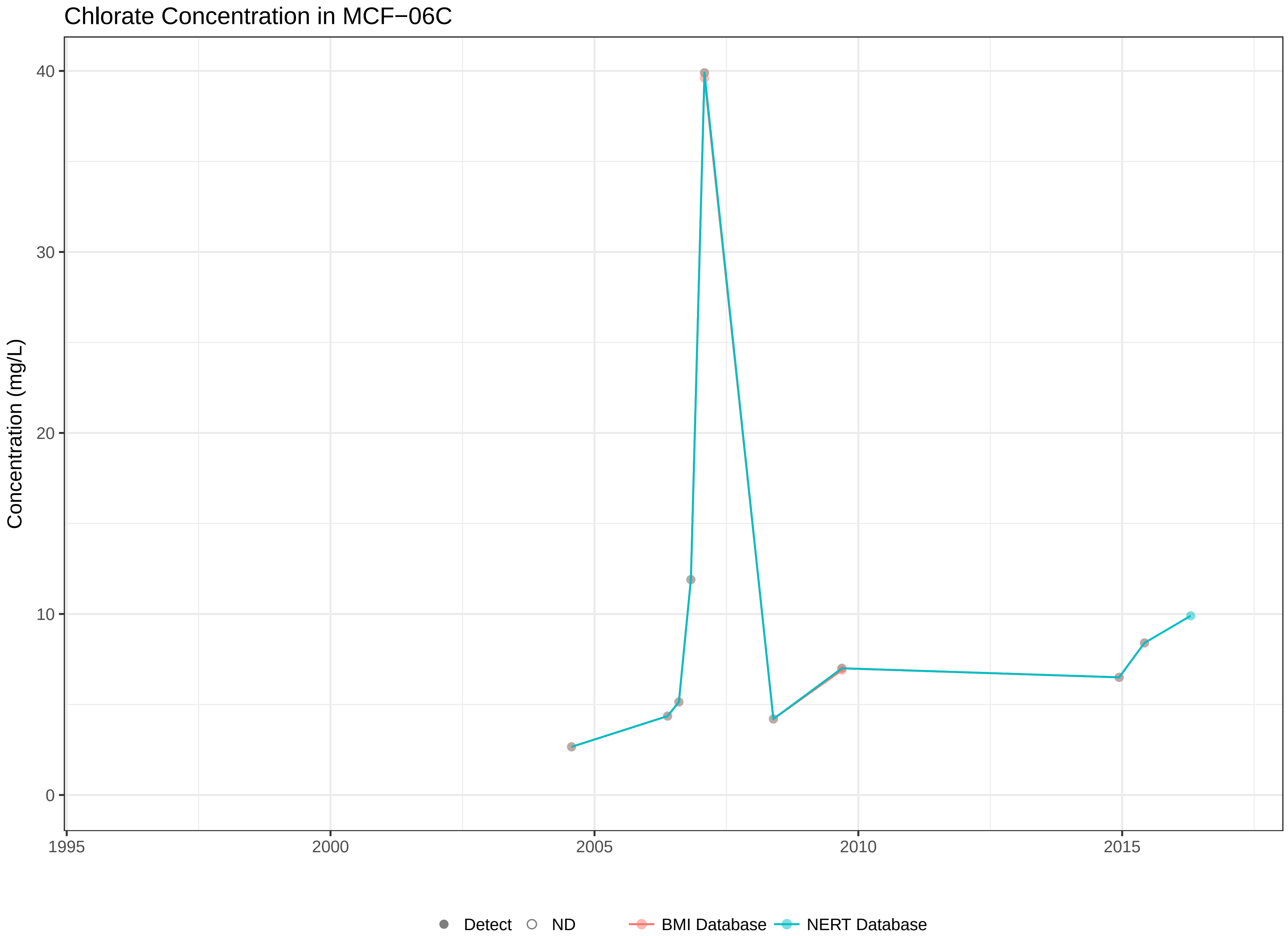
Chlorate Concentration in MCF−04



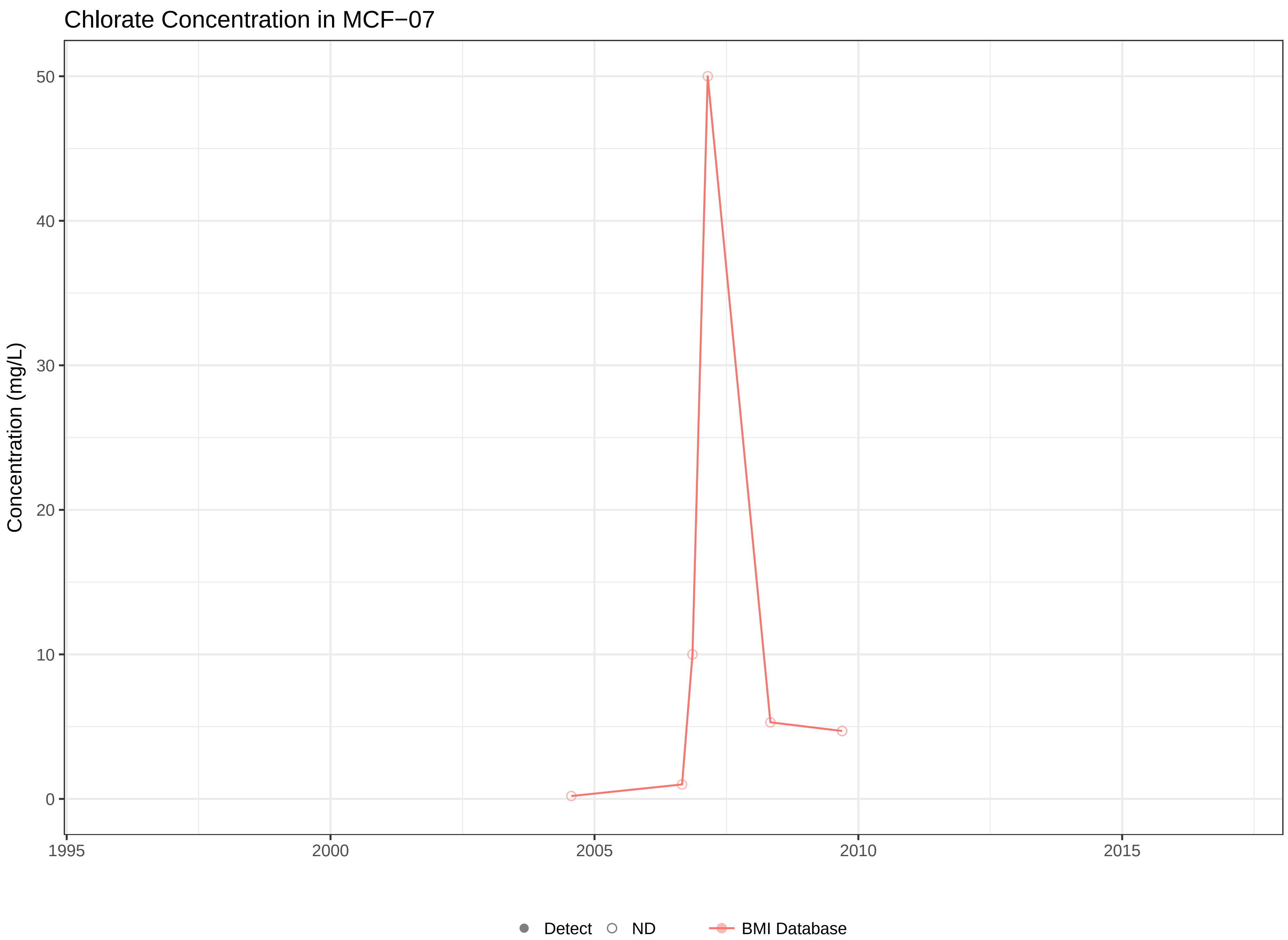


Chlorate Concentration in MCF−05
Concentration (mg/L)
100
75
50
25
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database


Chlorate Concentration in MCF−06B
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

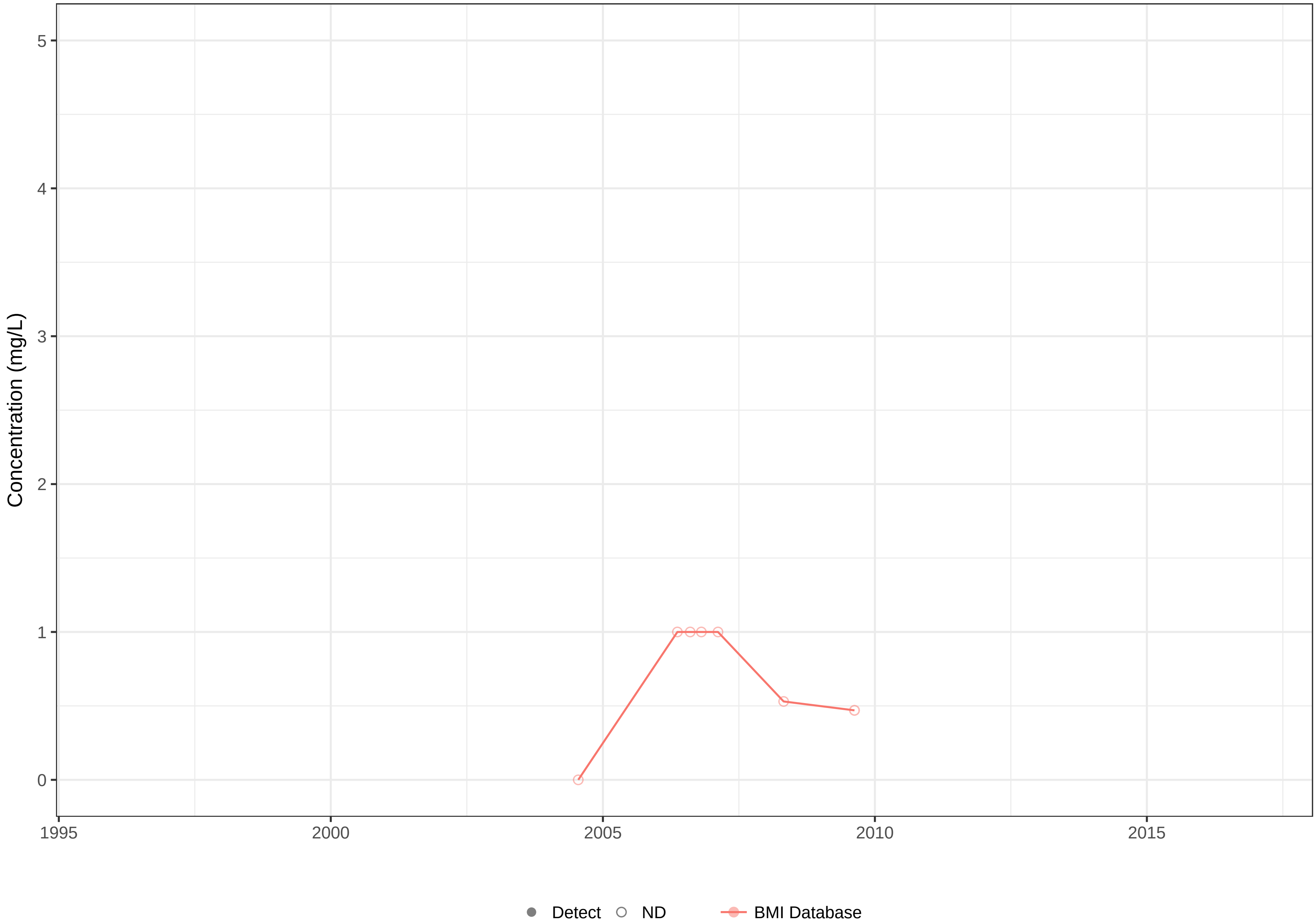


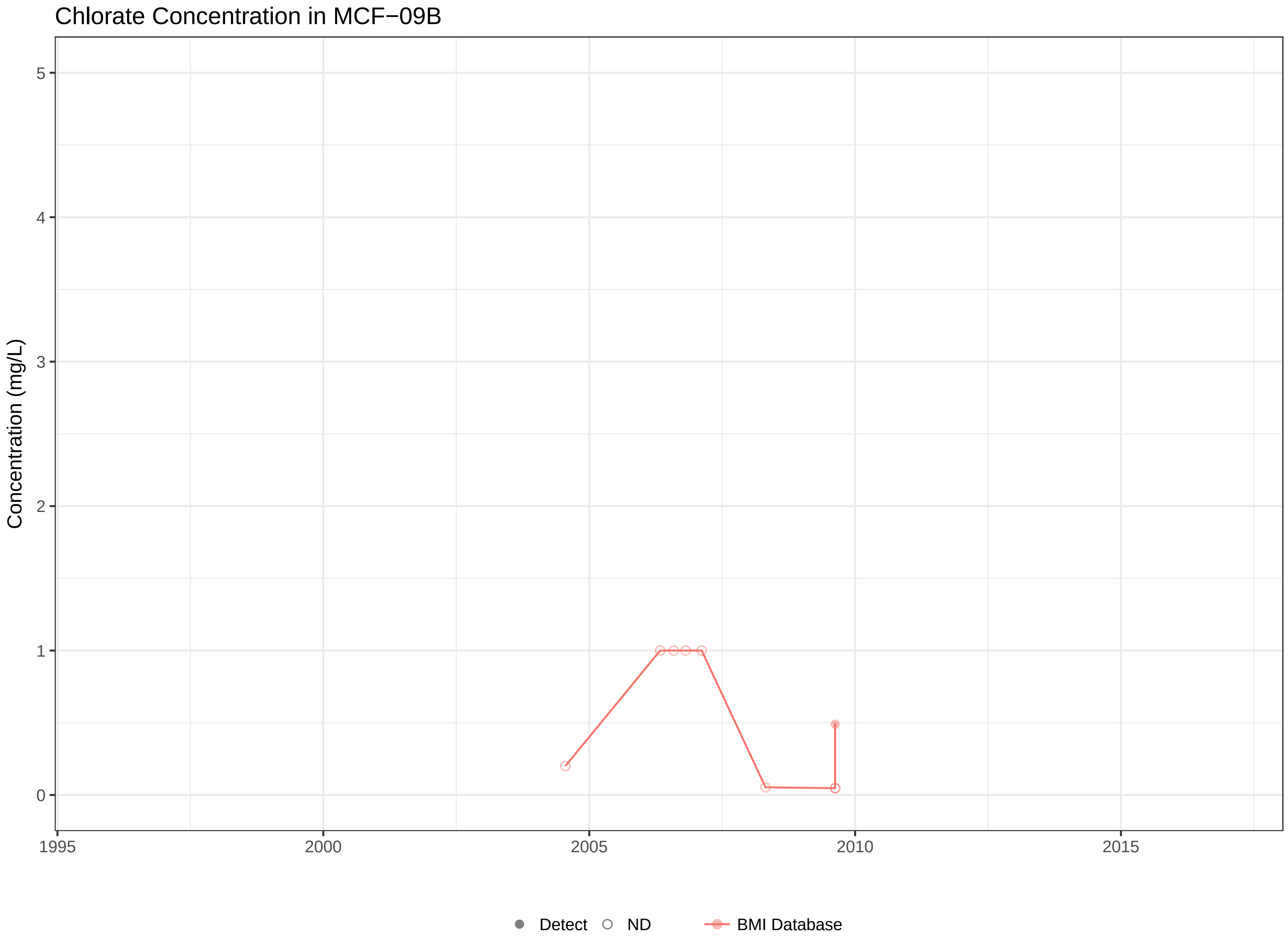
Chlorate Concentration in MCF−06C
Concentration (mg/L)
0
10
20
30
40
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



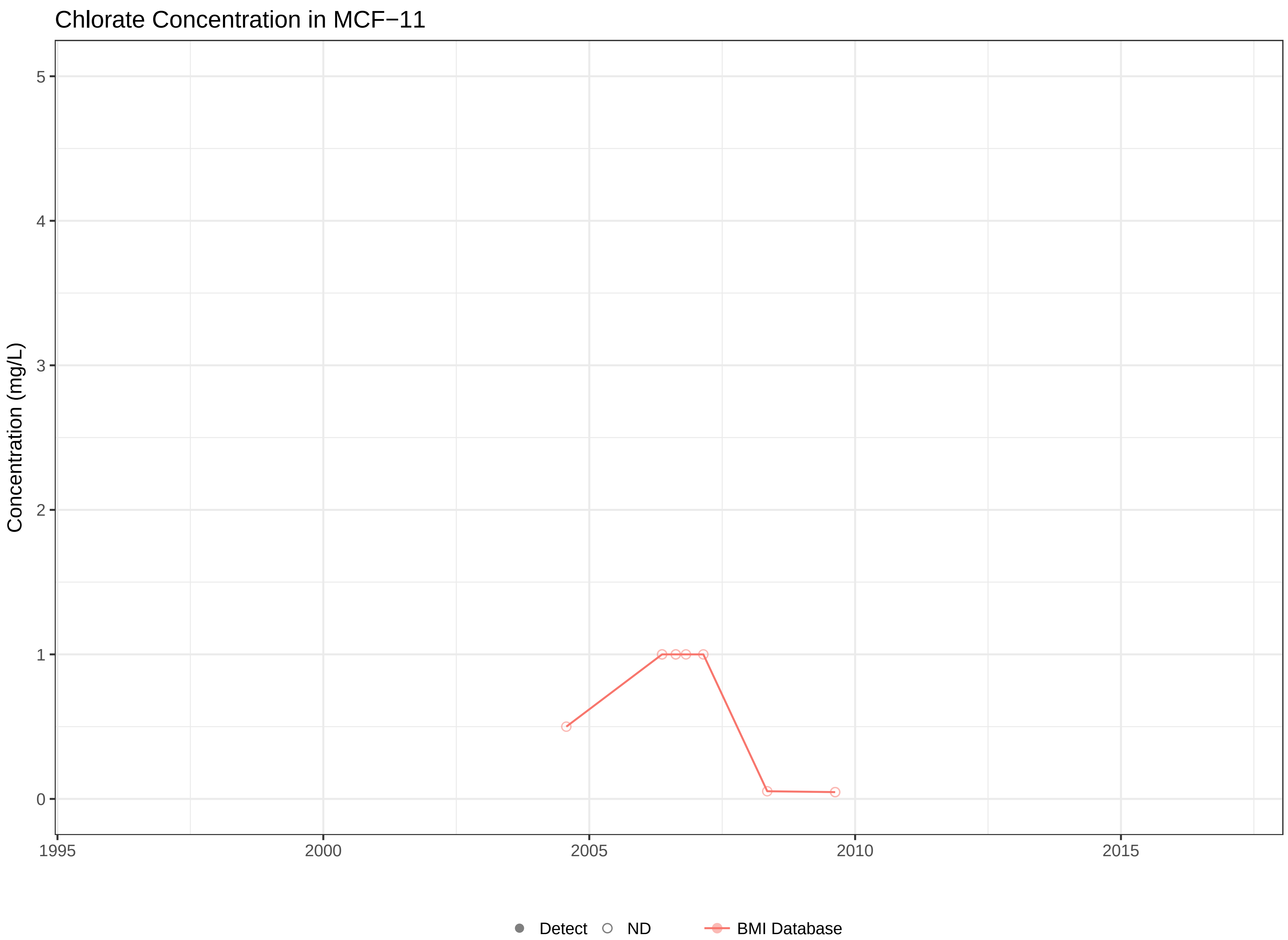
Chlorate Concentration in MCF−07
Concentration (mg/L)
50
40
30
20
10
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database

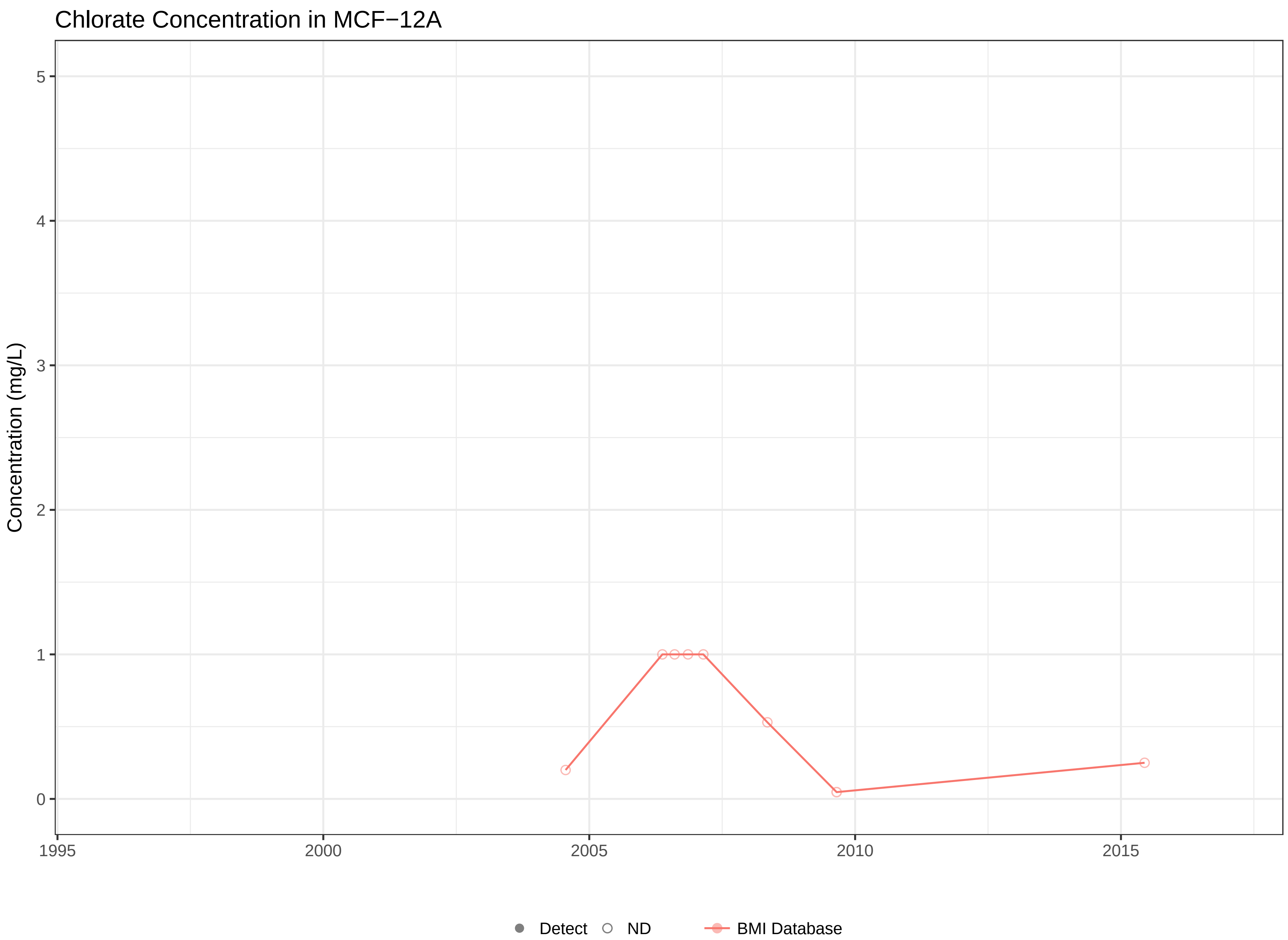
Chlorate Concentration in MCF−09A

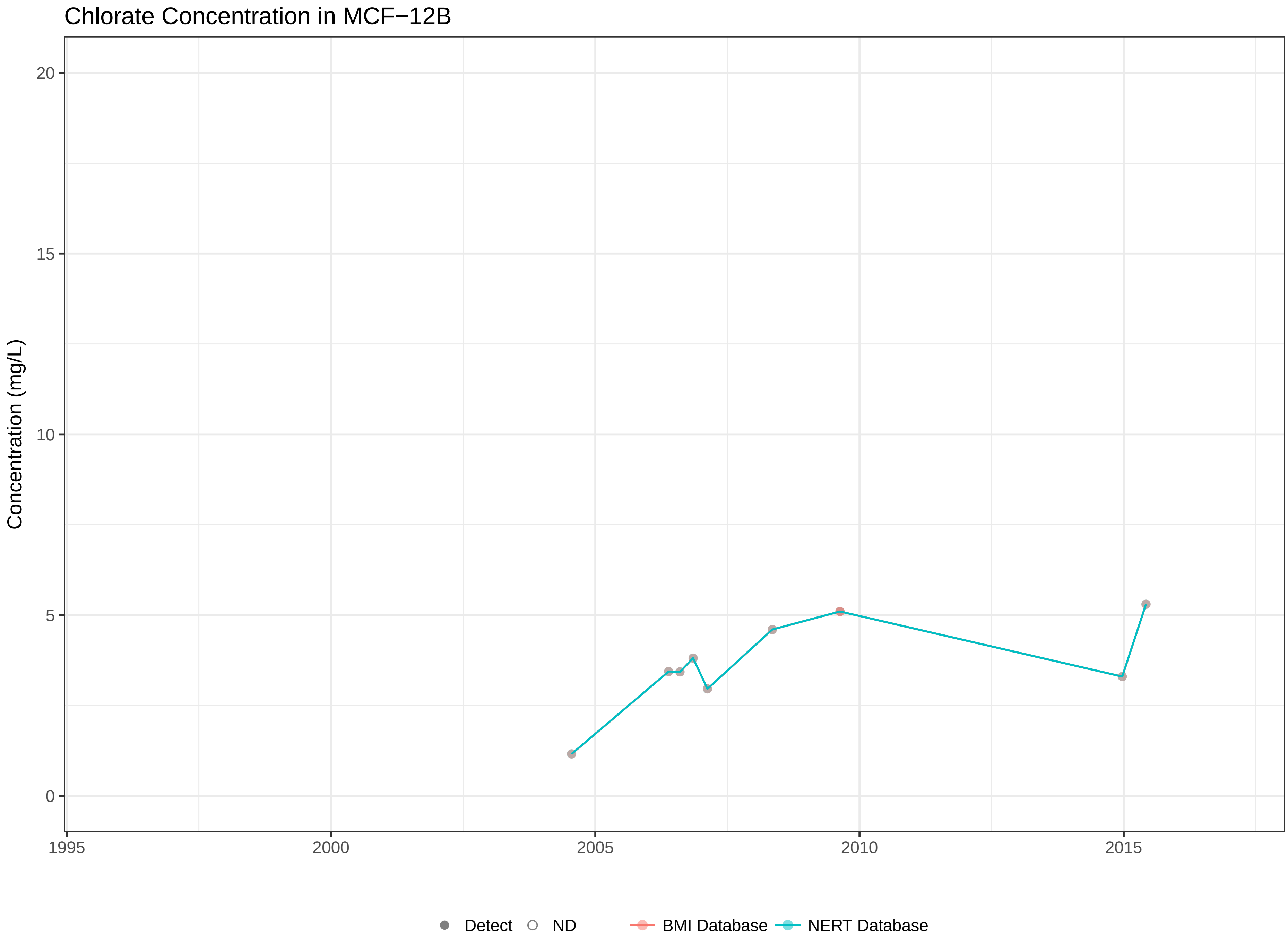


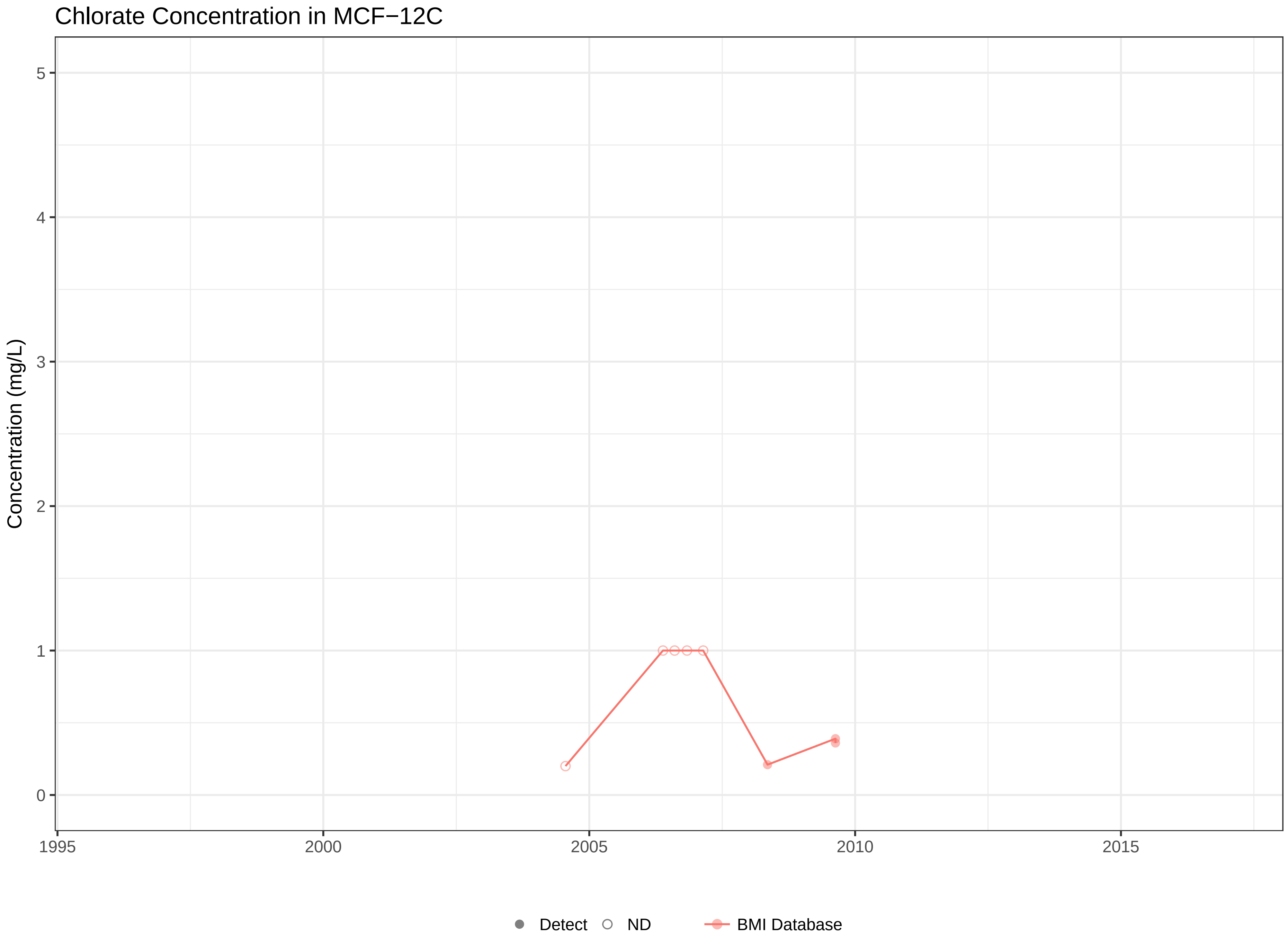


Chlorate Concentration in MCF−09B
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database


Chlorate Concentration in MCF−11
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database

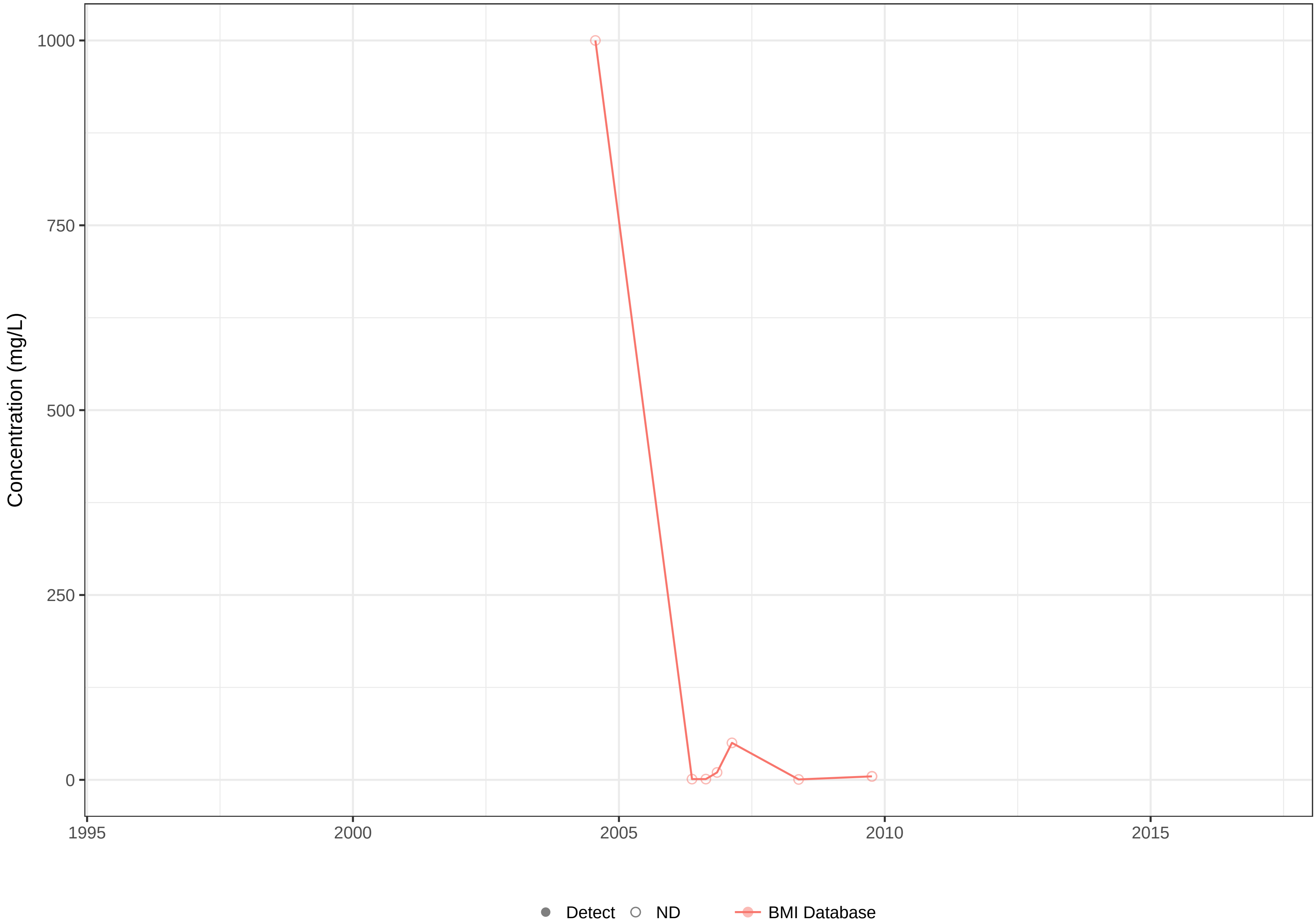

Chlorate Concentration in MCF−12A
Concentration (mg/L)
5
4
3
2
1
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database


Chlorate Concentration in MCF−12B
Concentration (mg/L)
20
15
10
5
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

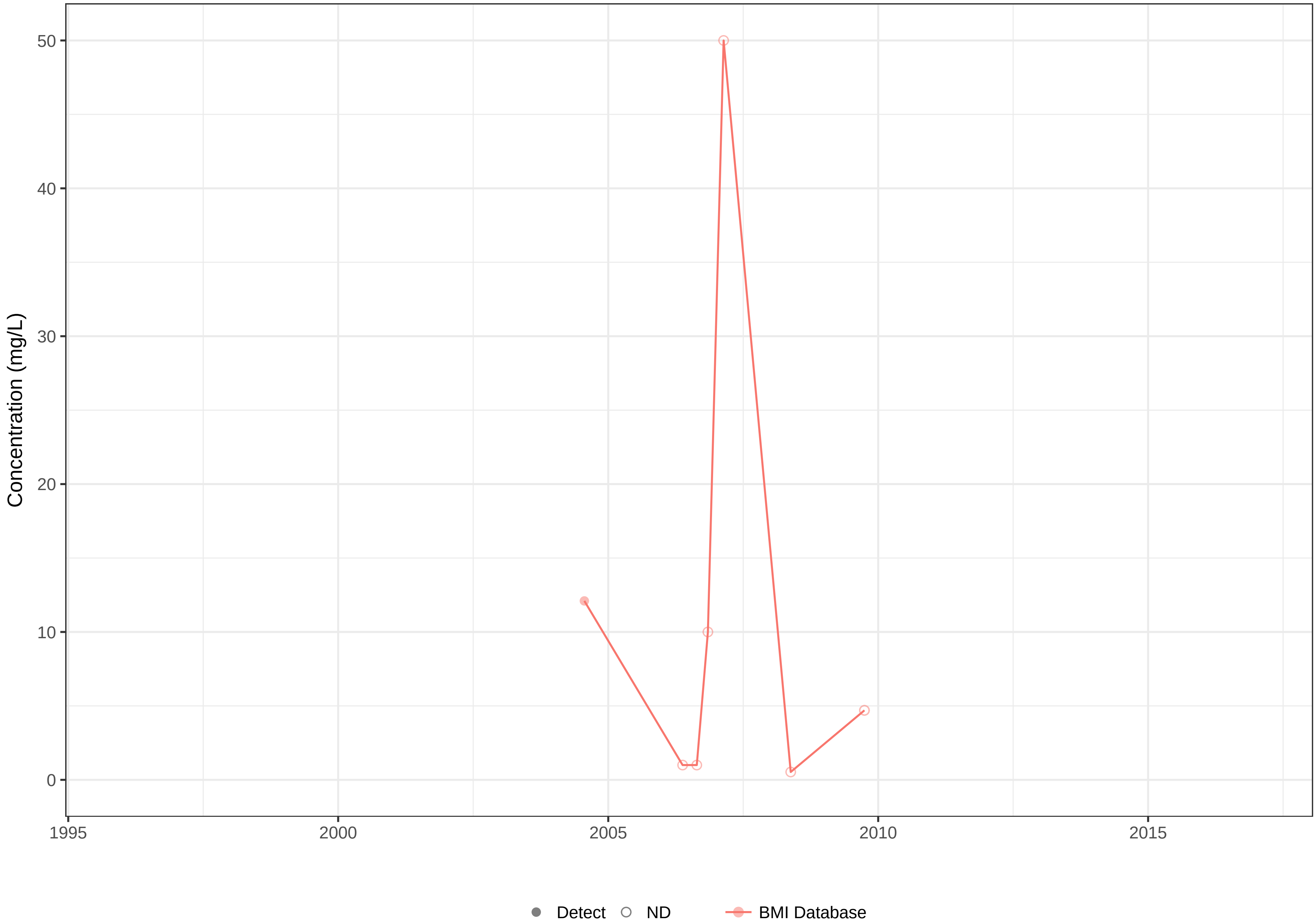


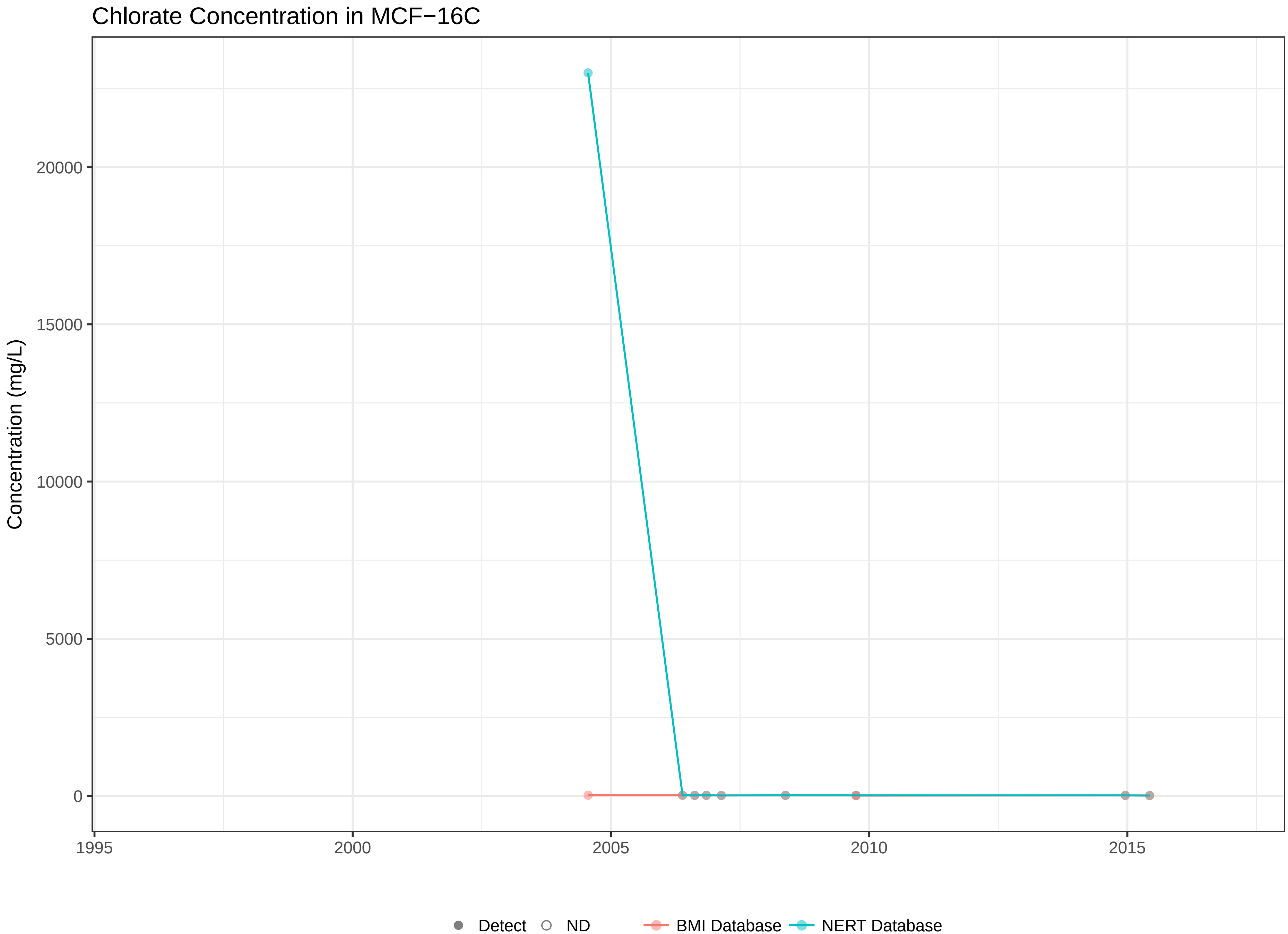
Chlorate Concentration in MCF−12C
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database

Chlorate Concentration in MCF−16A



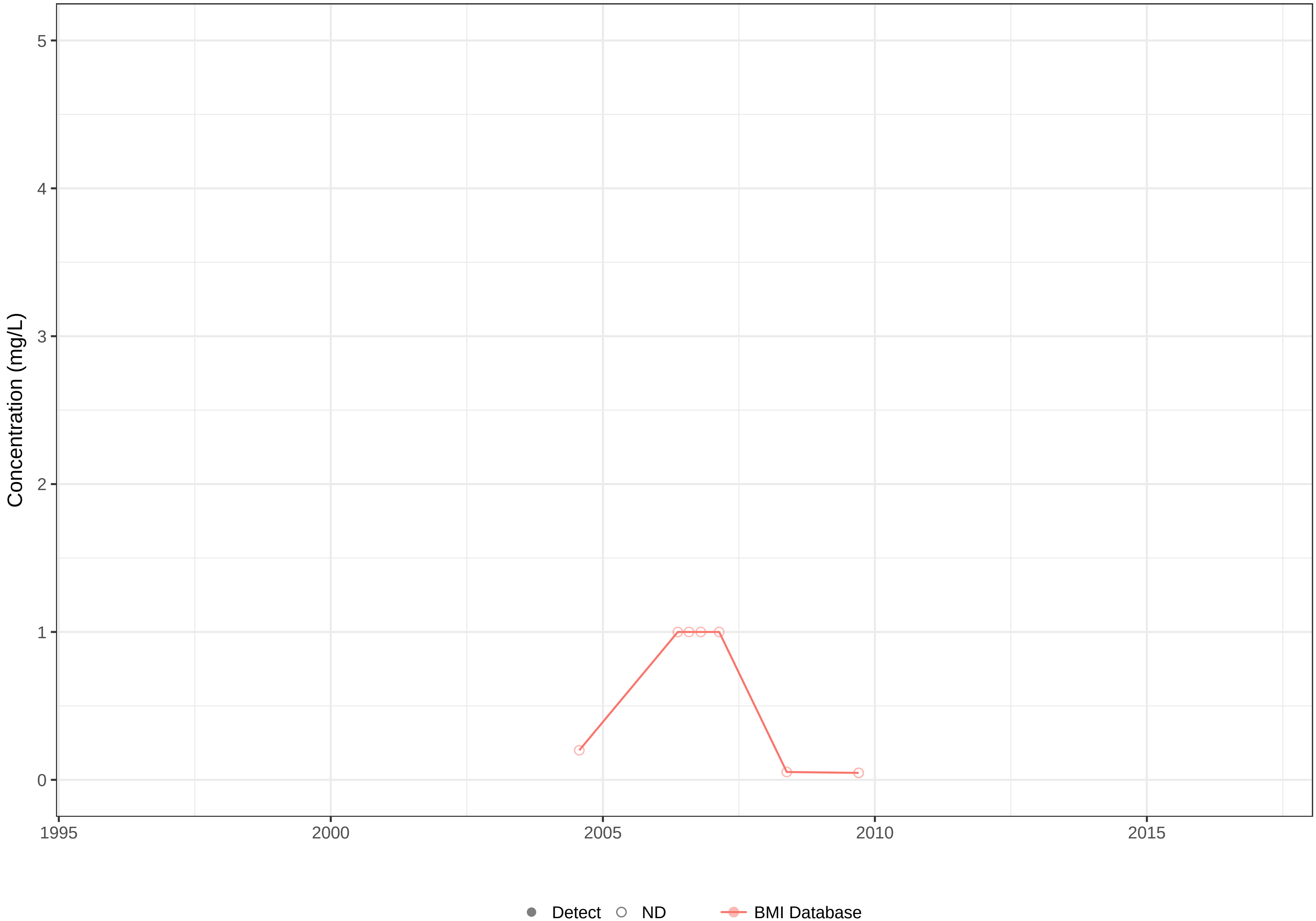
Chlorate Concentration in MCF−16B

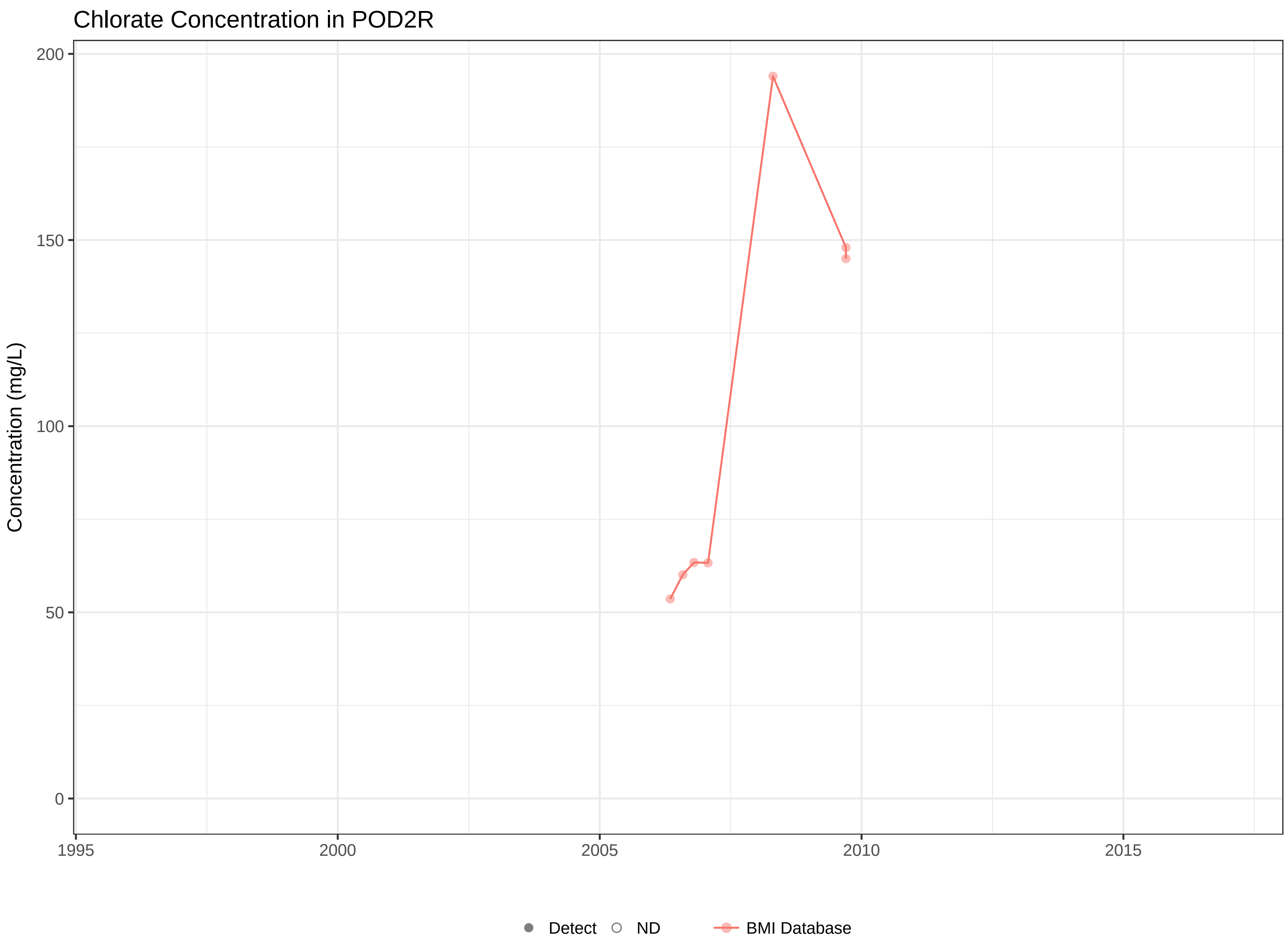




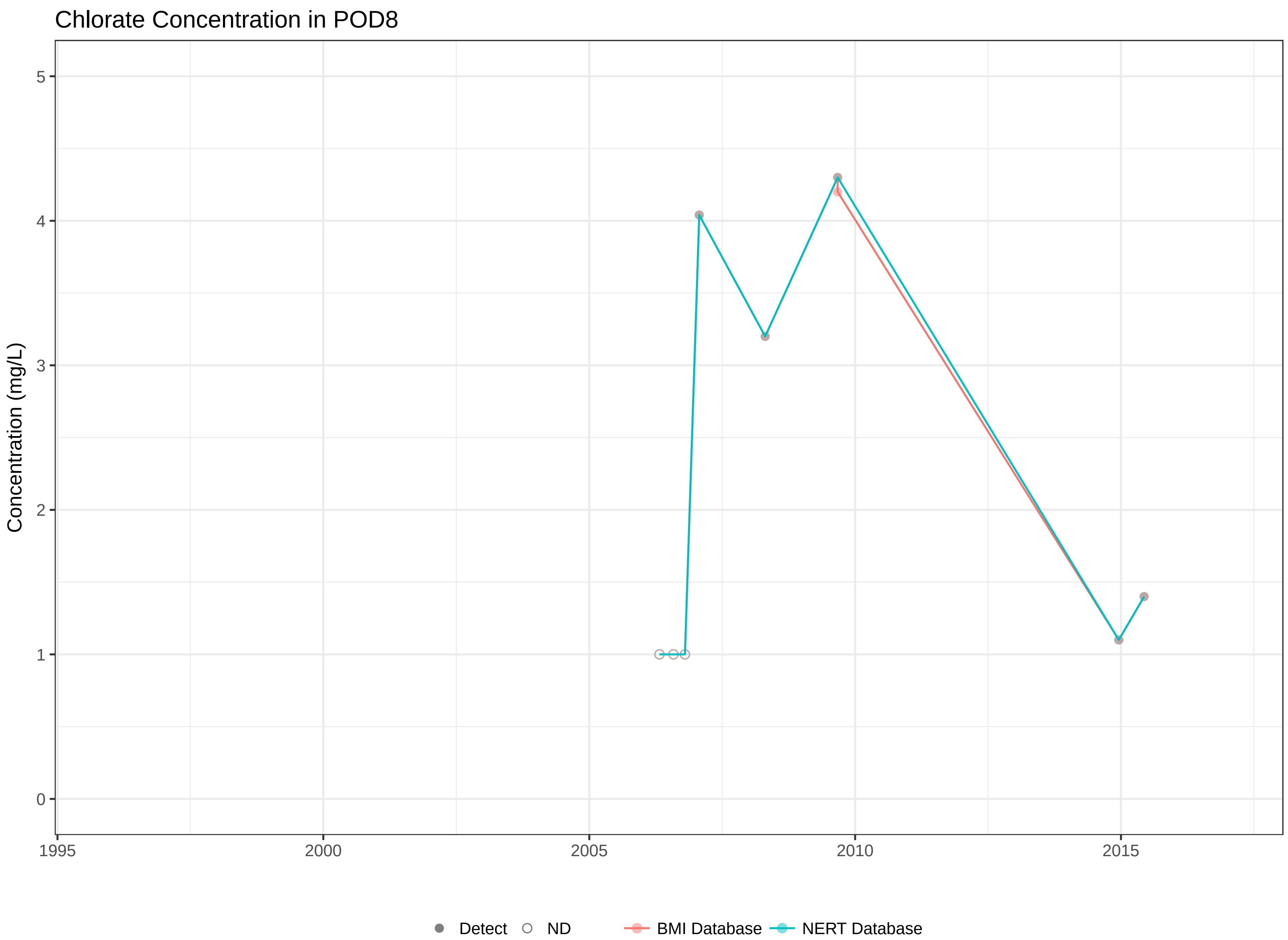
Chlorate Concentration in MCF−16C
Concentration (mg/L)
20000
15000
10000
5000
0
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database

Chlorate Concentration in MCF−27

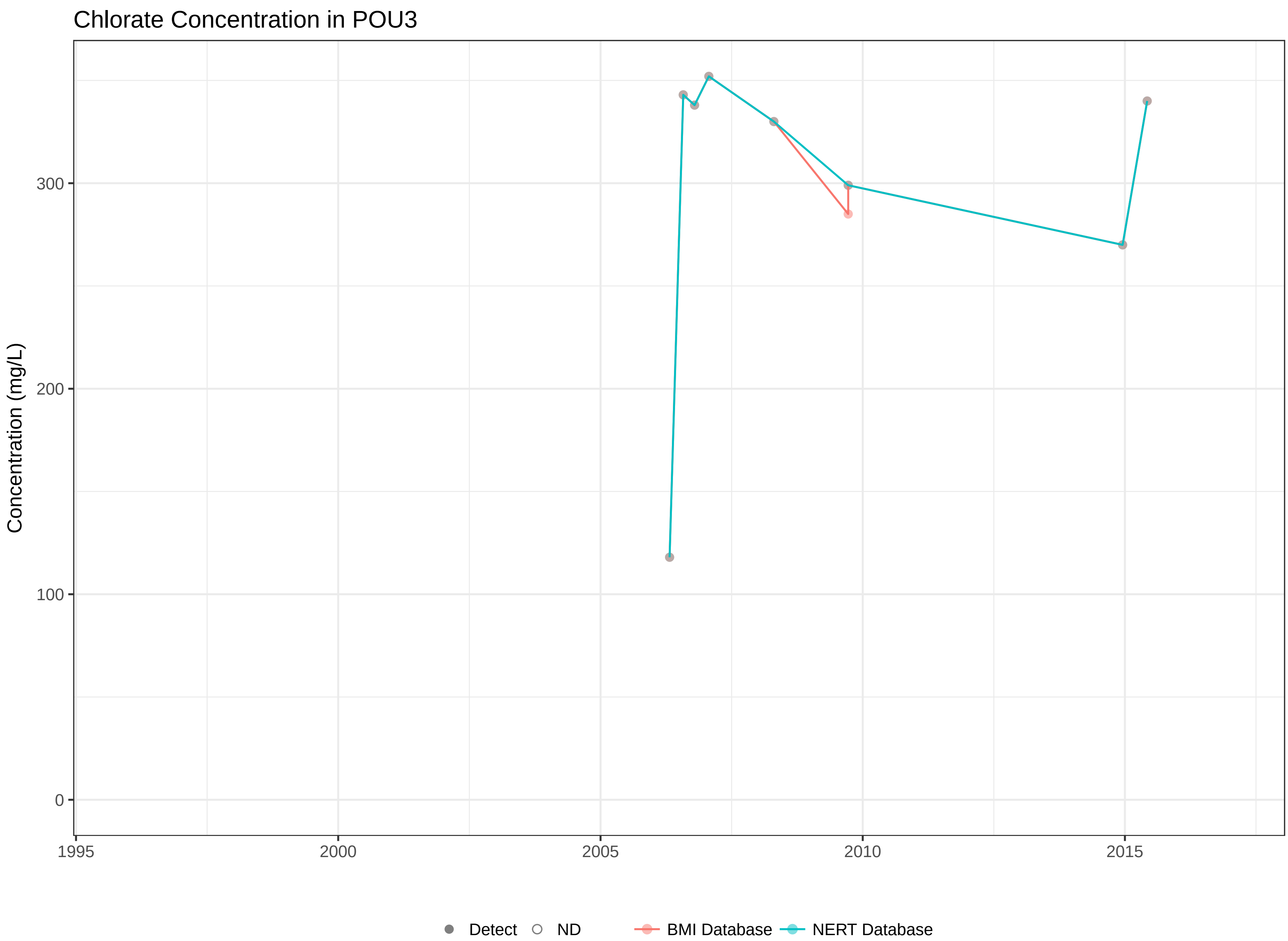




Chlorate Concentration in POD2R
Concentration (mg/L)
0
50
100
150
200
1995
2000
2005
2010
2015
Detect
ND
BMI Database



Chlorate Concentration in POD8
Concentration (mg/L)
0
1
2
3
4
5
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database



Chlorate Concentration in POU3
Concentration (mg/L)
0
100
200
300
1995
2000
2005
2010
2015
Detect
ND
BMI Database
NERT Database