Third Five Year Review Report
For
Vancouver Water Stations 1 and 4
City of Vancouver
Vancouver, Washington

September 2013

Prepared by:
United States Environmental Protection Agency
Region 10

Approved by: Date:

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Table of Contents

List of Acronyms……iv

Executive Summary……v

Five Year Review Summary Form……vi

I. Introduction……1

II. Site Chronology……..2

III. Background……4
Physical Characteristics……..4
Land and Resource Use……. ….8
Initial Investigation……..8
Historical Sources of Contamination……..8
Basis for Taking Action……..9

IV. Remedial Actions……..10
Remedy Selection……...10
Remedy Implementation……11
System Operation/Operation and Maintenance (O&M)…….....12

V. Progress Since the Last Five Year Review …….....13

VI. Five Year Review Process……..13
Administrative Components……13
Community Involvement…….....13
Document Review……13
Data Review…….....13
Five Year Review Site Inspection and Sampling ……15
Conclusions……15

VII. Technical Assessment……..16
Question A: Is the remedy functioning as intended by the decision documents?.....16
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?.....16
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?.....16
Technical Assessment Summary……17

VIII. Issues ……..……..17
IX. Recommendations and Follow-up Actions……17
X. Protectiveness Statement…….……17
XI. Next Review……..……...…….....17

Tables

Table 1 – Chronology of Site Events Water Station 1
Table 2 – Chronology of Site Events Water Station 4
Table 3 – Water Quality Results for Volatile Organic Compounds– Water Station 1 & 4

Figures

Figure 1 – Site Location Map
Figure 2 – Production Well Locations for Water Station 1
Figure 3 – Production Well Locations for Water Station 4

Appendix

Appendix A- City Monitoring Graphs of PCE Concentrations

References

List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
CFR	Code of Federal Regulations
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PCE	tetrachloroethene
PRP	Potentially Responsible Party
RA	Remedial Action
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SDWA	Safe Drinking Water Act
TCE	trichloroethene
VOC	volatile organic compound
WS1	Vancouver Water Station 1
WS4	Vancouver Water Station 4

Executive Summary

The remedy for the Vancouver Water Station 1 (WS1) & Water Station 4 (WS4) Superfund Sites in Vancouver, Washington involved selection of an existing air stripping treatment system that reduced tetrachloroethene (PCE) concentrations in drinking water to below the State and Federal Maximum Contaminant Level (MCL). The continued operation of the existing treatment systems along with monitoring by the City of Vancouver (City), was the selected final remedial action for both WS1 and WS4. The City has performed the remedy required in both the WS1 and WS4 Record of Decision (ROD) and incurred all costs associated with the installation and operation of the air stripping treatment systems for WS1 and WS4. The trigger for this Five Year Review is the second Five Year Review dated September, 2008.

The assessment of this Five Year Review found that the remedy is operating in accordance with the requirements of the ROD. The remedy is functioning as designed. Operation, maintenance and monitoring at the Site are being performed in accordance with the approved Operation and Maintenance Plan. The immediate threats have been addressed and the remedy is protective of human health and the environment.

Five Year Review Summary Form

SITE IDENTIFICATION		
Site Names: Vancouver Water Stations 1 and 4		
EPA IDs: WAD988519708/ WAD988475158		
Region: 10	**State:** WA	**City/County:** Vancouver/Vancouver

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): Nancy Harney
Author affiliation: US EPA Region 10
Review period: October 2008 – August 2013
Date of site inspection: April 2, 2013
Type of review: Policy
Review number: 3
Triggering action date: 9/11/2008
Due date *(five years after triggering action date)*: 9/11/2018

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five Year Review:
No issues were identified.

OU and Sitewide Protectiveness Statements

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU1 – entire WS1 & WS4	Protective	
Protectiveness Statement: The remedies at both WS1 and WS4 are protective of human health and the environment because the treatment system is functioning as intended and human and ecological risks are under control.		

Vancouver Water Station 1 & 4 Superfund Sites
Vancouver, WA
Third Five Year Review Report

I. Introduction

The purpose of a Five Year Review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five Year Review reports. In addition, Five Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Environmental Protection Agency (EPA) is preparing this Five Year Review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*
>
> The EPA interpreted this requirement further in the NCP; 40 CFR §300.430(f) (4) (ii) states:
>
> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The EPA Region 10 conducted the Five Year Review of the remedy implemented at Vancouver WS1 & WS4 Superfund Sites in Vancouver, Washington. This review was conducted by the Remedial Project Manager (RPM) for the Site from April 2013 through July, 2013. This report documents the results of the review.

This is the third Five Year Review for these Superfund Sites. The triggering action for this policy review was the completion of the second Five Year Review in September, 2008. This Five Year Review addresses both WS1 and WS4 since they are similar in nature and location. The Five Year Review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

II. Site Chronology

Table 1: Chronology of Site Events Vancouver Water Station 1 (WS1)	
Event	**Date**
EPA monitoring detected PCE contamination in WS1 (and WS4)	March 1988
City of Vancouver notified public of PCE groundwater contamination at both WS1 and WS4	February 1989
EPA proposed MCL for PCE (5 µg/L)	May 1989
EPA initiated investigations for PCE sources near WS1	August 1989
EPA Issued final MCL for PCE (5 µg/L)	January 1991
City of Vancouver expanded monitoring at WS1 to include weekly PCE analysis	1991
EPA conducted a hydrogeologic assessment of the Vancouver area and installed 5 GW monitoring wells near WS1.	Fall 1992
City of Vancouver installed 5 air stripping towers at WS1	May 1993
Vancouver WS1 was proposed for the NPL	June 1993
EPA evaluated WS1 for potential removal actions	1993
WS1 Officially placed on the NPL	June 1994
WDOH/ATSDR Preliminary Public Health Assessment concludes that no apparent human health hazard exists from drinking water at WS1	Fall 1994
EPA postponed further investigations due to funding constraints	Fall 1994
EPA samples GW at all 5 monitoring wells at WS1	July 1997
EPA initiates WS1 RI/FS	November 1997
EPA released final RI/FS report	July 1998
EPA released the proposed plan	July 1998
WS1 ROD signed	September 1998
Air stripping remedy continues	1993 – present
First Five Year Review completed	September 2003
Second Five Year Review completed	September 2008

Table 2: Chronology of Site Events Vancouver Water Station 4 (WS4)

Event	Date
EPA monitoring detected PCE contamination in WS1 and WS4	March 1988
City of Vancouver notified public of PCE groundwater contamination at both WS1 and WS4	February 1989
EPA/City began sampling in the vicinity of WS4	1989
4 highest contaminated WS4 wells taken out of service	April 1989
EPA proposed MCL for PCE (5 µg/L)	May 1989
City of Vancouver initiated field investigations for potential PCE sources	July 1989
EPA initiated investigations for PCE sources	August 1989
City of Vancouver removed WS4 from service	November 1989
EPA Issued final MCL for PCE (5 µg/L)	January 1991
Redesigned air stripping system put into place for WS4	January 1992
NPL listed WS4, due to groundwater PCE	October 1992
Preliminary health assessment for WS4 released for public comment	April 1993
EPA postponed investigations on WS4 due to lack of funding	September 1993
EPA resumes work on WS4 investigation	November 1997
EPA conducts Final Remedial Investigation for WS4	1998
EPA releases final RI/FS report for WS4	May 1999
Proposed plan for WS4 published	May 1999
WS4 ROD Signed	September 1999
Air stripping remedy continues	1999 – present
First Five Year Review Completed	September 2003
Second Five Year Review Completed	September 2008

III. Background

Physical Characteristics

Water Station 1

WS1 has been owned by the City for over 60 years. WS1 lies within Waterworks Park in the city of Vancouver, Washington, near the center of the city, approximately 0.75 miles east of Interstate 5 and approximately two miles north of the Columbia River (See Figure 1). The site is adjacent to commercial districts as well as residential areas. WS1 is a public water supply wellfield made up of ten production wells (See Figure 2), five air-stripping towers and a holding reservoir used to provide storage capacity to accommodate daily fluctuations in water demand.

Water Station 4

WS4 is also a public water supply wellfield in the City of Vancouver, Washington and is located approximately ½ mile north of the Columbia River (See Figure 1). The wellfield has been owned by the City for over 50 years. The site is defined as the wellfield, which encompasses approximately ½ acre and includes several support buildings, six production wells (See Figure 3), two air stripping towers, and one capped well.

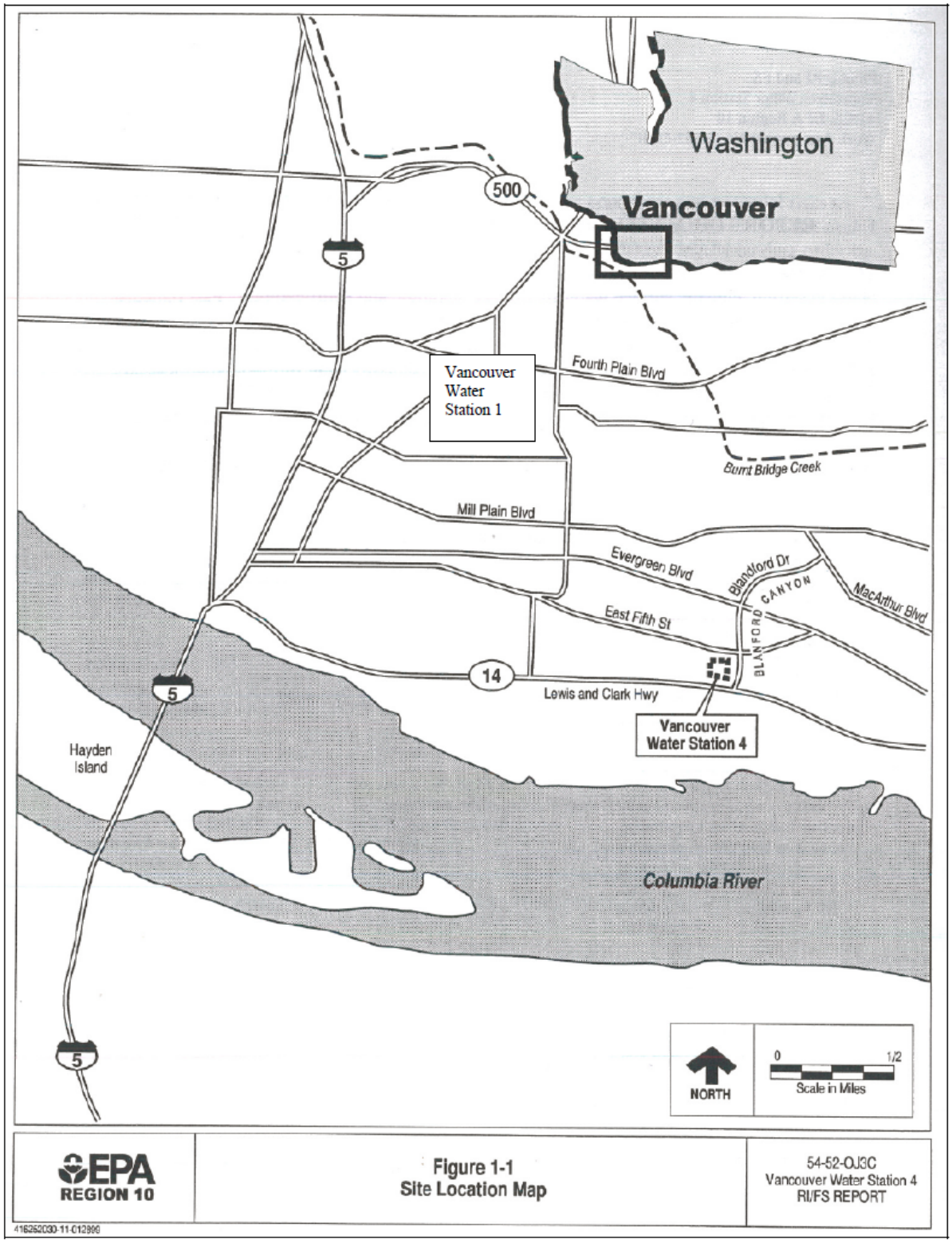


Figure 1 Site Location Map

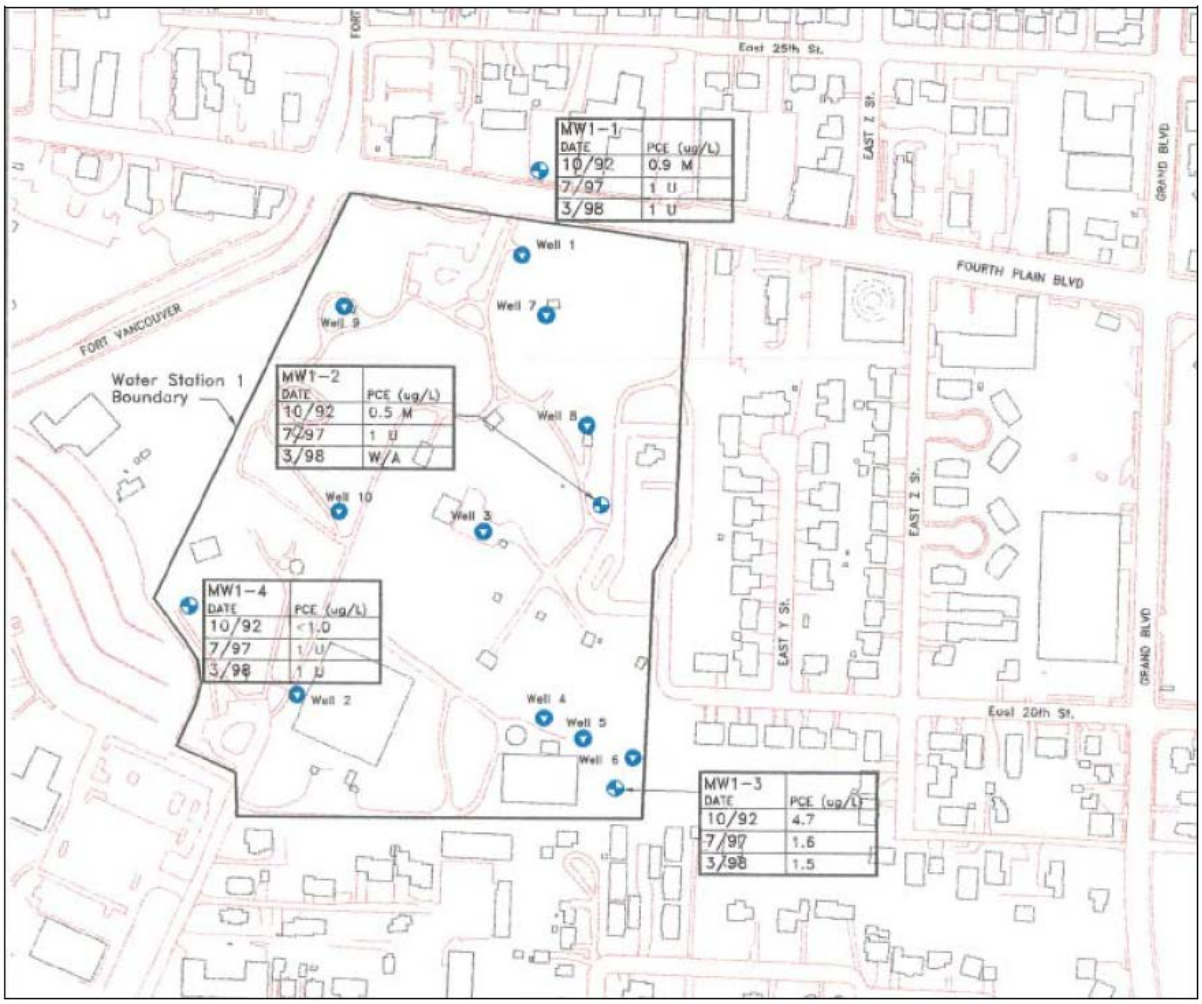


Figure 2 Production Well Locations for Water Station 1

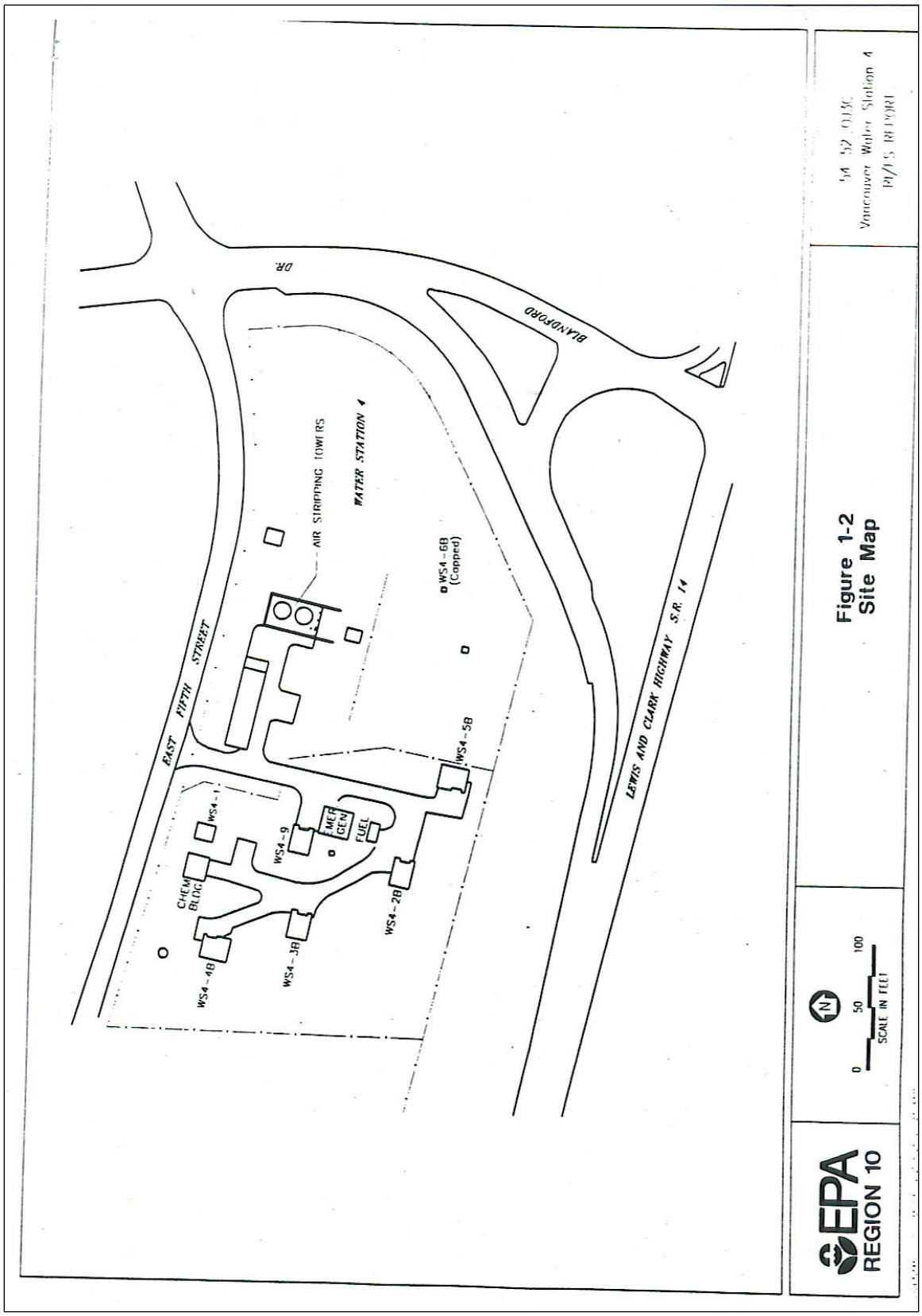


Figure 3 Production Wells for Water Station 4

Land and Resource Use

Water Station 1

Water from WS1 is blended together with water from several other wellfields to provide drinking water to the Vancouver region. The combined water supply system provides drinking water to approximately 150,000 people throughout the Vancouver area. Approximately half of the total water system production is supplied by WS1. The upper portion of the aquifer from which WS1 draws its water is approximately 200 feet below ground surface and supplies water to several municipal wellfields and an unknown number of private wells. All known private wells are used for irrigation or filling swimming pools. None of the private wells are known to be used for drinking water.

Water Station 4

Similar to WS1, water from WS4 is also blended together with water from several other wellfields to provide drinking water to the Vancouver region. Water from WS4 is primarily used to meet peak demands for water with the largest volumes pumped during the summer. Until the discovery that the groundwater was contaminated with tetrachloroethene (PCE)**,** WS4 provided about 25% of the public water supply for the city of Vancouver. Only two of the wells, with the lowest contamination, have been used since 1989.

Initial Investigation

When the federal Safe Drinking Water Act (SDWA) was amended to require suppliers of public drinking water to monitor for volatile organic compounds (VOCs), the City began monitoring water from WS1 and WS4. Results of this monitoring, which began in March 1988, indicated a persistent presence of PCE in the water at WS1 and WS4. In February 1989, in consultation with the Washington State Department of Health (WDOH), the City notified the public of the presence of PCE in the groundwater at both WS1 and WS4. Because PCE concentrations at WS1 were much lower than those at WS4, the notice stated that WS1 water was being blended with WS4 water to reduce overall PCE concentrations.

Historical Sources of Contamination

Water Station 1

In July 1989, the City initiated field investigations to determine if there was a source or sources of PCE or other VOCs near WS1. A soil-gas survey was conducted in the WS1 area, and 19 soil-gas samples were collected and analyzed. In addition, groundwater samples were collected from five existing private wells located within a 1-mile radius of WS1. From this data, there was no pattern in soil or groundwater results that indicated a source of PCE. Since the wellfield PCE concentrations were relatively low and suspected source areas were absent, no additional wells were installed at WS1 in an attempt to identify a PCE plume.

In August 1989, EPA Region 10 began a study that included soil-gas and groundwater monitoring in another attempt to identify potential sources of PCE detected at WS1 and several other Vancouver water stations. Eight groundwater samples were collected from production wells at WS1 and Water Station 3 (located approximately 1 mile northwest of WS1) and from private wells within approximately a 1-mile radius of WS1. A total of 194 soil-gas samples were collected throughout the city of Vancouver during the 1989 study, with 20 of the samples collected in the vicinity of WS1.

In February and March of 1990, 100 additional soil-gas samples were collected from 40 locations north and east of the site in order to try and identify potential PCE sources within the vicinity of WS1. To provide soil-gas depth profiles, multiple soil-gas samples were collected from each sampling location and analyzed in the field for VOCs.

Both the 1989 and 1990 phases of the investigation failed to identify a potential source of PCE entering WS1. PCE was detected in soil gas samples collected just north of the WS1, although the concentrations were not high enough to indicate that the area was responsible for the contaminated groundwater at WS1. Groundwater monitoring wells in and adjacent to the wellfield never showed concentrations of PCE above the MCL. Because significant PCE concentrations were not detected except in production wells and those concentrations were either below or just above the MCLs, EPA was unable to identify any historical sources of PCE to WS1. As a result, the RI/FS did not focus on source identification. EPA believed that conducting an expensive source investigation was not warranted because the likelihood of identifying a significant source was low. Therefore, no additional active investigation into potential sources for WS1 was conducted.

Water Station 4

Since 1991, PCE was detected in every deep monitoring well near WS4. Sustained PCE concentrations measured at WS4 and PW-2, a private well located approximately 200 yards northeast and upgradient of the wellfield, were many times greater than the maximum concentration measured at any monitoring well in the vicinity. However, no source primarily responsible for the sustained high concentrations of PCE measured at WS4 was identified. A significant reduction of groundwater PCE concentrations prior to 1998 strongly supported the conclusion that there was no ongoing source of PCE contamination in the area.

A baseline PRP search for PCE sources of contamination of groundwater in Vancouver, WA, affecting WS4 was begun by EPA civil investigators in November 1991 and was terminated due to funding constraints, prior to completion in March 1993. The EPA investigation explored historic uses of PCE and PCE disposal practices. Although multiple sources of PCE (e.g., dry cleaners) may have been present in the area around WS4, no source was identified that was primarily responsible for the sustained high concentrations and for which any additional source control cleanup action could be taken. The results of the PRP search led to the conclusion that while the dry cleaners on the plateau may have contributed to some PCE in groundwater, there was a strong likelihood that there were other sources that were responsible for the big increase in PCE levels detected in 1992/93. While the extent of the high-concentration PCE plume was not known, the significant reduction of PCE in production, monitoring and private wells prior to 1999, indicated that there was not an on-going source of PCE contamination near WS4.

Basis for Taking Action

Water Station 1

The production wells in WS1 were monitored in 1991 through 1992, and showed a trend of continuing and possibly increasing concentrations of PCE. Although the monitoring showed that the PCE concentrations in the combined output at WS1 measured at the reservoir remained below the PCE drinking water MCL of 5 µg/L, the concentrations in a few individual wells were consistently above the MCL. To effectively remove PCE from the drinking water supply, the City of Vancouver installed five air stripping towers at WS1 in 1993. Although the air stripping system was effectively removing PCE from the water

that Vancouver distributed for drinking water, in June 1993, EPA proposed WS1 for listing on the NPL because of PCE in the groundwater. The maximum detected PCE concentration in 1993 was 30 ppb (6/28/93). WS1 was officially placed on the NPL June 1994.

Results of the WS1 baseline risk assessment indicated that human health risks were within the NCP acceptable risk range. However, because groundwater was shown to have persistent concentrations of PCE above the MCL, it was still necessary to take remedial action at WS1 since the NCP requires that MCLs be met both in the groundwater and at the tap.

Water Station 4

In 1988, the City monitored the water at the six wells of WS4 weekly and discovered PCE in the ground water. The City used the results of the weekly ground water monitoring to determine which wells to use for drinking water production to ensure that the concentration of PCE in the drinking water delivered to its customers was as low as possible. In November 1989, all the wells of WS4 were removed from service and an active air stripping system was installed. Although the air stripping system effectively removed PCE from distributed drinking water, groundwater PCE concentrations remained above the MCL and WS4 was listed on the NPL in 1992.

Similar to WS1, the results of the baseline risk assessment for WS4 were within the NCP acceptable risk range. However, groundwater PCE concentrations were above the MCL and remedial action was necessary to prevent the possibility of imminent and substantial endangerment to public health.

IV. Remedial Actions

Remedy Selection

Water Station 1

The Remedial Action Objectives (RAOs) for WS1 did not include restoration of the aquifer to MCLs for PCE throughout the aquifer because no source was ever identified and a plume was not delineated. Instead, the primary RAO was to protect human health by reducing concentration of PCE in the drinking water produced from WS1 to below MCLs, and the secondary RAO was to reduce concentration of PCE in the production wells themselves at WS1 to below MCLs. EPA’s selected remedy at WS1 was to continue operation of the City’s air-stripping system for the groundwater at WS1 that was used as a public drinking water supply. With air stripping, water to be treated trickles down a packed column in a tower, which breaks the flow of water, creating as much surface area as possible. After breaking the flow of water, large volumes of air transfer the contaminants from the water through the process of evaporation. The air is then treated through granulated carbon, which adsorbs the PCE contaminant. The granulated carbon is then either regenerated or treated and disposed of at a hazardous waste facility.

The air-stripping system at WS1 continues to reduce the PCE concentration in the drinking water concentration to below detectable levels, thus eliminating the principal threat posed to human health from exposure to PCE in drinking water. This remedy is a proven technology for removal of PCE from drinking water and is cost effective. The air-stripping system at WS1 currently remains operational and, in order to ensure long term effectiveness, will remain in operation as long as necessary to keep drinking water PCE concentrations in WS1 below 5.0 µg/L at the effluent of treatment.

No ongoing source for the PCE in the groundwater at WS1 was identified. Therefore, the remedy focused on treatment of the drinking water and represented the maximum extent to which a permanent solution and treatment technology could be used in a cost-effective manner. Even though PCE sources were not controlled, the concentration of PCE in groundwater in the production wells at WS1 is expected to eventually decrease to a level below the MCL. The selected remedy also includes monitoring, by the City, to evaluate system effectiveness at removing PCE from both groundwater and drinking water. No Institutional Controls were necessary as part of the remedy selected in the ROD at WS1 because this is a wellhead protection remedy. No sources were ever identified that would warrant cleanup, no groundwater plume was identified, and the extent of groundwater contamination within the City was not delineated.

Water Station 4

The RAOs for WS4 are the same as WS1. Therefore, similar to WS1, EPA selected the City's previously implemented air stripping treatment system to reduce PCE concentrations in groundwater and drinking water to below the MCL in the productions wells at WS4. No ongoing sources for the PCE in the groundwater at WS4 were identified for which cleanup action could be taken, so the remedy focused on treatment of the drinking water produced from WS4. PCE concentrations in groundwater at WS4 are also expected to eventually decrease to a level below the maximum contaminant level (MCL). The selected remedy is monitored to evaluate system effectiveness at removing PCE from both groundwater and drinking water.

During the initial design of the air strippers, the concentration of PCE at WS4 was consistently in the range of 5 to 20 µg/L, so the stripper design was based on maximum expected concentrations of 100 µg/L. During 1991, the concentration of PCE increased rapidly to over 1000 µg/L in a private well located approximately 200 yards northeast and upgradient of the wellfield. Because of this increase, the two stripping towers, originally designed to run in parallel and to treat 8000 gallons per minute, were re-configured to run in series. The design change reduced the total flow to 4000 gpm, but enabled the system to remove much higher concentrations of PCE. No Institutional Controls were necessary as part of the remedy selected in the ROD at WS4 for the same reasons as WS1.

Remedy Implementation

Water Station 1

The air stripping system at WS1 has been in operation since 1993, before the site was listed on the National Priorities List. This system consistently reduced concentrations of PCE in treated water to below the level of detection. This action addressed the ingestion of PCE in contaminated drinking water, the principal threat to human health.

All water pumped at WS1 is treated by air stripping and distributed to customers as drinking water. Groundwater is pumped from WS1 at a rate that varies between 8 and 19 million gallons per day, depending on the time of year and customer demand.

The selected remedy ensures a high degree of certainty that the remedy will be effective in the long term because of the significant reduction of the contamination in the water that has been achieved through use of the existing air stripping system. No other treatment options were evaluated because the existing system was already in operation when the site was listed on the NPL and the technology has proven to be effective for removal of VOCs from water. For reasons previously described, source removal was not part

of the selected remedy. Periodic monitoring of the groundwater has been performed by the City to evaluate the effectiveness of and the need for continued operation of the treatment system at WS1.

Water Station 4

All water pumped from WS4 is treated by air stripping and distributed to customers as drinking water. The rate at which groundwater can be pumped from WS4 is limited by the rate at which the air stripping treatment can treat the water (4000 gallons per minute (gpm)) which is equivalent to a maximum of approximately 2.75 million gallons per day. The actual production rate is based on demand and is generally considerably less. While the primary purpose of air stripping is to cleanup the water being produced for distribution as drinking water, this action also serves as a pump-and-treat remedy that addresses the contamination of the groundwater at the site. Source removal is not part of the selected remedy.

Similar to WS1, periodic monitoring of the groundwater has been performed by the City to evaluate the effectiveness of and the need for continued operation of the treatment system at WS4. Groundwater monitoring consists of sampling production wells and monitoring wells for PCE and other VOCs. The City is responsible for monitoring the water at WS4 and has sampled each year from each active production well. EPA is responsible for reviewing the City's data annually.

Decisions on whether to continue and/or modify the monitoring program will be made by EPA in conjunction with the City.

System Operation/Operation and Maintenance

Due to a persistent presence of PCE in groundwater, the City installed air stripping towers at both WS 1 and WS4 before these sites were listed on the NPL by EPA. No viable PRPs were identified, and the City incurred all costs associated with the installation and operation of the air stripping systems at both WS1 and WS4. The final RODs selected continued operation of the existing treatment systems along with monitoring as the final remedial actions for both water stations and the City remains responsible for all costs associated with operation and maintenance of these treatment systems.

Water Station 1

The air stripping system at WS1was designed and built by the City and cost approximately $4 million. Operating costs, also paid by the City, were estimated in the ROD to be approximately $60,000/year. Costs have increased approximately 10% in the past five years (communication with Tim Brace, City of Vancouver).

Water Station 4

The air stripping system at WS4 cost the City approximately $5 million to design and build. Operation costs were estimated in the ROD to be approximately $230,000/year. However, carbon treatment was removed in 2009 and operating costs are now similar to WS1. (Communication with Tim Brace, City of Vancouver).

V. Progress Since The Last Five Year Review

The remedies were determined to be protective during the last Five Year Review and there has been no change in the remedy for either Water Station since that time. Follow-up actions from the previous Five Year Review are discussed below in Section IX.

VI. Five Year Review Process

Administrative Components

EPA is the lead agency for this Five Year Review. The EPA review team includes the Remedial Project manager for the site, Nancy Harney, and Bernie Zavala, the EPA staff Hydrogeologist. Representatives of the City also assisted with this review.

Community Involvement During the Five Year Review

EPA published a public notice in The Columbian on June 12, 2013 to notify the public that the Five Year Review was underway. The public notice announced the Five Year Review process and let the public know where they could find the final Five Year Review Report. Copies of the final Five Year Review Report will be placed in the local site repositories at the City of Vancouver public library, the EPA Superfund Records Center in Seattle as well as on the EPA Region 10 website http://yosemite.epa.gov/r10/CLEANUP.NSF/sites. Given the lack of public interest in these sites, EPA determined that a public meeting was not warranted.

Document Review

This Five Year Review consists of the previous Five Year Review Report, a review of RODs for both WS1 and WS4, the City's ground water monitoring well data and tower influent and effluent data, and EPA monitoring data.

Data Review

WS1 Sampling Results 2008 – 2013 and EPA's May 2013 Sampling Results

Since the last Five Year Review, the City has collected and analyzed the ground water quality data for PCE. The City has provided PCE ground water quality data (City, 2012) to EPA Region 10 in an electronic format. This groundwater data was collected from all the production wells prior to treatment and then after treatment (combined effluent). The City collected the groundwater data on a monthly basis for PCE. For the current Five Year Review, EPA has re-compiled the City's PCE data, for presentation purposes, selected one data point per month to visualize a trend plot along with the MCL of 5 µg/l (see appendix A). This appendix has the trend plots for twelve different production wells and the effluent (Reservoir) or after treatment. Overall, since the last Five Year Review, only three production wells (wells 1, 7 and 11) have been above the MCL during this period of time and all of the production wells have been trending downward below the MCL. It should also be noted that two of the three wells (#7 and #11) had only one month each of a detection of PCE above the MCL over this current Five Year Review period. The effluent or after treatment has been non-detect (0.40 µg/l) for PCE during this review period.

The groundwater sampling results from the EPA's May 2013 sampling event can be found in Table 3 and, for the most part, the parameter detected was PCE. Figure 2 shows the locations of the production wells for WS1 and the highest concentration of PCE was located at production well WS1-7 at a concentration of 5.7µg/L. TCE was also detected at WS1-1 at a concentration of 1.0 µg/L but no other detection of TCE occurred in any of the production wells at either of the wellfields. The combined influent concentration for PCE was not detected at 1.0 µg/L and the effluent concentration was not detected at 1.0 µg/L. The results from Water Station 1 during this sampling event agree reasonably well with the past data that was collected by the City (see Appendix A). The City, on a monthly basis, collects water samples from all the production wells and from the treatment system for PCE. The water quality data shows that PCE levels have been decreasing. The combined influent of PCE is below the MCL and the effluent is not detected at 1.0 µg/l.

WS4 Sampling Results 2008 – 2012 and EPA's May 2013 Sampling Results

Water Station 4 is located to the southeast of Water Station 1, see figure 1 and the production wells locations can be found on figure 3. As previously mentioned, the City has collected and analyzed the ground water quality data for PCE for both water stations 1 and 4. The City has provided PCE water quality data (City, 2012) to the EPA-Region 10 in an electronic format. This groundwater data was collected from all the production wells prior to treatment and then after treatment (combined effluent). The City collected the ground water data on a weekly basis for PCE. EPA-Region 10, for the current Five Year Review, has re-compiled the City's PCE data for presentation purposes to visualize a trend plot with the MCL of 5 µg/L (see Appendix A). This Appendix has the trend plots for six different production wells and the influent and effluent. Overall, the trends are moving downward and in fact, there has been a dramatic decrease in concentration below the MCL starting as early as May 2008. In August 2011, WS4-4B had concentrations below the MCL for PCE in all production wells. The combined influent was below the MCL, 2.7µg/L and there was no detection of TCE. The effluent concentration for PCE was not detected at 1.0µg/L.

The PCE concentrations from the May 2013 ground water sampling event are below the MCL. All of the production wells which were sampled had detectable concentrations of PCE but were still below the MCL, (See table 3). The combined influent of all the production wells had a concentration of PCE 2.7 µg/L and there were no detections of TCE. The effluent concentration for PCE was not detected at 1.0 µg/L. The results from WS4 during this sampling event agree reasonably well with the past data that was collected by the City (See Appendix A). As mentioned above, the Citycollects water samples from the production wells and the treatment system on a weekly basis. The general observations of the PCE data show a decreasing trend for all of the production wells.

Table 3: Water Quality Results for Volatile Organic Compounds – Water Station 1 & 4

Date	**Water Station 1/ Well Number**	**Analytical Parameters (µg/l)**	
		PCE	**TCE**
5/07/2013	WS1-1	3.1	1.0
5/07/2013	WS1-1 (duplicate)	3.2	1.0 U
5/07/2013	WS1-5	1.0 U	1.0 U
5/07/2013	WS1-7	5.7	1.0 U
5/07/2013	WS1-influent	1.0 U	1.0 U
5/07/2013	WS1-effluent	1.0 U	1.0 U
5/06/2013	WS-1-MW1-1	1.0 U	1.0 U
5/07/2013	WS-1-MW1-3	1.0 U	1.0 U

Date	**Water Station 4 / Well Number**	**Analytical Parameters (µg/l)**	
		PCE	**TCE**
5/07/2013	WS4-5B	2.6	1.0 U
5/07/2013	WS4-5B (duplicate)	2.6	1.0 U
5/07/2013	WS4-influent	2.7	1.0 U
5/07/2013	WS4-effluent	1.0 U	1.0 U
5/07/2013	WS4-9	2.9	1.0 U
5/07/2013	WS4-3B	3.1	1.0 U
5/07/2013	WS4-4B	4.0	1.0 U
5/07/2013	WS-Trip blank	1.0 U	1.0 U
5/07/2013	Pump rinsate	1.0 U	1.0 U

U- The analyte was not detected at or above the reported value.

Five Year Review Site Inspection and Sampling

On May 06, 2013, EPA's Hydrogeologist, Bernie Zavala, met with representatives from the City. The purpose of this site visit was to sample ground water for VOCs to assess the protectiveness of the remedy and to determine whether the air stripping towers were operational and functional. The EPA met with the City representatives and discussed the current operations and status of the treatment systems at both water stations. During that site visit, EPA sampled ground water from the production wells at WS1 and WS4. Both the influent and effluent from WS1 and WS4 were also sampled. Based on the sample results and observations during the site inspection the remedy is operational and functional.

No significant issues were identified regarding the air stripping towers of WS1 and WS4.

Conclusions

The data collected by EPA Region 10 for VOCs/PCE compared reasonably well with the data collected on a weekly and monthly basis by the City. The current PCE influent concentrations at both WS1and WS 4 are below the MCL. With treatment, the water quality is not detectable for PCE. In particular, WS4 shows a dramatic decrease in concentrations of PCE during the past five years when compared to the data from the 2008 Five Year Review (See Appendix A). Most of the production wells within the

well field show detectable concentrations of PCE but they are below the MCL of 5µg/l. The treatment system has effectively treated the PCE concentrations below detectable concentrations for PCE at 1.0 µg/l. Overall, the remedy is protective of human health and the environment and the treated water for both Water Stations is meeting the safe drinking water criteria for PCE.

VII. Technical Assessment

Question A: *Is the remedy functioning as intended by the decision documents?*

Yes. The air stripping towers are continuing to reduce PCE concentrations in drinking water to essentially non-detect levels, thus concentrations are below the MCL. The remedial action objective of removing PCE from the drinking water supply and reducing the concentration of PCE in ground water is still being accomplished by the air stripping towers at Vancouver WS1 & WS4 and therefore, the remedy is functioning as intended by the ROD.

Operation and maintenance of the air stripping towers has also been effective. The City is maintaining the air stripping towers in accordance with the ROD and O&M plan. As described in the data review section of this report, EPA's sampling results confirm the results from data collected by the City. O&M annual costs are generally consistent with original estimates although costs for WS4 have decreased as previously noted; costs have increased by about 10% in the past five years. There are no indications of any difficulties with the remedy**.**

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Yes. At the time of the ROD remedial action objectives for WS1 and WS4 were to protect human health by reducing concentrations of PCE in drinking water produced from WS1 to below the MCL specified in regulations promulgated under the federal Safe Drinking Act (SDWA) and in the state drinking water regulations. An additional remedial action objective for WS1 and WS4 was to protect human health by reducing PCE and concentrations to below the Method A cleanup level specified in the Washington State Model Toxics Control Act (MTCA) regulations and below the federal and state drinking water standards which are 5.0 µg/L.

There has been no change to the Washington State drinking water MCL for PCE. None of the assumptions used in the risk assessment relied upon for remedy selection have changed such that protectiveness of the remedy would be called into question. The baseline human health risk assessments for WS1 and WS4 were completed in accordance with EPA's risk assessment guidance. There is still no need for Institutional Controls at either WS1 or WS4. No potentially complete and/or significant exposure pathways to contaminants in ground water were identified for ecological receptors at the time of the ROD. Therefore, potential ecological risk was considered minimal. At the time of this review this consideration has not changed.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No other information calling into question the protectiveness of the remedy was identified during the Five Year Review.

Technical Assessment Summary

According to the documents and data reviewed, the remedy is functioning as intended by the ROD. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. ARARs for drinking water and groundwater standards for PCE concentrations cited in the ROD have been met. No changes in the toxicity factors for PCE were identified since the ROD was issued. No other information was identified during the Five Year Review that calls into question the protectiveness of the remedy.

VIII. Issues

No issues have been identified.

Based on the trend analysis for both water stations, it appears that the MCL for PCE is now being met at all wells. Further analysis should be done to ascertain if the ROD objectives for both WS1 and WS4 have been met and determine if these sites can be deleted from the NPL.

IX. Recommendations and Follow-Up Actions

No follow-up actions need to be tracked pursuant to this Five Year Review.

The ground water concentrations for PCE in the production wells for WS1 have been trending downward during the past Five Year Review period (2008 - 2012) and the combined influent water sample during the May 2013 sampling event by EPA was below the MCL. Based on both the pre and post treatment data that was collected by the City and EPA for PCE, it is recommended that a further determination (statistical analysis) be conducted on the water quality data for PCE to determine if the ROD objectives have been met and if both sites are eligible to be deleted from the NPL.

Continued monitoring and treatment is recommended for both Water Stations. Concentrations of PCE in the influent samples for both Water Stations were below the MCL during this past Five Year Review period and have met the requirements for the Safe Drinking Water Act for PCE.

X. Protectiveness Statement

The remedies at both WS1 and WS4 are protective of human health and the environment because the treatment system is functioning as intended and human and ecological risks are under control. Long-term protectiveness of the remedial action will be verified by regular monitoring by the City of Vancouver.

XI. Next Review

The next Five Year Review for both WS1 and WS4 must be completed by September 2018, five years from the date of this review.

References

City of Vancouver, 2012, *Ground Water Quality Database for PCE, Water Station 1 and 4*, Tim Brace, City of Vancouver, Vancouver, Washington, December 2012.

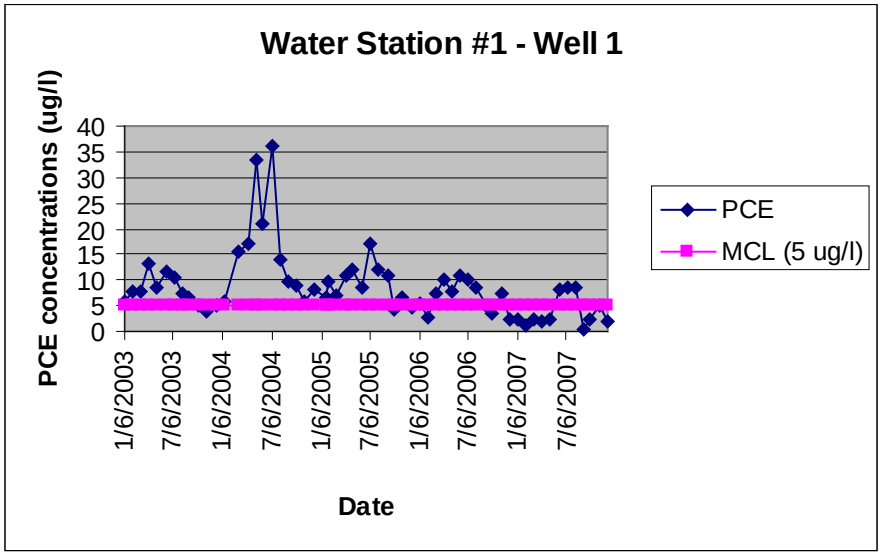
U.S. EPA. Trip Report, *Groundwater Sampling at Vancouver Water Stations 1 & 4, May 6&7, 2013*, Office of Environmental Assessment, EPA-Region 10.

U. S. EPA. Five Year Review Report, *Second Five Year Review Report for Vancouver Water Station #1 and #4 City of Vancouver*, Vancouver, Washington, September 2008.

Appendix A

The following groups of charts compare the PCE concentration trends for both the Second Five Year Review Period (2003-2007) and the Third Five Year Period (2008-2012) for Well Fields 1 and 4.

2003 - 2007



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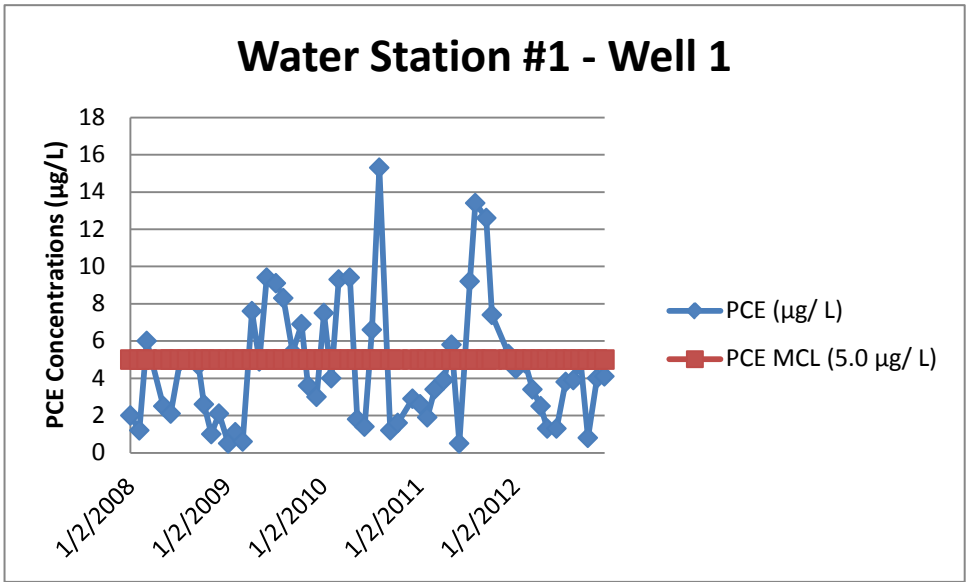

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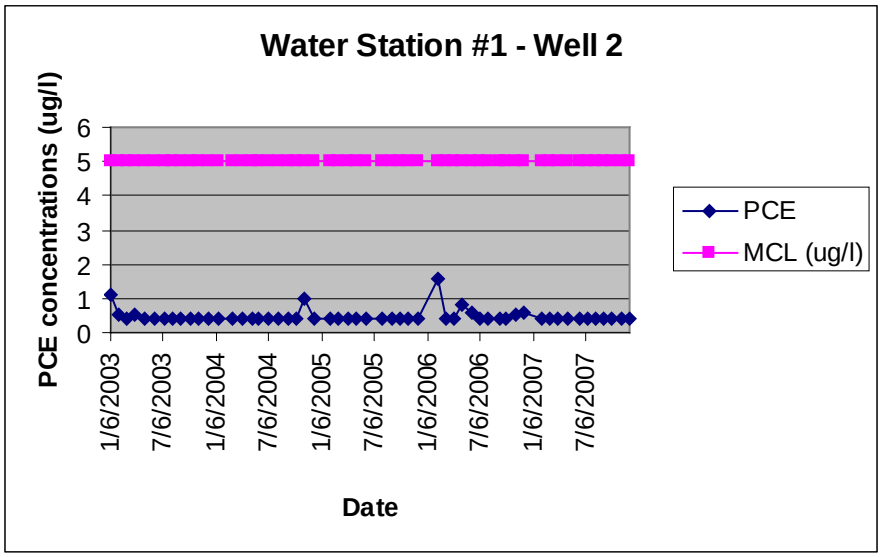

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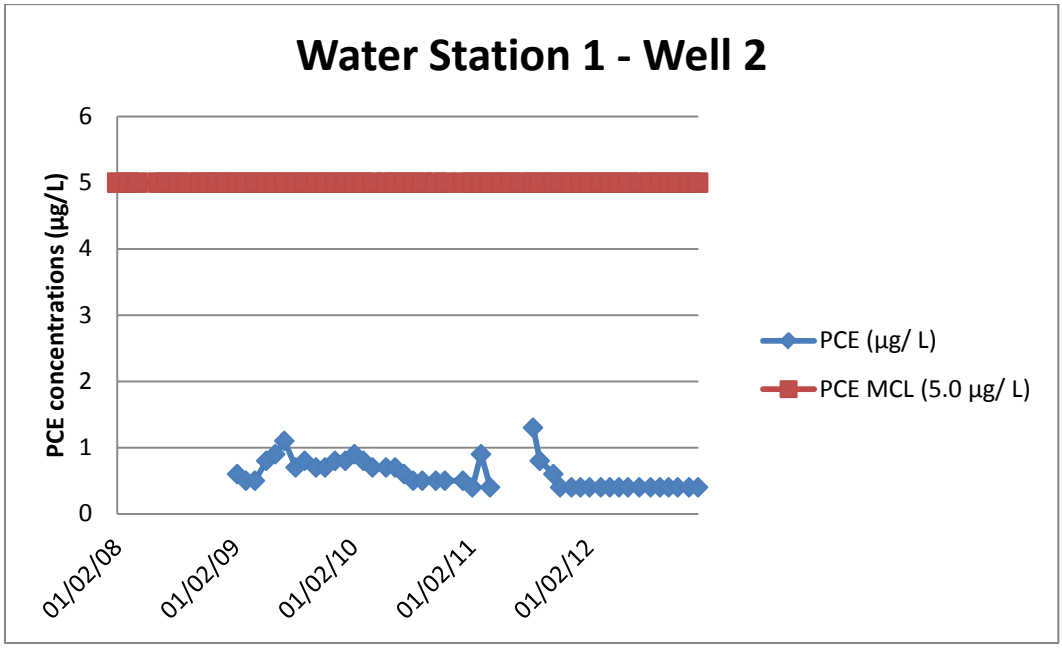

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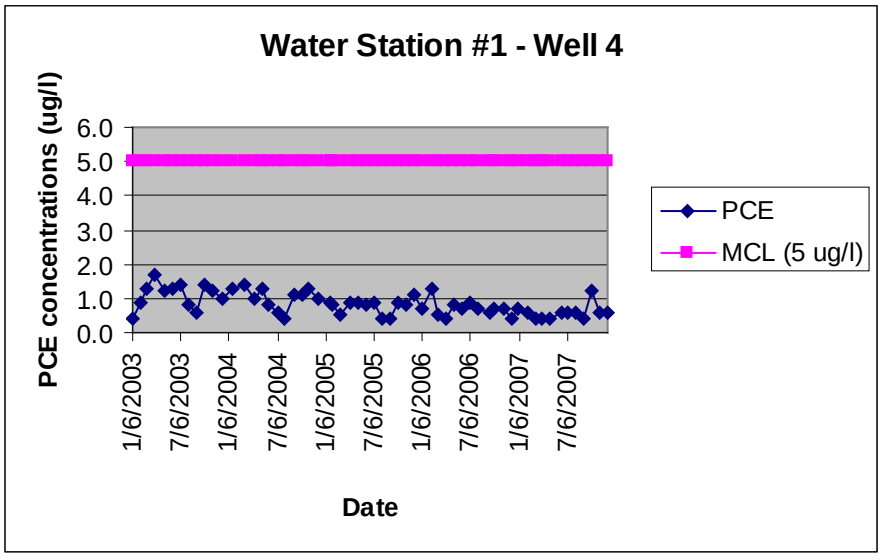

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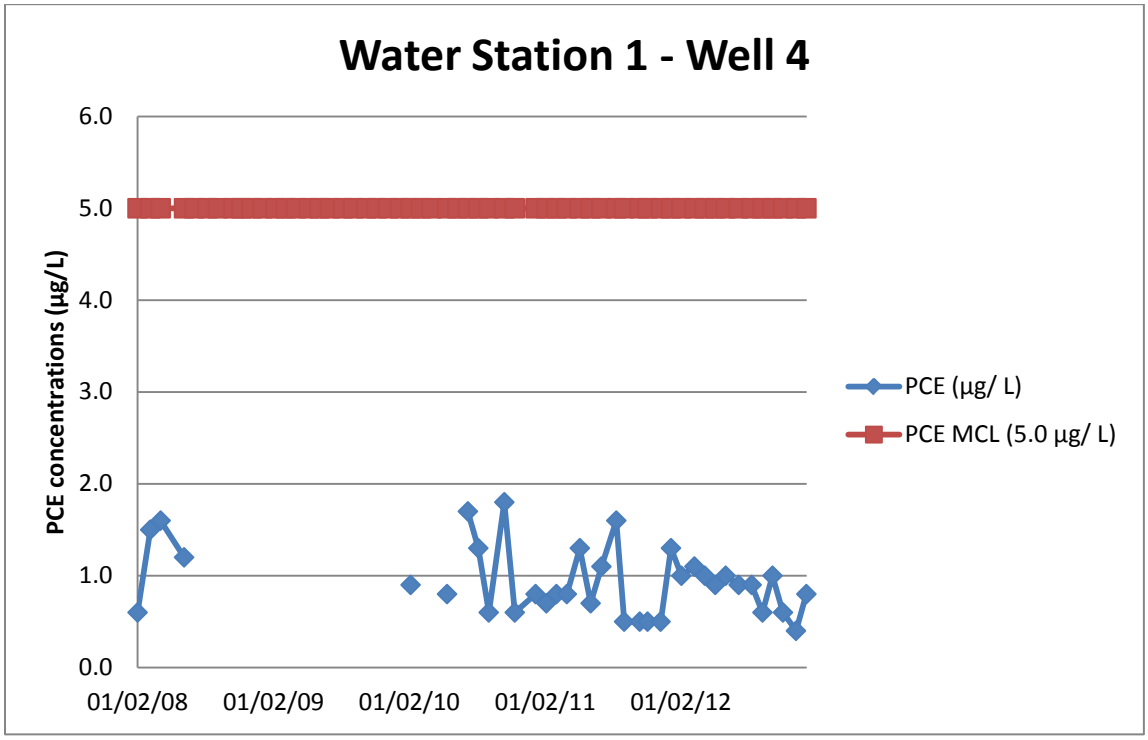

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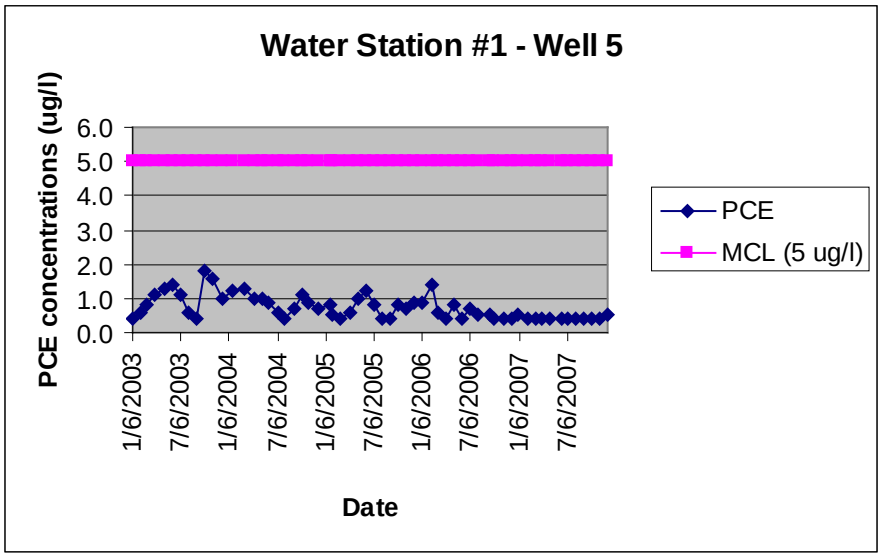

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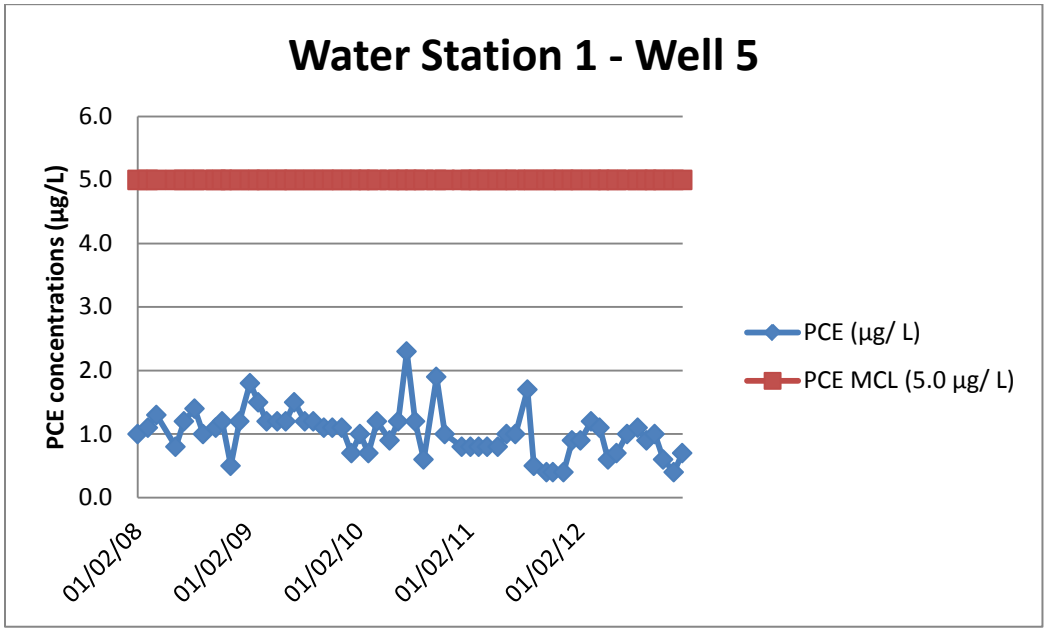

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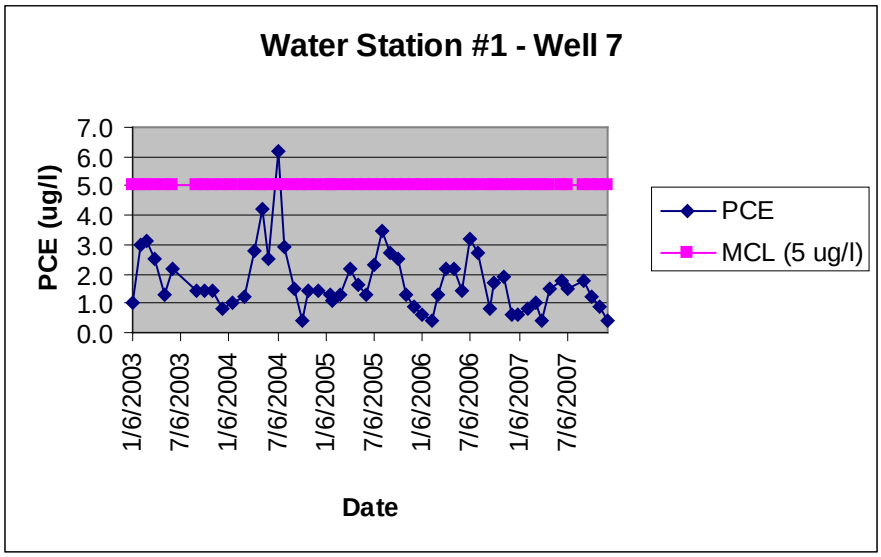

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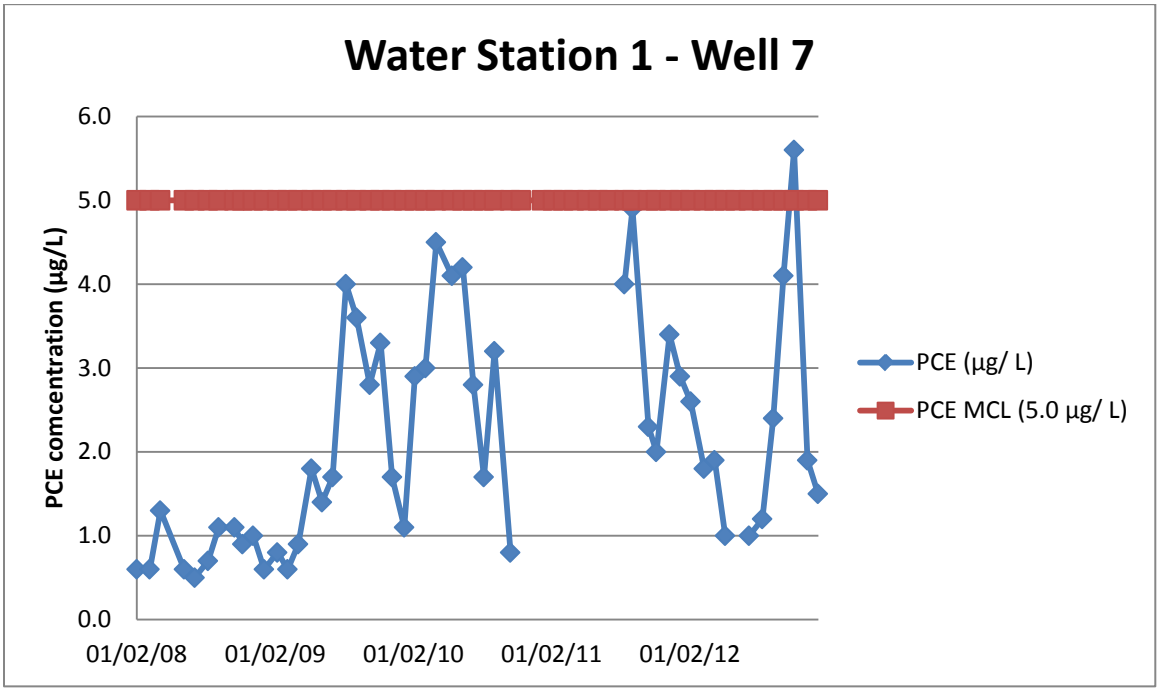

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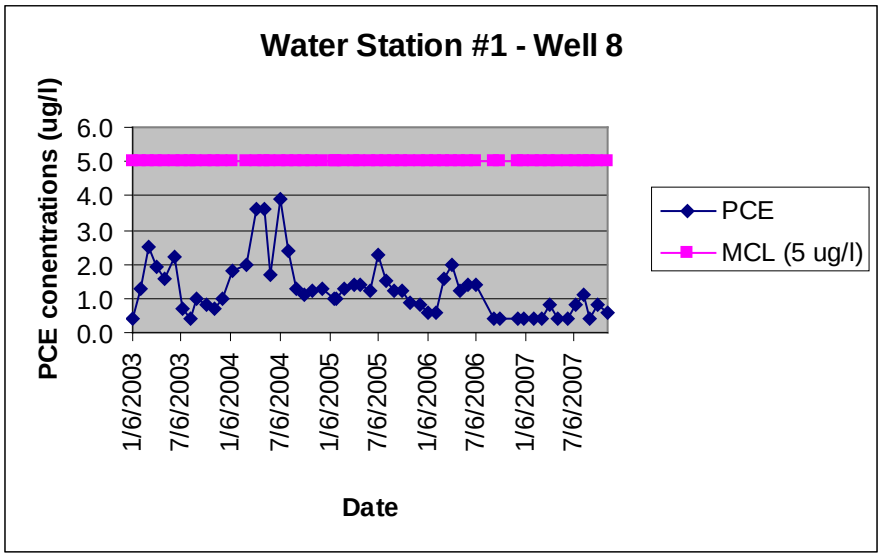

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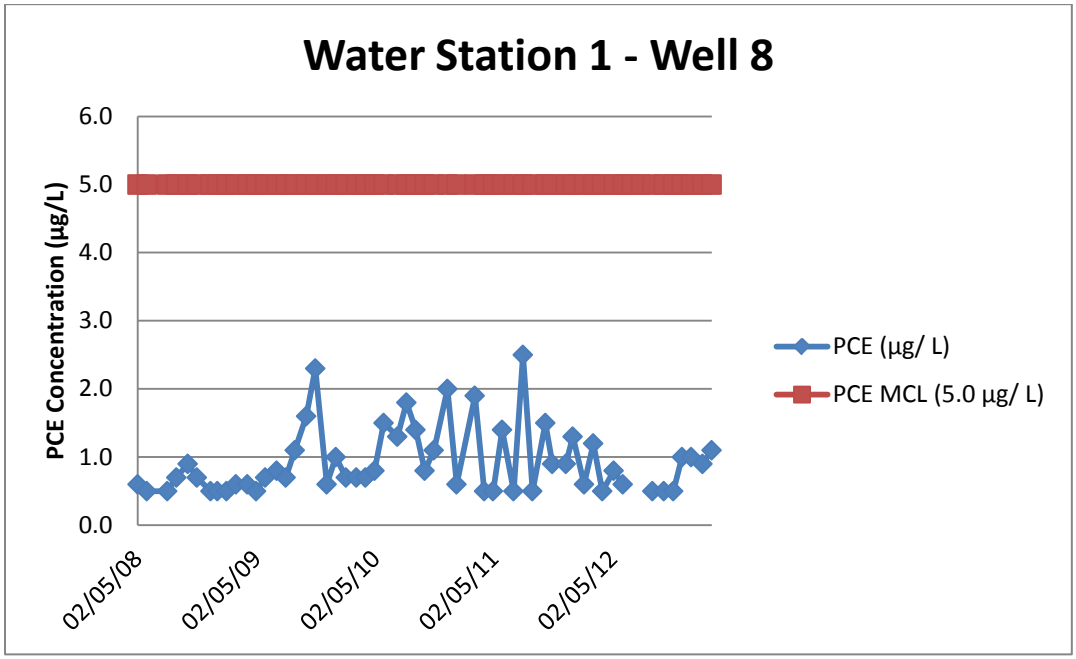

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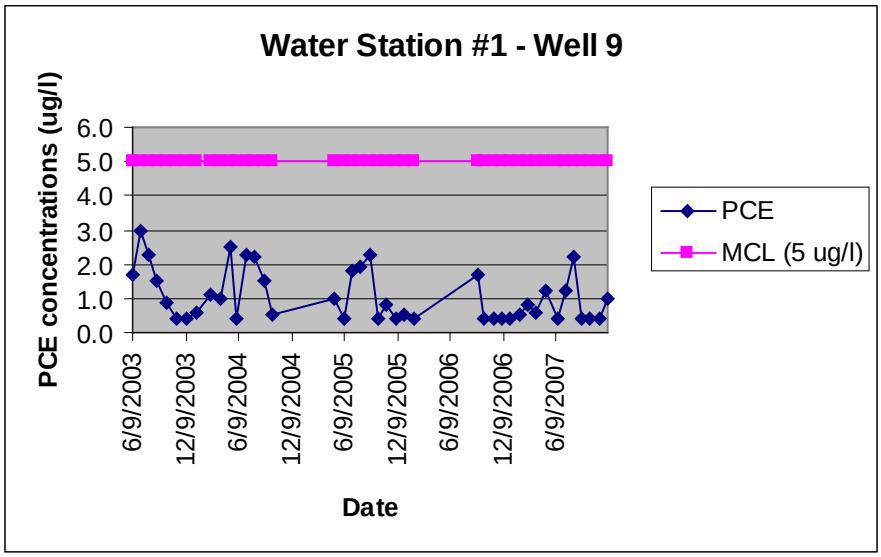

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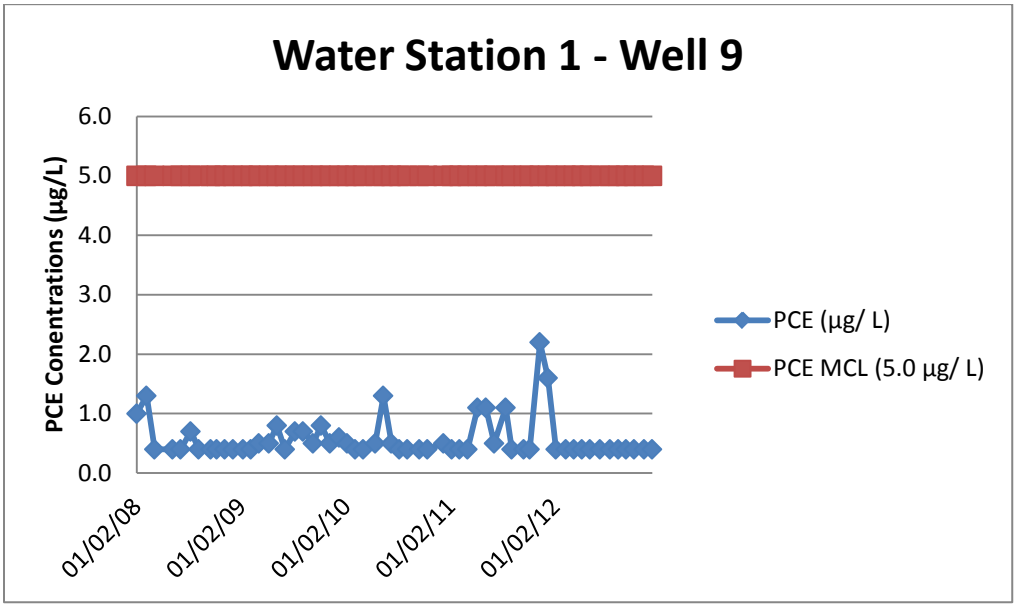

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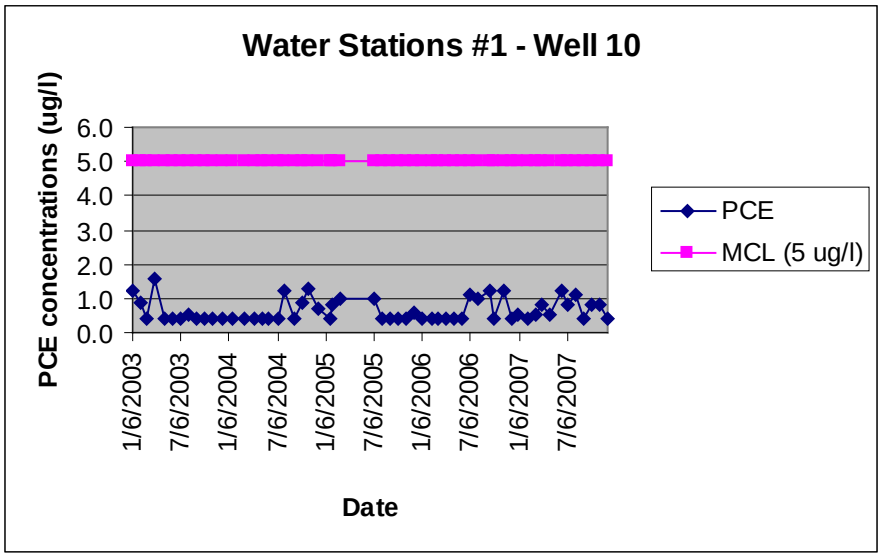

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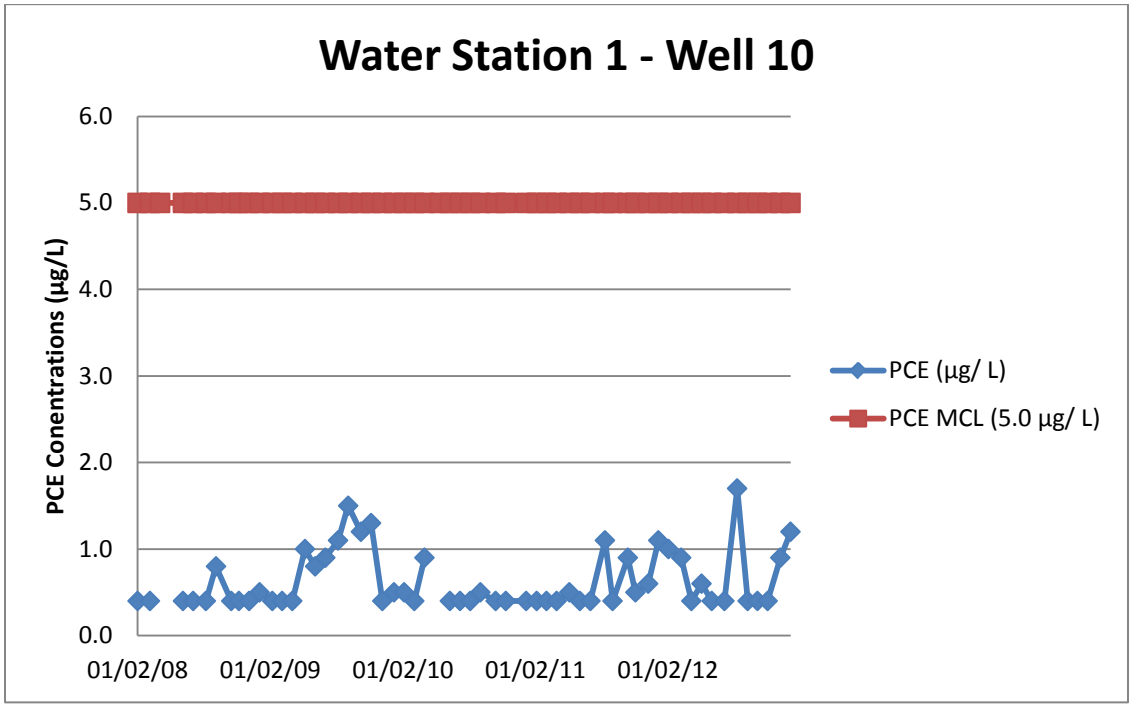

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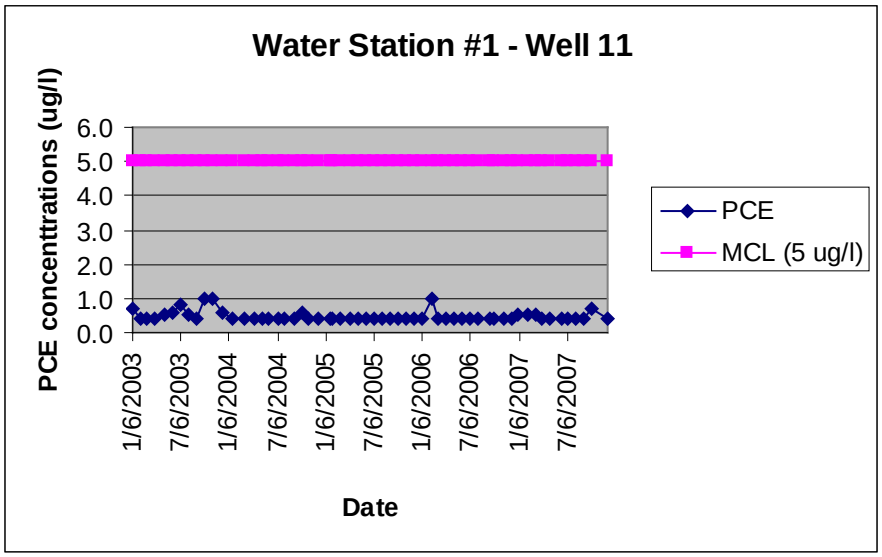

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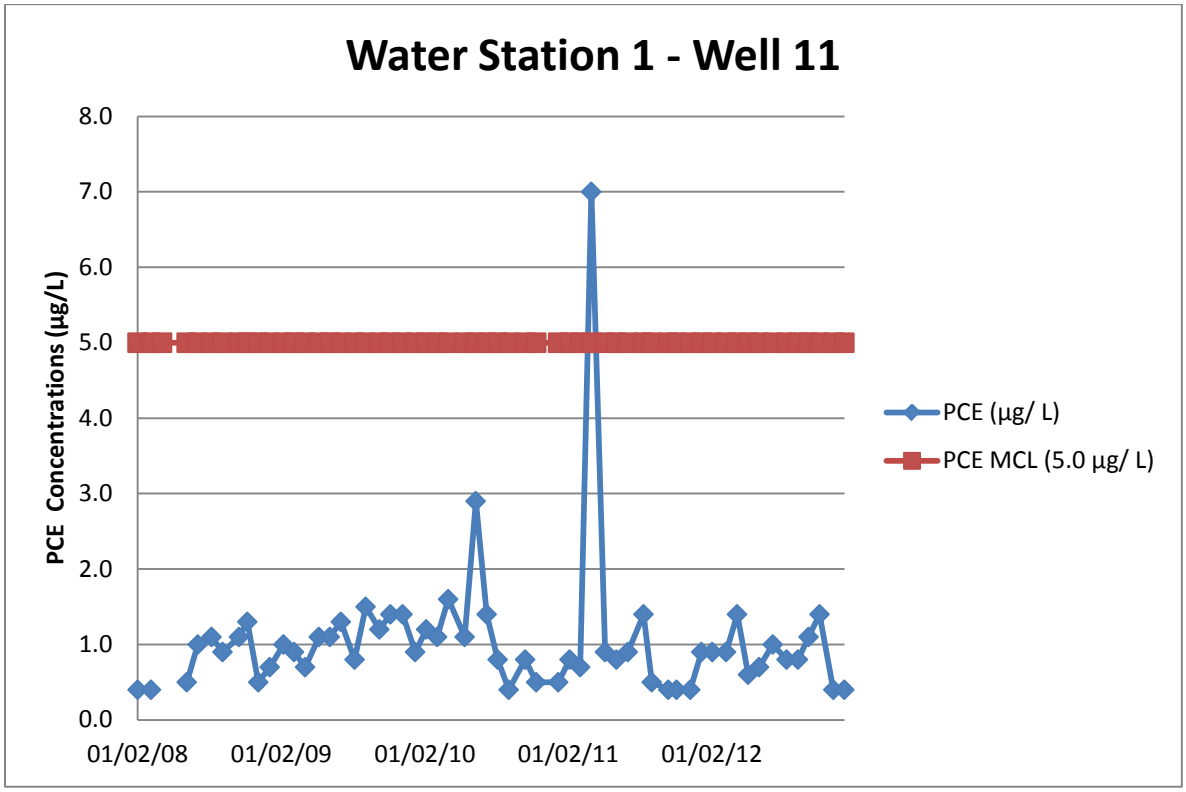

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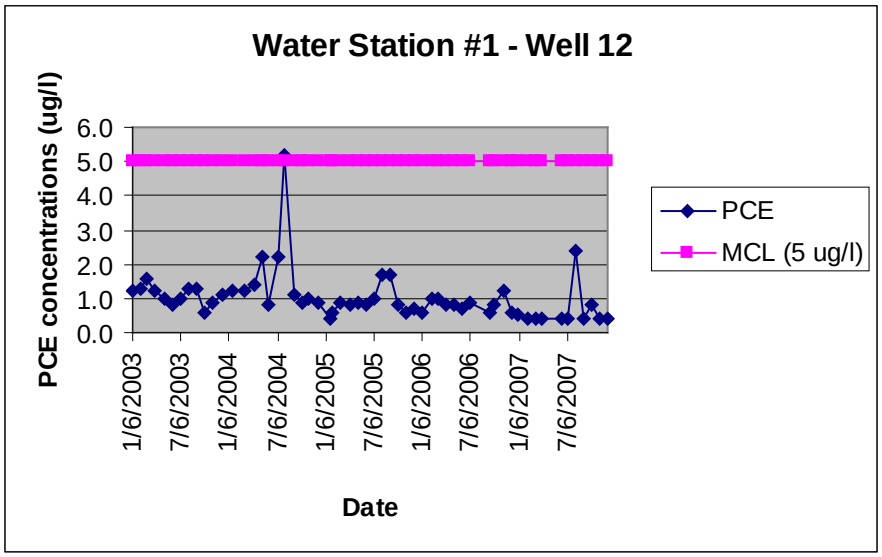

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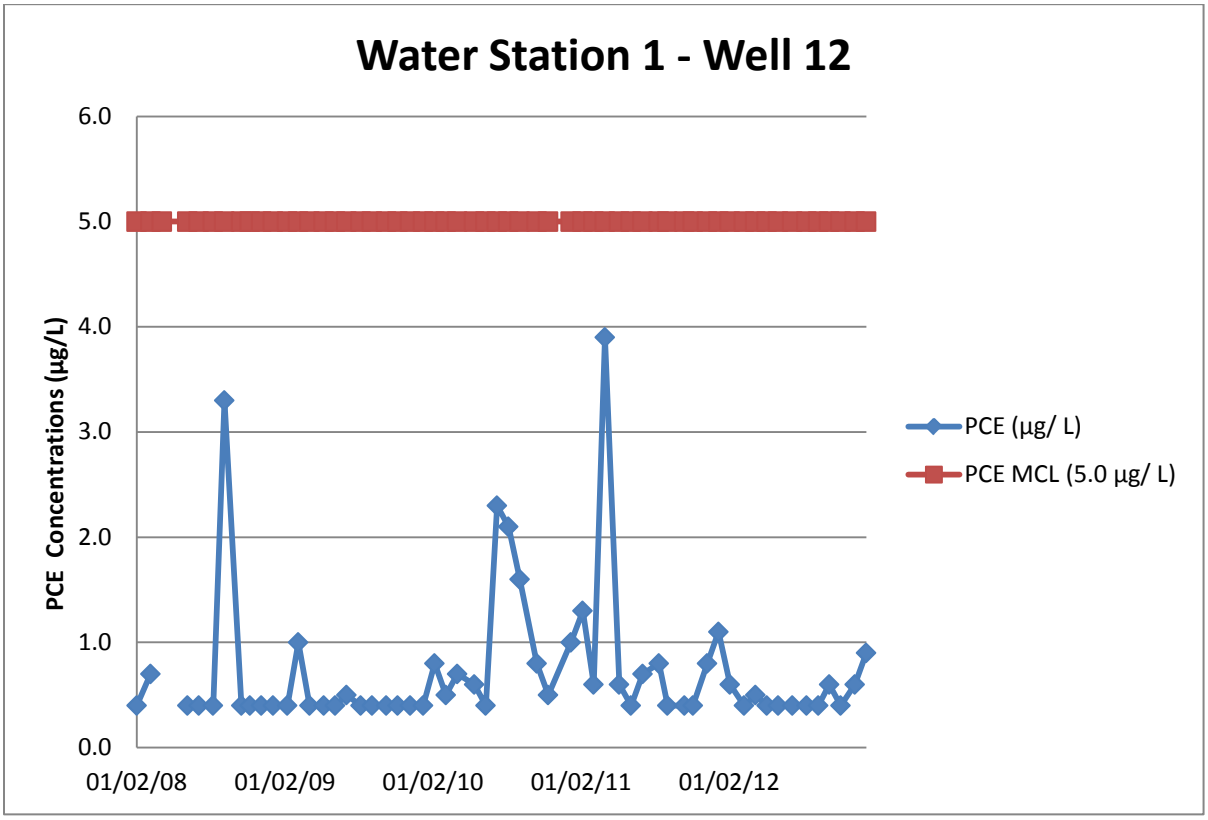

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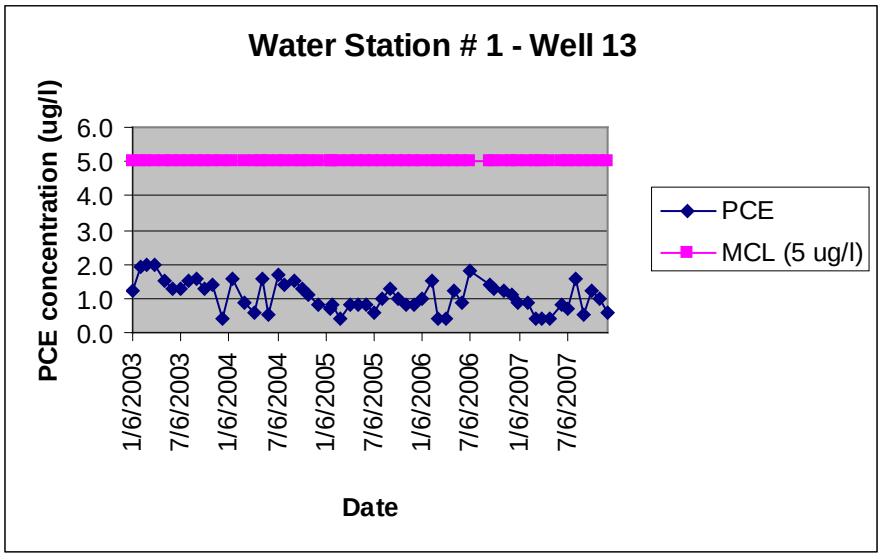

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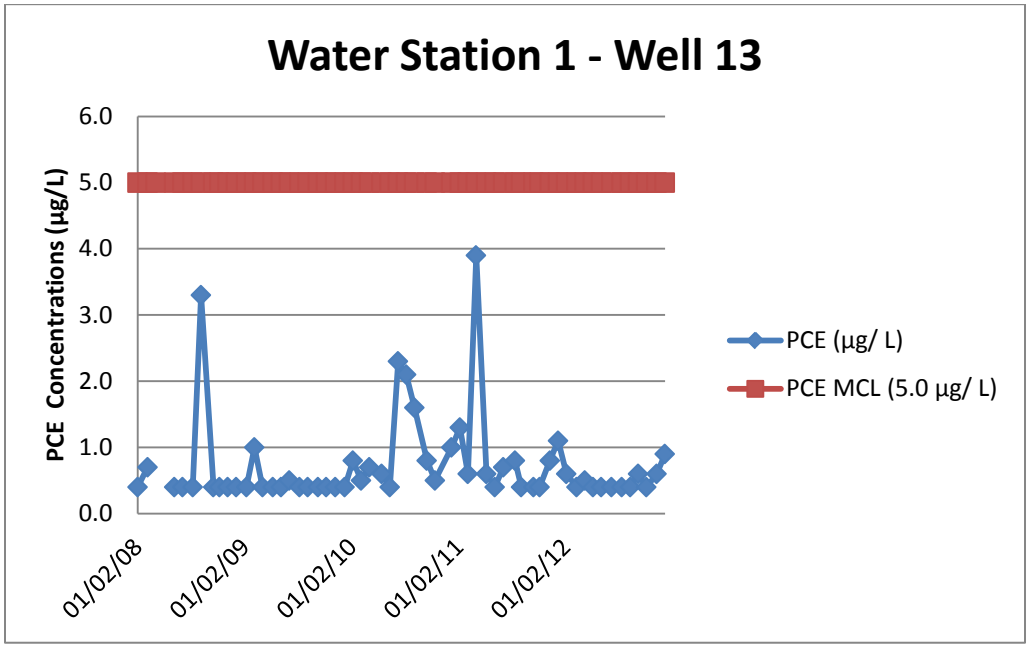

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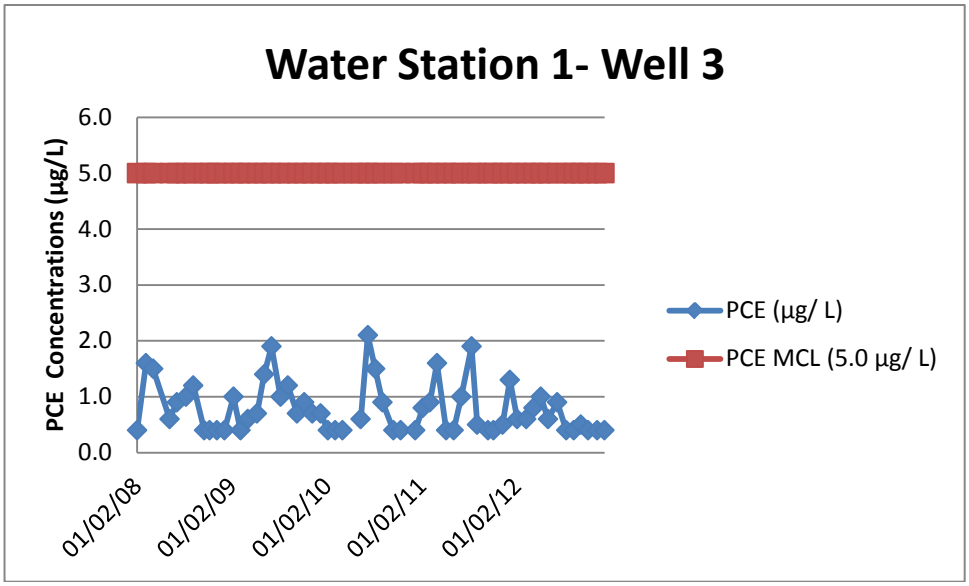

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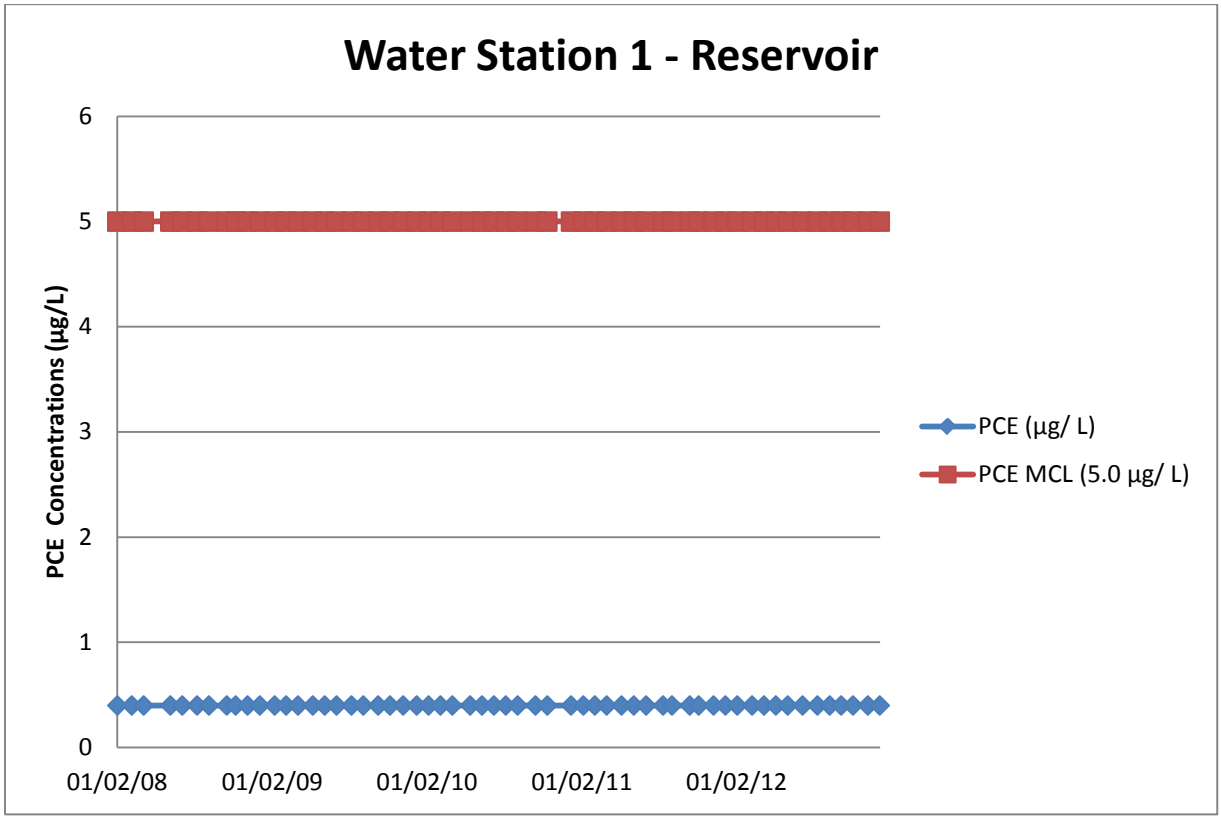

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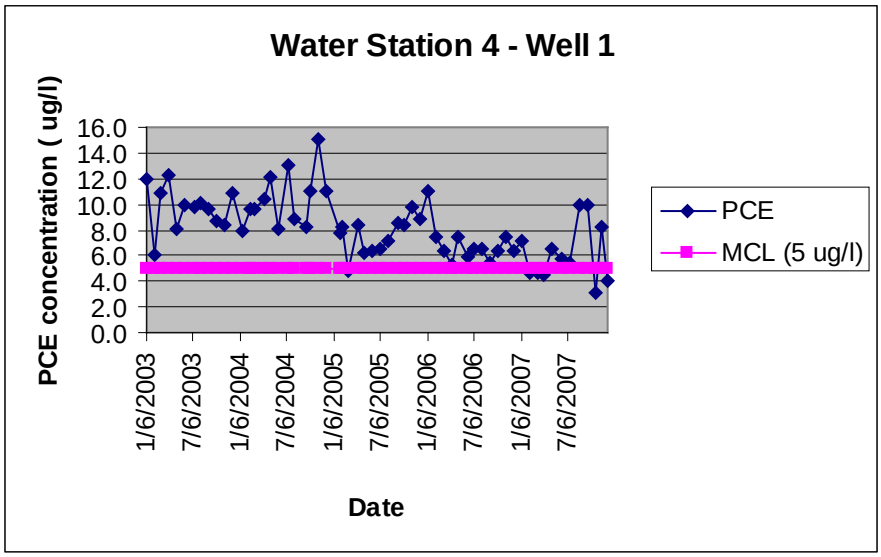

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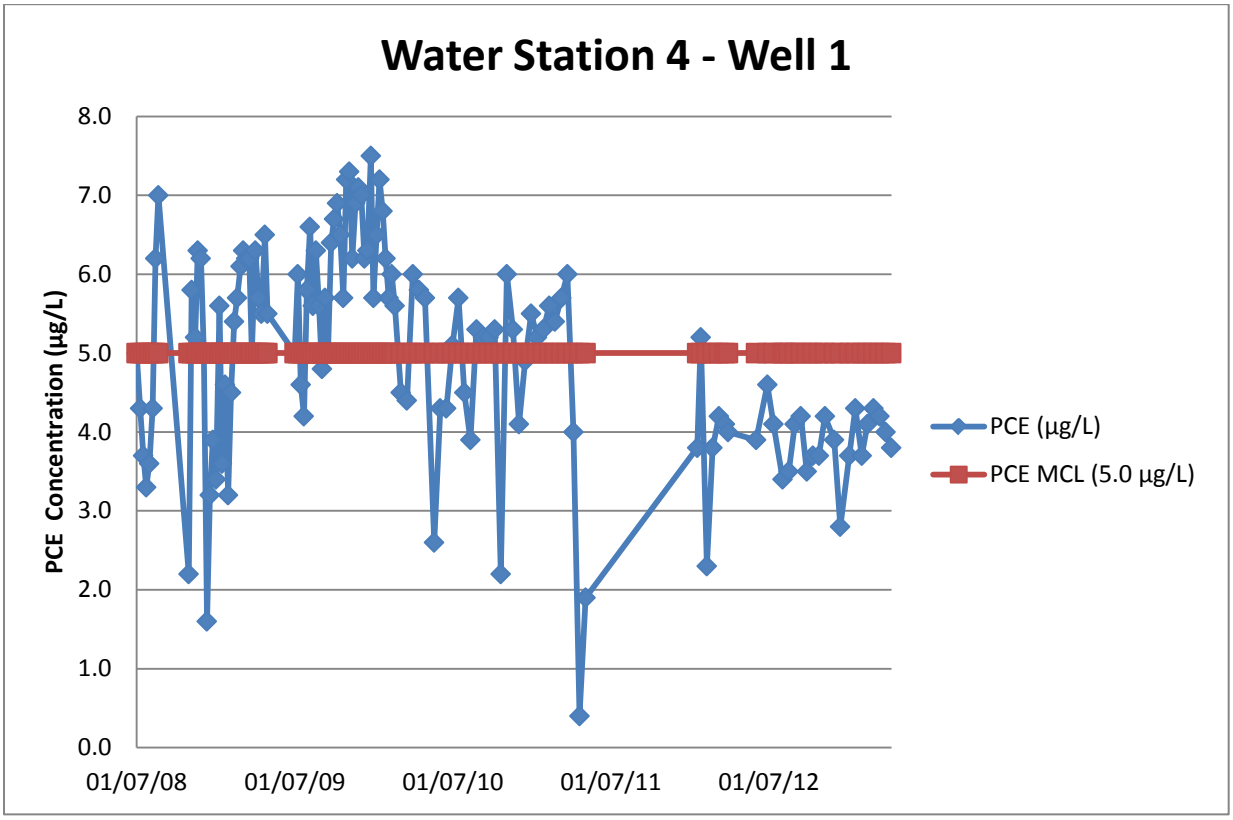

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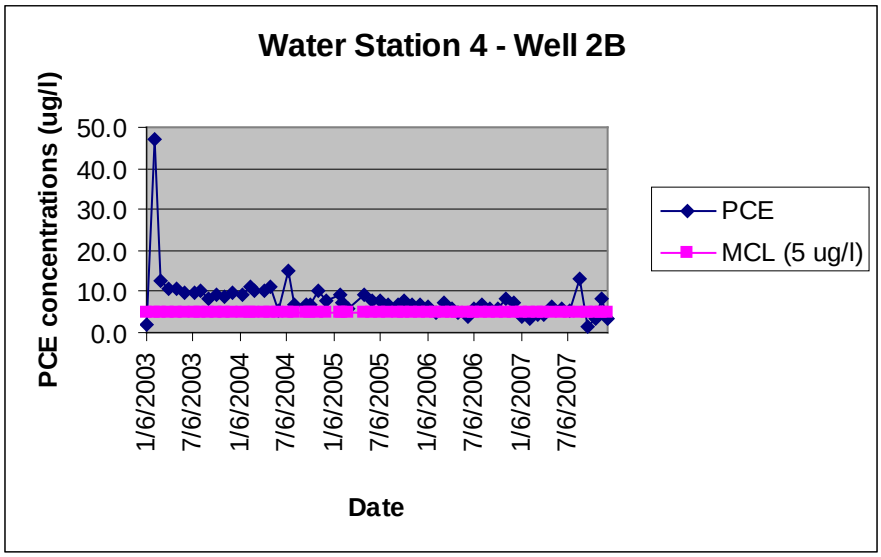

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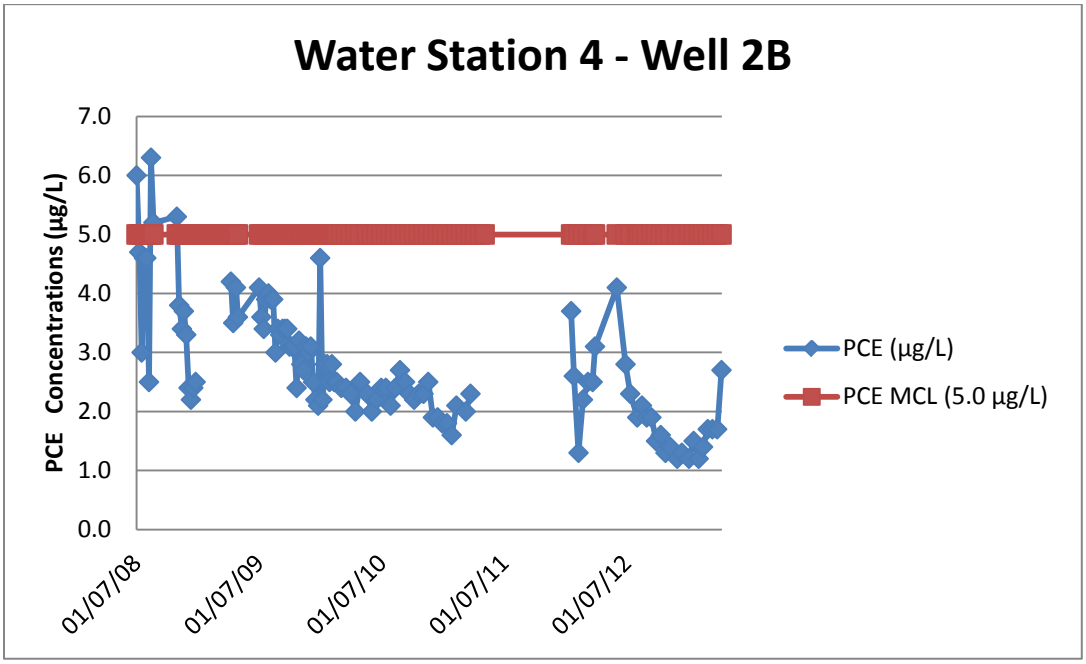

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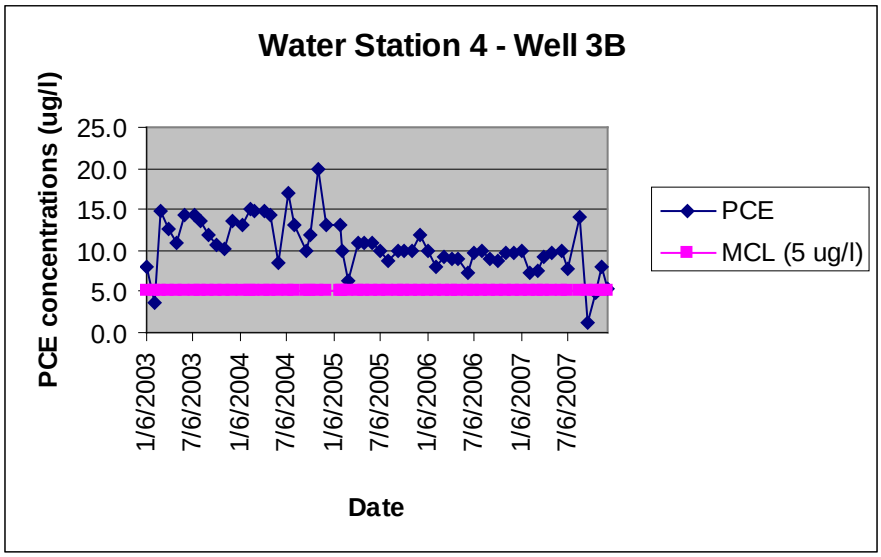

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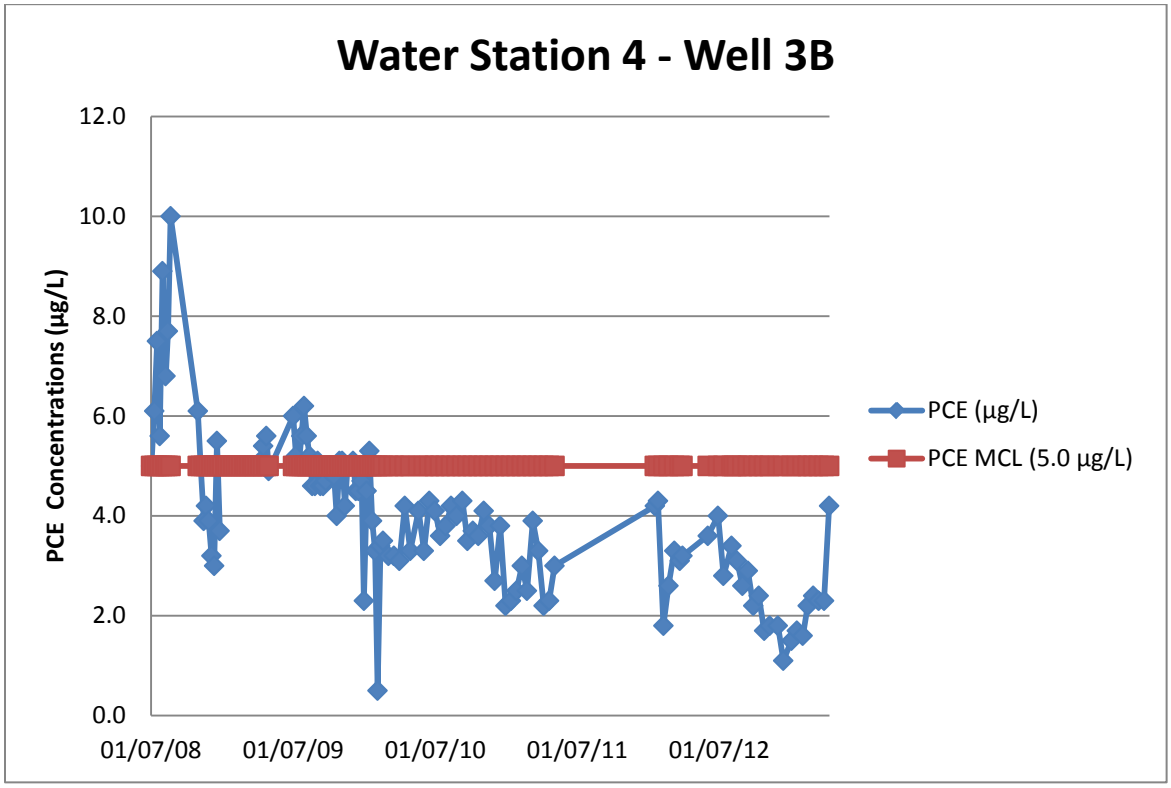

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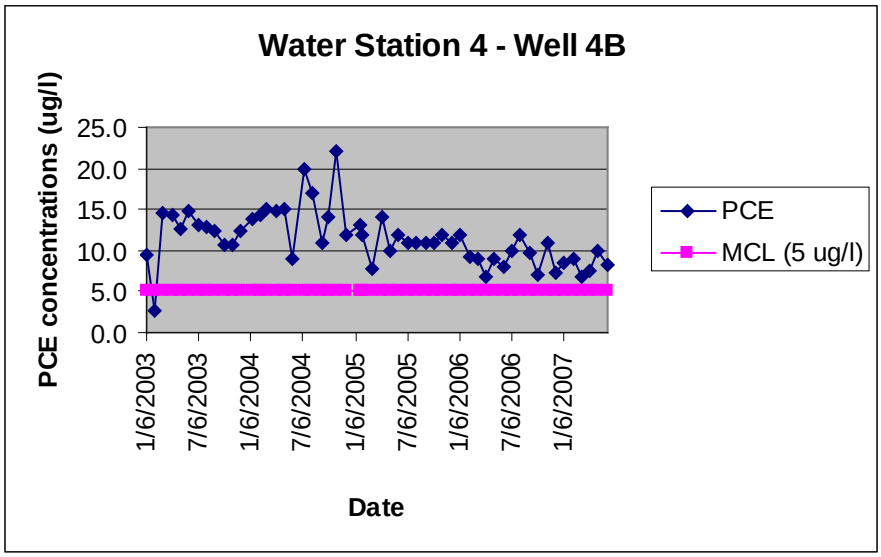

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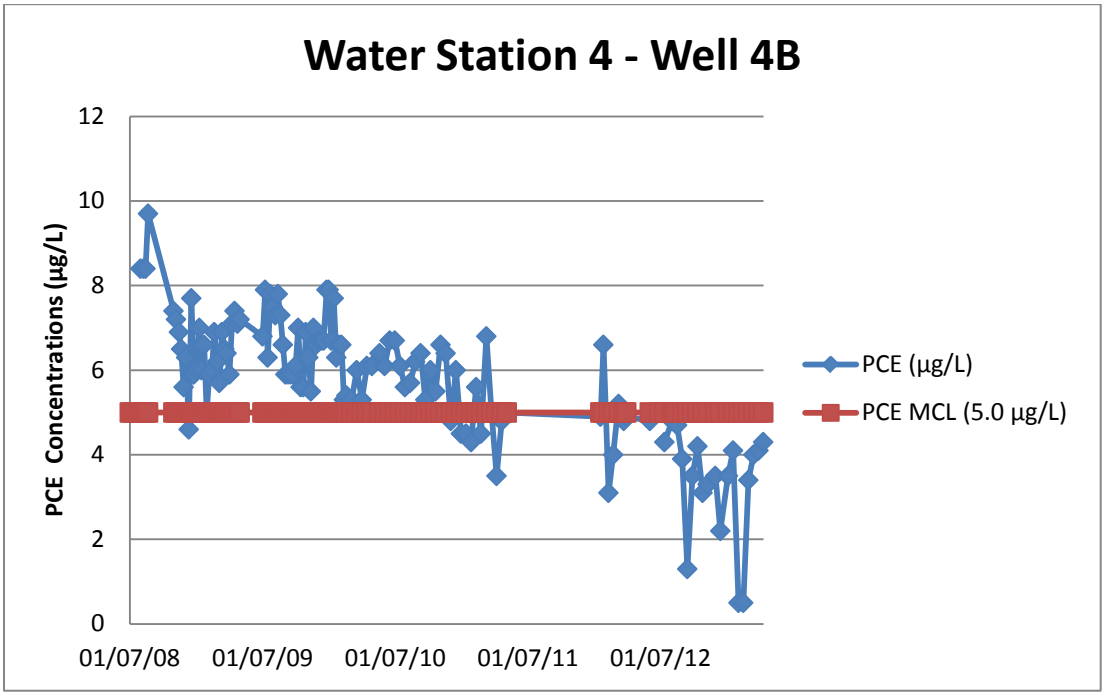

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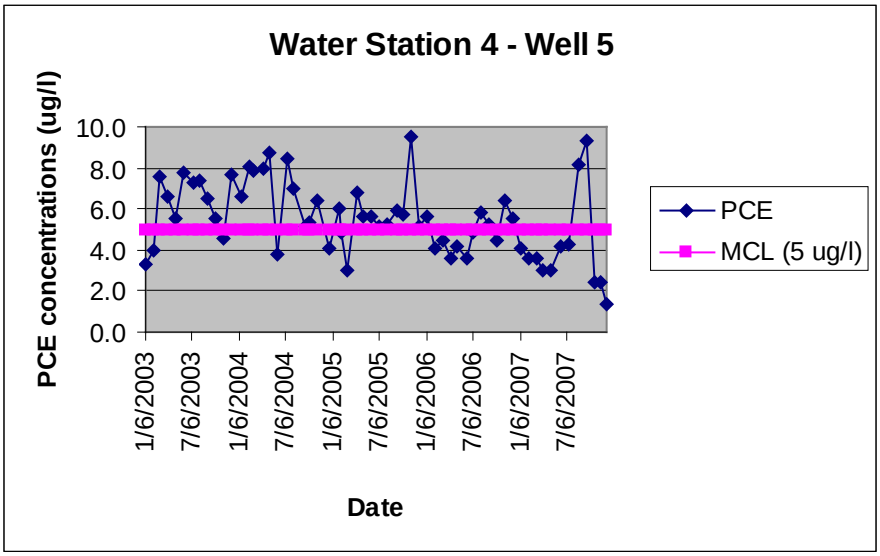

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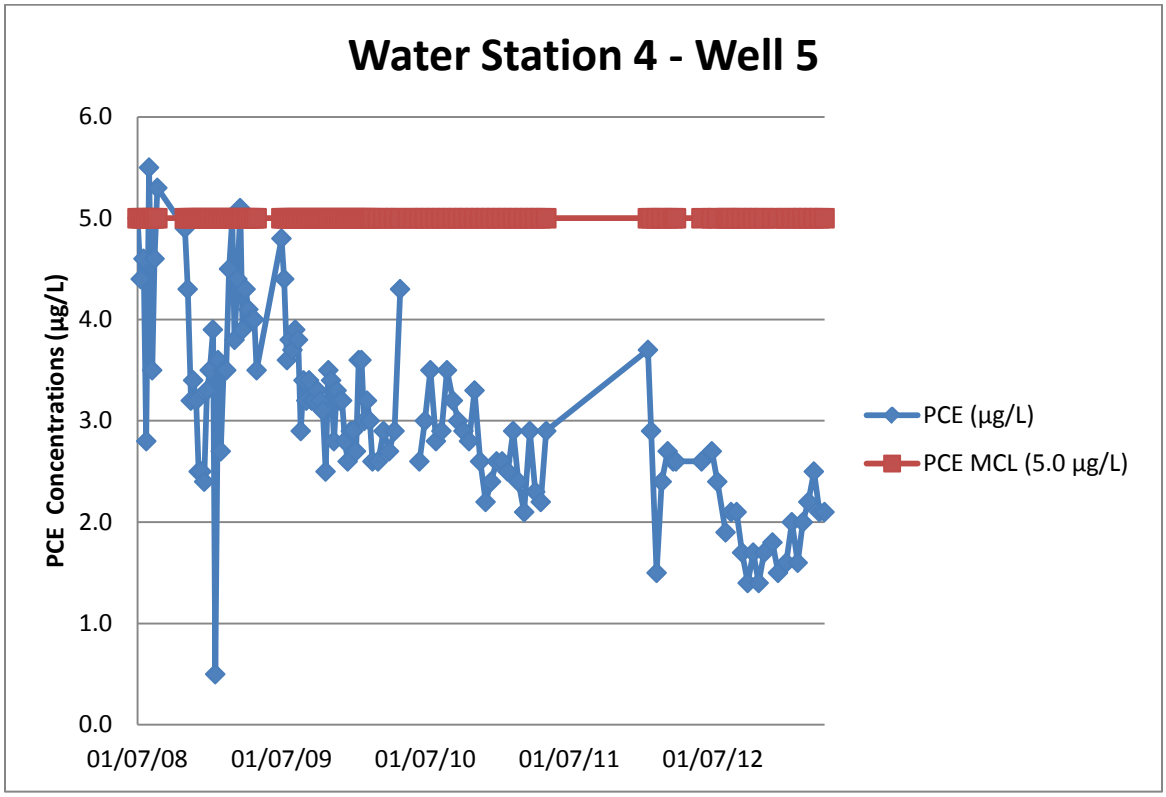

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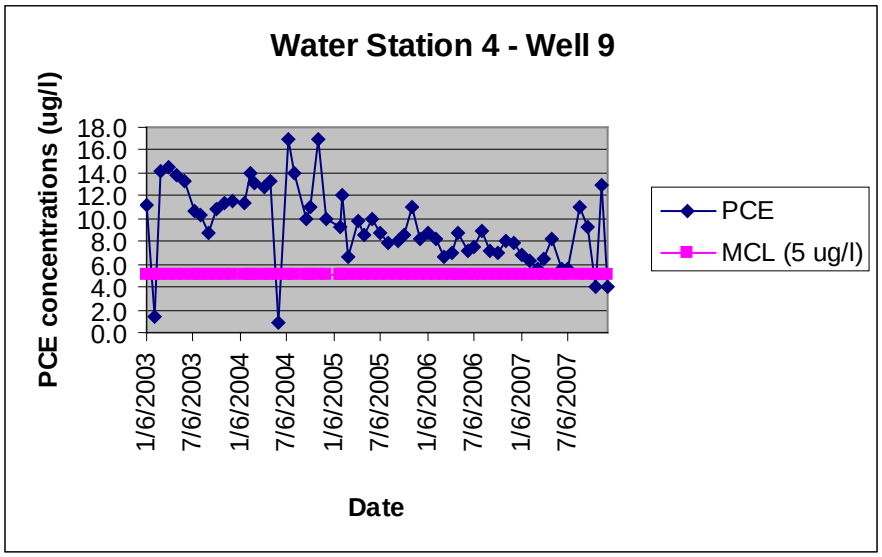

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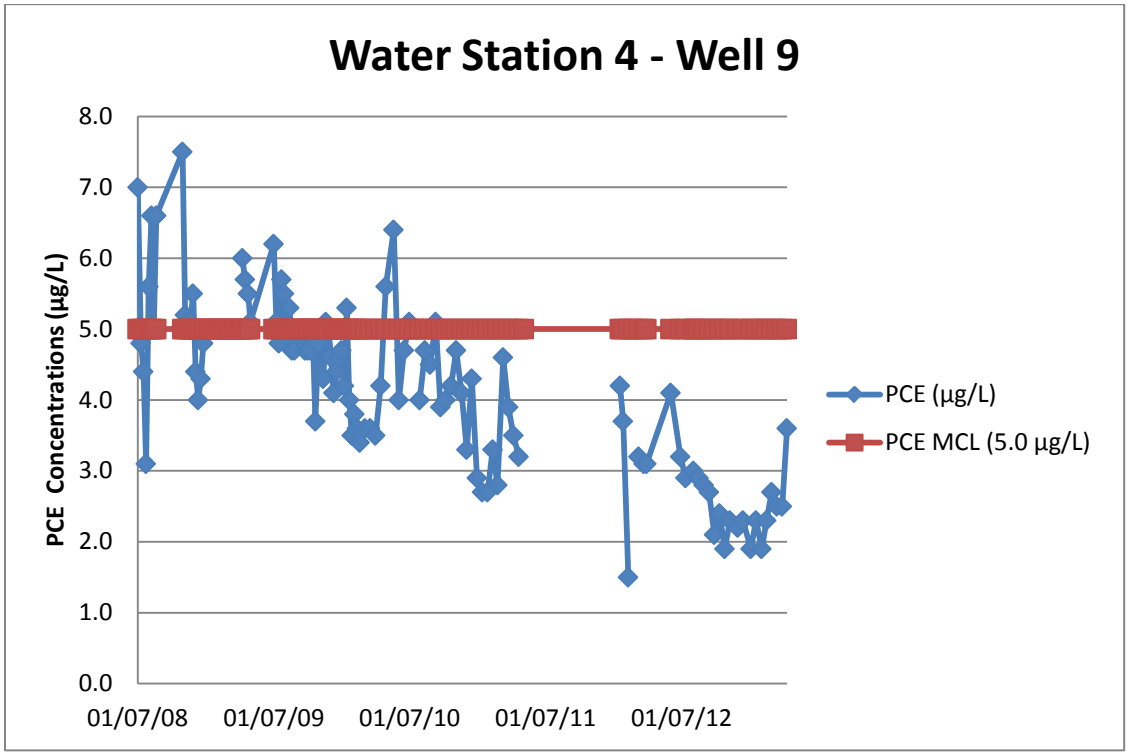

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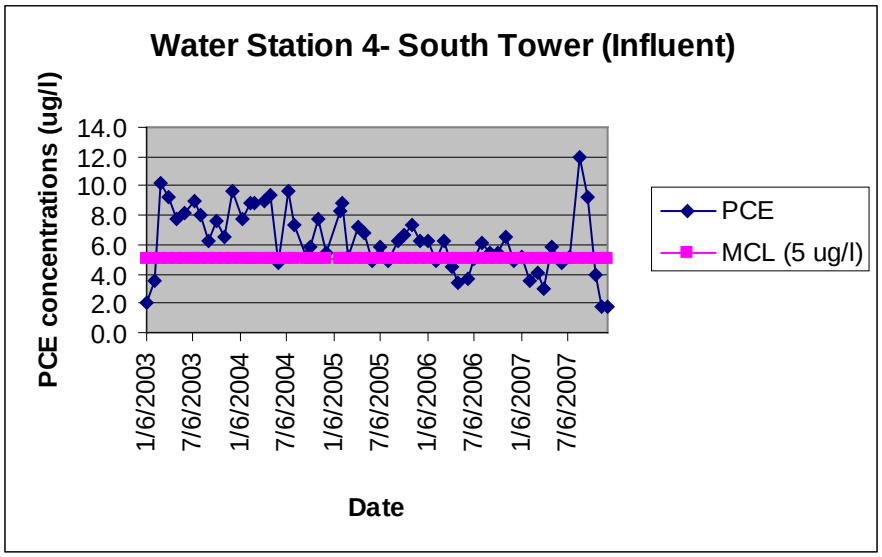

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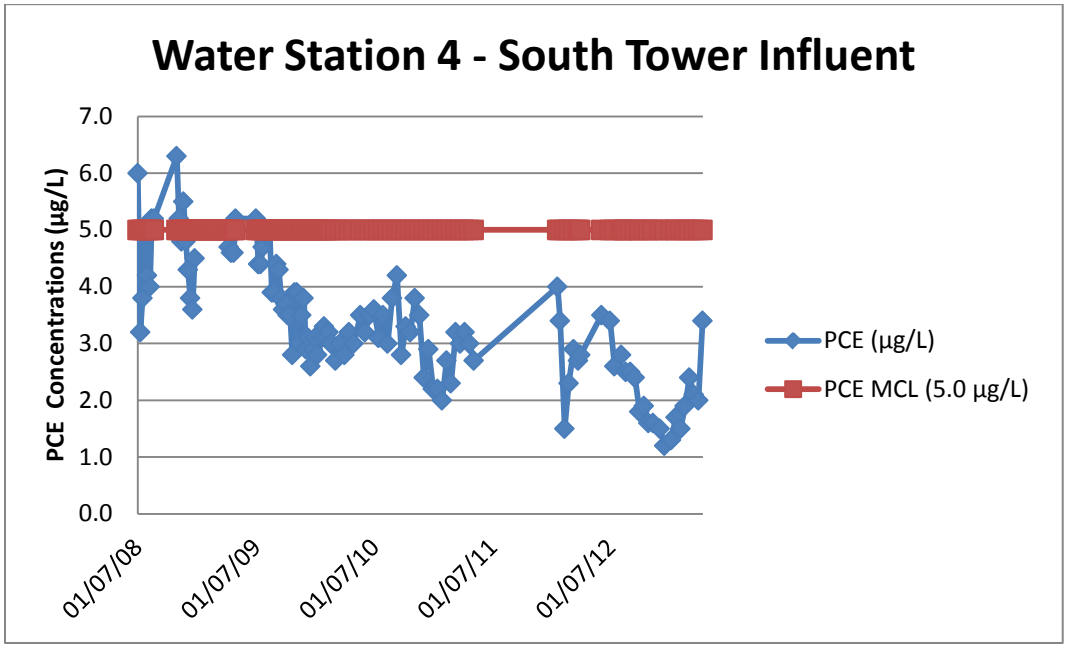

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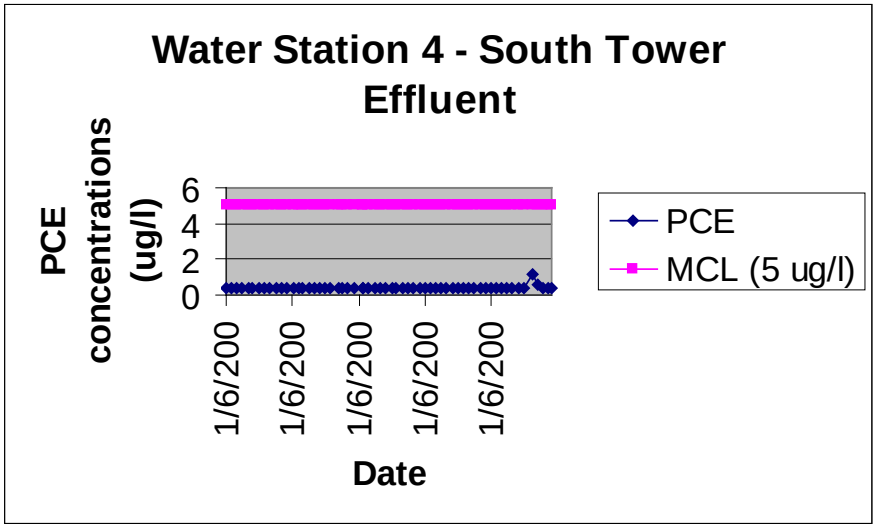
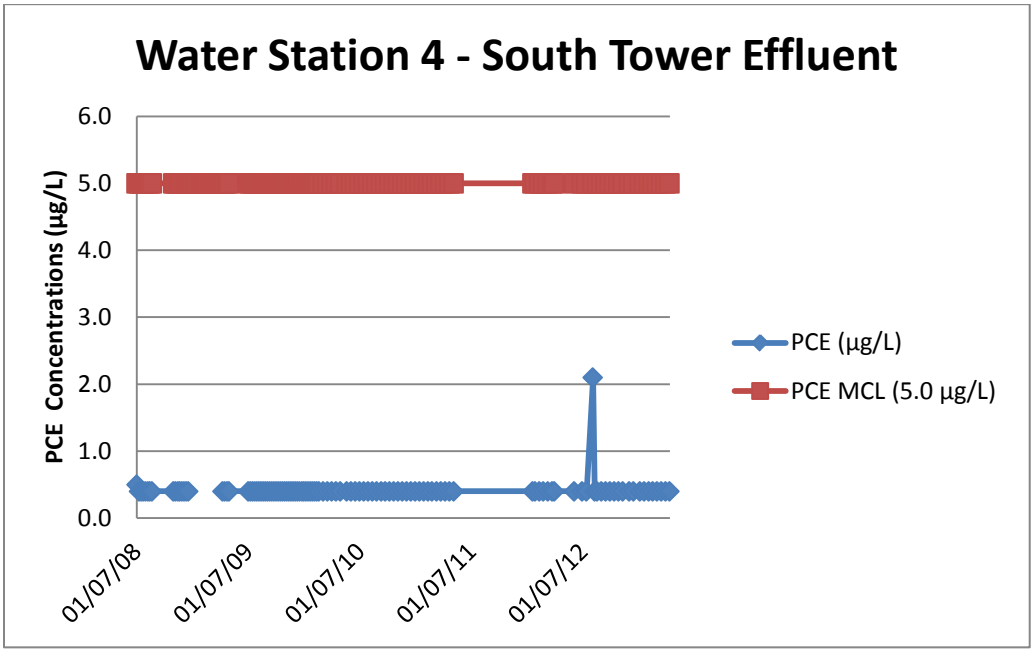
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