DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: Koppers Coal Tar Plant, Follansbee, West Virginia ("Site")
Facility Address: Koppers Road, Follansbee, West Virginia
Facility EPA ID #: WVD 00 433 6749

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

__X__ If yes - check here and continue with #2 below.

_____ If no - re-evaluate existing data, or

_____ If data are not available, skip to #8 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EIs) are measures used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EIs developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

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2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

_X_ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

References
[1] RCRA Facility Investigation (RFI) Report, Koppers Industries, Inc. Coal tar Processing Plant, Follansbee, West Virginia, March, 2000
[2] Surface Water/Sediment Investigation Report, Koppers Industries, Inc, Follansbee, West Virginia Plant, August 2001
[3] CMS Pre-Design Report, Koppers Follansbee, West Virginia Coal Tar Plant, July 2004
[4] DNAPL Recovery at R-225D Quarterly Progress Report, July 2004
[5] Interim Measures Work Plan Koppers Industries, Inc. Facility, Follansbee, West Virginia, July, 2002

Rationale
The evaluation of Site groundwater is based on a review of data from multiple phases of investigations beginning in the early 1980s, proceeding through and including a RCRA Facility Investigation (RFI). The Final RCRA Facility Investigation Report was submitted to the USEPA Region 3 in March, 2000 [1]. This work was followed by additional investigations of sediment and surface water media in the Ohio River in 2000 [2] and again in 2003 [3]. Details governing ongoing groundwater remedial activities related at the Site are discussed in the dense non-aqueous phase liquid (DNAPL) quarterly progress reports [4] and in the July 2002 Interim Measures Work Plan (IRM) submitted and approved by the USEPA. While the West Virginia Department of Environmental Protection (WVDEP) has always been peripherally involved in ongoing Site investigations, it was only recently that they obtained primacy over the HSWA amendments to RCRA. Based on this, USEPA Region 3 is presently transferring authority of the Site to WVDEP. The findings in this EI evaluation of the current understanding of groundwater migration at the site are based on the data collection and evaluation efforts reported in these documents. To minimize the reiteration of previously submitted information, relevant portions of these documents are incorporated to this form by reference only.

On-site groundwater in the perched, alluvial and bedrock aquifers, primarily in the northern portion of the site, exhibit dissolved-phase concentrations of polynuclear aromatic hydrocarbons (PAHs), methylphenols, and benzene, toluene, ethylbenzene, xylenes, and styrene (BTEXS) above USEPA's Maximum Contaminant Levels (MCLs) and health advisory limits for groundwater consumption [1]. The deeper zones (alluvial and bedrock) also have been found to contain DNAPL, which can act as a potential ongoing source for dissolved-phase contamination. DNAPL delineation downgradient (south and southwest) from the tank farm area and a former naphthalene process area along the Ohio River embankment (west of the tank farm) encountered a pool of DNAPL centered near a DNAPL recovery well R-225D (see Figures 9-20 through 9-29 [1]). As of June 2004, approximately 41,400 gallons of DNAPL have been recovered from well R-225D [4].

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

_ X _ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Migration of contaminated groundwater is generally stabilized. A discussion of the technical rationale supporting the conclusion that groundwater migration should be contained within the previously delineated groundwater is provided below.

. Groundwater exists at the Site within three water bearing zones (from upper to lower): perched; alluvial; and bedrock. All groundwater at the Site tends to move in a westerly direction towards of the Ohio River, which serves to act as a regional hydraulic flow boundary.

Migration of the perched groundwater aquifer has been controlled via an Interim Remedial Measure (IRM) recovery system since 1984. The system consists of a combination of interceptor trenches and wells running along the eastern and western property boundaries within the northern areas of the Site. Groundwater is pumped and treated at the Kopper's plant wastewater treatment operations providing protection of potential discharges of seeps off site. The perched aquifer has some leakage potential to the lower alluvial aquifer, yet is characterized as exhibiting very low yields. The perched zone also has limited recharge from upgradient zones, with most recharge resulting from surface water infiltration, which has been minimized in recent years via paving at the Site. Therefore, the perched zone appears to be stabilized in the northern area

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Perched water is not present in most of the southern plant area. In addition, constituent concentrations significantly decrease in concentration and frequency in the ore southern perched wells and are, therefore, unlikely to pose an ongoing concern for groundwater migration offsite. Sentinel wells were installed in all three zones (perched, alluvial, and bedrock) along the southern property boundary area to determine whether groundwater migration may be occurring parallel to the Ohio River shoreline were free of constituent detections.

Groundwater in the alluvial zone discharges to the Ohio River under normal river conditions, however, there is a flow reversal during high river stage events such as flood stages (see Figures 9-11 through 9-19 for representative potentiometric surfaces and head elevations in the RFI Report [1]). Groundwater in the bedrock zone generally

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[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

shows a positive or upward head, indicating a flow potential to the alluvial. Historical monitoring of groundwater located both north and south of the plant has demonstrated that the predominant flow path is towards the Ohio River from the on-plant areas. The only exception to that predominant flow path direction is when the river stage is rising rapidly, as can be observed under flood stage events. In those cases, the groundwater flow gradients are temporarily reversed. Therefore, the Ohio River acts as a migration barrier for groundwater from the alluvial aquifer off of the plant.

Dissolved phase flux to the Ohio River from the alluvial aquifer is not an existing risk based on current surface water sampling results [2] and based on human health risk estimates of the surface water results in the RFI [1]. Four rounds of surface water sampling (two during the RFI in 1993, once in 1996 during the RFI, and during the Ohio River investigation completed in 2000 [1, 2]). Detections of non-site-related constituents in the earliest round of surface water sampling were proven not to be site related in subsequent rounds. The most recent surface water sample results had no regulatory exceedances of water quality for either human health or aquatic risks.

Stabilization of ongoing sources in the deeper groundwater aquifers (i.e., DNAPL) has been ongoing since April 2000 with the implementation of a DNAPL interim measure at well R-225D (see Figure 9-20 [1]) to recover and reduce the source of DNAPL, to the extent practical. DNAPL recovery thus far (41,400 gallons as of June 2004 [4]) has been successful and continued DNAPL removal is anticipated. DNAPL levels in R-225D have fluctuated over time, but appear to have slowly decreased from 2002 until the present, with levels dropping from 3.5 to 4.0 feet in 2002 to approximately 2.0 to 2.5 feet currently. Beazer is evaluating the efficacy of adding a second DNAPL recovery well (R-231D) to enhance the source reduction of this subsurface DNAPL.

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4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

__X__ If yes - continue after identifying potentially affected surface water bodies.

_____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s)

As stated in #3 above, the site conceptual model developed for groundwater beneath the Site [1, 3] has concluded that discharge is occurring into the Ohio River at the site. With ongoing perched groundwater recovery and treatment and the implementation of a DNAPL interim measure in the deeper zone, that discharge potential is believed to have been significantly reduced since environmental investigation began and corrective actions have been undertaken. Direct evidence of this reduction can be seen with the absence of significant shoreline embankment seeps that had historically occurred as a result of mixing of discharges from the perched and shallow alluvial zones. Groundwater discharge is believed to be most predominant from the alluvial aquifer [3].

The USEPA has raised the issue of the potential for groundwater contaminated with DNAPL to affect sediment in the Ohio River. While visual impacts were noted at some sediment sample locations near the Site in the 2000 and 2003 Ohio River investigations [2], [3], it can not be conclusively determined whether this material is the result of historical or ongoing releases. Mitigation measures for DNAPL control will be included in the upcoming CMS as part of the corrective action planning progress and will be integral to the final remedy. This position is similar to the following USEPA's position, as taken from USEPA's corrective action web site: "In many cases, RCRA facilities are located near rivers or other water bodies characterized by historic sediment contamination. In such situations, the potential contribution or current groundwater discharge to sediment quality (and similarly, to the hyporheic zone) would be beyond the scope of a groundwater E.I. determination. Instead, sediment quality issues would be dealt with as a part of the final remedy (or perhaps more broadly as part of an area-wide investigation).

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5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

__X__ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Three substantial rounds of surface water sampling (two during the RFI [1] and one as part of the initial Ohio River investigation in 2000 [2]) have shown that there are acceptable risks to human health. To further substantiate this position mass loading calculations for two site-related constituents (benzene and benzo(a)pyrene) were completed using maximum site historical concentrations discharging from the alluvial aquifer to the Ohio River. This was done to demonstrate the potential "significance" of the discharge to the Ohio River. See Attachment 1 for the mass loading calculations. Even though maximum or conservative input assumptions were applied, all values are below their respective water quality criteria, further supporting the sampling data we have collected to date.

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR
2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

_X_ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Groundwater monitoring is currently being conducted as part of the site's perched groundwater recovery system under a 1984 Consent Decree executed through the United States Department of Justice. Additionally, groundwater is currently being monitored around the closed RCRA surface impoundment under a post-closure care permit. Changes and additions to the existing groundwater monitoring programs were proposed in the Interim Measures Work Plan [5]. Because the Ohio River serves as a migration barrier and there are no groundwater users at or in the vicinity of the plant, there are no known human receptors to groundwater beneath the plant. The mass loading calculations presented herein and the surface water monitoring performed demonstrate the unlikelihood of an unacceptable human health risk. Therefore, additional monitoring, other than that previously proposed, does not appear to be warranted. As described in the Interim Remedial Measures Work Plan [5], DNAPL recovery will continue until the corrective action objectives can be satisfactorily demonstrated to the WVDEP and USEPA. Performance criteria for the potential cessation of the DNAPL and perched groundwater recovery systems will be incorporated in the Corrective Measures Study (CMS).

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8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

_X___ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Koppers Coal Tar Processing Plant, EPA ID# WVD 00 433 6749 located in Follansbee, West Virginia. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN - More information is needed to make a determination.

Completed by (signature) ______________________________ Date ____________
(print) ______________________________
(title) ______________________________

Supervisor (signature) ______________________________ Date ____________
(print) ______________________________
(title) ______________________________
(EPA Region or State) ______________________________

Locations where References may be found:

1) USEPA Region 3 Offices
2) WVDEP Offices, Charleston, WV
3) Beazer East Offices
4) BBL Offices

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ATTACHMENT 1

Calculations for Mass Loading in the Ohio River
Groundwater Migration Under Control Environmental Indicator Evaluation (August 2004)
Beazer East, Inc.
Follansbee, West Virginia

Using the following mass balance (loading) equation: **(Cgw)(Qgw)=(Csw)[(Qgw)+(0.1)(Qsw)]**, where:
- Cgw = chemical concentration representing groundwater
- Qgw = groundwater flow
- Qsw = surface water flow
- and 0.1 = USEPA allowed dilution factor of 1 in 10.

Surface water chemical concentrations can be predicted by solving for Csw => **Csw**=Cgw(Qgw)/[Qgw+0.1(Qsw)]

Mass loaded chemical concentrations in the Ohio River were predicted using this formula as a conservative measure to evaluate whether groundwater discharge to the Ohio River was "insignificant". These conservatively predicted concentrations are compared to Federal Ambient Water Quality Criteria below to demonstrate the insignificance of the discharge.

The calculation involved determining the average thickness and width of the alluvial zone at the site to calculate the area of groundwater discharge.

Assumption: The width of the aquifer used was the distance between two alluvial monitoring wells (OW-3B and OW-2A) that had the highest concentrations of benzene detected along the river. These wells along the river are adjacent to wells with much lower concentrations of benzene. OW-3B and OW-2A are approximately 420 feet apart. The distance between these two wells was used for the mass loading calculation for all four parameters evaluated.

Assumption: Groundwater elevations reported in the RFI from OW-3B and OW-2A were used to represent the alluvial aquifer thickness. The saturated thickness was calculated by subtracting the approximate elevation of bedrock in the vicinity (597 ft AMSL) from the average groundwater elevation in each well (644.83 ft AMSL for OW-3B and 649.06 ft AMSL for OW-2A). An average thickness of 50 feet was used for the calculation.

Area (A) = Width (ft) X Thickness (ft)
A = 21000 ft^2

The Q7-10 data (for the New Cumberland and Pike Island locks) supplied by the USACOE was used for the flow of the surface water. The USACOE reported average flow values were based on 31 years of data (1949-1979).

(Qsw) =>	5750 cfs	New Cumberland Lock and Dam
	5830 cfs	Pike Island Lock and Dam

The average of the two values was used in the mass loading calculation. **5790 cfs or 5.00E+08 ft^3/day**

The following K(h) value was reported as a range of values for the alluvial zone in the RFI. The hydraulic conductivity values from the RFI ranged between 1 x 10-2 to 1 x 10-5 cm/sec. Given the physical characteristics of the alluvial, 1 x 10-3 cm/sec was believed to be most representative.

(K(h)) => 1.00E-03 cm/sec or 2.83 ft/day (max)

The conservatively estimated value for the site hydraulic gradient (i) used was the highest in a arange of gradients reported in the RFI at 0.001 ft/ft in the deep alluvial. For comparison, shallow alluvial had a gradient reported as 0.0004 ft/ft.

(i) => 1.00E-03 ft/ft

Using the conservative hydraulic gradient, the K value for the alluvial unit, and the approximate area of groundwater discharge, the groundwater flux was calculated using the following equation: Q=K(h) x i x A.

(Qgw) => 59.53 ft^3/day

To estimate the loading of each contaminant to surface water the following equation was used:

(Cgw)(Qgw)=(Csw)[(Qgw)+(0.1)(Qsw)] where C=concentration. Q=flow, 0.1 USEPA allowed dilution factor of 1 in 10.

<u>Benzene</u> in OW-2A	**<u>Predicted Ohio River Csw</u>**	**AWQC ***
Cgw = **3.4 mg/L**	**4.045798E-06** mg/L or	
Qgw= 59.3 ft^3/day	**0.00405** ug/L	**2.2** ug/L
Qsw=5.0E+08 ft^3/day		

Formula:
Csw=Cgw(Qgw)/[Qgw+0.1(Qsw)]

(Cgw)(Qgw)=(Csw)[(Qgw)+(0.1)(Qsw)] where C=concentration. Q=flow, 0.1 USEPA allowed dilution factor of 1 in 10.

<u>Benzo(a)pyrene</u> in OW-2A	**<u>Predicted Ohio River Csw</u>**	**AWQC ***
Cgw = **0.9 mg/L**	**1.07E-06** mg/L or	
Qgw= 59.3 ft^3/day	**0.0011** ug/L	**0.0038** ug/L
Qsw=5.0E+08 ft^3/day		

Formula:
Csw=Cgw(Qgw)/[Qgw+0.1(Qsw)]

* - Represents the lowest available Federal Ambient Water Quality Criteria for each.