Iowa's Web Based RBCA Tier 2 and Site Monitoring Report Application User's Manual

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1. INTRODUCTION

In May 2017, the Iowa DNR Underground Storage Tank Section transitioned from a traditional client-server type risk-based corrective action (RBCA) software program to a web-based application. The new web-based application ("application") performs the same functions as the Tier 2 Version 3.0 software ("software") in essentially the same ways. Site specific target levels and risks determined are unchanged. Two major changes exist; the new application is hosted entirely online, and correct mathematical analysis of all water line receptors is now possible.

Efforts have been made to ensure the transition to the new application is as smooth as possible; however, growing pains are inevitable and some new things will have to be learned and some adjustments made. We believe that people knowledgeable of or trained on the RBCA software (versions 2.51 and later) will recognize common workflows and all of the required features and naming conventions of the software when using the application. Risk analyses from the application will be identical to those calculated in the software. Site Specific Target Levels (SSTLs) in the application will be +/- 1% of the values found in version 3.0 of the RBCA software.

The items listed below are important points of interest for understanding and operating the RBCA application. Please read through them before attempting to complete work on a site in the new application.

Things to Know

- Google Chrome is the preferred web browser for the RBCA application. **The application is stable and fully functional on all common browsers**, though printing and some data entry fields *may* have optimal appearance in Chrome. The RBCA application is also usable on mobile devices running iOS, Android, or Windows Mobile.
- The RBCA application is entirely hosted online and is subject to the same rules as other State of Iowa applications (such as Facility Explorer). This means that a logged-on session will expire after 15 minutes of *inactivity*. Please make sure that you use the Save and/or Update buttons to avoid losing unsaved data due to inactivity.
- Records associated with the RBCA process have always been and will continue to be public record, available to all citizens. Formerly, it was necessary to make a public records request or come to DNR Records Center in person to view the reports or obtain software files. It is worth noting that information contained in the application will be easier for the public to access than were files that required RBCA software. Once a RBCA application report has been submitted, the record will be visible to the public (whether or not it has been reviewed by a DNR Project Manager).

Logging in

- A valid Iowa Enterprise A&A user name and password will be required in order to use the RBCA application in *edit* mode. Click on "Create an Account" at the top of the RBCA application log in page to obtain an Iowa Enterprise A&A account if you do not already have one. This is the same account (and same user name and password) that is used for well searches in Facility Explorer. CGPs will already have an A&A account. **If you are a new CGP or CGP assistant, you will need to contact the DNR UST Section to ensure that your information has been added to the list of RBCA users.**
- The new application will be available to the general public (just like the Tanks Database), though various types of users will have different levels of access with different privileges.
  - CGPs and CGP assistants (CGPAs) will be able to access all LUST sites assigned to any CGP working for the same company (as recorded in the Tanks Database). The CGP and CGPA have essentially the same rights. Both can begin a RBCA application-based report, edit an in-process report, download data, and save reports. *Only* CGPs will have the ability to *submit* a report to DNR.
  - DNR project managers (PMs) will have the same rights as CGPs with the exception of the added ability to accept and reject reports.
  - DNR employees who are not PMs such as Field Office staff can view RBCA application reports, view monitoring well selections, and download data, but cannot edit or approve/reject reports.
  - Administrators have all of the rights available to DNR PMs along with the abilities to delete reports and "unlock" RBCA application reports that have been submitted, but not yet approved/rejected.
  - The general public will have view only rights to RBCA application reports and data once they have been submitted to DNR.

- After you are logged on, your name and privileges will be displayed in the lower right hand corner of the screen.

Searching for a LUST Site and Selecting a Report

- Once a user is logged in, they may search by LUST name, LUST number, UST registration number, address, city, county, field office, risk classification, or any combination of these.
- Search results will populate as a list below the search box with corresponding LUST numbers, names, risks, and cities. Select the site in which you are interested.
- The site home screen will list information about the LUST site taken from the Tanks Database and have a list of RBCA application reports either completed or in progress for the site. Each row indicates an individual report (Tier 2, SMR, etc.). Each report will have a type, description, dates, status, CGP, and reclassification requests noted.
- All pre-existing LUST sites will have the most recent Tier 2 and most recent SMR uploaded. The Tier 2 will be "locked" and the SMR will be available for edit. **In order to edit the SMR, it is necessary to first select a risk.** Click on "Edit" in the SMR row and you will be directed to a report/site information screen where a drop-down menu will allow selection of current site risk. This **must** be done before an SMR can be edited.
- The far left column will list the actions available to the user for each report.
  - View: The user can view the report, but not make any changes.
  - Edit: Allows edits or data additions to be made to all areas of the report. Will not be available after the report is submitted.
  - Play: A new feature available at all times allowing the user to "test" the effects of altering any parameter they wish without actually changing the original copy. For example, if you wanted to know what the result of adding a monitoring well in a particular spot might be on a plume, you could create a Play copy of the given report, add the well in the Play, and see how the plume is affected without the worry of compromising the original. The Play feature will create a virtual clone of the report for which is it activated at the time of the activation. Play copies can be saved for future use or for use in negotiations. If you will not use a play copy in the future, we recommend deleting it to avoid clutter on the site page.
  - Revise: A Tier 2 report may need to be revised for a variety of reasons. The "Revise" function will create an exact copy of the most recent Tier 2 report in the system and will ask you what data (if any) you would like to import from the most recent SMR.
  - Delete: Only available to the Admin for actual reports. Available to CGP, CGPA, and PM for "play" reports.
- If this is the initial RBCA report for a given site (i.e. nothing exists in the RBCA application because there was no existing software file to upload), you will need to select "New Tier 2" and begin a new report. Sites in the SMR stage and either high or low risk as of April, 2017 will have their Tier 2 and most recent SMR data uploaded to the application.

Printing Report Pages, Maps, and Data Tables

- Maps will be available as either a pdf file or a dxf (AutoCAD) file. In order to print a map (pdf), the user will need to:
  1. Click "Plot."
  2. The map will plot to a scale fitting the screen size. If you have a predetermined scale that you need (1" = 30' for example), you can enter a scale into the scale box and replot the map.
  3. Toggle the "Show Print Area" feature. Gray lines will appear denoting the area that will be converted to pdf. Move the plot to correspond with the available print area. It may be necessary to adjust the scale to ensure that the entire plot can be printed on a single sheet of paper. The map will move and zoom just like Google Earth (drag and drop, scroll wheel on the mouse).
  4. Click "Export" and choose pdf as the file type.
  5. The user can choose a location on the printed page for the **source well** if desired (for example if you are printing the RID map on an already printed aerial photo). Measure to the desired source well (in inches) from the upper edge and the left edge of the paper. Using this feature, you can accurately print a contour or RID map on an already printed aerial photo.
  6. **Make certain to <u>un</u>-check the "Fit to Page" option** when printing your pdf map (and when printing the aerial photo). If you do not un-check this option, Adobe may scale the map to fit the page and may not print at the desired scale depending on the settings of your individual printer and computer.

7. If you need an AutoCAD file, simply select “dxf” and the application will deliver this file type.

- Viewing and printing of Monitoring Maps has been conveniently relocated inside the Pathway Evaluation buttons.
- Required elements of the physical Tier 2 Report copy *other than maps*, such as sample data, data before modeling, and monitoring plans will be printed directly from the application (from your web browser). To print these items simply click the right mouse button and select “Print” from the menu displayed. The required items have been optimized to ensure that they will print properly; however, if a page is not printing correctly, you may need to expand the margins of the print area in your browser print settings. The pages have been sized to print correctly with the default settings in the most common web browsers. Some pages (such as data tables) will print more effectively in landscape format and some will be more efficiently printed in portrait format.
- All maps will default to 10’ grid spacing. In many cases, a 10’ grid spacing is appropriate; however, there are situations where the grid spacing should be smaller or larger. Since the new application is hosted online, a larger grid spacing will speed up the process of calculating and plotting a map. This may be helpful where there are large, complex plumes or large volumes of data. Some situations (small plumes, Sw/W calculations) may benefit from a smaller grid spacing to promote accuracy.
- All pages that do not have an “Export” button should be printed directly from the browser window by right clicking the mouse and selecting “Print.”
- It is important that printing of data tables and site information pages be done in **View** mode. Maps that use the “Export” button can be printed from either edit or view mode with equal success. The view mode has been optimized to print the report in an efficient and neat format. Printing pages such as data tables in edit mode will not yield satisfactory results.

Navigating, Saving, Updating, and Submitting Reports

- A “Back” button is provided on each page. This button will take you back one level closer to the main site page each time it is clicked. Using the Back button is preferred to using the back arrow on your browser if you have made changes to a screen or data table. This will ensure that your new data or selections are properly preserved.
- Many data entry fields in the new application contain logic that will not allow implausible to incorrect data types to be entered. An error message will show if data of the incorrect format or data outside acceptable limits is entered and the “Save” button is clicked. The offending data field(s) will be highlighted in red for easy location. It was possible to enter identical samples in some locations of the Tier 2 software. These data were uploaded to the new application; it *may* be necessary to rename a small number of data points in order for them to work in the new application. This might be as simple as adding a dash or slash or number to the second of a pair of “identical” samples.
- Data entry screens have “Save” buttons located below the data tables that must be clicked in order for any data entered to remain in the table after leaving the screen. A small message box will appear in the upper right hand corner of the screen noting that the save was successful. The “Save” button will not save data if it is clicked after a session has been timed out. Note: Logged in sessions will expire or be “timed out” after 15 minutes of *inactivity*.
- Screens where selections are made (such as monitoring well selection or borehole zoning selection) will automatically preserve the selections made when exiting the screen. No “Save” button is provided or required on these screens.
- If you attempt to save or submit a report and all required data has not been supplied, or all necessary selections have not been made, an error message in the upper right hand corner will notify you that the report or field is not complete and offer instructions on how to rectify the situation.
- The main report page has two blue buttons at the top:
  - Update: This button will update all site parameters and equation results with the most recently entered data and selections. It is recommended that a user clicks the Update button before exiting the application to make sure that all work is saved and up to date.
  - Submit: The Submit button will only be available to CGPs and is the final step in the process of completing a report in the RBCA application. After all data is entered and you are satisfied with the results, click the Submit button to complete the online report process. This will automatically send an email to the DNR PM

alerting them that a RBCA application report has been submitted for the site. **This action is a signal that the report is finished and no more work will be completed in the RBCA application before DNR review.**

Other Changes and General Information on the Transition from Software to the RBCA Application

- As part of the transition in April 2017, every effort was made to upload as much information from the most recent software file of each active high and low risk LUST site into the database of the application. **Despite this, we encourage the user to review site information in the application and inform the DNR PM if there are important items missing or that require a change.**
- The most recent Tier 2 and SMR software file for each active site was uploaded to the application. This was done by an uploader program written by DNR Application Development. The Tier 2 was automatically "approved" to allow for an editable SMR to be created and uploaded in "saved" status.
- Before completing pathway evaluation or other operations in the application, it was recommended to enter and "**Save**" groundwater, soil (for rev. Tier 2), and soil gas data. Data analysis functions may operate more accurately if data has been saved after import. This was recommended only on the first use of the application for each LUST site. Once done it will not need to be done again.
- The "Use in Model" check box replaced the "Data Adjustment" feature in the software that was separate from the data entry table. Sample data that was uploaded in bulk was used to pre-select or un-select the "Use in Model" box. If you encounter variations in the model that are unexpected in a subsequent revised Tier 2, it is suggested to compare the "Use in Model" boxes with the data adjustment screen in the software file to make sure they match.
- When completing the first revised Tier 2 in the application, compare input data (e.g., hydrogeology data, source width, length data) uploaded to the application from the software file. Some parameters have fewer decimal places allowable in the new application. If you obtain site specific target levels (SSTLs) or simulated concentrations that are greater than 1% different from previous values using the same groundwater data, it is a good idea to ensure that hydrogeology and source width/length data match.
- **All receptor data contained in historical software files was uploaded to the new application with the exception of water line data.** This was because the water line data in the application is now separated into four types with varied target levels necessitating re-entry.
  - Water Line A: PVC or iron water mains with non-petroleum resistant gaskets
  - Water Line B: PVC or iron water service lines with non-petroleum resistant gaskets
  - Water Line C: PE/PB/AC/plastic water mains and service lines
  - Water Line D: Petroleum resistant water mains and service lines (non- receptors)
- It is no longer possible to plot source width and length for chemicals having less than three data points in the application. This should produce fewer extraneously large plumes and corresponding Sw/W values that do not represent reality.
- Naphthalene was removed as a chemical of concern throughout the application.
- Methyl-tertiary butyl ether (MtBE) was added to the groundwater data table providing a convenient place to store MtBE data rather than submitting separate Excel files. Individual sites retain their formerly agreed upon MtBE reporting requirements and historical MtBE excel files have been maintained .
- Waste Oil (TEH-WO) was removed from the chemicals of concern for soil samples since no target levels have been published. Waste Oil is still included in the soil data table for informative purposes.
- Many of the monitoring well and borehole parameters (such as zoning designation and risk) that were toggled or entered in the software are now small dropdown menus in the application. You may either use the mouse to select a well and the appropriate designation, or for quicker data entry, use the Tab and arrow keys.
- When completing a revision of the Tier 2 model (or when adding new data *after* completing a pathway evaluation) in the application and adding new groundwater, soil, or soil gas data, it is necessary to reopen the appropriate preliminary receptor evaluation requirements and the pertinent pathway evaluation(s). Data that will later be used to calculate entries in the monitoring plan is generated in these areas and if they are not reopened prior to generating a monitoring plan, it is possible for receptors that should either drop off or be added to the monitoring plan to not display on the plan. This was also a requirement for the RBCA software.
- The acronym "PWL" formerly stood for *plastic* water line; it now denotes a *potential* water line.
- Drinking water or non-drinking water well data that *are not* to be used for RBCA purposes (SSTLs, contouring, risk analysis) should not be entered into the application groundwater sample data table (even if they are going

to be "ignored"). The application has a special area for entering non-RBCA water samples collected from locations such as taps, faucets, water lines, hydrants, wells, and surface waters. Please use this new table to avoid clutter in the sample data table.

- The Tier 2 Cover Page is now a fillable pdf available on the DNR UST website (form 542-0723) rather than being printed from the application.
- In the software, it was possible at any time during the life of a LUST site to modify the Tier 2 portion of the software after a Tier 2 Report had been completed and accepted (i.e. during SMR or Tier 3 monitoring). Due to the database structure of the new application, it is no longer be possible to modify the Tier 2 module "on the fly." A revised Tier 2 report is necessary if large-scale changes (things that cannot be changed in the SMR) are desired. **It will be important** to make certain all Tier 2 parameters are set appropriately before submitting the online report.
- All data tables that have blue column headers are sortable. For example, the column label "B (µg/L)" in the Groundwater Data Table for benzene concentration is blue, and sortable. The table will initially be sorted alphanumerically by well label. Clicking once on the Benzene column label will sort the column from lowest to highest and the selection is expanded so that all rows are sorted as units. Clicking the Benzene label a second time will result in the column being resorted highest to lowest. Refreshing the screen (Ctrl + F5, or the refresh icon on your browser) will resort the table in original order.

1.1 The Origins of Iowa RBCA

The Risk-Based Correction Action (RBCA) process for Iowa's Leaking Underground Storage Tanks (LUSTs) was mandated by the Iowa legislature through Iowa House File 508, signed into law by the governor on May 25, 1995. This legislation called for a tiered assessment approach consistent with the "Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites." This is an emergency standard, ES38-94, published by the American Society of Testing and Materials (ASTM) in 1994. The final ASTM standard was published as E 1739-95.

The legislation said, in essence, that RBCA would be applied to LUST sites in Iowa. The legislation required the formation of a Technical Advisory Committee (TAC) fill in the details. The legislation required the TAC be made up of representatives from the: Iowa Environmental Council, Petroleum Marketers of Iowa, Iowa League of Cities, Iowa Groundwater Association, Iowa Petroleum Council, Consulting Engineers of Iowa, Iowa Association of Business and Industry and the Administrator of the Iowa Comprehensive Petroleum Underground Storage Tank Fund Board. The DNR was instructed to work jointly with the TAC to prepare draft rules for presentation to the Environmental Protection Commission. The RCBA program and rules were primarily developed by the TAC, with input from the DNR. The TAC began meeting in June 1995 and met on a regular basis for over a year. The RBCA rules developed by the TAC, and put into rule form by the DNR, became effective in January 1997. The TAC made final decisions by majority vote. NOTE: DNR was not a voting member of the committee. The TAC ceased to exist, as required by House File 508, when the Environmental Protection Commission adopted the final rules.

1.2 Overview of the Iowa DNR RBCA Program

RBCA considers the potential for chemical exposure by pathways from a source to a receptor, using a Tiered approach. Tier 1 assumes a receptor could be exposed to a chemical-of-concern at the source location and has more stringent target levels based on the risk of exposure at the source. Tier 2 assumes exposure to a chemical-of-concern might occur at some distance from the source and allows for site-specific target levels (SSTLs) based on this distance. A Tier 3 approach may be used in instances where it is believed an alternative approach may better reflect site conditions. For more information on the tiered RBCA approach, please refer to Iowa Administrative Code Chapter 135 and the respective Tier 1 and 2 Guidance Documents.

2. OVERVIEW OF THE TIER 2 RBCA METHODOLOGY

The Tier 2 RBCA recognizes exposure to chemicals occurs through pathways. Chapter 135 defines a "Pathway" as a "transport mechanism by which chemicals of concern may reach a receptor(s) or the location(s) of a potential receptor." A "Receptor" refers to "enclosed spaces, conduits, protected groundwater sources, drinking and non-drinking water wells, surface water bodies, and public water systems which when impacted by chemicals of concern may result in exposure to humans and aquatic life, explosive conditions or other adverse effects on health, safety and the environment as specified in these rules." A receptor may be an "actual" receptor, one presently in existence, or could be

"potential," or not in existence at the time of assessment, but which could reasonably be expected in the future. Whether a pathway is "complete" or "incomplete" is determined by the source of contamination and the mechanisms of chemical migration. Complete pathways must be evaluated. Incomplete pathways do not require evaluation. The DNR generally classifies pathways into seven categories:

1. Groundwater Ingestion
2. Soil Leaching to Groundwater
3. Groundwater Vapor to Enclosed Space
4. Soil Vapor to Enclosed Space
5. Groundwater to Water line
6. Soil to Water line
7. Surface Water

In the Tier 2 application the pathways are grouped by media type: groundwater pathways, soil leaching pathways, and soil pathways.

Groundwater Pathways

The source of contamination for the groundwater pathways is existing groundwater contamination. The mechanism for chemical migration is groundwater transport. The risk-based target levels at the receptors (points of exposure) are groundwater concentrations.

The groundwater concentrations at a receptor, under existing conditions, are estimated by: 1) interpolation using measured concentrations and 2) simulation (modeling) of chemical transport in the groundwater. The groundwater simulation model assumes steady-state and uses site-specific data (source location, source concentration, source width and length, hydraulic conductivity, gradient, plume migration direction, and plume spread or range). The groundwater transport model is used to estimate the maximum groundwater concentrations that may occur in the future at a receptor, given the known conditions at the site. It is difficult to predict or forecast, with any level of confidence, the future evolution of a groundwater plume. Current plume measurements may not reflect the ultimate extent or magnitude. Yet, a no action required classification may be granted for a site based on modeling, without actual measurements to confirm the ultimate extent and magnitude of groundwater contamination (i.e., without actually measuring the groundwater concentration at a receptor ten years from now). Hence, one of the criteria for groundwater transport modeling at Tier 2 is to be reasonably confident actual groundwater concentrations at a receptor are not likely to exceed the target levels at any time in the future. That is, we would rather overestimate the maximum concentration that might occur at a receptor in the future, than underestimate.

If the simulated or measured concentrations at a receptor exceed the target levels, the groundwater model is then used to estimate the groundwater concentrations required to meet the target levels, and presumably protect the receptor. The groundwater concentrations required (according to the modeling) to meet the target levels at the receptor are called "site-specific target levels," or SSTLs. These are site-specific, receptor-specific, and chemical-specific. If groundwater concentrations do not exceed the groundwater SSTLs, we are reasonably confident (according to the modeling) that groundwater concentrations at the receptor (now or in the future) will not exceed the target levels.

Soil Leaching Pathway

Existing soil contamination is the source for the soil leaching pathway. The mechanism of chemical migration is soil contamination leaching to the groundwater table, followed by groundwater transport. The risk-based target levels at the receptors (points of exposure) are groundwater concentrations.

Simulation modeling is used to estimate the future groundwater contamination that may result from current soil contamination. If a simulated groundwater concentration at a receptor exceeds a target level, the models are used to estimate the soil concentration required to be reasonably confident the groundwater target level at the receptor is not exceeded, now or in the future. The resulting soil concentration is called a soil source (or soil leaching) SSTL (site-specific target level). This SSTL is pathway-specific, chemical-specific, and receptor-specific. If a soil concentration does not exceed a soil leaching SSTL, we are reasonably confident the future groundwater concentration at a receptor (resulting from soil contamination) will not exceed the groundwater target level.

Here again, it is difficult to predict/forecast, with a reasonable level of confidence, groundwater concentrations that may occur in the future from current soil contamination. Current measurements may not reflect the ultimate extent or magnitude of the plume, or current groundwater concentrations may actually be below method detection levels, or "non-detect." Yet, a no action required classification may be granted for a site based on modeling without, in many cases, confirming by actual measurements the ultimate extent and magnitude of groundwater contamination (i.e., without actually measuring the groundwater concentration at a receptor ten years from now). Hence, one of the criteria for the modeling of soil leaching at Tier 2 is to be reasonably confident actual future groundwater concentrations, resulting from current soil contamination, will not exceed a target level at a receptor. Again, we would rather overestimate the maximum potential concentration at a receptor in the future, than underestimate.

Soil Pathways

Soil Vapor to Enclosed Space Pathway

Existing soil contamination is the source of contamination for the soil vapor to enclosed space pathway. Migration of contaminated air/vapor in the vadose (unsaturated) zone is the transport mechanism of concern. The risk-based target levels are soil concentrations. The route of exposure is inhalation of vapors by humans in enclosed spaces. However, the TAC did not develop or select a model for vadose zone vapor transport. The modeling for this pathway does not include lateral (or horizontal) chemical vapor transport in the vadose zone. Hence, this pathway does not compute a soil SSTL, in the usual sense. That is, this pathway does not compute soil SSTLs for the soil concentrations that are simulated to meet the inhalation target levels at an enclosed space receptor, after accounting for lateral vapor transport in the vadose zone.

Vertical vapor transport modeling was used to convert the risk-based inhalation target level in an enclosed space to a soil concentration or soil target level for the soil immediately below or adjacent to an enclosed space (i.e., basement). These soil SSTLs are for the soil directly beneath or adjacent to an enclosed space. If soil concentrations beneath or in the immediate vicinity of an enclosed space do not exceed the soil SSTLs, we are reasonably confident (based on the modeling and assumptions) the concentrations in the air inhaled by a human in the enclosed space will not exceed the risk-based inhalation target levels. The TAC decided the soil target levels for the pathway would be the soil SSTLs for soil immediately adjacent to an enclosed space.

Soil to Water Line Pathway

Existing soil contamination is the source for the soil to water line pathway. The receptor is a water line. Target levels have been set for groundwater in contact with different types of water lines. See Tier 1 guidance. The soil leaching model was used to estimate the soil concentrations that would result in the groundwater target levels. These soil concentrations are the soil target levels for water lines. The objective is to not exceed the soil target levels in the vicinity of a water line.

Pathways and Media Type

The following table shows the media for receptor target levels and for corrective action. For example, for groundwater pathways, the target levels at the receptors are groundwater concentrations and the media for corrective action, if needed, is groundwater. For soil leaching, target levels at the receptors are groundwater concentrations, and the media for corrective action is soil.

Pathway	Receptor Target Level Media	Corrective Action Media
Groundwater	Groundwater	Groundwater
Soil Leaching	Groundwater	Soil
Soil	Soil	Soil

2.1 An Overview of Receptor Types and Notation

A number of different receptor types are defined for Iowa RBCA. Their names and shorthand notations (as used in the application), grouped by route of exposure, are:

Groundwater Ingestion Receptors (Groundwater Ingestion and Soil Leaching to Groundwater Ingestion Pathways)

- Actual
  - DWW: Drinking Water Well
  - NDWW: Non-Drinking Water Well
- Potential
  - PGWS: Protected Groundwater Source

Vapor Receptors (Groundwater Vapor to Enclosed Space, Soil Vapor to Enclosed Space, and Soil Leaching to Groundwater Vapor to Enclosed Space Pathways)

- Actual
  - ACSR: Actual Confined Space Residential
  - ACSNR: Actual Confined Space Nonresidential
  - ASSR: Actual Sanitary Sewer Residential
  - ASSNR: Actual Sanitary Sewer Nonresidential
- Potential
  - PCSR: Potential Confined Space Residential
  - PCSNR: Potential Confined Space Nonresidential
  - PSSR: Potential Sanitary Sewer Residential
  - PSSNR: Potential Sanitary Sewer Nonresidential

Water lines Receptors (Groundwater to Water line, Soil to Water line, and Soil Leaching to Groundwater to Water line Pathways)

- Actual
  - WL: Water line
  - PWL: Potential Water line

Surface Water Body (SWB) Receptors (Groundwater to Surface Water Body, Soil Leaching to Surface Water Body)

- Actual

Surface Water Criteria for Designated Use Streams (µg/l)

Designated Uses for Surface Water Classification	B* (CW1)	B* (CW2)	B* (WW-1)	B* (WW-2)	B* (WW-3)	B* (LW)	C**	State Owned Lakes
	Aquatic Life						Drinking Water	
	Cold Water		Warm Water			Lakes & Wetlands		
Benzene	290	290	290	290	290	290	5	2
Ethylbenzene	3,700	3,700	3,700	3,700	3,700	3,700	700	2
Toluene	1,000	1,000	1,000	1,000	1,000	1,000	1,000	2
Xylenes	73,000	73,000	73,000	73,000	73,000	73,000	10,000	5
TEH-Diesel	75,000	75,000	75,000	75,000	75,000	75,000	1,200	500
TEH-Waste Oil	40,000	40,000	40,000	40,000	40,000	40,000	400	400

*Use Tier 1 levels for Surface Water
**Use Tier 1 levels for Groundwater Ingestion Actual

B(CW1): Cold Water Aquatic Life Type 1
B(CW2): Cold Water Aquatic Life Type 2
B(WW-1): Warm Water Type 1
B(WW-2): Warm Water Type 2
B(WW-3): Warm Water Type 3
B(LW): Lakes and Wetlands

C: Drinking Water
State Owned Lakes

2.2 Receptor Types

Groundwater Ingestion Receptors (Groundwater Ingestion and Soil Leaching to Groundwater Ingestion Pathways)
The concern is with ingestion (drinking) of contaminated groundwater.

Drinking Water Well (DWW):
An actual receptor. An existing groundwater well that supplies drinking water. This includes wells supplying water used primarily for the final production of food or medicine for human consumption in facilities routinely characterized with the Standard Industrial Codes (SIC) group 283 for drugs and 20 for foods, or North American Industry Classification System (NAICS) Codes of 3254 for drugs and 311 for food (Chapter 567-135.2(455B)).

Non-Drinking Water Well (NDWW):
An actual receptor. An existing groundwater well supplying water that is not defined as a drinking water well, including an abandoned groundwater well not properly plugged in accordance with department rules in 567 Chapters 39 and 49.

Groundwater wells that are not defined as drinking water or non-drinking water wells include groundwater monitoring wells and extraction wells for remediation systems, and wells used in a closed loop water system (i.e., a heat pump). However, if the well serves a consumptive use, such as evaporative cooling (e.g., a production well), it must be considered a non-drinking water well.

The risk-based target levels must be met at the water well receptor. The groundwater target levels at drinking and non-drinking water wells are shown in the Iowa Tier 1 Look Up Table. The levels applicable to drinking water wells (DWWs) are under the Groundwater Ingestion Exposure Pathway, Actual Receptor. The levels applicable to non-drinking water wells (NDWWs) are under the Groundwater Ingestion Exposure Pathway, Potential Receptor. These target levels apply at all Tiers (Tier 1, Tier 2, and Tier 3).

Protected Groundwater Source (PGWS):
A potential receptor. Our concern is with the potential for ingestion of contaminated groundwater that is not currently used as a drinking water source.

A Protected Groundwater Source is defined in Subrule 567—135.2, as "a saturated bed, formation, or group of formations that has a hydraulic conductivity of at least 0.44 meters per day (m/d) and a total dissolved solids of less than 2,500 milligrams per liter (mg/L) or a bedrock aquifer with total dissolved solids of less than 2,500 milligrams per liter (mg/L) if bedrock is encountered before groundwater."

The protected groundwater source receptor exists when the first encountered groundwater meets the definition of a protected groundwater source. If bedrock is encountered before groundwater, a protected groundwater source is assumed, regardless of the hydraulic conductivity measurements (i.e., even if the hydraulic conductivity is measured as less than 0.44 m/d).

The groundwater target levels for a protected groundwater source are shown in the Iowa Tier 1 Look Up Table. The levels applicable to a protected groundwater source are under the Groundwater Ingestion Exposure Pathway, Potential Receptor.

Vapor Receptors (Groundwater Vapor to Enclosed Space, Soil Vapor to Enclosed Space, and Soil Leaching to Groundwater Vapor to Enclosed Space Pathways)
Also called "Vapor to Enclosed Space" receptors. See 567-135.10(6), 156-135.10(7) (Tier 2 Guidance, Chapter 3).

The route of exposure for vapor receptors is the inhalation (breathing) of contaminated air by humans in an enclosed space. (However, vapors can also create explosive hazards for their receptors.) The risk-based inhalation target levels are limitations on the concentration of a chemical inhaled by a human. Vertical vapor transport models are used to compute

the soil and groundwater concentrations beneath the receptor that will meet the inhalation target levels. These soil and groundwater concentrations are the target levels for the vapor receptors and apply to the soil and groundwater directly beneath and immediately adjacent to the receptor.

The vapor receptors also have vapor target levels. These target levels are the vapor concentrations immediately beneath or adjacent to an enclosed space that would result in indoor air concentrations that meet the inhalation target levels (according to the modeling). The vapor target levels are:

Chemical	Target Level (µg/m3)
Benzene	600,000
Toluene	9,250,000

The target levels are the same for all vapor receptor types and chemicals. Vapor (soil gas) sampling is optional as part of the Tier 2.

Vapor receptors are divided into two major categories: confined space receptors and sanitary sewer receptors.

Confined Space Receptors (Actual and Potential)
At Tier 2 a confined space is a basement in a building occupied by humans. Buildings constructed with a concrete slab on-grade, or buildings constructed without a concrete slab, but with a crawl space, are not considered confined spaces.

Actual Confined Space Residential (ACSR) and Actual Confined Space Nonresidential (ACSNR): These are existing confined space receptors (basements in an existing building occupied by humans). The pattern of occupancy is used to determine if the receptor is residential or nonresidential. A residence or home that could be occupied by the same person on a 24-hour basis would be considered residential. For example, a nursing home, daycare, or schools would be considered residential, even if the property is zoned nonresidential. An office building or factory that is not continuously-occupied by the same person on a 24-hour basis would be considered nonresidential.

Potential Confined Space Residential (PCSR) and Potential Confined Space Nonresidential (PCSNR): Potential confined space receptors are confined spaces that do not presently exist, but could exist in the future. Roads and public rights-of-way are not considered potential confined space receptors. Current zoning is used to determine whether a potential confined space receptor is residential or nonresidential. An area without zoning is assumed to be residential.

Sanitary Sewer Receptors (Actual and Potential)
Chapter 135 and the Tier 2 Guidance state, “sanitary sewers are considered confined space receptors….” However, in the Tier 2 application a “confined space” refers only to a basement in a building occupied by humans. Sanitary sewers and confined spaces are treated as separate receptor types.

The route of exposure for a sanitary sewer receptor is inhalation of contaminated air. The concern is with sanitary sewers or their utility envelopes creating an inhalation hazard by acting as a route for vapors to migrate into a building occupied by humans. Vapors can also create an explosion hazard. However, because of the uncertainties with attempting to model vapor migration along or through a sanitary sewer or its envelope, the sanitary sewer itself is used as a surrogate receptor. That is, the sanitary sewer is treated as a receptor, and the groundwater target levels or soil concentrations apply to the groundwater beneath the sanitary sewer and the soil in the vicinity of the sanitary sewer. The objective is to limit the groundwater and soil concentrations adjacent to the sanitary sewer, in order to meet inhalation target levels in the building to which the sanitary sewer is connected.

Actual Sanitary Residential (ASSR) and Actual Sanitary Sewer Nonresidential (ASSNR): An actual sanitary sewer is an existing sanitary sewer connected to an existing building. The zoning (residential or nonresidential) is based on the zoning (or occupancy) of the building the sanitary sewer connects to, not the zoning where the sanitary sewer is located.

Potential Sanitary Sewer Residential (PSSR) and Potential Sanitary Sewer Nonresidential (PSSNR): Potential sanitary sewers are locations where sanitary sewers do not presently exist, but could exist in the future. A public right-of-way is a possible location for a potential sanitary sewer. For potential sanitary sewers, the zoning of a public right-of-way is assumed to be the same as the zoning of the property directly adjacent to the right-of-way. An area without zoning is assumed to be residential exposure.

Water Line (WL) Receptors

The water line receptor is often incorrectly overlooked in Tier 2 SCRs. You should review the Tier 2 Guidance carefully with regard to water line receptors. The concern is the water inside the line becoming contaminated by external contact with contaminated soil or groundwater and diffusion of contamination into the water line. As a surrogate for someone drinking contaminated water from a water line, the water line itself is treated as a receptor. There are actual (existing) and potential water line receptors.

It should be assumed every property has a water service line unless the property is undeveloped or has no water usage. Water service lines can connect from the property to the main or to a water well providing water. If the construction material of a water service line or main is unknown then the water line should be considered a receptor and the most restrictive target levels should be used.

Surface Water Body Receptors

The concern with contamination of surface water bodies is from infiltration of contaminated groundwater. Surface water bodies are actual receptors. There are no potential surface water body receptors. There are two categories of receptor types: designated use and general use. See the Tier 2 Guidance, Chapter 3.

Designated use segments are assigned or declared by the state, and have specific water target levels. General use segments do not have specific water target levels. However, both designated use and general use have a visual inspection requirement. If a general use segment fails visual inspection, then specific water target levels are applied.

2.3 Receptor Target Levels by Media

Each receptor type has groundwater and/or soil, risk-based target levels. The target levels apply at or near the receptor. In some cases, the target levels are based on direct exposure (groundwater target levels at drinking water wells). In other cases, the target levels are developed using vertical transport modeling (for a confined space, the concern is inhalation in an enclosed space). Groundwater and soil target levels were developed using vertical vapor transport models to relate the vapor concentration at a person's nose in the enclosed space to the groundwater and soil concentrations beneath the enclosed space.

The following table shows the target level media for each receptor type:

Target Levels by Media at the Receptor

Receptor Type	Route of Exposure	Groundwater Target Levels at the Receptor	Soil Target Levels at the Receptor	Soil Gas Target Levels
DWW	Ingestion	Yes	No	No
NDWW	Ingestion	Yes	No	No
PGWS	Ingestion	Yes	No	No
WL	Ingestion	Yes	Yes	No
PCSR	Inhalation	Yes	Yes	Yes
ACSR	Inhalation	Yes	Yes	Yes
PCSNR	Inhalation	Yes	Yes	Yes
ACSNR	Inhalation	Yes	Yes	Yes
PSSR	Inhalation	Yes	Yes	Yes
ASSR	Inhalation	Yes	Yes	Yes
PSSNR	Inhalation	Yes	Yes	Yes
ASSNR	Inhalation	Yes	Yes	Yes
SWB	Ecological	Yes	No	No

2.4 Receptor Types and Pathways

For each receptor type, the following table lists applicable pathways. An "X" means the receptor type is applicable for the pathway. An "N/A" means the receptor type is not applicable for the pathway.

Receptor Type	Groundwater Source	Soil Leaching	Soil Vapor to Enclosed Space	Soil to Water line
Drinking Water Well-DWW	X	X	N/A	N/A
Nondrinking Water Well-NDWW	X	X	N/A	N/A
Protected Groundwater Source-PGWS	X	X	N/A	N/A
Water line-WL	X	X	N/A	X
Potential Confined Space Residential-PCSR	X	X	X	N/A
Actual Confined Space Residential-ACSR	X	X	X	N/A
Potential Confined Space Nonresidential- PCSNR	X	X	X	N/A
Actual Confined Space Nonresidential- ACSNR	X	X	X	N/A
Potential Sanitary Sewer Residential-PSSR	X	X	X	N/A
Actual Sanitary Sewer Residential-ASSR	X	X	X	N/A
Potential Sanitary Sewer Nonresidential- PSSNR	X	X	X	N/A
Actual Sanitary Sewer Nonresidential- ASSNR	X	X	X	N/A
Surface Water Body (All Types)	X	X	N/A	N/A

3. APPLICATION OVERVIEW

The following is an overview of the major sections of the Tier 2 portion of the application, listed in the typical order of completion. Each task is covered in more detail, later.

a. Site Identification:
   Enter the information identifying the site. The LUST number for the site is shown on the tables and plots printed by the application.

b. Enter Data:
In general, you should enter all groundwater sample data, soil sample data, and vapor sample data for the site. The application does data management and analysis. The application, for example, automatically determines the concentrations assigned to each sampling location, and the groundwater and soil sources.

c. Data Adjustment:
Indicate the groundwater or soil data should be ignored (if any) by the application. You will need to provide justification why data can be ignored.

d. Hydrogeology:
Enter the hydrogeologic data. The application does not contour groundwater elevations or provide head gradient estimates. You will need to do this outside the application. The application does provide contouring of groundwater and soil concentrations.

e. Source Width and Length for Soil and Groundwater:
The application provides tools for estimating Source Width and Length from the soil and groundwater data.

f. Receptor Questions:
A series of questions are presented to help identify the receptor types and chemicals you need to evaluate for your site.

g. Receptor Type Evaluation Requirements (Preliminary Pathway Evaluation Requirements).
This is an important step in the Tier 2 process. The results indicate the receptor types you must evaluate at Tier 2 and the receptor types you do not need to evaluate. This information is pathway specific:
    - Groundwater Ingestion
    - Soil Leaching to Groundwater
    - Groundwater Vapor to Enclosed Space
    - Soil Vapor to Enclosed Space
    - Groundwater to Water line
    - Soil to Water line
    - Surface Water

You need to complete tasks (a) through (f) before you produce the final receptor type evaluation requirements.

h. Receptor Identification:
You use receptor identification plumes generated by the application to identify the receptors present for each pathway.

All receptors of a type are entered in the same table. A receptor is only entered once, regardless of the number of pathways for which it needs evaluation. On the other hand, for a receptor to be entered, it only needs to be identified by one of the receptor identification plumes (groundwater ingestion, soil leaching, groundwater vapor to enclosed space, soil vapor to enclosed space, groundwater to water line, soil to water line, surface water).

In the application you <u>do not</u> and <u>should not</u> enter potential receptors at the soil or groundwater sources. The application will automatically assume and evaluate potential receptors at the soil and groundwater sources.

i. Entering Receptors:
Enter the receptors you have identified for your site.

j. Pathway Evaluations:
For organization, and because of procedural differences, the pathway evaluations are divided into three categories.
    - Groundwater Pathways (Groundwater Ingestion, Groundwater Vapor to Enclosed Space)
    - Soil Leaching to Groundwater
    - Soil Pathways (Soil Vapor to Enclosed Space and Soil to Water line)

Monitoring well identification, Site-Specific Target Level (SSTL) Tables, Receptor Summaries, and Corrective Action Maps are produced under each pathway, as appropriate.

k. Groundwater Monitoring Plan:
   The application combines the results from the pathway evaluations for the groundwater pathways and soil leaching pathways into a Groundwater/Soil Leaching Monitoring Plan for your site. For the joint monitoring plan to be complete, you complete the pathway evaluations Groundwater and Soil Leaching prior to production of the final Groundwater/Soil Leaching Monitoring Plan.
l. General Plume Contouring:
   The application provides tools for general contouring of the soil, vapor, and groundwater chemical concentration data.

Bedrock

Note that if bedrock is encountered before groundwater for your site, you may have a "Bedrock" site. A "Bedrock" site has unique procedures, and you are required to use the "Bedrock" software. If bedrock is encountered before groundwater you need to check the rules and guidance to determine if you should be performing a "Bedrock" analysis. In the Rules, bedrock assessment is covered in detail under 135.10(3), Bedrock Assessment. In the Tier 2 Guidance, bedrock assessment is discussed in detail in Chapter 4, Bedrock Assessment. If bedrock is encountered before groundwater and your site is not "exempt granular" (see the Tier 2 Guidance for definitions), you should not be using the Tier 2/SMR application described in this manual. You must use the Tier 2 Bedrock software to evaluate a "granular" or "nongranular" bedrock site. If your bedrock site does qualify as "exempt granular," then you should be using the application described in this manual. The bedrock software can be downloaded from the UST webpage.

Additional information is available on the UST webpage regarding the application.

4. GETTING STARTED WITH TIER 2 APPLICIATION

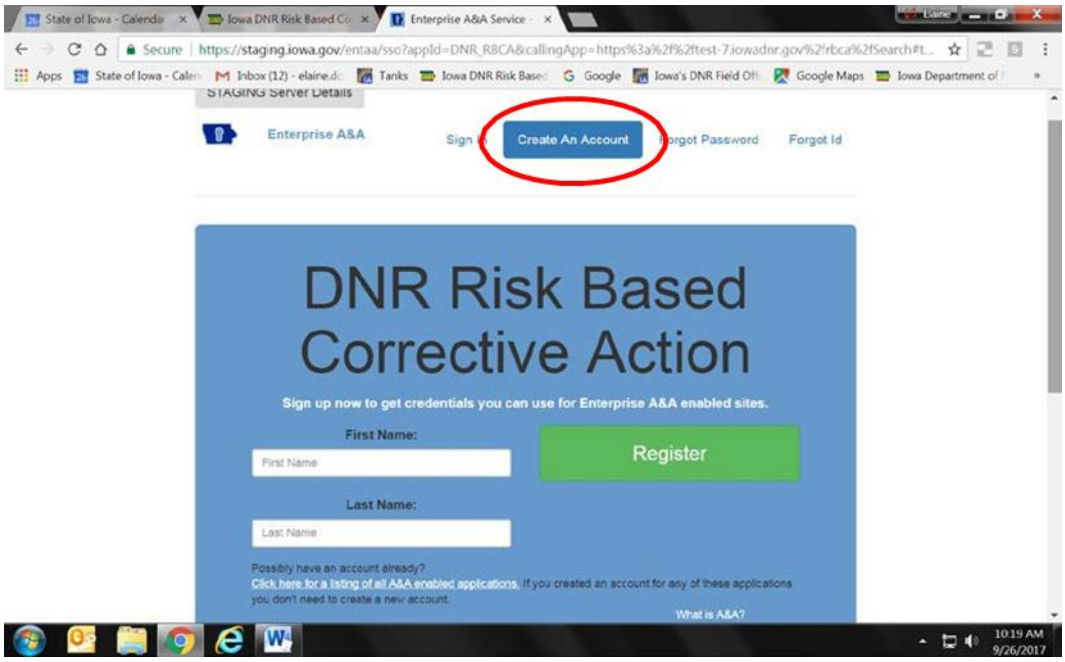
In May 2017, the Iowa DNR Underground Storage Tank Section transitioned from a traditional client-server type risk-based corrective action (RBCA) software program to a web-based application. The web-based application ("application") performs the same functions as the Tier 2 Version 3.0 software ("software") in essentially the same ways. Site specific target levels and risks determined remain the same.

The items listed below are important points of interest for understanding and operating the RBCA application.

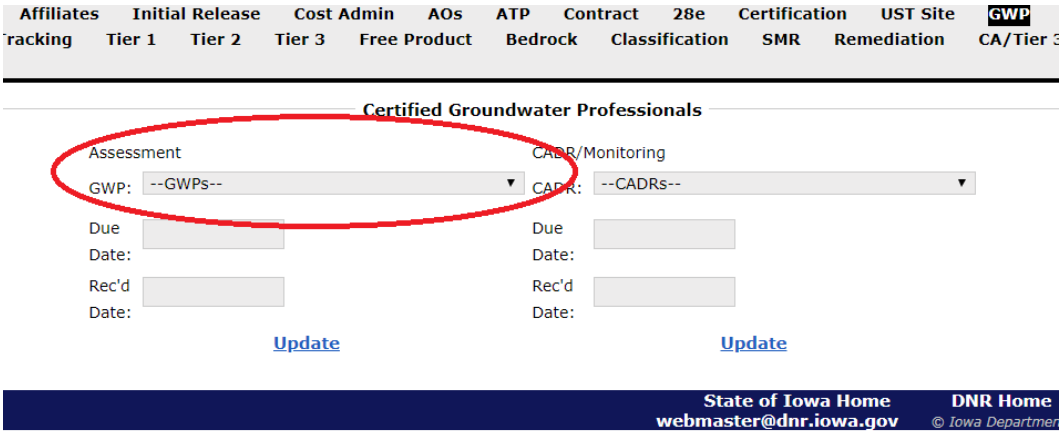
- Google Chrome is the preferred web browser for the RBCA application. **The application is stable and fully functional on all common browsers**, though printing and some data entry fields *may* have optimal appearance in Chrome. The RBCA application is also usable on mobile devices running iOS, Android, or Windows Mobile.
- The RBCA application is entirely hosted online and is subject to the same rules as other State of Iowa applications (such as Facility Explorer). This means that a logged-on session will expire after 15 minutes of *inactivity*. Please make sure that you use the Save and/or Update buttons to avoid losing unsaved data due to inactivity.
- Records associated with the RBCA process have always been and will continue to be public record, available to all citizens. Once a RBCA application report has been submitted, the record will be visible to the public (whether or not it has been reviewed by a DNR Project Manager).

Logging in

- A valid Iowa Enterprise A&A user name and password is required in order to use the RBCA application in *edit* mode. Click on "Create an Account" at the top of the RBCA application log in page to obtain an Iowa Enterprise A&A account if you do not already have one. This is the same account (and same user name and password) that is used for well searches in Facility Explorer. CGPs will already have an A&A account. **If you are a new CGP or CGP assistant, you will need to contact the DNR UST Section to ensure that your information has been added to the list of RBCA users.**

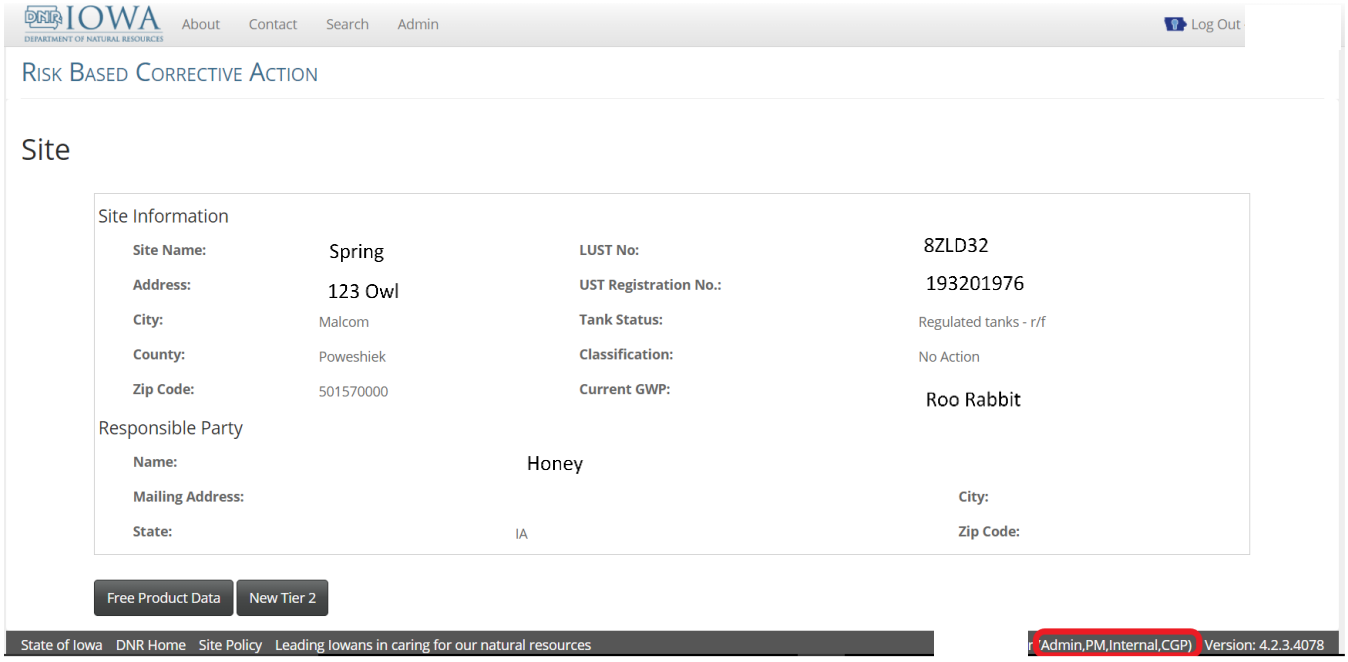


- The application is available to the general public (just like the Tanks Database), though various types of users will have different levels of access with different privileges.
  - CGPs and CGP assistants (CGPAs) are able to access all LUST sites assigned to any CGP working for the same company (as recorded in the Tanks Database). The CGP and CGPA have essentially the same rights. Both can begin a RBCA application-based report, edit an in-process report, download data, and save reports. *Only* CGPs have the ability to *submit* a report to DNR. Make sure that the CGP from your company is assigned to the site in the Tanks Database under GWP/Assessment. Contact DNR project manager for the change if necessary.



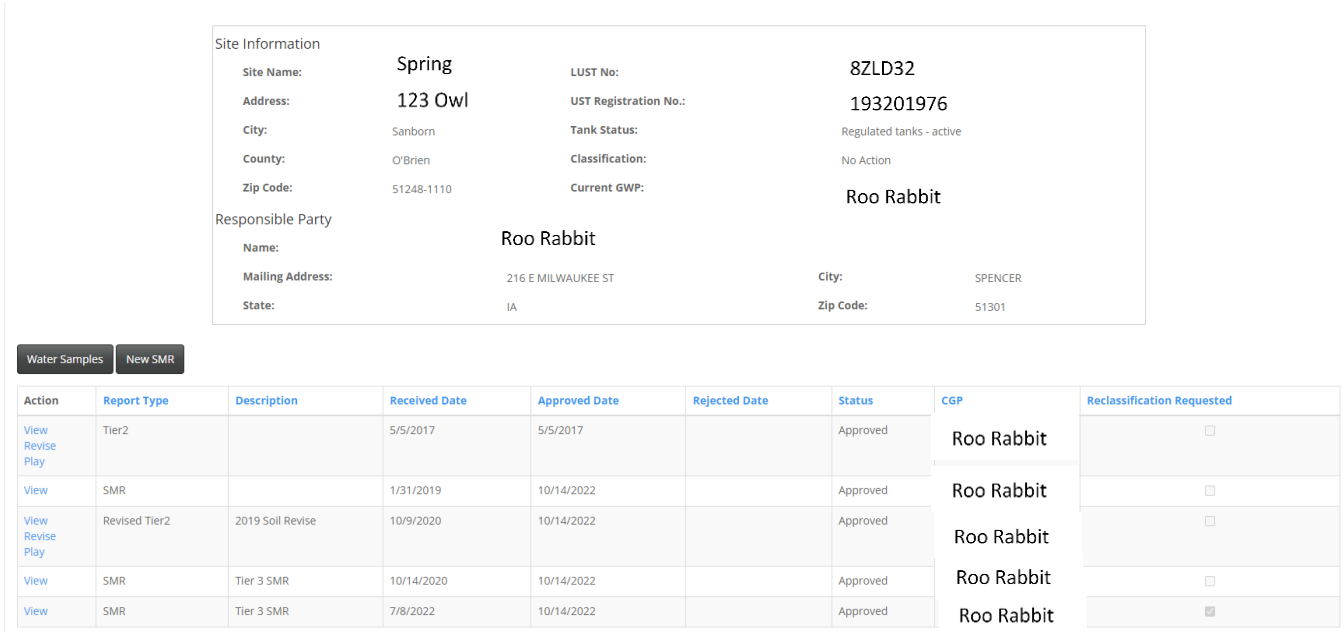
  - DNR project managers (PMs) have the same rights as CGPs with the exception of the added ability to accept and reject reports.
  - DNR employees who are not PMs such as Field Office staff can view RBCA application reports, view monitoring well selections, and download data, but cannot edit or approve/reject reports.
  - Administrators have all of the rights available to DNR PMs along with the abilities to delete reports and "unlock" RBCA application reports that have been submitted, but not yet approved/rejected.
  - The general public have view only rights to RBCA application reports and data once they have been submitted to DNR.

- After you are logged on, your name and privileges will be displayed in the lower right hand corner of the screen.



Searching for a LUST Site and Selecting a Report

- Once a user is logged in, they may search by LUST name, LUST number, UST registration number, address, city, county, field office, risk classification, or any combination of these. Search results will populate as a list below the search box with corresponding LUST numbers, names, risks, and cities. Select the site in which you are interested.
- The site home screen will list information about the LUST site taken from the Tanks Database and have a list of RBCA application reports either completed or in progress for the site. Each row indicates an individual report (Tier 2, SMR, etc.). Each report will have a type, description, dates, status, CGP, and reclassification requests noted.



- Software files for all pre-existing open LUST sites were uploaded. All existing closed LUST sites that received no action required classification by May 2017 were not included in the upload.
- The far left column will list the actions available to the user for each report.

Water Samples | New SMR

Action	Report Type	Description	Received Date	Approved Date	Rejected Date	Status	CGP	Reclassification Requested
View Revise Play	Tier2		5/5/2017	5/5/2017		Approved	Roo Rabbit	☐
View	SMR		1/31/2019	10/14/2022		Approved	Roo Rabbit	☐
View Revise Play	Revised Tier2	2019 Soil Revise	10/9/2020	10/14/2022		Approved	Roo Rabbit	☐
View	SMR	Tier 3 SMR	10/14/2020	10/14/2022		Approved	Roo Rabbit	☐
View	SMR	Tier 3 SMR	7/8/2022	10/14/2022		Approved	Roo Rabbit	☑
View Edit Delete	SMR	Tier 3 SMR				Saved	Roo Rabbit	☐

- View: The user can view the report, but not make any changes.
- Edit: Allows edits or data additions to be made to all areas of the report. Will not be available after the report is submitted.
- Play: A new feature available at all times allowing the user to "test" the effects of altering any parameter they wish without actually changing the original copy. For example, if you wanted to know what the result of adding a monitoring well in a particular spot might be on a plume, you could create a Play copy of the given report, add the well in the Play, and see how the plume is affected without the worry of compromising the original. The Play feature will create a virtual clone of the report for which is it activated at the time of the activation. Play copies can be saved for future reference or for use in negotiations but cannot be submitted. If you will not use a play copy in the future, we recommend deleting it to avoid clutter on the site page.
- Revise: A Tier 2 report may need to be revised for a variety of reasons. The "Revise" function will create an exact copy of the most recent Tier 2 report in the system and will ask you what data (if any) you would like to import from the most recent SMR.
- Delete: Only available to the Admin for submitted reports. Available to CGP, CGPA, and PM for play and saved reports.

Handling Commingled LUST Sites Using the Online RBCA Application

Often, commingled LUST sites were combined into a single software file for both properties when using the RBCA software program. This file was submitted for both sites and two identical copies of the printed report were made, one for each site. In the "old" software, a file could be named anything in the "Site ID" field and could reflect the presence of data from two neighboring LUSTs.

The new online RBCA application uses database-type architecture and does not have "files" in the manner that would be produced by a program. This means that a single report (Tier 2 or SMR) cannot be attributed to multiple LUSTs automatically.

When data was uploaded to the new RBCA application for LUSTs that were/are part of a commingled site, two copies of the most recent software file were made; one with each LUST number (assuming there were two sites involved). Going forward, an online submission must be made for each LUST associated with a commingled site. The amount of additional work associated should be minimal and limited to entering the new sample data two times since copies of the most recent Tier 2 and SMR already exist for each LUST.

Please submit both a report in the RBCA application and a paper copy for each site of a commingled pair. Make note on the paper copies that the site is part of a commingled association. Additionally, please record in the "Description" field of the application report that the site is comingled. In accordance with previous policy, make justifications for site-specific monitoring plan modifications if necessary (i.e. if the two sites will not be using the same set of wells).

Order of Report Submission

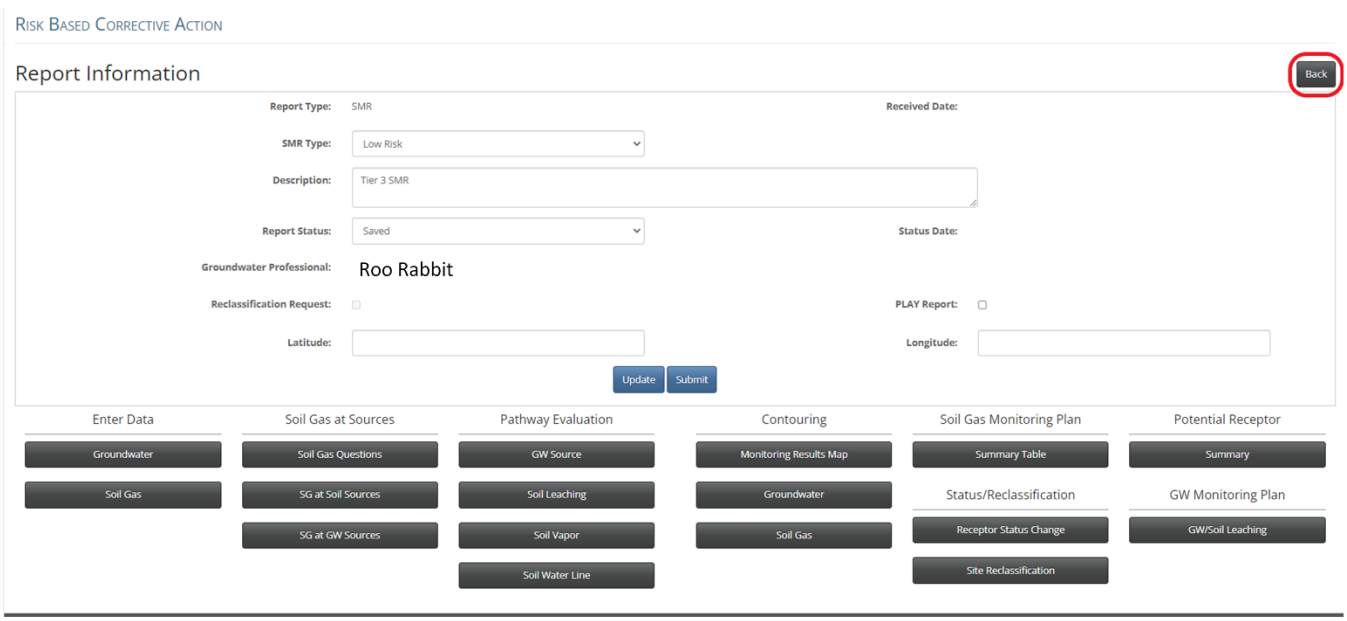
The report ordering is important. Each subsequent report (regardless of type) takes a virtual "snapshot" of the previous report to use as a base upon which to build the new report. For example, if you are tasked with completing a revised T2

and SMR in a given year, you <u>must</u> complete the revised Tier 2 (RT2) before creating the new SMR. Any SMR created before the new RT2 is submitted will not "see" changes made to the T2 model, since the changes did not exist at the time when the SMR was created. If an extraneous report is created by accident, delete it before moving on.

Action	Report Type	Description	Received Date	Approved Date	Rejected Date	Status
View Revise Play	Tier2		5/6/2017	5/6/2017		Approved
View Edit Delete	SMR	low risk				Saved
View Play	Revised Tier2		2/14/2019			Submitted
View Edit Delete	SMR	Post OE SMR	2/15/2019			Saved

Navigating, Saving, Updating, and Submitting Reports

- A "Back" button is provided on each page. This button will take you back one level closer to the main site page each time it is clicked. Using the Back button is preferred to using the back arrow on your browser if you have made changes to a screen or data table. This will ensure that your new data or selections are properly preserved.



- Many data entry fields in the new application contain logic that will not allow implausible to incorrect data types to be entered. An error message will show if data of the incorrect format or data outside acceptable limits is entered and the "Save" button is clicked. The offending data field(s) will be highlighted in red for easy location. It was possible to enter identical samples in some locations of the Tier 2 software. These data were uploaded to the new application; it *may* be necessary to rename some data in order for them to work in the application. This might be as simple as adding a dash or slash or number to the second of a pair of "identical" samples.

Groundwater Data

Back

Save

- Error: The Sample Date field is required.

Well/BH Label	Sample Date	X (ft)	Y (ft)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	TEH-D (µg/L)	TEH-WO (µg/L)	Ground Surface Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Static Water Level (ft)	K (m/day)	TDS (mg/L)	MtBE (µg/L)	Use In Model
MWB		84	66							1551.20	1551.06	1548.20					☑
MWB	09/19/2002	84	66	14000.00	18000.00	1800.00	10000.00			1551.20	1551.06	1548.20	1542.04				☑
MWB	09/03/2003	84	66	14300.00	9960.00	1280.00	6030.00			1551.20	1551.06	1548.20	1543.16				☑
MWBA	08/17/2004	84	66	358.00	847.00	235.00	1730.00			1551.25	1550.86	1546.25	1543.80				☐

Groundwater Data

Back

Save

- Error: Well Label 'MWA' must be unique.
- Error: Well Label 'MWA' must be unique.
- Error: Well Label 'MWA' must be unique.

Well/BH Label	Sample Date	X (ft)	Y (ft)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	TEH-D (µg/L)	TEH-WO (µg/L)	Ground Surface Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Static Water Level (ft)	K (m/day)	TDS (mg/L)	MtBE (µg/L)	Use In Model
MWA	01/01/1990	15	78							1551.57	1551.37	1148.57					☑
MWA	05/19/1993	15	78	<1.00	<1.00	<1.00	<1.00			1551.57	1551.37	1148.57	1543.10				☑
MWA	05/19/1993	84	66	13000.00	15000.00	1400.00	8100.00			1551.20	1551.06	1548.20	1544.11				☑
MWB	05/04/1998	84	66	8700.00	5400.00	900.00	3400.00			1551.20	1551.06	1548.20	1543.90				☑
MWB	04/13/1999	84	66	3540.00	1420.00	585.00	1340.00			1551.20	1551.06	1548.20	1549.20				☑

- Data entry screens have “Save” buttons located below and above the data tables that must be clicked in order for any data entered to remain in the table after leaving the screen. The “Save” button will not save data if it is clicked after a session has been timed out. Note: Logged in sessions will expire or be “timed out” after 15 minutes of *inactivity*.
- If you attempt to save or submit a report and all required data has not been supplied, or all necessary selections have not been made, an error message in the upper left hand corner will notify you that the report or field is not complete and offer instructions on how to rectify the situation.

RISK BASED CORRECTIVE ACTION

Report Information

Back

- Site Reclassification Request must be answered.

Report Type:

Received Date:

SMR Type: Low Risk

Description: Tier 3 SMR

Report Status: Saved

Status Date:

Groundwater Professional:

Reclassification Request: ☐

PLAY Report: ☐

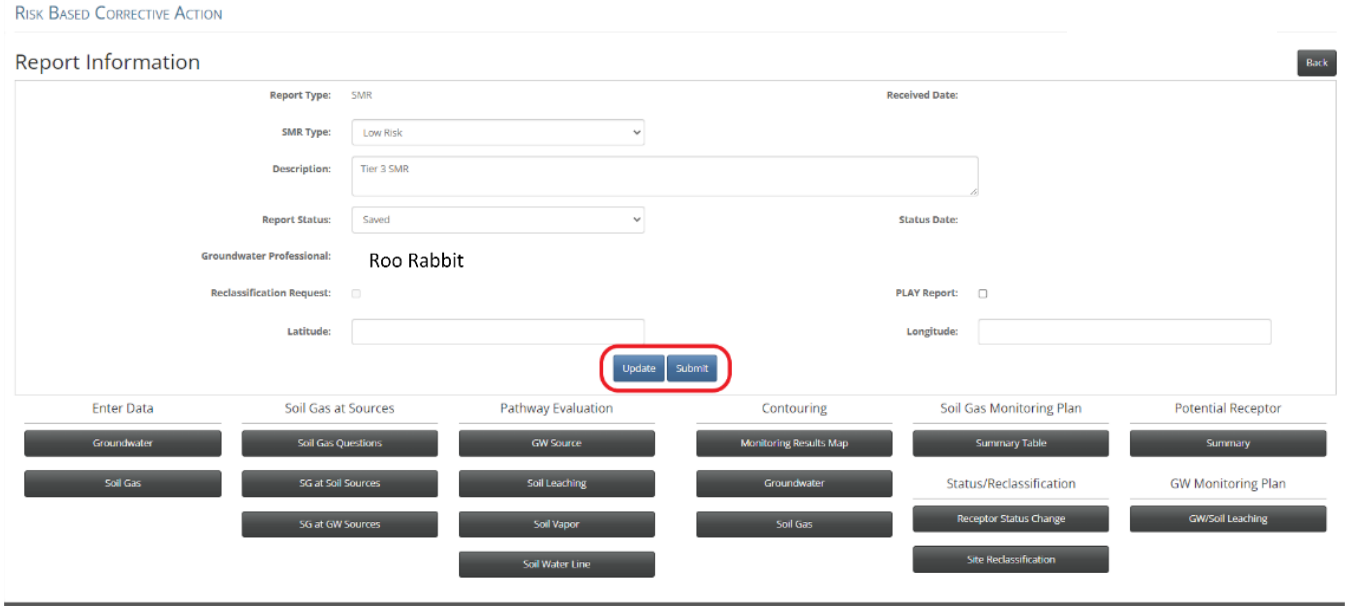
Latitude:

Longitude:

Update Submit

Enter Data	Soil Gas at Sources	Pathway Evaluation	Contouring	Soil Gas Monitoring Plan	Potential Receptor
Groundwater	Soil Gas Questions	GW Source	Monitoring Results Map	Summary Table	Summary
Soil Gas	SG at Soil Sources	Soil Leaching	Groundwater	Status/Reclassification	GW Monitoring Plan
	SG at GW Sources	Soil Vapor	Soil Gas	Receptor Status Change	GW/Soil Leaching
		Soil Water Line		Site Reclassification	

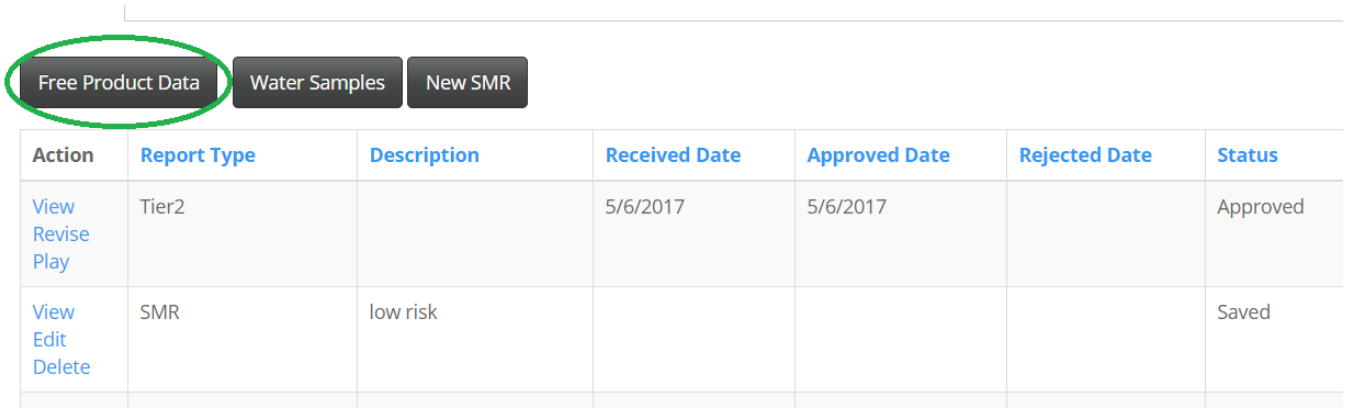
- The main report page has two blue buttons at the top:



  - Update: This button will update all site parameters and equation results with the most recently entered data and selections. It is recommended that a user clicks the Update button before exiting the application to make sure that all work is saved and up to date.
  - Submit: The Submit button will only be available to CGPs and is the final step in the process of completing a report in the RBCA application. After all data is entered and you are satisfied with the results, click the Submit button to complete the online report process. This will automatically send an email to the DNR PM alerting them that a RBCA application report has been submitted for the site. **This action is a signal that the report is finished and no more work will be completed in the RBCA application before DNR review.**

Free Product Data

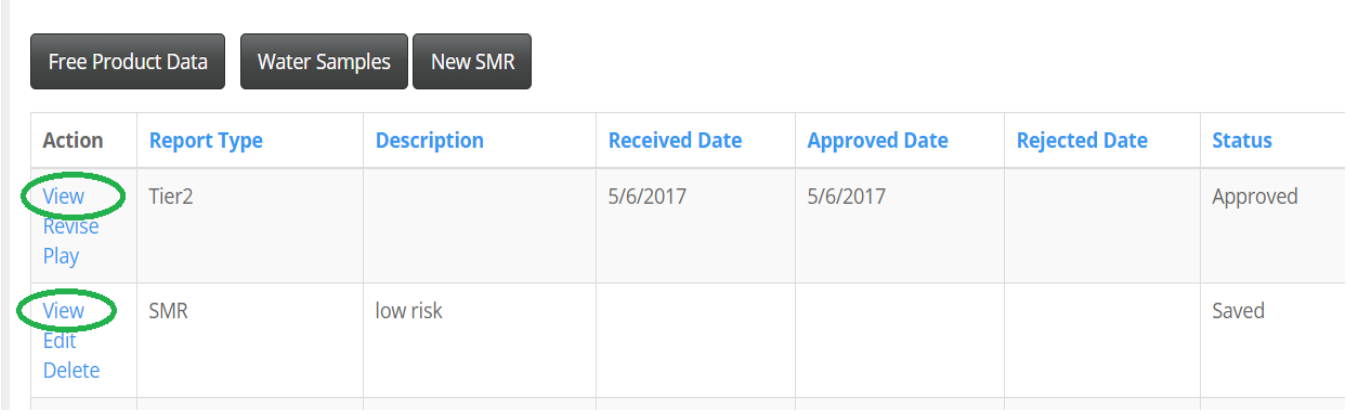
A button entitled "Free Product Data" is located below the site information on the report selection screen of each site. The Free Product reporting feature has been deactivated. As of September 2022, free product recovery data can no longer be submitted in the application. Any existing data already entered in the application is now read only. Free Product Recovery Reports may be submitted electronically using DNR Form 542-1424. Electronic copies of the completed form should be submitted to ust.rbcasoftwaremtbe@dnr.iowa.gov.



Action	Report Type	Description	Received Date	Approved Date	Rejected Date	Status
View Revise Play	Tier2		5/6/2017	5/6/2017		Approved
View Edit Delete	SMR	low risk				Saved

Printing/Saving as PDF/Exporting Report Pages, Maps, and Data Tables

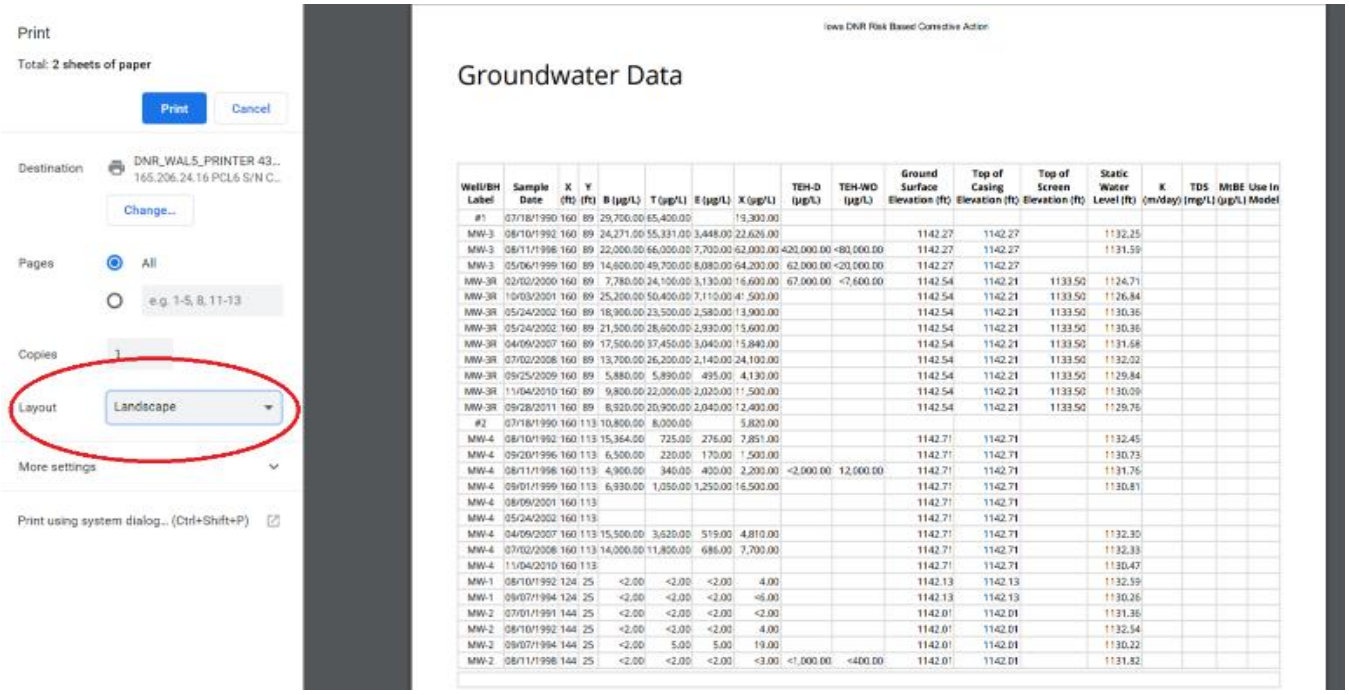
All printouts included in the paper copy of a submission or saved to electronic report submission should be printed/saved using the "View" mode of the application. All required prints appear best using the View mode and printing/saving in Edit will not yield satisfactory results.



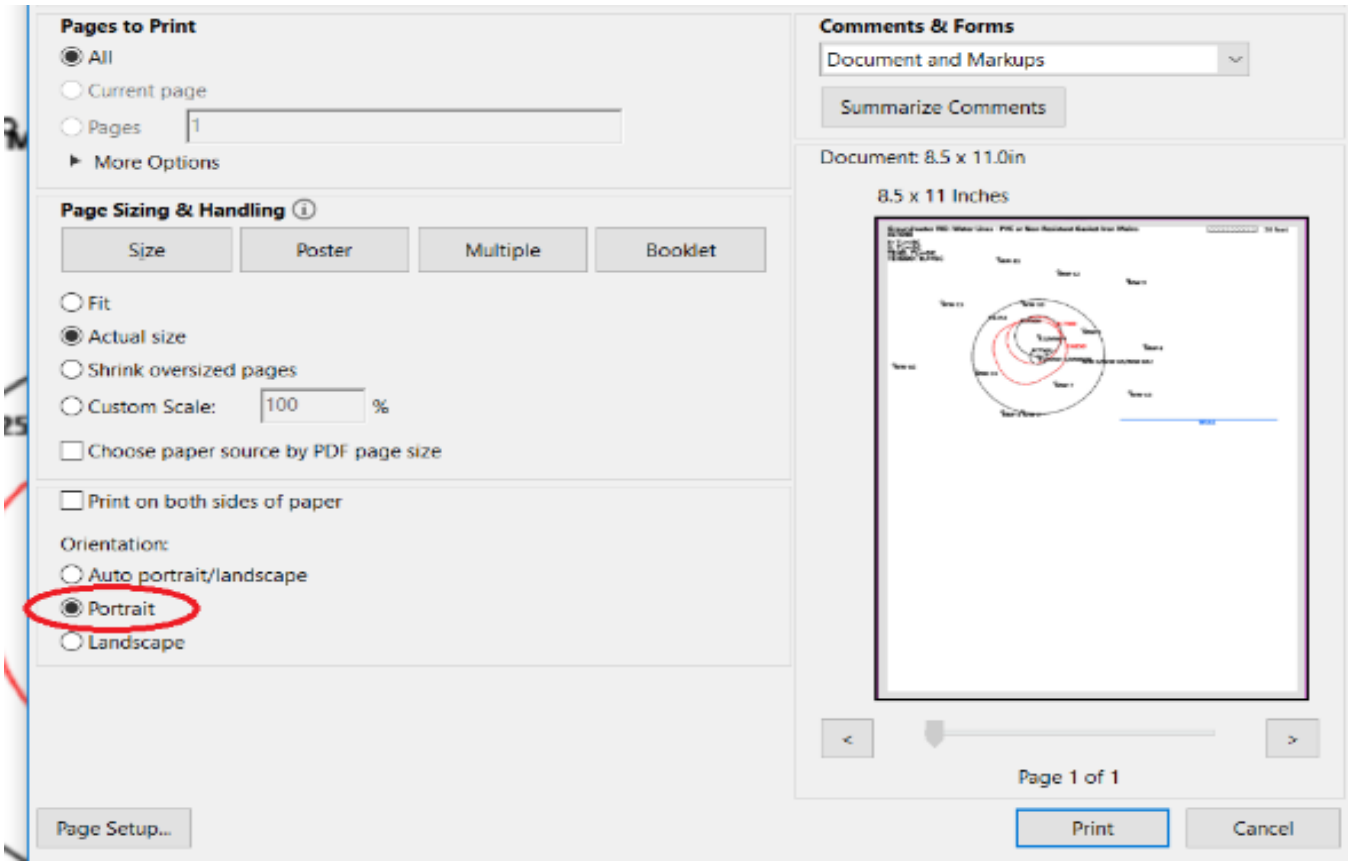
Free Product Data | Water Samples | New SMR

Action	Report Type	Description	Received Date	Approved Date	Rejected Date	Status
View Revise Play	Tier2		5/6/2017	5/6/2017		Approved
View Edit Delete	SMR	low risk				Saved

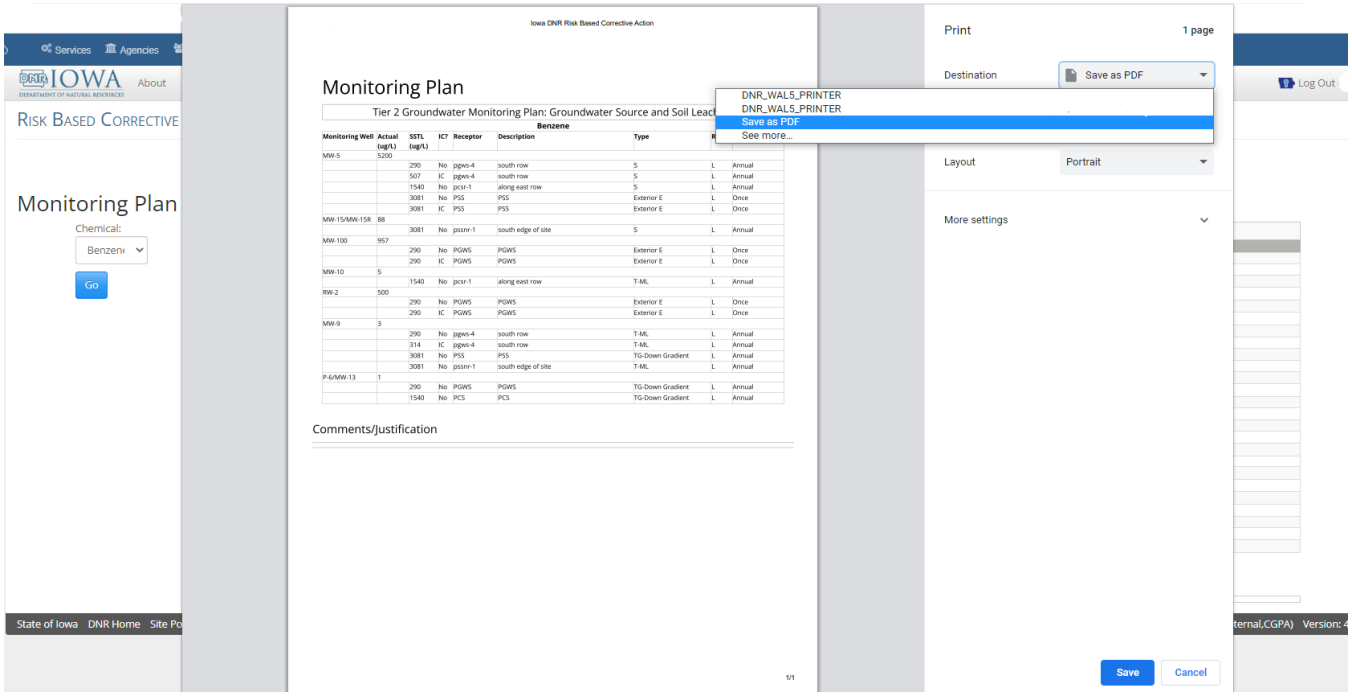
Use both landscape and portrait modes for printing/saving as applicable. Example: Data tables are best printed in landscape while many maps are best printed in portrait.



Well/BH Label	Sample Date	X (ft)	Y (ft)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	TEH-D (µg/L)	TEH-WD (µg/L)	Ground Surface Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Static Water Level (ft)	K (m/day)	TDS (mg/L)	MtBE (µg/L)	Use In Model
#1	07/18/1990	160	89	29,700.00	65,400.00		19,300.00										
MW-3	08/10/1992	160	89	24,271.00	55,331.00	3,448.00	22,626.00			1142.27	1142.27		1132.25				
MW-3	08/11/1998	160	89	22,000.00	66,000.00	7,700.00	62,000.00	420,000.00	<80,000.00	1142.27	1142.27		1131.59				
MW-3	05/06/1999	160	89	14,600.00	49,700.00	8,080.00	64,200.00	62,000.00	<20,000.00	1142.27	1142.27						
MW-3R	02/02/2000	160	89	7,780.00	24,100.00	3,130.00	16,600.00	67,000.00	<7,600.00	1142.54	1142.21	1133.50	1124.71				
MW-3R	10/03/2001	160	89	25,200.00	50,400.00	7,110.00	41,500.00			1142.54	1142.21	1133.50	1126.84				
MW-3R	05/24/2002	160	89	18,900.00	23,500.00	2,580.00	13,900.00			1142.54	1142.21	1133.50	1130.36				
MW-3R	05/24/2002	160	89	21,500.00	28,600.00	2,930.00	15,600.00			1142.54	1142.21	1133.50	1130.36				
MW-3R	04/09/2007	160	89	17,500.00	37,450.00	3,040.00	15,840.00			1142.54	1142.21	1133.50	1131.68				
MW-3R	07/02/2008	160	89	13,700.00	26,200.00	2,140.00	24,100.00			1142.54	1142.21	1133.50	1132.02				
MW-3R	09/25/2009	160	89	5,880.00	5,890.00	495.00	4,130.00			1142.54	1142.21	1133.50	1129.84				
MW-3R	11/04/2010	160	89	9,800.00	22,000.00	2,020.00	11,500.00			1142.54	1142.21	1133.50	1130.09				
MW-3R	09/28/2011	160	89	8,920.00	20,900.00	2,040.00	12,400.00			1142.54	1142.21	1133.50	1129.76				
#2	07/18/1990	160	113	10,800.00	8,000.00		5,820.00										
MW-4	08/10/1992	160	113	15,364.00	725.00	276.00	7,851.00			1142.71	1142.71		1132.45				
MW-4	09/20/1996	160	113	6,500.00	220.00	170.00	1,500.00			1142.71	1142.71		1130.73				
MW-4	08/11/1998	160	113	4,900.00	340.00	400.00	2,200.00	<2,000.00	12,000.00	1142.71	1142.71		1131.76				
MW-4	09/01/1999	160	113	6,930.00	1,050.00	1,250.00	16,500.00			1142.71	1142.71		1130.81				
MW-4	08/09/2001	160	113							1142.71	1142.71						
MW-4	05/24/2002	160	113							1142.71	1142.71						
MW-4	04/09/2007	160	113	15,500.00	3,620.00	519.00	4,810.00			1142.71	1142.71		1132.30				
MW-4	07/02/2008	160	113	14,000.00	11,800.00	686.00	7,700.00			1142.71	1142.71		1132.33				
MW-4	11/04/2010	160	113							1142.71	1142.71		1130.47				
MW-1	08/10/1992	124	25	<2.00	<2.00	<2.00	4.00			1142.13	1142.13		1132.59				
MW-1	09/07/1994	124	25	<2.00	<2.00	<2.00	<6.00			1142.13	1142.13		1130.26				
MW-2	07/01/1991	144	25	<2.00	<2.00	<2.00	<2.00			1142.01	1142.01		1131.36				
MW-2	08/10/1992	144	25	<2.00	<2.00	<2.00	4.00			1142.01	1142.01		1132.54				
MW-2	09/07/1994	144	25	<2.00	5.00	5.00	19.00			1142.01	1142.01		1130.22				
MW-2	08/11/1998	144	25	<2.00	<2.00	<2.00	<3.00	<1,000.00	<400.00	1142.01	1142.01		1131.82				

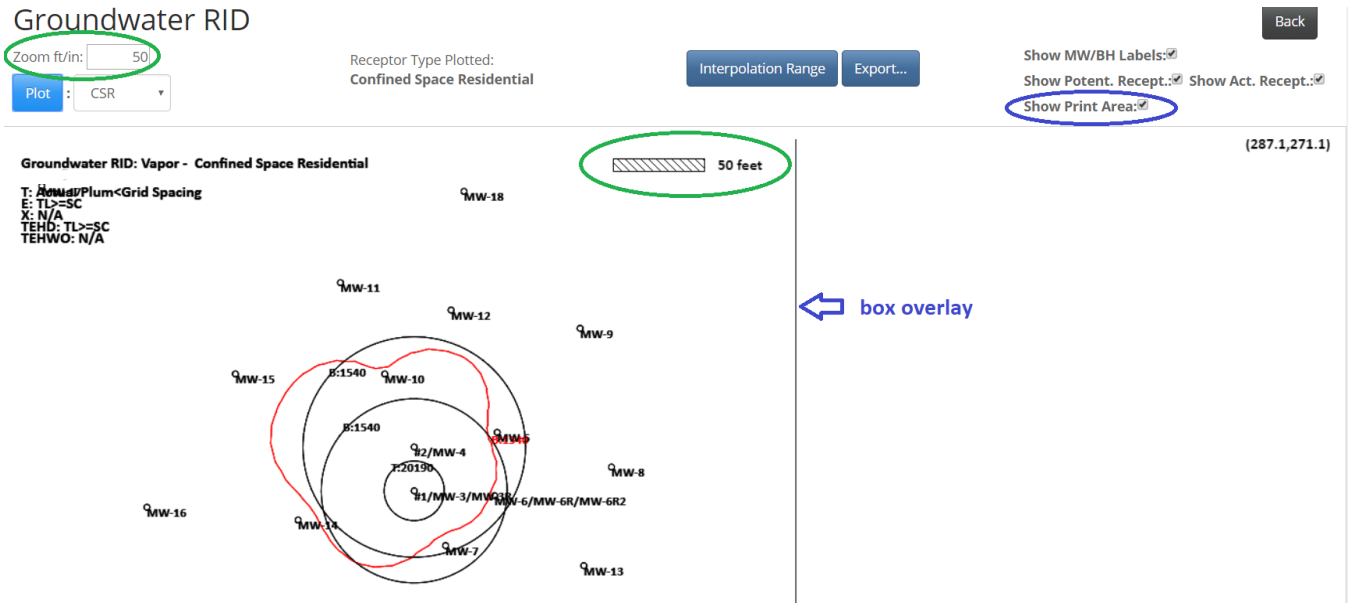


Required elements of the Tier 2 Report or SMR ***other than maps***, such as sample data, data before modeling, justifications and monitoring plans must be printed/saved directly from the application (from your web browser). To print/save these items click the right mouse button and select "Print" from the menu displayed. Then you can either send the page to print directly or save it as a PDF page.

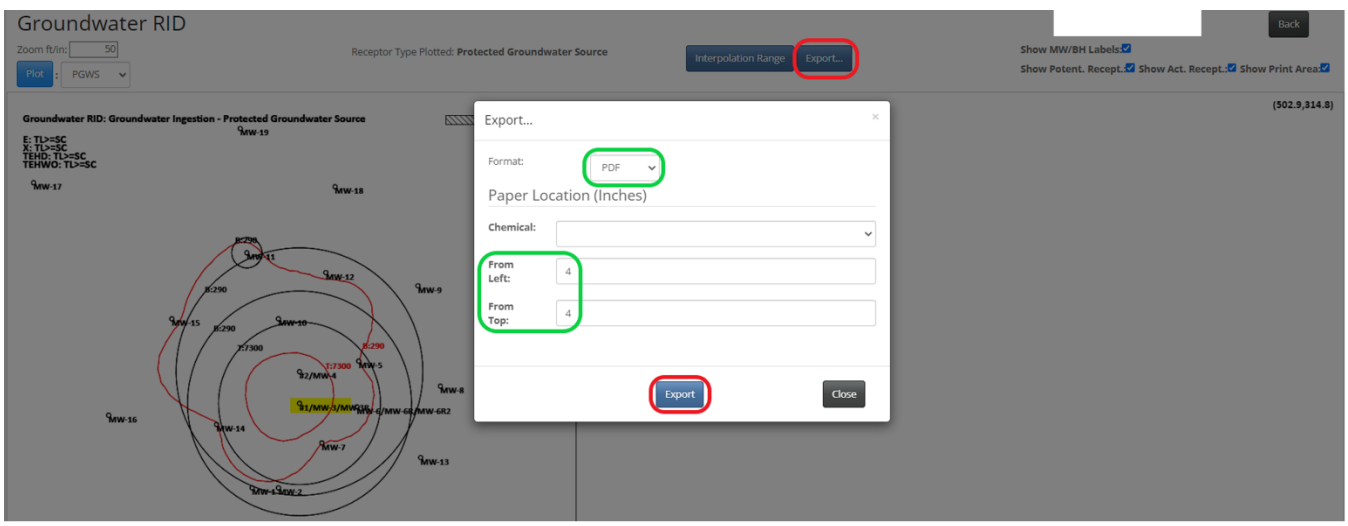


The required items have been optimized to ensure that they will print properly; however, if a page is not printing correctly, you may need to expand the margins of the print area in your browser print settings. The pages have been sized to print correctly with the default settings in the most common web browsers.

Maps must be exported as either a PDF file or a DXF (AutoCAD) file. “Plot” the desired map on the screen. The map will plot to a scale fitting the screen size. Before generating a PDF map from the application, use the “Zoom” and the “Show Print Area” features to give the map an appropriate scale for the size of the printed page. The Show Print Area button will place a box overlay on the map that indicates what will be included in the pdf file, allowing you to best use the space. Move the plot to correspond with the available print area. The map will move and zoom just like Google Earth (drag and drop, scroll wheel on the mouse).

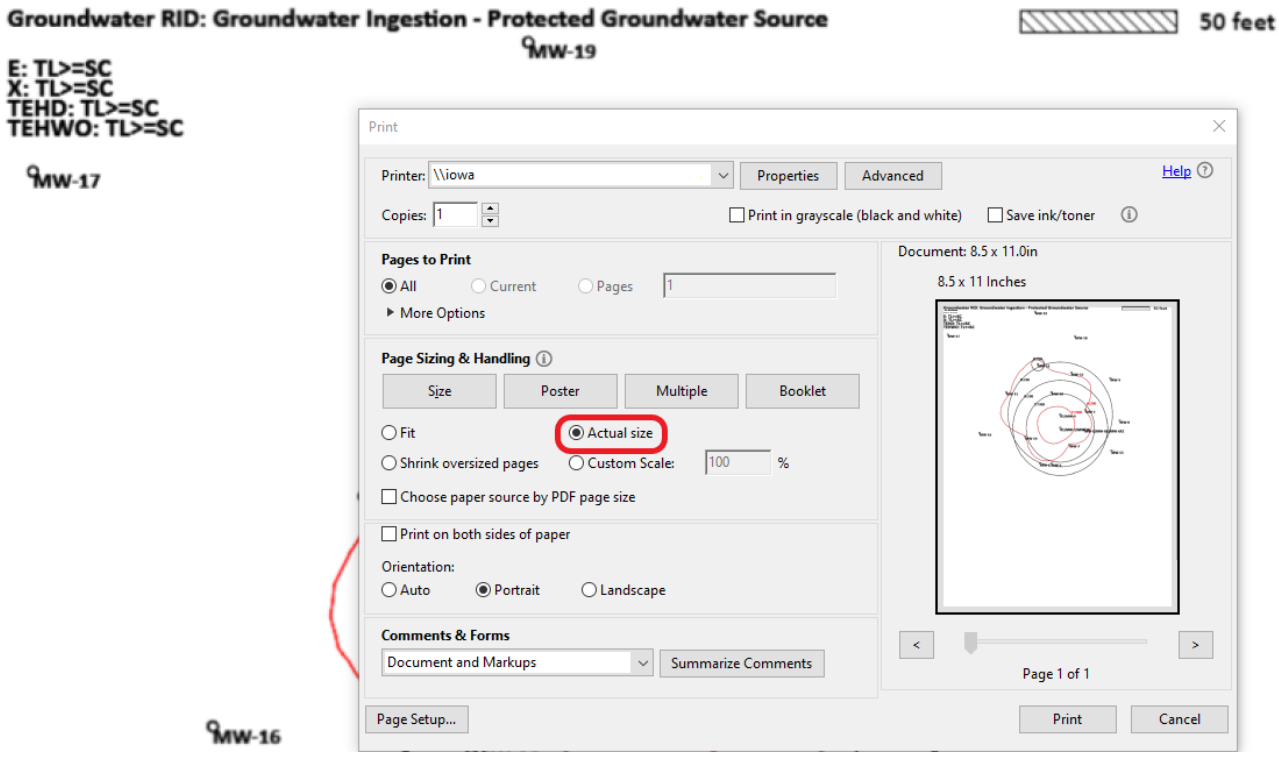


Click “Export” and choose PDF as the file type.



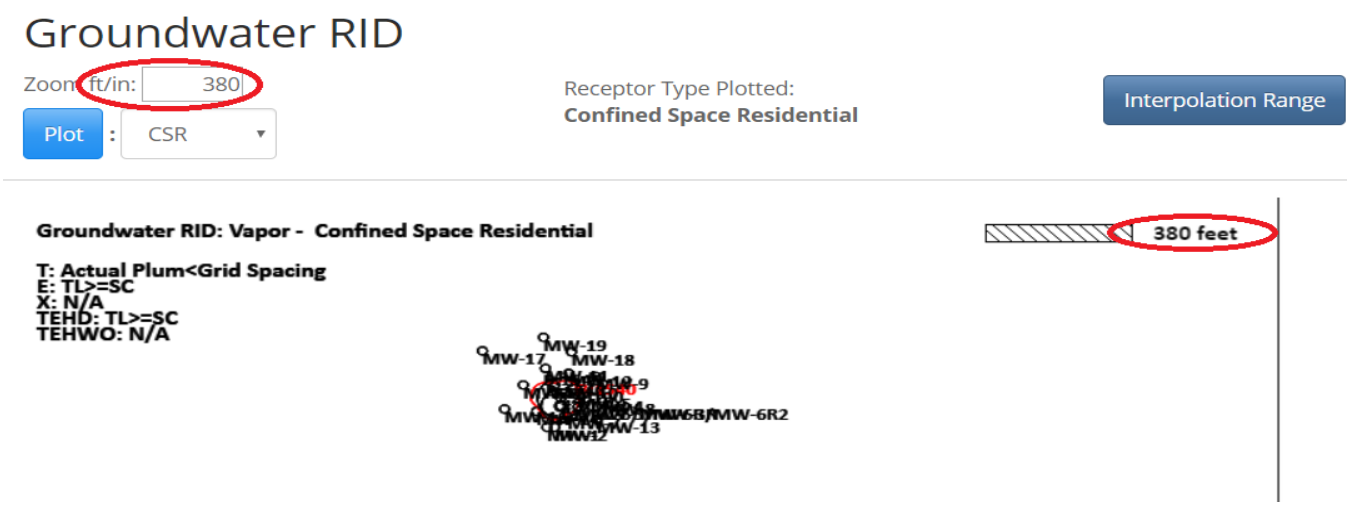
The user can choose a location on the printed page for the **source well** if desired (for example if you are printing the RID map on an already printed aerial photo). Measure to the desired source well (in inches) from the upper edge and the left edge of the paper. Using this feature, you can accurately print a contour or RID map on an already printed aerial photo.

When printing PDF maps (and when printing the aerial photo), ensure that the **“Actual Size”** selection is made in print preferences. If the printer is allowed to auto-size the maps, the one-inch scale bar included may not be one inch long on the printed copy.



If you need an AutoCAD file, simply select “DXF” and the application will deliver this file type.

The maximum scale size for maps in the application is 1 inch = 380 ft. This means that all plumes at <3000 ft in greatest dimension can be fit onto a page.

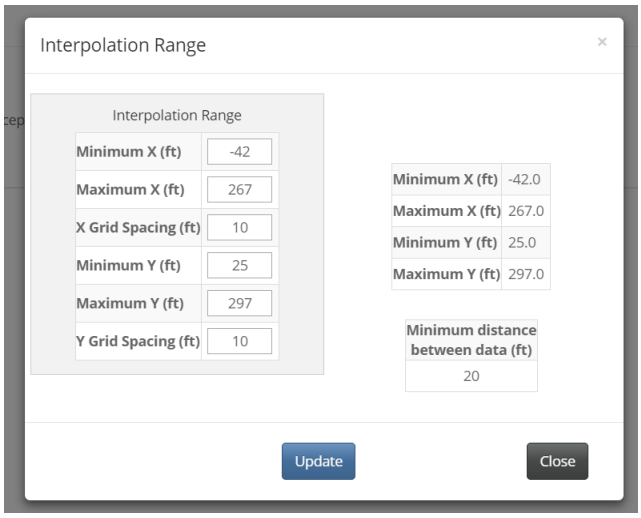


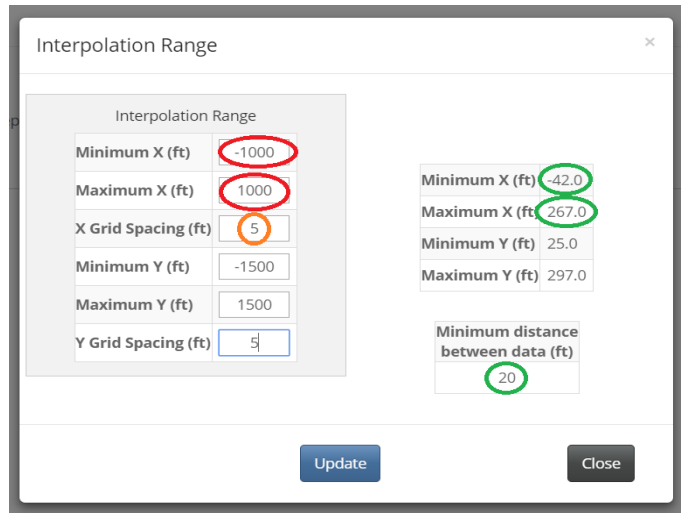
All maps will default to 10’ grid spacing. Choosing an appropriate grid spacing is essential to ensure timely plotting of maps. For each “square” of a grid, the application must calculate five concentrations for each analyte/receptor pair or for each chemical when contouring. Small grid spacing (such as 5 feet) and/or unnecessarily large XY map size can require the system to calculate (and transmit over the internet) hundreds of thousands of point concentrations. You will “time out” of the application before the application produces the map.

It is very important to select an XY map size and a grid spacing that will encourage the system to make only those calculations that are truly required. Examples:

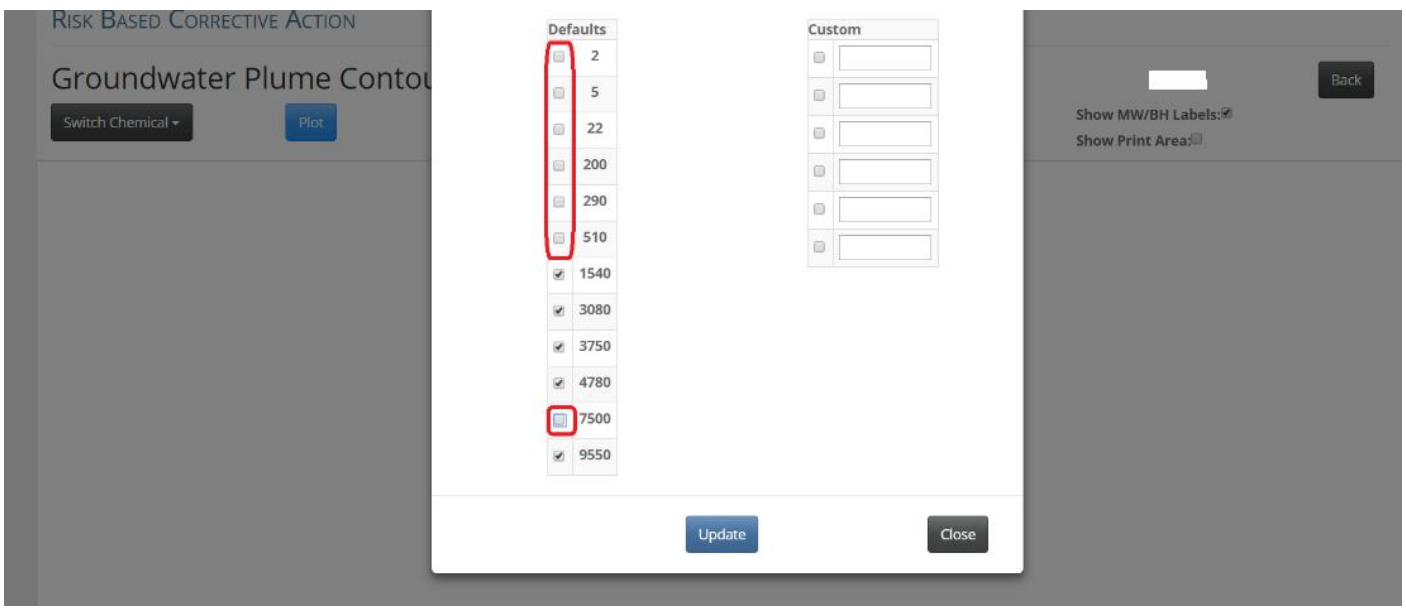
1. On a large site, set the grid spacing to 20’ rather than 10’ or 5’.
2. On a small corner gas station, set the min and max XY for a 100’ x 100’ box rather than a 300’ x 300’ box.
3. If you have a tiny plume (often a soil plume) around a single well/boring, zoom in and plot your map using only a

very small XY box. Use appropriately reduced grid spacing (5' or sometimes as small as 1') rather than requiring the system to make a huge number of calculations that do not affect the area of interest.





When contouring, de-select target levels that are not relevant to map that you are producing. Having extra contours selected will slow down map plotting. For example, if you are contouring the map for groundwater vapor, de-select the target levels for non-vapor receptors.

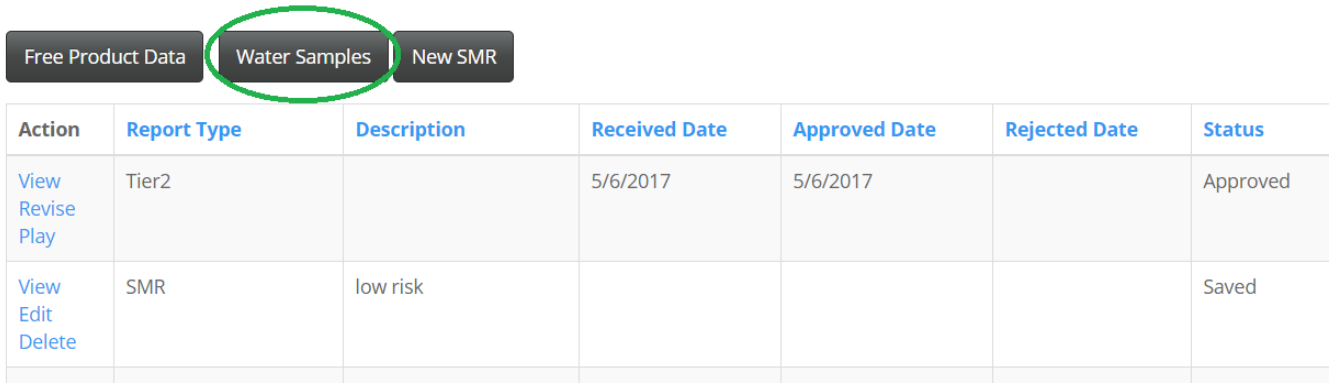


General Information

- To facilitate the 2017 transition from software to the application the most recent Tier 2 and SMR for each open site were uploaded to the application. The Tier 2 was automatically "submitted" to allow for the SMR report to be created. When an uploaded site is accessed for the first time, there is a Tier 2 report in submitted/locked status and an SMR in fully filled out form, but still editable. New sample data should be added to the open SMR and completed as normal.
- Before completing pathway evaluation or other operations in the new application, it is recommended to enter and "**Save**" groundwater, soil (for rev. Tier 2), and soil gas data.
- It will not be possible to plot source width and length for chemicals having less than three data points. This should produce fewer extraneously large plumes and corresponding Sw/W values that do not represent reality.
- Naphthalene was removed as a chemical of concern throughout the application.
- Methyl-tertiary butyl ether (MtBE) has been added to the groundwater data table.
- Waste Oil (TEH-WO) was removed from the chemicals of concern for soil samples since no target levels have

been published. Waste Oil is still included in the soil data table for informative purposes.

- When completing a revision of the Tier 2 model (or when adding new data *after* completing a pathway evaluation) in the application and adding new groundwater, soil, or soil gas data, it is necessary to reopen the appropriate preliminary receptor evaluation requirements and the pertinent pathway evaluation(s). Data that will later be used to calculate entries in the monitoring plan is generated in these areas and if they are not reopened prior to generating a monitoring plan, it is possible for receptors that should either drop off or be added to the monitoring plan to not display on the plan.
- The acronym "PWL" formerly stood for *plastic* water line. Henceforth, it will denote a *potential* water line.
- Drinking water or non-drinking water wells that *are not* to be used for RBCA purposes (SSTLs, contouring, risk analysis) should not be entered into the groundwater sample data table (even if they are going to be "ignored"). The application has a special area for entering non-RBCA water samples collected from locations such as taps, faucets, water lines, hydrants, wells, and surface waters.



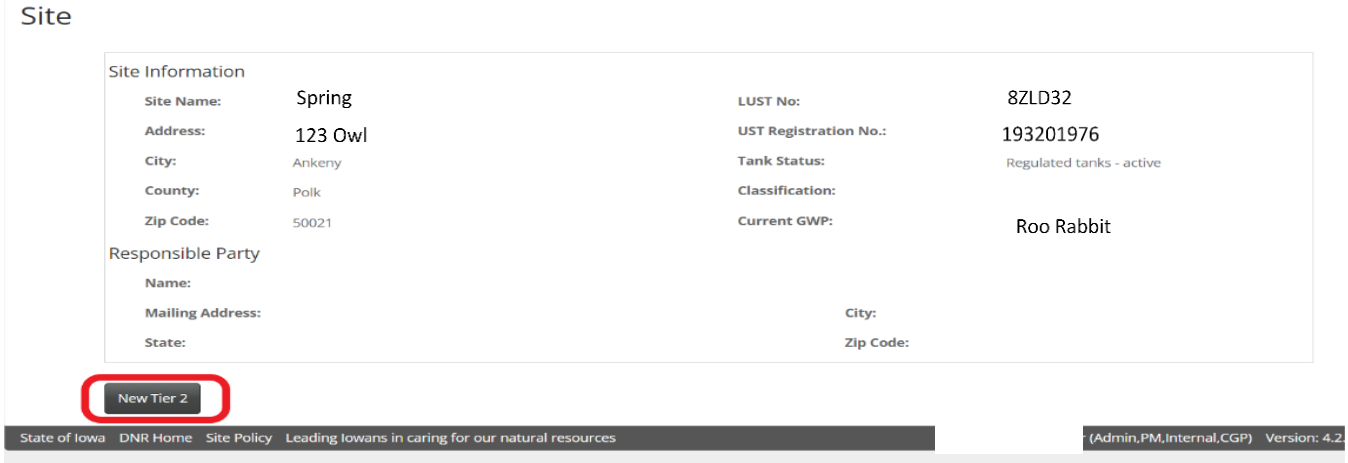
Action	Report Type	Description	Received Date	Approved Date	Rejected Date	Status
View Revise Play	Tier2		5/6/2017	5/6/2017		Approved
View Edit Delete	SMR	low risk				Saved

- The Tier 2 Cover Page is a fillable pdf available on the DNR UST website (form 542-0723) rather than being printed from the application.
- In the software, it was possible at any time during the life of a LUST site to modify the Tier 2 portion of the software after a Tier 2 Report had been completed and accepted (i.e. during SMR or Tier 3 monitoring). Due to the database structure of the application, a revised Tier 2 report is now necessary if large-scale changes (things that cannot be changed in the SMR) are necessary.
- All data tables that have blue column headers are sortable. For example, the column label "B (µg/L)" in the Groundwater Data Table for benzene concentration is blue, and sortable. The table is initially sorted alphanumerically by well label. Clicking once on the Benzene column label sorts the column from lowest to highest and the selection is expanded so that all rows are sorted as units. Clicking the Benzene label a second time results in the column being resorted highest to lowest. Refreshing the screen (Ctrl + F5, or the refresh icon on your browser) restores the table in original order.

Creating a Tier 2 Report in the Application

To begin work on a new Tier 2, revised Tier 2, or SMR in the application you will need to log into the application and then search for and then select the site you will be working on. If you are experiencing trouble logging in to the application or accessing the site you want to work on it may be because the email address associated with your Iowa A&A account is not the same as the email address on file with the UST Section at DNR or because a groundwater professional from your company has not yet been assigned in the Storage Tanks Database under GWP/Assessment. Contact a DNR project manager for changes if necessary.

To begin work on an initial Tier 2 for the site in the application select the site using the application search feature. Click on the new Tier 2 Button.



Please note, if you are working on a revised Tier 2 or SMR in the application you will also need to understand the order of submission because each subsequent report (regardless of type) relies upon previous reports to use as a base upon which to build the new report. Information on completing a post-Tier 2 SMR in the application is covered in a separate, later section of this document.

4.1 Site Cartesian Coordinate System

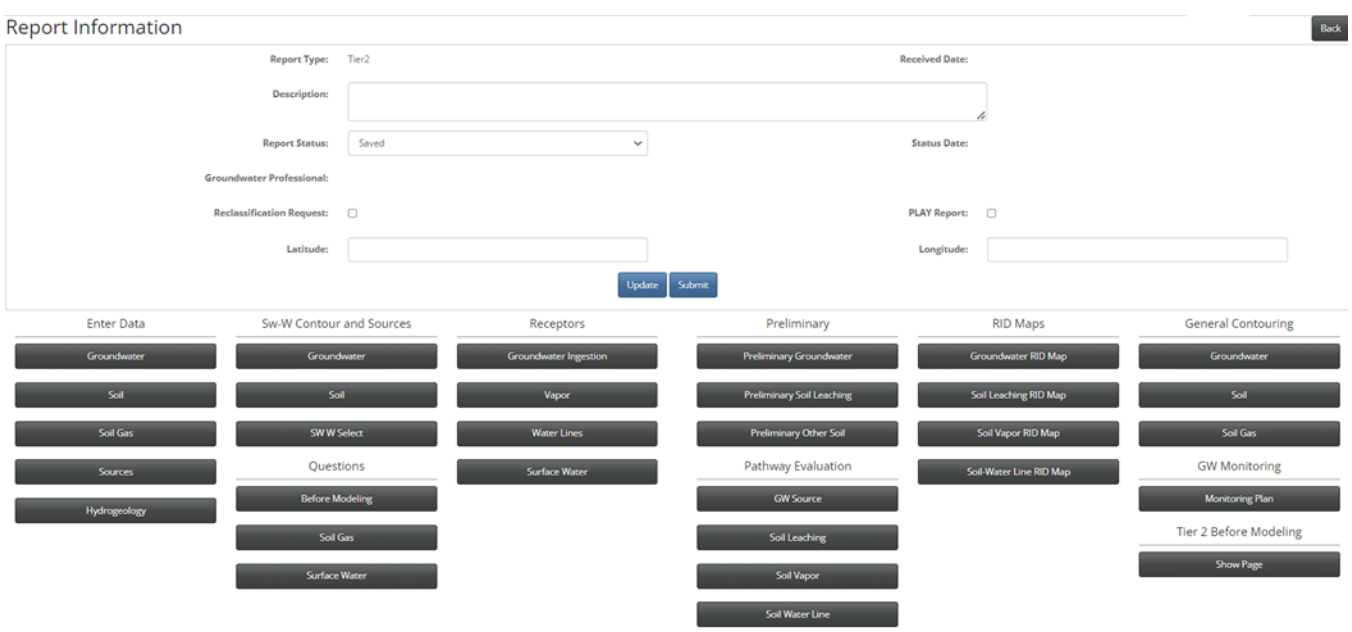
To use the Tier 2 application, you must define a Cartesian coordinate system for your site. Figure 1 is an example showing the X and Y directions. X always increases from left to right, and Y always increases from bottom to top. It is recommended you select North as vertically upward (Positive Y). The location of the coordinate system origin (0,0) is up to you.

In the Tier 2/SMR application, the length unit is always feet. Do not enter the units, just the values for x and y, in units of feet.

The locations of all monitoring wells, soil samples, adjacent property boundaries, and receptors are specified using the Cartesian coordinate system for the site.

4.2 Entering Tier 2 Data

Selecting a New Tier 2 or Revised Tier 2 in the application will bring up the Tier 2 data entry form or screen. The structure of the form is arranged to present a logical work flow, moving down each column and across from left to right.



5. CONTAMINANT DATA, GROUNDWATER, SOIL, AND VAPOR

All soil, vapor, and groundwater contaminant data ever measured at the site or obtained during site investigations must be entered into the application. Refer to Tier 2 Guidance. Soil and groundwater samples from releases of petroleum-regulated substances must always be analyzed for the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX). Additionally, if the release is suspected to include any petroleum-regulated substance other than gasoline or gasoline blends, or if the source of the release is unknown, the soil and groundwater samples must also be tested for the presence of total extractable hydrocarbons (TEH).

The application automatically manages and organizes the sample data and will assign chemical concentrations to each sampling location and determine the source concentrations. The criteria used for data selection and the procedure for modifying the data selection are discussed later.

5.1 Tier 2 Groundwater Sample Data

Click the "Groundwater button on the Tier 2 data entry form to begin adding pre-RBCA (e.g. UST closure groundwater data, Phase II groundwater data) and groundwater data collected for the Tier 2 assessment.

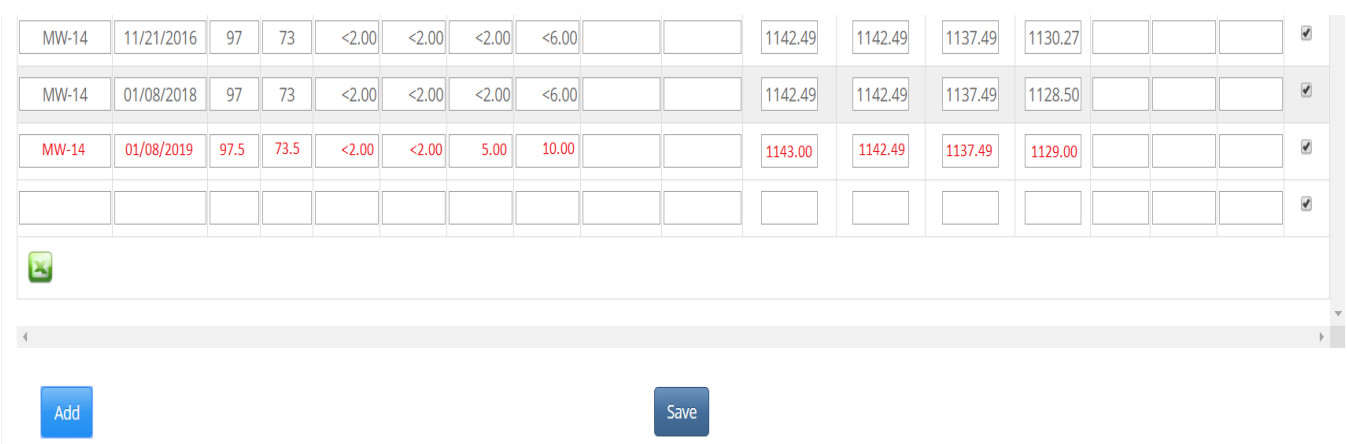
Please note you should not enter groundwater data collected after the RBCA Tier 2 was submitted in the Tier 2 groundwater data form, unless you are re-doing a Tier 2 with additional post-Tier 2 groundwater data. Groundwater sample data collected as part of a post-Tier 2 Site Monitoring Report (SMR) sampling should be entered in a different form accessed in the SMR portion of the application, which is covered is a separate section of this document.

Important: Groundwater concentration data collected as part of post-RBCA SMR sampling should only be entered in the Tier 2 groundwater data form if conditions warrant rerunning the Tier 2 analysis of groundwater receptor pathways. Refer to SMR guidance for conditions which warrant rerunning the Tier 2 with post-Tier 2 SMR groundwater sampling data. If you need to rerun the Tier 2 for groundwater pathways using post-Tier 2 SMR groundwater data, you will need to complete a revised Tier 2. When you select an option "Revise," you will be asked if you want to import SMR data. You will be asked to select which data to import.

The sample data input is by row. Each groundwater analytical sample occupies one row. To start, click on the cell under "Well/BH Label" and type in the well label. To move to the next column, use the Tab key or place the mouse cursor on the cell you want to move to and click the left mouse button.

❖ **Adding Rows to Data Tables:** There are two ways to add new data to the groundwater and soil data tables.

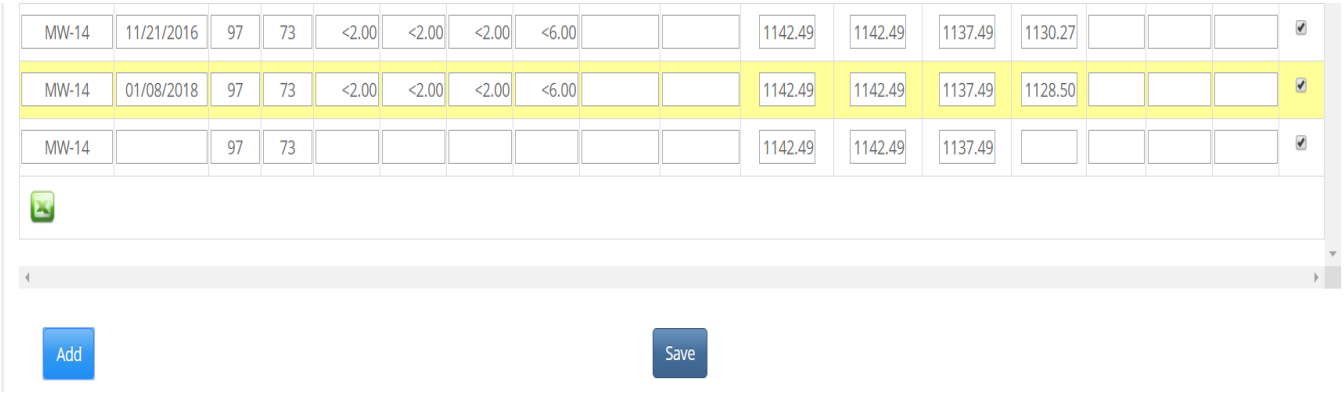
1. You can simply add a new row and type in the required data for the well or soil sample (the new row will be entirely blank and all data will need to be re-entered).



MW-14	11/21/2016	97	73	<2.00	<2.00	<2.00	<6.00			1142.49	1142.49	1137.49	1130.27				☑
MW-14	01/08/2018	97	73	<2.00	<2.00	<2.00	<6.00			1142.49	1142.49	1137.49	1128.50				☑
MW-14	01/08/2019	97.5	73.5	<2.00	<2.00	5.00	10.00			1143.00	1142.49	1137.49	1129.00				☑
																	☑

2. If you are adding a new sample for a well that already exists in the table (Example: MW-9 has pre-existing samples in the data table and you have collected another from the same well), you can click on the well in question and it will highlight in yellow. Clicking the "Add" button with a highlighted row will yield a copy of said

row without data that will be necessarily new for the sample (date, BTEX, D, WO, SWL). The caveat for using copy-and-add is that the pre-populated fields are fixed. They cannot be changed. If you have a replacement well, or wish to update a parameter such as TOC or XY, you should not use copy-and-add.



MW-14	11/21/2016	97	73	<2.00	<2.00	<2.00	<6.00			1142.49	1142.49	1137.49	1130.27				☑
MW-14	01/08/2018	97	73	<2.00	<2.00	<2.00	<6.00			1142.49	1142.49	1137.49	1128.50				☑
MW-14		97	73							1142.49	1142.49	1137.49					☑

3. If you accidentally add an extraneous row, you can leave it completely blank and it will disappear when the data table is saved. If you have a row that you want to delete, the best option is to simply re-use it for another sample. Rows are difficult to delete in the database structure, so ignoring it by unchecking the "Use in Model" box and then overwriting it with a new sample in the future is the best way to get rid of an unwanted row (note: this strategy will not work with rows that have been added using copy-and-add since the given row is linked to the others of the same well name).

❖ **X and Y Values for Monitoring Wells:** Monitoring wells with different names cannot have identical XY values. For example, if MW-3 is destroyed and replaced with MW-3R, the replacement well cannot have the exact same XY as the original well. If you note an error message when saving the groundwater data table saying that "Rows must be unique," examine the highlighted rows to see if they share a common XY, but have different names. You will have to adjust XY values with a minimal offset (suggest <1 ft). Also, a similar situation can arise if a row of groundwater data is accidentally entered twice resulting in two identical rows of data.

MW-18	09/07/1994	187	253	<2.00	<2.00	<2.00	<6.00			1140.70	1140.70	1135.70	1130.07	
MW-19	09/07/1994	115	297	<2.00	<2.00	<2.00	<6.00			1140.18	1140.18	1135.18	1129.90	
MW-19R		115	297											
MW-19R	__/__/____	115.5	297.5											

❖ **It Looks Like Excel, But It Isn't**: The groundwater and soil data tables in the application may resemble Excel, but they do not operate in the same manner. It is not possible to copy and paste multiple boxes at one time. This is a requirement related to security and not something we could change. The data displayed are drawn from many different database tables and assembled for the on-screen table display.

Sample Date: Enter the date the sample was collected. The format is mm/dd/yyyy.

X,Y Location: Enter the (x,y) location of the well or borehole, based on the Cartesian coordinate system you have chosen

for the site. The units are feet. Do not enter the units, just the location in feet.

Chemical Concentration Columns: Benzene, toluene, ethylbenzene, xylenes, total extractable hydrocarbons as diesel (TEH-D), and total extractable hydrocarbons as waste oil (TEH-WO) are the risk-based chemicals of concern evaluated by the application. The units for groundwater concentrations are micrograms per liter, or µg/L. Do not enter the units, only the concentration in µg/L.

Check the units reported on the original laboratory data sheets to ensure the correct unit is applied. For example, TEH in groundwater is often reported in milligrams per liter, or mg/L, on the laboratory sheet and must be converted to µg/L for the Tier 1 and Tier 2 evaluations.

If you do not have data for a chemical leave the chemical column space for that blank for that sample.

Samples Below Detection Limits: For samples with concentrations below the method detection limit, or laboratory reporting limit (e.g., "non-detect"), you must enter "<" followed by the detection limit. For example, if the sample is less than the method detection limit for a chemical and the detection limit is 10 µg/L, enter <10.

Automatic Number Formatting: The Tier 2 application accepts concentrations in groundwater data out to two decimal places. Decimal concentrations of greater than two places will be rounded up or down to the nearest two decimal place. For example, an entered groundwater concentration of 5.237 micrograms per liter (ug/L) would be rounded to 5.24 ug/L. Also, all data that are less than 0.01 mg/kg or µg/L is displayed as <0.01 in the application.

Groundwater Surface Elevation, Top-of-Casing Elevation, Top-of-Screen Elevation, Static Groundwater Elevation: Enter the values requested in feet above mean sea level. Enter only the value, not the units. If the information is not available, leave the column space blank.

Hydraulic Conductivity: You are required to estimate the hydraulic conductivity for your site. Generally, this is done by slug testing a minimum of three monitoring wells. The analysis of slug test data must be done using the Bouwer-Rice method (Bouwer, H., 1989, The Bouwer and Rice Slug Test – An Update, Groundwater, Vol. 27, No. 3, pg. 304-309). For additional information on hydraulic conductivity estimation (and the slug test information you are required to send to the DNR) refer to Tier 1 Guidance.

If slug testing was performed at a monitoring well location, enter the estimated hydraulic conductivity in meters per day (m/d). A hydraulic conductivity value (K) of 5 m/d may be used when the recharge rate of the well is too rapid to be accurately measured. Refer to Tier 2 Guidance. Leave the column space blank if hydraulic conductivity testing was not performed at the monitoring well location.

TDS: If any of the hydraulic conductivity measurements exceed 0.44 m/d, groundwater samples may be collected from the wells used for slug testing and analyzed for total dissolved solids (TDS) to determine whether a protected groundwater source is present. Refer to Tier 1 Guidance. If TDS were measured, enter the concentration in milligrams per liter (mg/L). Leave the column space blank if there is no TDS data.

MTBE: In accordance with Iowa Administrative Code (IAC) 567-135.18(2)**,** water samples must be analyzed for MTBE when collected for risk-based corrective action as required in rules 567—135.8(455B) through 567—135.12(455B). These sampling requirements include but are not limited to Tier 2 assessments where groundwater ingestion pathway evaluation and subsequent monitoring is required. If groundwater samples were analyzed for MTBE, enter the concentration in milligrams per liter (µg/L). Leave the column space blank if there is no MTBE data for that location.

Use in Model:
This column space allows the certified groundwater professional to select or deselect the data which is to be used in the Tier 2 evaluation. Data which is not selected for use in the model will be "ignored" in the Tier 2 evaluation performed by the application. An explanation must be provided in the Tier 2 Data Before Modeling section of the Tier 2 application for any data which not used or "ignored."

5.2 How Tier 2 Organizes Groundwater Sample Data

The Tier 2 program organizes and analyzes the groundwater sample data. This is done automatically, but we will discuss the process.

The groundwater data is first grouped by (x,y) location. Samples within 5 feet radial distance are treated as representing the same location. The samples at the same location are sorted by date, from the oldest to the most recent. For each chemical, a single concentration is assigned to each location. The chemical concentrations are used for contouring, determination of source location/concentration, and risk classification.

The location a groundwater sample is assigned can be affected by the order in which the data is listed in the table. The application looks at the location of the first groundwater sample in the grid. It then searches the following groundwater data in the grid, in the order shown in the grid. Any sample within 5 feet radial distance is considered to be at the same location, and the sample is not considered again. The application then moves down in the grid to the next sample not assigned a location. All following samples are checked against this location. Samples within 5 feet are assigned to the location. This continues until all samples have been assigned a location. If a number of samples are close together (i.e., four samples on a line, each spaced 4 feet apart), the order of the samples in the grid can affect their location assignment.

Consider the following example. Assume the following three samples are available from two wells. For purposes of illustration, we will look at benzene and toluene. Assume monitoring well MW-3 was no longer usable after 1994 and MW-8 was installed as a replacement:

Well	Sample Date	X (ft)	Y (ft)	Benzene (µg/L)	Toluene (µg/L)
MW-3	04/05/1992	100	100	2,000	4,000
MW-3	04/09/1994	100	100	1,000	5,000
MW-8	04/12/1997	101	103	800	4,700

Regardless of where the three samples are entered in the Groundwater Sample Data form, the application will organize the samples as shown. MW-8 is treated as a sample from the same location as MW-3, because it is within 5 feet (radial distance) of MW-3.

The application will assign a benzene and toluene concentration to the location, based on all the groundwater samples assigned to the location. For each chemical, the criteria for assigning a concentration to a location are either the maximum of the two most recent samples or the most recent sample if steady and declining criteria are met. Steady and declining criteria state: three samples at least six months apart, cannot have concentrations increasing more than 20% from one sample to the next, and concentrations cannot increase more than 20% from the third (oldest) to the most recent sample.

In the example above, the benzene concentrations meet steady and declining criteria, so the benzene concentration used for the location is the most recent sample, 800 µg/L. Toluene does not meet steady and declining criteria, so the maximum of the two most recent samples is assigned. For toluene, the second sample concentration is assigned to the location (5,000 µg/L). So, the chemical concentrations assigned to a location may be from different sampling dates and/or wells. This approach is applied to all chemicals.

5.3 Tier 2 Soil Sample Data

Soil data for a site is entered and evaluated exclusively at Tier 2 in the application. The grid for entering Tier 2 soil analytical data and groundwater data are similar. Click the “Soil” button in the “Enter Data.” One row of the grid (table) is used for the results from one soil sample analysis. See the Tier 2 Guidance, Section 6-2, for additional information on soil analytical data. Enter the actual measured values for the individual concentrations. Refer to the importance of the correct labeling and X,Y coordinates discussed earlier in this document to avoid error messages and data not being saved when clicking the “Save” button.

5.4 How Tier 2 Evaluates Soil Sample Data

The evaluation process for soil and groundwater data is similar, but not exactly the same. Soil samples are grouped by location, then sorted by date at each location (oldest to most recent). Samples within a 5-foot radial distance are considered to represent the location and the data is lumped together.

In contrast to groundwater data, steady and declining or the maximum of the two most recent samples is not used for soil data. For soil data, the concentration from the most recent sample for a chemical is assigned to the location. If there are multiple samples from different depths on the most recent date, the maximum concentration is used.

The application groups soil samples by location, based on the order the data is encountered in the grid. For example, the application looks at the location of the first soil sample in the grid. It then searches the following soil sample locations in the grid. Any sample within 5 feet radial distance is considered to be at the same location, and the sample is not considered again. The application then moves down in the grid to the next sample not assigned a location. All following samples are checked against this location. This continues until all samples have been assigned a location. If a number of samples are near to each other (four samples on a line, each spaced 4 feet apart), the order of the samples in the grid can affect the location assignment.

When selecting the (x,y) locations for soil samples taken on the same date (e.g., tank closure, over- excavation), selecting locations at least 5 feet apart will assure such samples are treated independently. Samples lumped together because they are less than 5 feet apart may adversely affect the size of the contoured plumes.

5.5 Groundwater and Soil Data Adjustment

You should enter all groundwater and soil analytical data available for the site . The application will reduce the data using the specified. The data reduction is done automatically using all the data, except for samples you specifically exclude. If you exclude a sample, you will need to provide a justification. For example, perhaps the location of a soil sample has since been excavated. To exclude a sample from the evaluation process, you must tell the application which samples to ignore by unchecking the box in “Use in Model.”

Important:
You do not need to ignore multiple samples collected from the same boring on the same date to have the application assign the correct concentration to a location. This is done automatically by the application.

How Ignores Can Be Lost
If you set a sample to be “Ignored,” but then go back and change the sample data, there is a good chance the ignore selection will be lost. This is because the text string identifying the sample changes when you change the sample data. For example, if you set a groundwater sample to “Ignore,” but then change the data for the sample, such as changing the label or date or a concentration, the “Ignore” selection will be lost.

If you change the sample data for an ignored sample, you should go back and see if you need to reset the ignore selection.

5.6 Viewing Groundwater and Soil Sources

The application automatically identifies the groundwater and soil sources, based on the sample data entered, the Tier 2 procedures for evaluating multiple soil and groundwater samples from a location, and user selection, if any, for samples to ignore. The source location and concentration for a chemical is the location with the maximum concentration.

To view the groundwater and soil sources selected by the application, on the “Main Form,” click the “Sources” button in the “Enter Data” frame. The sources are displayed for your information. You cannot select or modify a source location or concentration from this form.

Water Supply Notification
The source concentrations can be used to determine if you need to do water supply notification:

If groundwater source concentrations exceed the Tier 1 level for drinking water wells and/or the groundwater is a protected groundwater source, you need to provide notification of the site conditions on the Water Supply Notification Form to the DNR Water Supply Section. If a county has delegated authority, send the form to the designated county authority for issuing well construction permits as listed in Appendix H of the Tier 2 Guidance. Notification does NOT clear the groundwater ingestion pathway if the Tier 1 levels for potential groundwater ingestion are exceeded (refer to Tier 2 Guidance, Water Supply Notification).

The Tier 1 levels for drinking water wells are:

Benzene	Toluene	Ethylbenzene	Xylenes	TEH-Diesel	TEH-Waste Oil
5 µg/L	1,000 µg/L	700 µg/L	10,000 µg /L	1,200 µg /L	400 µg /L

5.7 Vapor (Soil Gas) Data

Please see the Tier 2 Guidance for additional information on vapor sampling.

Vapor sampling is optional at Tier 2. You are not required to sample vapor at Tier 2. If you do sample vapor, the results are applicable to vapor receptors (confined space and sanitary sewer). If you pass the Tier 2 evaluation based on groundwater or soil data, but fail the evaluation due to vapor sampling, you must still address the vapor concentrations at the site before receiving no further action classification.

To pass using vapor sampling at a location requires two samples, collected at least two weeks apart, both of which must meet the vapor target levels.

If you pass vapor sampling at a source location (groundwater, soil), this clears (no action required) all the vapor receptor types (confined space and sanitary sewer, actual and potential) for the appropriate pathway. You may also, under defined conditions, clear an actual receptor by passing vapor sampling at an appropriate location between the source and the actual receptor, a so-called alternative point of compliance (refer to Tier 2 Guidance). The following table shows the applicable source location for doing vapor sampling at the source for each pathway.

Pathway	Vapor Source Measurement Locations
Groundwater Source	Groundwater Sources
Soil Leaching	Soil Sources
Soil Vapor to Enclosed Space	Soil Sources

Click “Soil Gas” in the “Enter Data” frame to activate the “Soil Gas Data” form. Enter soil gas lab data and associated information. Some of the columns in the table offer dropdown menus to make appropriate choices.

Soil Gas Data

Save

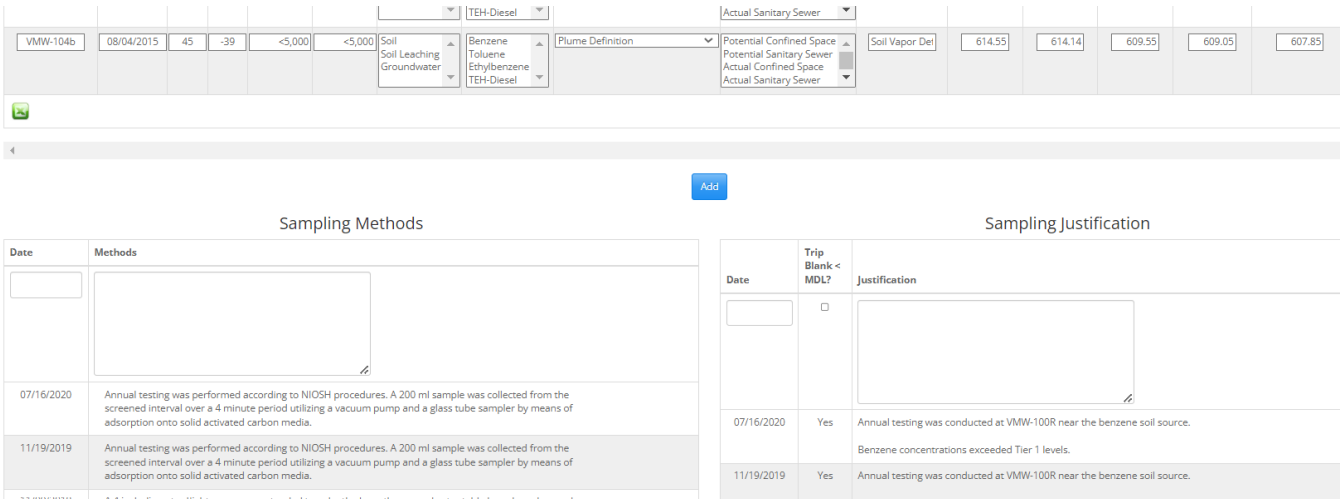
Well or Vapor Sample ID Label	Sample Date	X (ft)	Y (ft)	B (µg/m3)	T (µg/m3)	Pathway	Chemicals Of Concern	Purpose of Well or Sample	Receptor Types	Name of Source or Receptor	Ground Level Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Soil Gas Sample Elevation (ft)	Static Groundwater Elevation (ft)
VMW-1a	08/13/1997	37	88	7,000	<5,000	Soil Soil Leaching Groundwater	Benzene Toluene Ethylbenzene TEH-Diesel	Source	Potential Confined Space Potential Sanitary Sewer Actual Confined Space Actual Sanitary Sewer	old soil source	615.71	615.39	608.66	608.64	608.60
VMW-1a	08/13/1997	37	88	7,000	<5,000	Soil Soil Leaching Groundwater	Benzene Toluene Ethylbenzene TEH-Diesel	Source	Potential Confined Space Potential Sanitary Sewer Actual Confined Space Actual Sanitary Sewer	old soil source	615.71	615.39	608.66	608.64	608.60
VMW-1b	09/05/1997	37	88	494,000	182,000	Soil Soil Leaching Groundwater	Benzene Toluene Ethylbenzene TEH-Diesel	Source	Potential Sanitary Sewer Actual Confined Space Actual Sanitary Sewer Other	old soil source	615.71	615.39	608.66	608.64	608.50
VMW-1b	09/05/1997	37	88	494,000	182,000	Soil Soil Leaching Groundwater	Benzene Toluene Ethylbenzene TEH-Diesel	Source	Potential Confined Space Potential Sanitary Sewer Actual Confined Space Actual Sanitary Sewer	old soil source	615.71	615.39	608.66	608.64	608.50

The application will sort the vapor data by location and date.

The Tier 2/SMR application does not do risk classification analysis of the vapor data. Under Questions (discussed later), you can specify whether vapor data sampling criteria has been met at soil or groundwater sources, and the application will account for this when doing Risk Classification for vapor receptors. But, it is up to you to correctly determine vapor sampling has passed. The Tier 2 portion of the application does not automatically determine whether vapor sampling has passed at the sources or for specific receptors.

Soil Gas Sampling Methods

The two text boxes are used to enter information on soil gas "Sampling Methods" and "Sampling Justification." The information is automatically printed when you printout the vapor data.



							TEH-Diesel		Actual Sanitary Sewer						
VMW-104b	08/04/2015	45	-39	<5,000	<5,000	Soil Soil Leaching Groundwater	Benzene Toluene Ethylbenzene TEH-Diesel	Plume Definition	Potential Confined Space Potential Sanitary Sewer Actual Confined Space Actual Sanitary Sewer	Soil Vapor Def	614.55	614.14	609.55	609.05	607.85

Add

Sampling Methods

Date	Methods
07/16/2020	Annual testing was performed according to NIOSH procedures. A 200 ml sample was collected from the screened interval over a 4 minute period utilizing a vacuum pump and a glass tube sampler by means of adsorption onto solid activated carbon media.
11/19/2019	Annual testing was performed according to NIOSH procedures. A 200 ml sample was collected from the screened interval over a 4 minute period utilizing a vacuum pump and a glass tube sampler by means of adsorption onto solid activated carbon media.

Sampling Justification

Date	Trip Blank < MDL?	Justification
07/16/2020	Yes	Annual testing was conducted at VMW-100R near the benzene soil source. Benzene concentrations exceeded Tier 1 levels.
11/19/2019	Yes	Annual testing was conducted at VMW-100R near the benzene soil source.

5.8 14-day, 6-month rules for Soil Gas Data Evaluation

The application performs soil gas evaluation to assign concentrations to locations. A measured soil gas concentration is assigned to each location for Benzene and Toluene. Soil gas sample locations within 5 feet (radial distance) are treated as representing the same location. Like groundwater and soil, the location of the first soil gas sample in the grid is checked against all following samples. Any samples within 5 feet are assigned to the same location and the samples are no longer considered. Then the next sample is found that has not been assigned a location and all following samples not already assigned a location are checked against this sample. This continues until all samples have been assigned a location. If a number of samples are less than 5 feet apart on a line, the order in which the samples are listed in the soil gas data grid could affect the locations the samples are assigned to.

In assigning a soil gas concentration to a location, the samples considered to represent the same location are first sorted from oldest to most recent. For each chemical the maximum of the two most recent samples is assigned as the chemical concentration for a location, subject to the 14-day, 6-month rules. Rules require that soil gas samples from a location be separated by at least 14 days, and that a waiting period of 6 months is required after a soil gas sample exceeds a target level, before re-sampling.

At a location the concentration used is the maximum concentration for all samples between Date A and Date B, inclusive, where:

Date A is the date of the most recent soil gas sample.

Date B is the date of the first prior sample that is at least 14 days earlier than Date A. However, if a failing soil gas sample exists less than 6 months (≤180 days) prior to Date B, then Date B is the date of the failing soil gas sample.

To make this more concrete, consider the following examples. The examples are for benzene, but the same process is applied for toluene.

Example 1

Date	Concentration (µg/m3)
12/01/2001	520,000
2/02/2002	467,000
2/20/2002	346,000

The concentration assigned in example 1 is 467,000, the maximum of the 2 most recent samples, because the last two samples are 14 or more days apart, and there is not a failing sample in the 6 months prior to 2/02/2002. That is Date A = 2/20/2002 and Date B = 2/02/2002 and the maximum of all samples between Date A and Date B, inclusive, is used.

Example 2

Date	Concentration (µg/m3)
12/01/2001	620,000
2/02/2002	467,000
2/10/2002	346,000

The concentration assigned in example 2 is 620,000. Although the 2 most recent samples meet the 14-day rule, there is a failing sample within 6 months of the 2nd of the 2 most recent. All three samples will be evaluated for the location. In this case Date A = 2/20/2002 and Date B = 12/01/2001, and the maximum concentration between Date A and Date B, inclusive, is used.

Example 3

Date	Concentration (µg/m3)
12/01/2001	578,000
2/02/2002	467,000
2/20/2002	346,000

The concentration assigned in example 3 is 578,000. The 2 most recent samples are not at least 14 days apart. The sample from 12/01/2001 is the first sample that is at least 14 days earlier than the most recent. The maximum concentration from the 3 samples will be assigned to the location.

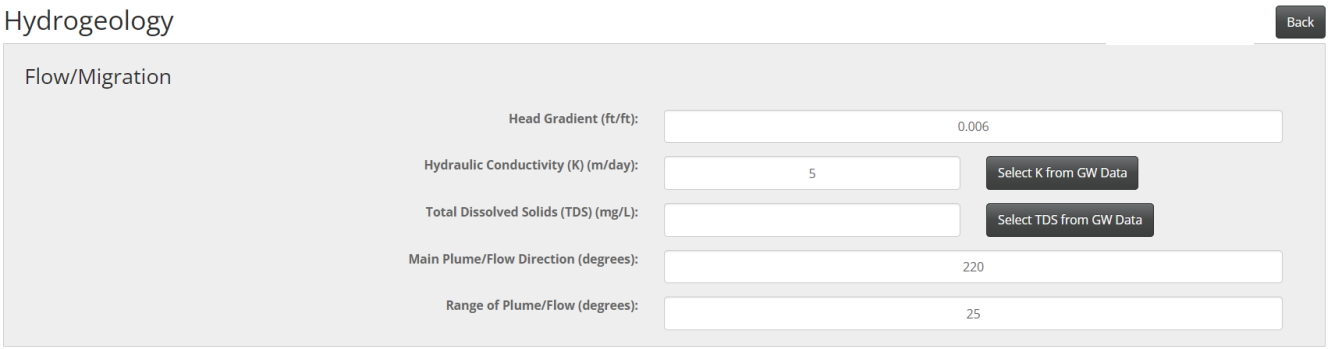
If you have a single sample at a location, the concentration from the single sample will be assigned to the location. The maximum soil gas concentration for each chemical is the maximum from among the concentrations assigned to each location.

At Tier 2 the concentrations assigned to a location are used for contouring only. During SMR the concentrations assigned to a location are used to check whether soil gas sampling has passed or failed at Tier 2 soil and groundwater source locations.

6. HYDROGEOLOGY

Click the “Hydrogeology” button in the “Enter Data” frame. In this form you enter some of the basic information required for Tier 2 modeling of steady-state soil leaching to groundwater and groundwater contaminant transport. The equations and assumptions used are specified in the Iowa RBCA rules and Tier 2 Guidance.

6.1 Flow/Migration Parameters



Head Gradient
The head gradient is the average overall slope of the groundwater table representative of where the plume has migrated, or is likely to migrate. The head gradient can be estimated from contouring measured water level elevations. The Tier 2 application does not contour water level elevations or estimate the head gradient. You must estimate the head gradient outside of the Tier 2 application. In the Tier 2 application, you enter the value you have determined.

Mathematically, the head gradient can have a negative sign, depending on the direction of flow. However, for the Tier 2 program the direction of flow is accounted for with the plume flow direction, and the head gradient should always be entered as a positive number.

Hydraulic Conductivity
Hydraulic conductivity (K) is usually estimated from slug testing a number of wells at the site. For a slug test where the recharge rate is too rapid for accurate measurement, use a hydraulic conductivity value of 5 m/d. Refer to Tier 2 Guidance. For Tier 2, you must use the highest hydraulic conductivity, unless justification is provided for using a different value. Keep in mind, you must enter the results of your hydraulic conductivity testing as part of the "Groundwater Data." You should have already entered such data before you enter the "Hydrogeology" form.

Click the "Select K from GW Data" button to activate the "Hydraulic Conductivity Selection" form. This form searches the Groundwater Data and inserts the highest K value from the table. You can change the selected hydraulic conductivity manually. If you type a value other than the maximum, you will need to provide justification.

Total Dissolved Solids
The total dissolved solids (TDS) entry works similarly to hydraulic conductivity. Click "Select TDS from GW Data." The TDS data entered as part of the groundwater data is sorted from lowest to highest. Generally, the default is to use the smallest measured value from TDS.

Main Plume/Flow Direction
This is the primary direction the plume is migrating or is expected to migrate. The direction is measured clockwise in degrees from the Y (due north, vertically upward) direction. For main plume/flow direction the vertically upward direction is 0 degrees. The main plume/flow direction should be the mid-line of the plume in the direction of migration. See Figure 1 for an example.

The Tier 2 application does not estimate the main plume/flow direction. You must estimate the value outside the program and enter the number. Some judgment is required, usually involving contours of the measured groundwater concentrations and water table elevations.

After the flow direction is determined, measure the angle, in degrees, of the migration direction from the vertical (north), with positive being clockwise. If you measure counter-clockwise from vertical upward, the degrees should be input as negative.

For our example, as illustrated in Figure 1, use a main plume/flow direction of 156 degrees.

Range of Plume/Flow
Iowa RBCA Tier 2 uses a solution to a steady-state groundwater transport model which only predicts the concentrations on a line directly downgradient from the source (in the main plume/flow direction). In order to account for potential lateral spread in a plume as it migrates, locations not directly downgradient are given concentrations that are a fraction of the directly downgradient concentrations. The range of plume flow is used to account for the current spread of the plume in the downgradient direction, as illustrated in Figure 2. The range entered is added to each side of the main plume/flow direction. By default, 30 degrees is automatically added to the range of plume flow to account for possible future spreading of the plume. Locations to each side of the main plume/flow direction within the range plus 30 degree cone are assigned 100% of the downgradient concentration. If a location is 100 feet from the source and in the range plus 30 degree cone, the concentration is calculated as if the location is 100 feet directly downgradient.

For the example in Figure 2 the range is 37 degrees. This means locations within 67 degrees (37 degree range + 30 degree default) of either side of the main plume/flow direction will be modeled to have a concentration equivalent to the directly downgradient concentration.

Under some circumstances, you must consider the concentrations in all directions to be 100% of the downgradient concentration. If the groundwater gradient is less than 0.005 or the groundwater contaminant plume shows no definitive direction or shows direction reversals, values will be assumed to be 100 percent of the modeled [simulated] values in all directions from the source. Refer to Tier 2 Guidance. To implement this situation, you must set the range of plume/flow to 150 degrees. This will result in treating all directions as equivalent to 100% of downgradient (150+30=180 for each side), and the modeled plume for a chemical will be a circle with the center at the source location.

When the range is less than 150 degrees, an upgradient fraction is computed internally and used for concentrations directly upgradient. The maximum value is 0.2 (20%). The upgradient fraction is decreased as the groundwater velocity increases (as estimated by the hydraulic conductivity times the head gradient).

Locations between the 100% direction and directly upgradient are given percentages between 100% and the upgradient %, based on a linear interpolation of the angle of the point between the 100% direction and the upgradient direction.

Modeled (simulated) concentrations are based on an adjusted distance. For example, if a location has a radial distance of 100 feet from the source, and is 54% of downgradient, the concentration for the location is computed as if the point is 185 feet directly downgradient (100 feet/0.54).

6.2 Soil Parameters
You are not required to measure the soil parameters (fraction organic carbon, total porosity, and soil bulk density). Clicking the “Insert Defaults” button for soil parameters inserts the default values for all three parameters. If default values are replaced with field measurements, field measurements must be obtained and used for all three of the parameters (fraction organic carbon, total porosity, and soil bulk density). See Tier 2 Guidance. The analytical model for Tier 2 are homogenous and isotropic; therefore, a single value must be used for each parameter.

Don’t forget to “Save” all data.

Justifications
The “Hydrogeology” frame contains two forms: “Tier 2 Data Before Modeling Justification” and “Site Hydrogeology Justification Section” located below the “Flow/Migration” and “Soil Parameters” forms. The justification forms provide text boxes where you enter the information required for “Tier 2 Data Before Modeling Justification” and “Site Hydrogeology Justification Section.” The information you type into the text boxes is stored in the data file and can be printed later.

For “Tier 2 Data Before Modeling Justification,” the Tier 2 Guidance says, “If diesel and/or waste oil were stored on site, but samples were not analyzed using Method OA-2, provide a justification for not testing for TEH (i.e., if the questions “TEH-diesel required?” and/or “TEH-waste oil required?” were answered “No”). If “Groundwater encountered?” was

answered “No,” explain why. Additional justification may be provided for responses given in “Tier 2 Data Before Modeling,” if necessary for clarification. Justification must be provided for any ignored data.”

Tier 2 Data Before Modeling Justification

Date	Justification
10/09/2020	Subsequent to the OE, additional soil samples were "ignored": H@9', 14@8', B14@8R, BH-100@6', BH-100@7', BH-100R, J@9', BH-10 & BH-11.
05/06/2017	The USTs at the site have been reported to have stored only gasoline. Some of the groundwater samples have been analyzed to contain diesel and waste oil at concentrations greater than the target level for groundwater ingestion. Waste oil and diesel in groundwater have been found above target levels, therefore groundwater TEH waste oil and diesel analysis are required. There are no records of diesel or waste oil at the site and numerous other soil and groundwater samples from the site have been analyzed and determined to contain no TEH above the minimum detection limits. Soil samples at the site have never been analyzed for the presence of TEH diesel or waste oil. As a result of this, contouring the soil TEH diesel or waste oil plumes for the purposes of general contouring or Sw & W measurements is not possible. In a letter dated July 15, 1994, Roger Davis, stated that the groundwater treatment system treated approximately 30 million gallons of contaminated groundwater from October 1988 through June 1993. As required by the DNR, our company has ignored all groundwater analytical data in the Tier 2 software prior to June 1993.

For “Site Hydrogeology Justification,” the Tier 2 Guidance says, “Explain which points or contours were used to determine the gradient at the site. If the main plume migration and groundwater flow are not in the same direction, or if they are multidirectional, explain how the MAIN PLUME/FLOW was determined. Explain how the RANGE of PLUME/FLOW was determined. If source dimensions other than those determined by application were used, explain why. If soil parameters other than the defaults are used for modeling, explain how these soil parameters were obtained.”

Site Hydrogeology Justification Section

Date	Justification
05/06/2017	Hydraulic Gradient: Three sets of monitoring wells were used to compute the hydraulic gradient with the following results: MW-2 to MW-8 I = 0.006 MW-16 to MW-12 I = 0.0002 MW-15 to MW-9 I = 0.012 These sets of wells were picked because they appeared to be representative of the hydraulic gradient at the site. The average of these results (0.006) was used for the Tier 2 modeling. Hydraulic Conductivity: Our company performed slug tests on MW1 and MW6 for a phase II investigation in 1987. Values were calculated at 2x10-3 to 3X10-3 centimeters per second, or 0.023 to 0.043 meters per day. On June 13, 1996, our company personnel attempted to perform slug tests on MW2 and MW9. Each well was pumped for at least 15 minutes with no notable drawdown. The quick recovery of the wells, as well as the sand sediments, suggests that the hydraulic conductivity at the site is well above 0.44 meters per day.

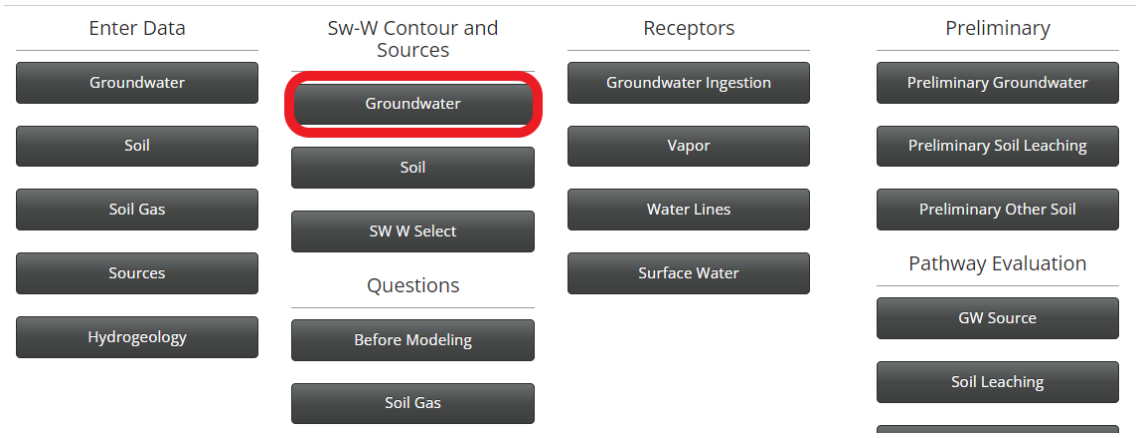
Don’t forget to “Save” all data.

7. SOURCE WIDTH (SW) AND SOURCE LENGTH (W) CONTOURING

The analytical mass transport models used for soil leaching to groundwater and groundwater contaminant transport require values for size of source of contamination: a source width (Sw) and a source length (W) for groundwater and soil contamination. The Tier 2 estimation method involves contouring the soil and groundwater concentrations. Source width and length estimation is discussed in the Tier 2 Guidance. The application provides tools for estimating source width and length.

7.1 Groundwater Source Width and Length Estimation

Click the “Groundwater” in the “Sw-W Contour and Sources” frame to activate the “Groundwater: Source Width (Sw) and Source Length (W) Contouring” form.

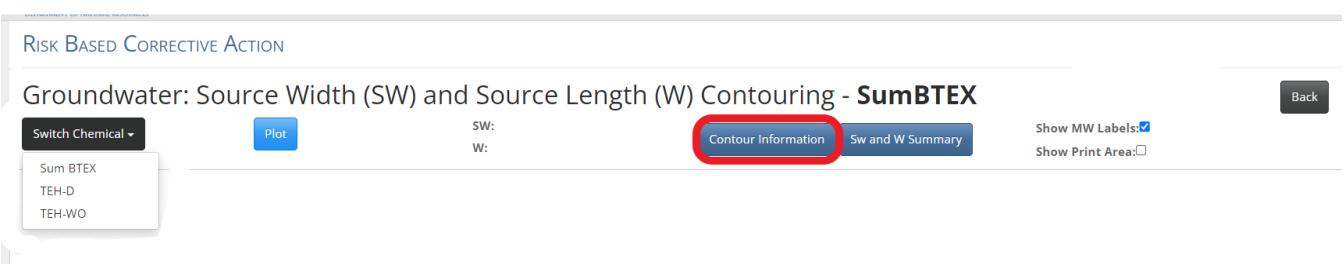


The application automatically sums the BTEX concentrations for the groundwater data and applies a criteria (maximum of two most recent or steady and declining) to assign a Sum BTEX value to each location. In essence, Sum BTEX is treated like another chemical.

The chemical to be contoured is selected using the drop-down list box beneath the "Switch Chemical" label. The options are Sum BTEX, TEH-D, or TEH-WO.

Interpolation Range

Click the "Contour Information" frame. The "Interpolation Range" frame shows the range of sample locations (Minimum X, Maximum X, Minimum Y, Maximum Y), grid spacing, and the concentration to be contoured. The concentration contoured for Sw-W estimation is specified by rule to be 50% of the maximum. Also shown is the minimum radial distance between sample locations, "Minimum distance between data." The interpolation range is used to tell the application the range and resolution to use when interpolating concentrations between the measured chemical concentrations in groundwater. It is up to the user to input interpolation range information, and to modify the range as needed to achieve an acceptable plot.



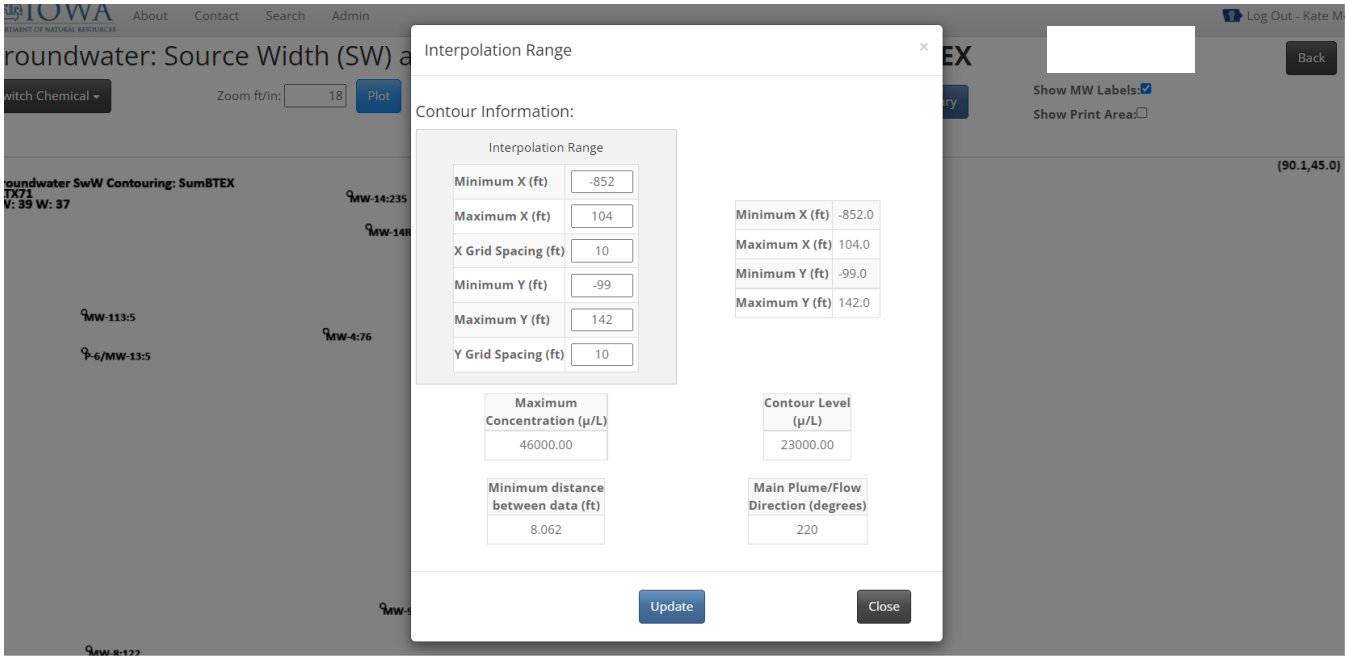


Figure 3 is an example of an interpolation grid for the following settings:

Minimum X (ft)	Maximum X (ft)	X Grid Spacing (ft)	Minimum Y (ft)	Maximum Y (ft)	Y Grid Spacing (ft)
0	90	10	-30	100	10

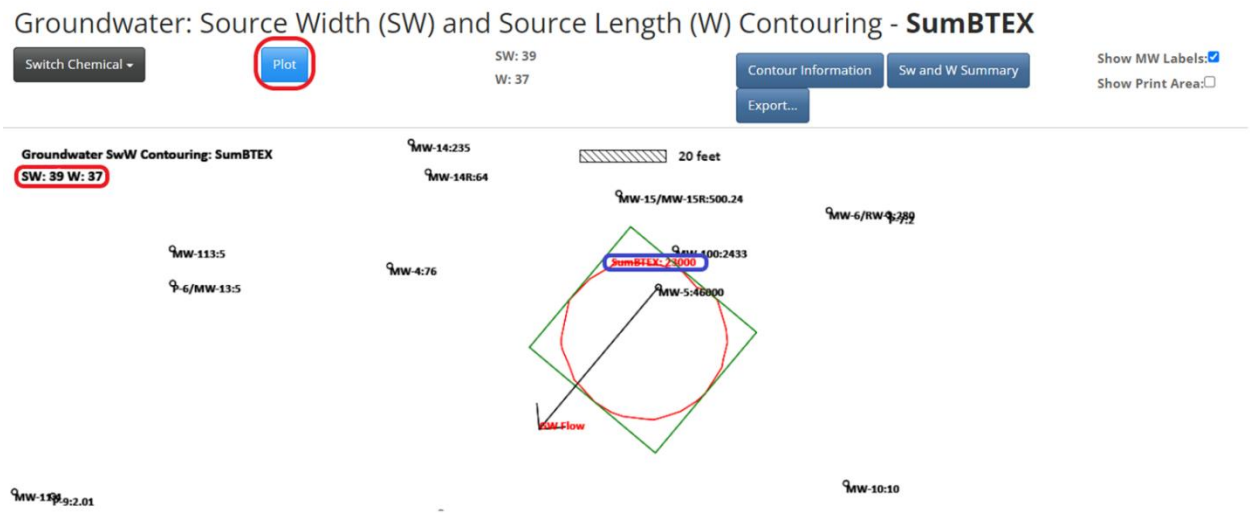
Using the measured groundwater concentrations and their locations, an interpolation method (by Roland Hardy) is used to fit a function to the data that matches the measured concentrations at their locations. This function is used to estimate (interpolate/extrapolate) concentrations at every grid point (the points where the grid lines intersect). It is analogous to generating additional concentration data at grid points consistent with the actual measured concentrations (as measured by a defined, but selected, mathematical function). In addition to the grid intersection points, interpolated values are also generated at the center point of each cell, shown by the grid detail in Figure 3.

The finer the grid (i.e., smaller grid spacing), the more points interpolated and the smoother the contoured curve. The trade-off is computational effort. Interpolation of each point requires a certain amount of computational time (the time increases with the number of actual data points). If you double the number of interpolation points, the computation time required for interpolation will double. Also, the problem is two- dimensional (x,y). If the x and y grid spacing are both decreased by half, the number of grid points (and associated computational time) will increase by four times.

It is not necessary to match the X or Y range of the data exactly. For example, if the Minimum X is -32, entering -40, -50, -100, etc. is acceptable. The application uses the interpolated concentrations at the grid points to track, or trace out, lines of equal concentration (contour lines).

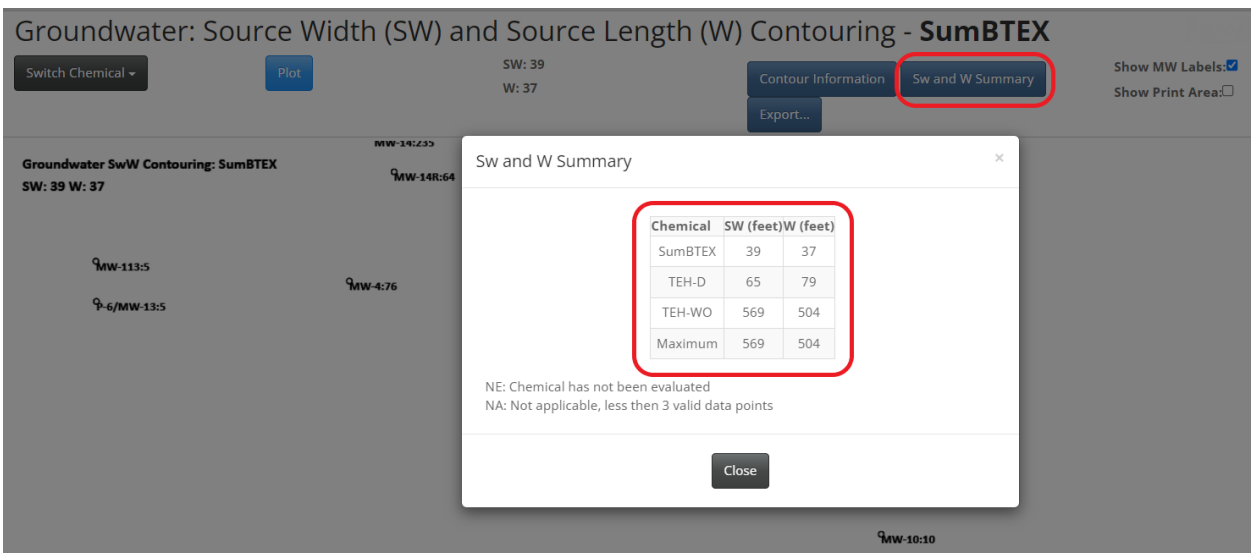
Click “Plot.” The application will perform the interpolation calculations and track the contour lines, then show the plot on the screen.

The application plots a contour for 50% (11,500) of the maximum Sum BTEX (23,000). The application draws a rectangle around the contour, with one of the axes oriented parallel to the direction of groundwater flow. Shown at the top of the form is Sw (39 feet), which is the width of the contour perpendicular to the groundwater flow direction (width of the box perpendicular to the groundwater flow direction). Also shown is W (37 feet), which is the length of the contour parallel to the groundwater flow direction (width of the box parallel to the groundwater flow direction).



Summary

Click the "Sw and W Summary" button. This brings up a summary table of the results. The application stores the information displayed.



7.2 Soil Source Width and Length Estimation

Source width and length estimation for soil source is similar to groundwater. Click the "Soil" button in the "Sw-W Contour and Sources" frame to activate the "Soil: Source Width (Sw) and Source Length (W) Contouring" form. Repeat the steps as for Groundwater Source.

7.3 Setting Soil and Groundwater Source Width and Length

The application does not automatically use the values generated by groundwater source width and length estimation and soil source width and length estimation. You must specify the Sw and W values the application will use for Tier 2 and SMR analysis. In most cases, you will use the values generated by the application, but to allow for exceptions you must input the Sw and W values.

Click the "Sw W Select" button in the "Sw-W Contour and Sources" frame to activate the "Source Width and Length Selection" form. The two tables on the left of the form summarize the results from contouring Sw and W for groundwater and soil in the Tier 2 application. The table on the upper right, "Width and Length Contour Results," shows the maximum Sw and W for groundwater and soil found via the application (i.e., the maximum in each column for the tables on the left side of the form).

Source Width and Length Selection

GW Contoured Width and Length

Chemical	SW (feet)	W (feet)
SumBTEX	39	37
TEH-D	65	79
TEH-WO	569	504

Soil Contoured Width and Length

Chemical	SW (feet)	W (feet)
SumBTEX	52	38
TEH-D	NE	NE

Width and Length Contour Results

Source	SW (feet)	W (feet)
Groundwater	569	504
Soil	52	38

Site Source Width and Length for Modeling

Source	SW (feet)	W (feet)
Groundwater		
Soil		

Insert Contoured Results

In many situations, the values shown in the upper right table will be the appropriate ones to use for the Tier 2 analysis. To use these values, click the "Insert Contoured Results" button, and the values in the upper right table will be inserted as the Sw and W values in the lower right table.

If necessary, you can directly type Sw and W values into the lower right table. The values in the lower right table will be used for modeling. You must enter values into the table, either by using the "Insert Contoured Results" button or by typing in values. The application does not automatically update the values. If, for example, you later entered some TEH-WO data and needed to use the data as part of Sw-W contouring, you would need to do the Sw-W contouring and return to this form to update, if necessary, the site Sw-W values.

7.4 Adjustments to Sw-W Contouring Results

There are situations where you may need to modify the Sw-W values determined by the application. Two situations which might occur are: 1) there is no definitive flow direction (the range of plume flow is 150 degrees) or 2) there are multiple contour lines. We will examine these situations.

No Definitive Flow Direction

You are required to enter a main plume/flow direction, even if the range of plume flow is 150 degrees. The main plume/flow direction is used by the application to estimate Sw-W in Sw-W contouring (sets the orientation of the rectangular box). However, in this situation, the Sw-W estimated by the application may not be appropriate. Figure 4 shows an example for this situation. In this example, the range is 150 degrees, and you need to use the maximum length of the plume for both Sw and W (see the Tier 2 Guidance), not the dimensions estimated by the application based on the main plume/flow direction. You will need to manually determine the Sw-W values from a print out of the plot, rather than using the application determined values. The maximum length (Figure 4) looks to be about 94 feet, and Sw = W = 94 feet for TEH-D for this situation.

In this situation, you would apply the same procedures for each chemical and manually determine the maximum Sw and W for groundwater and soil. You would then directly input your manually-determined Sw and W values for groundwater and for soil into the application.

Multiple Contour Lines

When the application contours 50% of the maximum for Sw-W, in some situations more than one closed contour line may result. In this situation, the application estimates Sw-W from the total spread, which may not be appropriate (there are cases where the result is appropriate if the plumes overlap).

Figure 5 is an example for this situation. This example has produced two separate plumes. It is assumed there is a definite groundwater flow direction. Sw can be viewed as the width of plume(s) perpendicular to the groundwater flow direction, and W as the width of plume(s) parallel to the groundwater flow direction. The use of this approach for estimating Sw and W is shown in Figure 5. Sw is estimated as 59 feet and W is estimated as 58 feet, instead of 89 and 90 feet, respectively, as estimated by the application.

For the chemicals where such a situation occurs, you need to calculate Sw and W from the plots as needed, and

manually enter the maximum Sw and W values for groundwater and for soil.

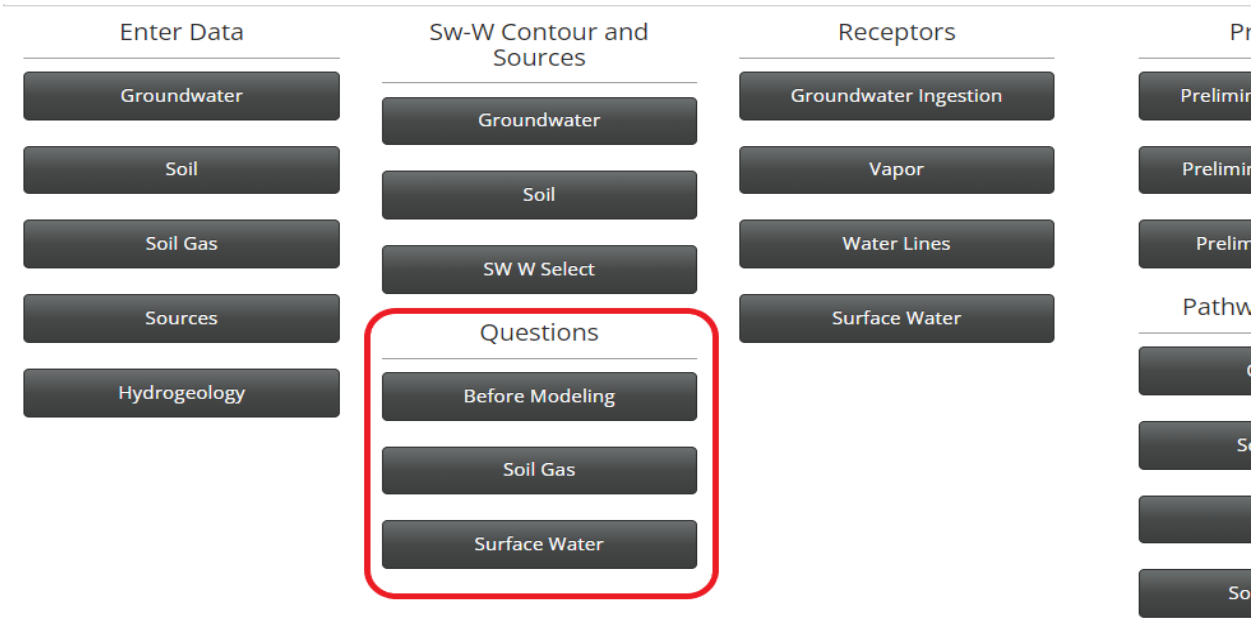
For the case of multiple plumes *and* no definite flow direction, determine the maximum length for each plume, add the lengths together, and use the resulting value for Sw and W.

8. RECEPTOR TYPE EVALUATION REQUIREMENTS

The RBCA process and rules are fairly complex. It can be difficult to determine the receptor types you need to evaluate. For example, even if you have a no action required classification for a pathway at Tier 1, you may still need to evaluate the pathway at Tier 2. The Tier 2 application determines the receptor types you need to evaluate for your site, based on your answers to some questions, soil and groundwater data, policy, and modeling. The results are output as the "Preliminary Pathway Evaluation Requirements" in the Tier 2 SCR.

8.1 Questions

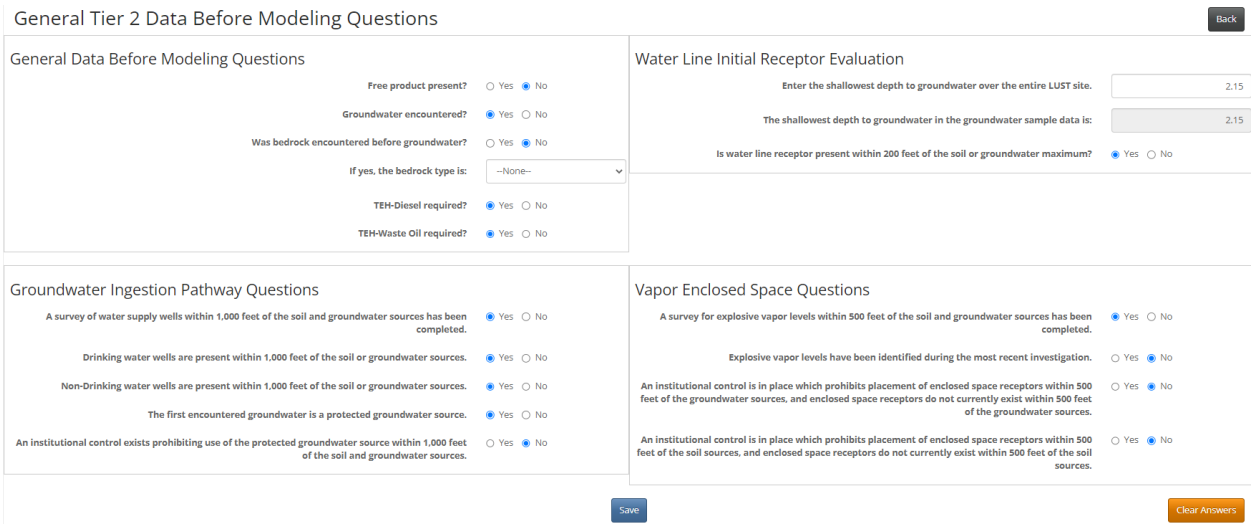
The buttons in the "Questions" frame on the "Main Form" access the questions used to determine the receptor types you need to evaluate. You <u>must</u> answer all the questions to ensure you get the correct results. Your responses are displayed in the "Tier 2 Data Before Modeling" printout in the Tier 2 SCR.



General

Click the "Before Modeling" button in the "Questions" frame to activate the "General Tier 2 Data Before Modeling Questions" form. For our example, the following answers have been selected:

Free Product Present: No
Groundwater Encountered: Yes
Was bedrock encountered before Groundwater: No
TEH-Diesel required: Yes
TEH-Waste Oil required: Yes



Bedrock

Note that if you answer YES to "Was bedrock encountered before Groundwater" for your site, you may have a "Bedrock" site. A "Bedrock" site has different procedures and may need to be evaluated using separate bedrock software instead of the application. If bedrock is encountered before groundwater you need to check the rules and guidance to determine if you should be performing a "Bedrock" analysis. In the Rules, bedrock assessment is covered in detail under 135.10(3), Bedrock Assessment. In Tier 2 Guidance, bedrock assessment is discussed in detail in Chapter 4, Bedrock Assessment. If bedrock is encountered before groundwater and your site is not "exempt granular" (see Tier 2 Guidance for definitions), you should not be using this application to evaluate this site. There is the Tier 2 Bedrock Version 1.20 software for evaluating "granular" and "nongranular" bedrock sites. If your bedrock site does qualify as "exempt granular," then you should use the Tier 2 application to evaluate the site.

Groundwater Ingestion

The responses in this form are used, along with source concentrations and modeling results, to determine whether the drinking water well type, non-drinking water well type, or protected groundwater source type need to be evaluated for groundwater or soil leaching.

For our example, the questions are answered as shown below:

Well Survey: Yes
Drinking Water Wells: Yes
Non-Drinking Water Wells: Yes
Protected Groundwater Source: Yes
Institutional Control: No

Important:

IAC 567-135.2 defines a "protected groundwater source" as a saturated bed, formation, or group of formations that has a hydraulic conductivity of at least 0.44 meters per day (m/d) and a total dissolved solids of less than 2,500 milligrams per liter (mg/l) or a bedrock aquifer with total dissolved solids of less than 2,500 milligrams per liter (mg/l) if bedrock is encountered before groundwater. You must answer the question for protected groundwater source, even if you have entered the hydraulic conductivity and total dissolved solids in the Hydrogeology form. The application does not automatically determine whether the first encountered groundwater is a protected groundwater source. The application uses your "Yes" or "No" answer to the Protected Groundwater Source question to determine whether a protected groundwater source is present. There are cases, "exempt granular" bedrock for example, where the first encountered groundwater is considered a protected groundwater source, even if K is <0.44 m/day.

Vapor to Enclosed Space

Move to the "Vapor Enclosed Space Questions" form.

Explosive Vapor Survey (See the Tier 2 Guidance, Explosive Vapor Survey)

As stated in the Tier 2 Guidance: “An explosive vapor survey should be conducted, at a minimum, in the nearest subsurface enclosed spaces in all directions from the source and in any places with a history of vapor problems. Enclosed spaces for the purpose of the explosive vapor survey include buildings with basements, storm and sanitary sewers, and underground utility vaults.”

For our example the questions have been answered as shown:

Explosive Vapor Survey: Yes
Explosive Vapors Identified: No
Institutional Control, Groundwater Vapor: No
Institutional Control, Soil Vapor and Soil Leaching: No

Water Line

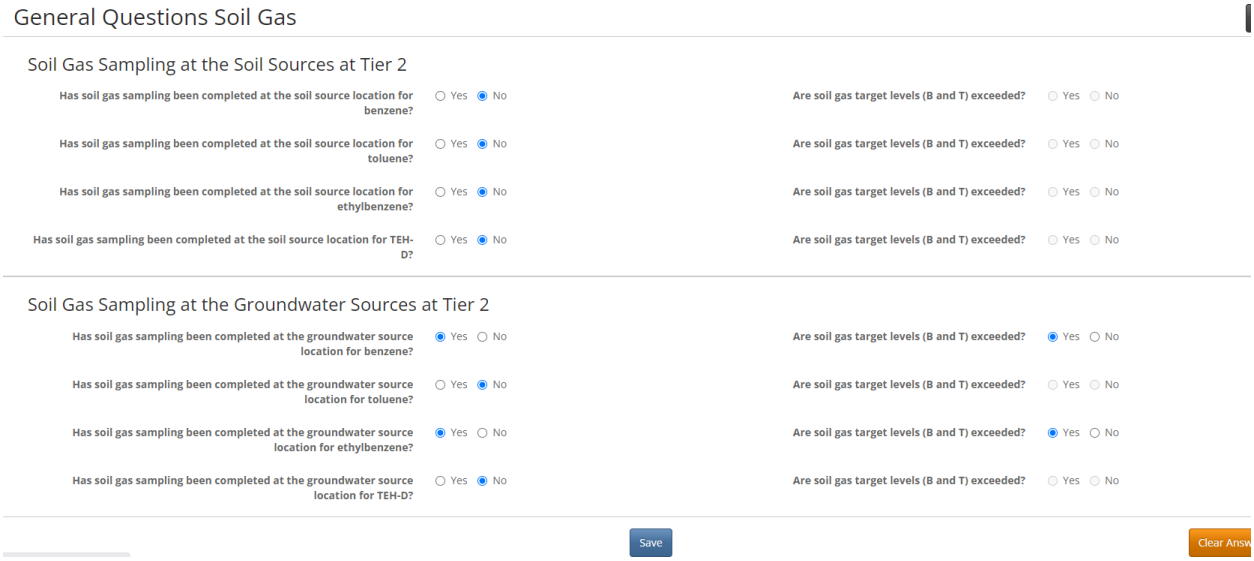
Move to the “Water Line Initial Receptor Evaluation” form.

The application searches through the groundwater sample data you have entered to determine the shallowest measured depth to groundwater below the ground surface, and displays the result as “The shallowest depth to groundwater in the groundwater sample data is….” You need to enter the shallowest measured depth to groundwater (from the ground surface) over the LUST site. If you have other data not entered as part of the groundwater data showing a shallower depth to groundwater, you should enter such information as the shallowest depth. If you have such data, you could also enter the data as groundwater sample data, even if no chemical concentrations were measured (use N), and the data will be used in calculating the shallowest depth to groundwater. In any case, you must enter a shallowest measured depth to groundwater (measured from the ground surface). The application uses the entered value to evaluate the potential water line receptors.

For our example, we have used the shallowest depth to groundwater found in the groundwater data, 2.15 feet. Also, for our example, the response to the statement, “A water line is present within 200 feet of the soil or groundwater maximum,” is “Yes.”

Soil Gas

Click “Soil Gas” button in the “Questions” frame on the “Main Form.” Your answers are used to determine whether or not you will need to evaluate vapor receptors for soil vapor or soil leaching to groundwater at Tier 2. That is, you are indicating whether or not you have passed vapor sampling criteria at a soil source at Tier 2. These questions are for soil gas sampling at the soil and groundwater source at Tier 2. If you perform soil gas sampling at soil sources after you have completed and submitted your Tier 2, you should identify the results in the SMR application, not here.

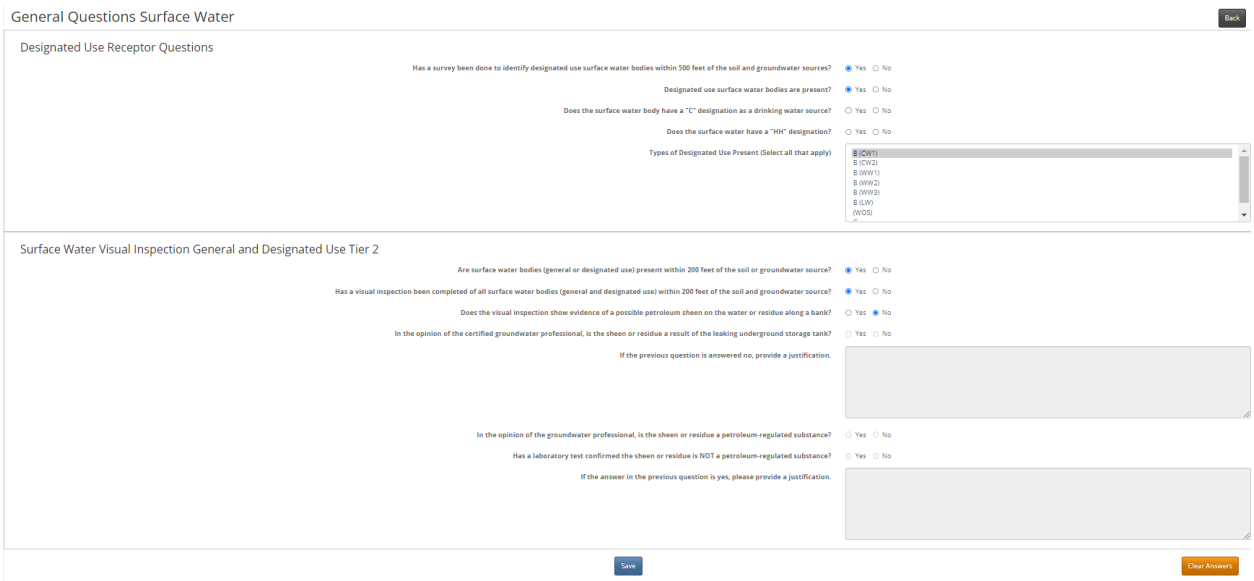


The application does not determine, based on your vapor samples, the answers to these questions, nor does it check your answers against the vapor data you have entered. See the Tier 2 Guidance for information on vapor sampling and the required criteria for passing. You have to determine whether you have passed vapor sampling criteria at the soil and groundwater sources.

If you have passed vapor sampling criteria at the sources at Tier 2 you must answer both questions to have the application recognize you have passed. For example, you must answer "Yes" to, "Soil Gas sampling has been completed at the groundwater source location for benzene," and "No" to "Are soil gas target levels (B and T) exceeded," to receive credit for passing vapor at the benzene groundwater source. If you answer "No" to "Soil Gas sampling has been completed at the groundwater source location for benzene" and "No" to "Are soil gas target levels (B and T) exceeded," the application will assume you have not passed vapor sampling at the soil source for that chemical.

Surface Water

Click the "Surface Water" button in the "Questions" frame on the "Main Form." For more information on Surface Water Bodies, refer to the Tier 2 Guidance.



A survey is required to identify any designated use surface water bodies within 500 feet of the sources. If designated use receptors are present within 500 feet, you should identify the types of designated uses surface water bodies present.

For our example the answers are as shown below:

A survey has been done…: Yes
Designated use surface water bodies are present: Yes
Type Present: B(CW1)

Visual inspection is required of both general use and designated use water bodies.

For our example the questions are answered as shown:

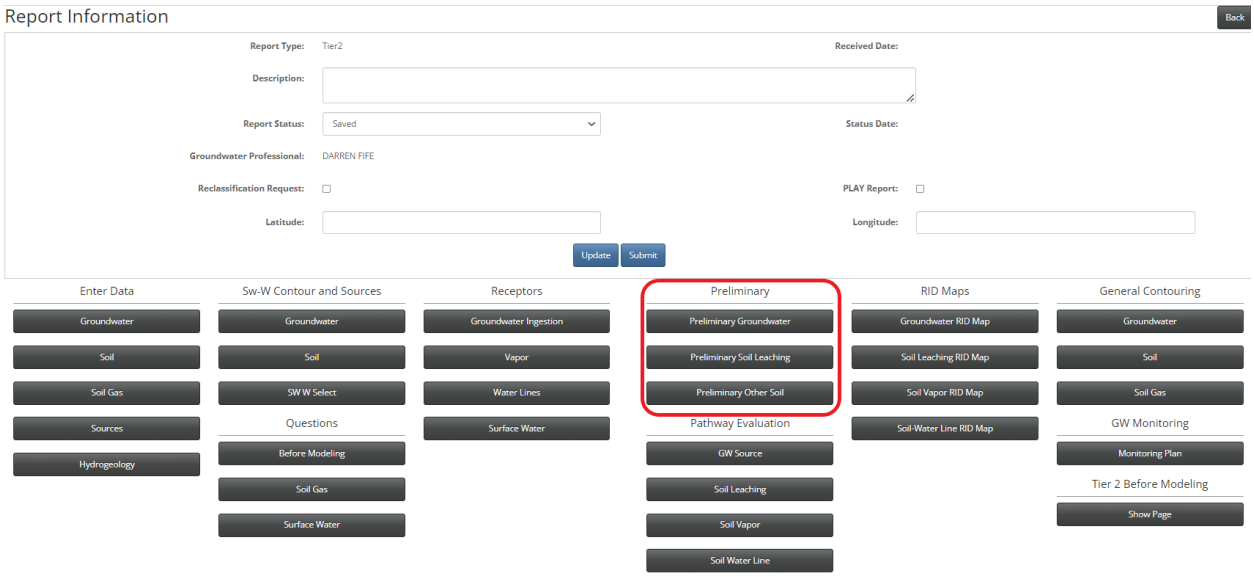
Are surface water bodies (general or designated use) present within 200 feet…: Yes
Has a visual inspection been completed of all surface water bodies…: Yes
Does the visual inspection show evidence of a possible petroleum sheen…: No

If a petroleum sheen is present, provide justifications in the appropriate Justification boxes in this frame.

8.2 Preliminary Pathway Evaluation Requirements

The "Preliminary Pathway Evaluation Requirements" are an integral part of the Tier 2 application. They identify the "Receptor Types" you must evaluate for your site. It is important you complete the "Preliminary Pathway Evaluation

Requirements” before you generate “Receptor Identification Plumes” and identify receptors.



The results are valid only if you have input the required information. In order for the results to be valid, you need to have:

- Entered all groundwater, soil and vapor data.
- Specified groundwater and soil data adjustment, if needed.
- Completed the data in the hydrogeology form.
- Determined and entered Sw-W values for groundwater and soil.
- Correctly answered all questions contained in the “Questions” frame.

These tasks have been completed for the example problem.

Click the individual buttons in the “Preliminary” frame to activate the “Preliminary Pathway Evaluation Requirements” forms for groundwater, soil leaching and other soil pathways.

Preliminary Pathway Evaluation Requirements Groundwater

Legend

Pathway	Receptor Description	Receptor Tag	Evaluate	B	T	E	X	TEH-D	TEH-WO
Groundwater Ingestion	Drinking Water Wells	DWW	X	X	X	X	X	X	S<TL
	Non Drinking Water Wells	NDWW	X	X	X	S<TL	S<TL	S<TL	S<TL
	Protected Groundwater Source	PGWS	X	X	X	S<TL	S<TL	S<TL	S<TL
Vapor	Confined Space Residential	CSR	X	X	X	X (FSG)	N/A	S<TL	N/A
	Confined Space Non-Residential	CSNR	X	X	S<TL	X (FSG)	N/A	S<TL	N/A
	Sanitary Sewer Residential	SSR	X	X	S<TL	X (FSG)	N/A	S<TL	N/A
	Sanitary Sewer Non-Residential	SSNR	X	X (FSG)	S<TL	N/A	N/A	S<TL	N/A
Water Lines	PVC or Non-Resistant Gasket Iron Mains	WLA	X	S<TL	X	S<TL	S<TL	S<TL	S<TL
	PVC or Non-Resistant Gasket Iron Service Lines	WLB	X	X	X	S<TL	S<TL	S<TL	N/A
	PE/PB/AC Mains or Service Lines	WLC	X	X	X	S<TL	S<TL	S<TL	N/A
	Non-Receptor Water Lines	WLD	CNE	N/A	N/A	N/A	N/A	N/A	N/A
	Water Line Taps	WLE	CNE	N/A	N/A	N/A	N/A	N/A	N/A
Surface Water	Cold Water Aquatic Life Type 1	B (CW1)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	Cold Water Aquatic Life Type 2	B (CW2)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	Warm Water Type 1	B (WW1)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	Warm Water Type 2	B (WW2)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	Warm Water Type 3	B (WW3)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	Lakes and Wetlands	B (LW)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	Water of the State	(WOS)	NAR	RNP	RNP	RNP	RNP	RNP	RNP
	General Use	(GU)	NAR	VIP	VIP	VIP	VIP	VIP	VIP
	Drinking Water Source	C	NAR	RNP	RNP	RNP	RNP	RNP	RNP

If there is an “X” for any chemical for a receptor type, the receptor type needs to be evaluated for that source. That is, you need to generate a receptor identification plume for that source type and receptor type, and determine if any receptors are present at your site.

If a chemical does not need to be evaluated (symbol other than an X), a reason the chemical does not need to be

evaluated is indicated. Clicking the “Legend” button in the upper right corner of the screen provides descriptions of the symbols in the table. For example, X (FSG) symbol means “Evaluation required, failed soil gas at source”

Another example, symbol “NSC” (No Source Concentration for the chemical) is based on whether sample data (groundwater or soil) has been entered for a chemical. The application does not check whether sample data should have been entered for a chemical. For example, if you answered TEH-D data is required, but have not entered TEH-D data, NSC will still be shown. <u>It is up to you to ensure you have entered the required soil or groundwater data.</u>

The results in the “Preliminary Pathway Evaluation Requirements” table are based in part on:

- Comparing source concentrations to the minimum default target levels for a receptor type.
- Computing vertical soil leaching and comparing the modeled groundwater concentrations at the soil sources to the minimum default groundwater target levels.
- Answers to “Questions” (e.g. for vapor receptors, if you indicated you passed vapor sampling at a source.)

Having to evaluate a receptor type does not mean you will have receptors of that type. It means you must follow procedures to determine whether you have receptors of that type.

9. RECEPTOR IDENTIFICATION

After you determine the receptor types you need to evaluate, the “Receptor Identification Plumes” (RID Maps) are used to identify the receptors of that type, if any, for your site. You enter the identified receptors into the application using buttons in the “Receptors” frame (refer to the Entering Receptors section).

The buttons to reach the receptor identification plumes are grouped together in the “RID Maps” frame on the “Main Form.”

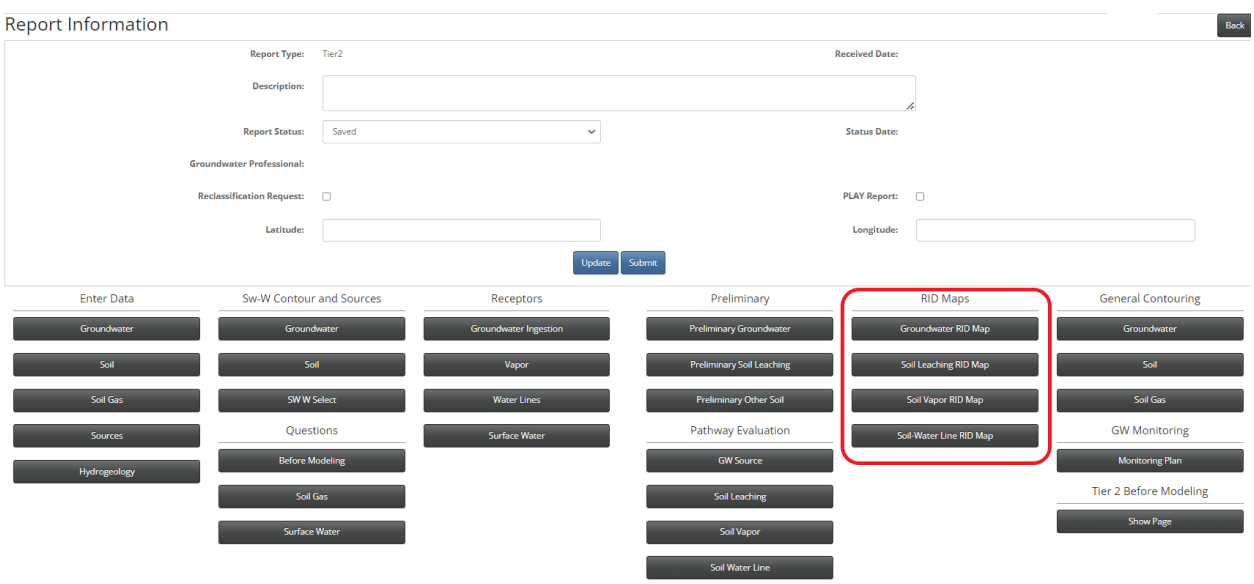


Table 1 shows an example of the “Preliminary Pathway Evaluation Requirements.” We will illustrate receptor identification for:

- Non-Drinking Water Wells
- Protected Groundwater Source
- Confined Space, Residential and Nonresidential
- Sanitary Sewer, Residential and Nonresidential
- Water line
- Surface Water Body

For the following source pathway types: Groundwater, Soil Leaching, Soil

The sequence you use for receptor identification does not matter. For example, you could decide to do receptor identification for soil leaching first.

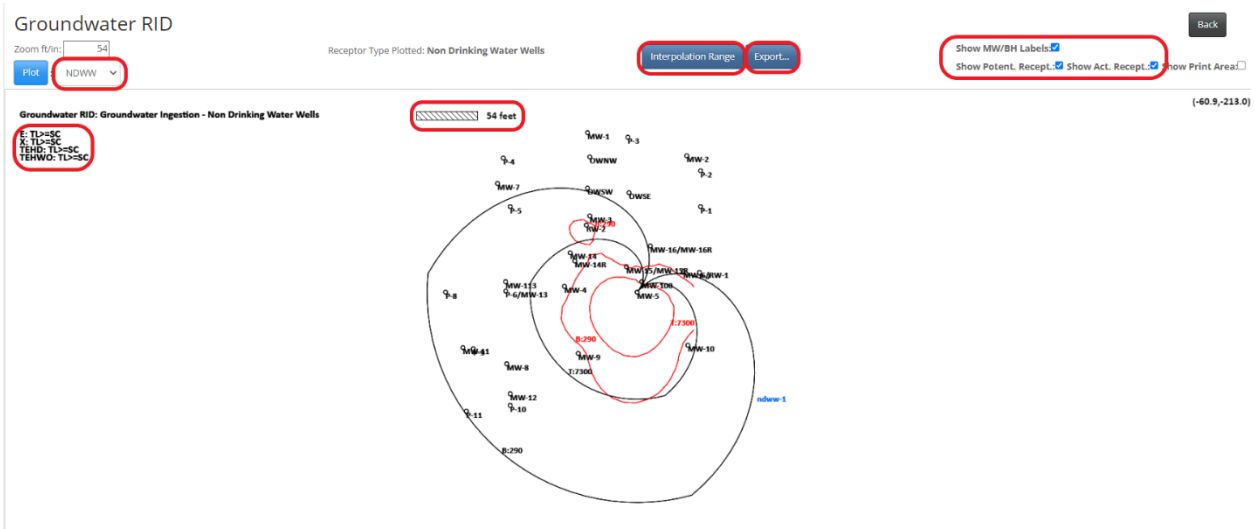
The application generates a receptor identification plume based on groundwater or soil data, not based on whether you have to evaluate the receptor type according to the "Preliminary Pathway Evaluation Requirements." For example, the application may generate a receptor identification plume for protected groundwater source, even if the first encountered groundwater is not a protected groundwater source. Or, the application may generate a receptor identification plume for confined space residential receptors, regardless of whether or not you have passed vapor sampling.

Whether you need to identify receptors of a type (need to generate a Receptor Identification Plume) for a pathway should be based on the "Preliminary Pathway Evaluation Requirements" for the pathway, not on whether the application will plot a "Receptor Identification Plume" for the receptor type.

9.1 Groundwater Pathways, Receptor Identification Plumes

The receptor types you need to evaluate for groundwater pathways are shown under "Groundwater Pathways" in the "Preliminary Pathway Evaluation Requirements" Table 1.

Click "Groundwater RID Map" in the "RID Maps" frame, to activate the "Groundwater RID" form. This form is used to generate a "Receptor Identification Plume" for each "Receptor Type" you need to evaluate under "Groundwater Source."



The receptor identification plumes for groundwater plot simulated and interpolated groundwater concentrations, contoured to the target levels for the receptor type. If you are required to evaluate a receptor type for the pathway, you need to overlay the receptor identification plume on your site map. If a receptor of that type is present and in the receptor identification plume, it is a receptor for your site and needs to be entered into the application. If a receptor of the type is present, but does not fall within the receptor identification plume, it is not a receptor for the site and does not need to be entered into the application.

Use the drop-down list box in the upper left corner of the "Groundwater RID" form to select a receptor type. Select "NDWW" (Non-drinking water wells). Adjust, if necessary, "Interpolation Range" and grid spacing to make sure the contour lines close on the plot.

Click "Plot." The application will plot, if possible, the simulated and contoured target levels for all the chemicals of concern, using the default or Tier 1 target levels for the receptor type. For non-drinking water wells the groundwater target levels are:

Groundwater Target Levels for Non-Drinking Water Well Receptors (µg/L)

Benzene	Toluene	Ethylbenzene	Xylenes	TEH-D	TEH-WO
290	7,300	3,700	73,000	75,000	40,000

If a chemical cannot be contoured or simulated, a reason is indicated in the upper left-hand corner of the plot. The reasons for not contouring a chemical are given in red, followed by the reasons for not simulating a chemical in black. For example, ethylbenzene (E: TL>=SC) is not contoured or simulated because the target level (3,700) is greater than the source concentration.

The contours simulated by the Tier 2 groundwater contaminant transport model are shown in black. The contours from interpolation of the actual groundwater sample data are shown in red.

You can click the option buttons in the "Show MW/BH Labels" frame to toggle the display of monitoring well labels. For our example NDWW-1 is shown on the plot. For a new site, no receptors would be shown. You can choose to show actual and potential receptors by checking the corresponding boxed in the upper right corner of the form.

The "Receptor Identification Plume" is used to identify receptors. Any non-drinking water well (NDWW) on or within the simulated <u>or</u> contoured plumes is a non-drinking water well receptor. You will need to overlay the receptor identification plumes on your site map to identify the appropriate receptors.

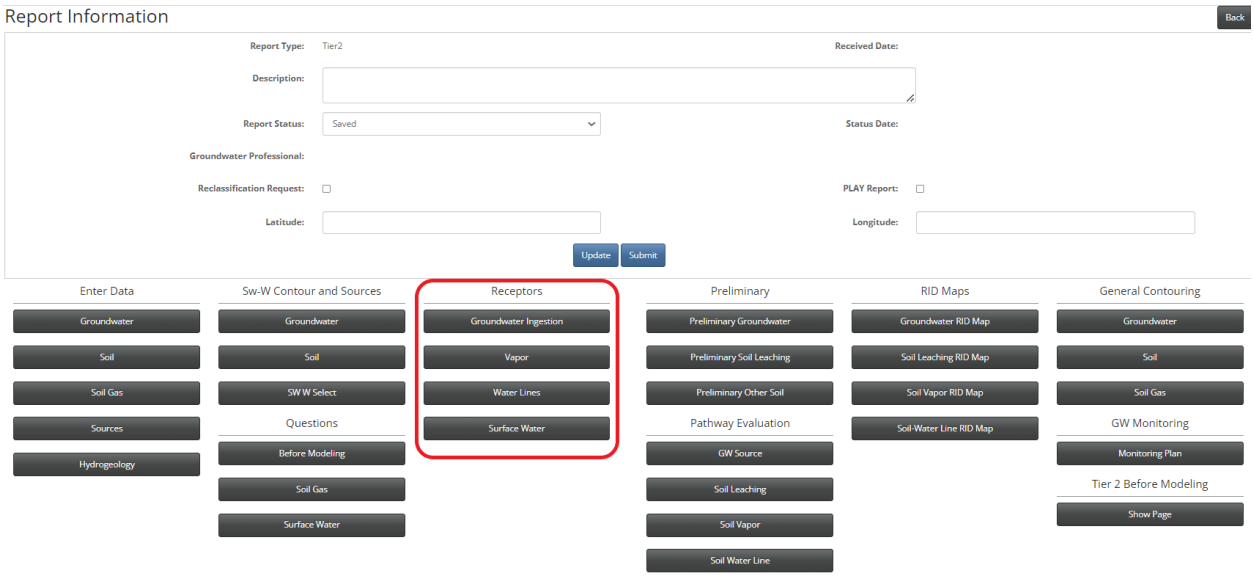
You can send the "Receptor Identification Plume" directly to your printer. You can also save the plot to a PDF file or to an AutoCAD® compatible DXF file using "Export" button and then import the DXF file into your CAD application to overlay on your site map. Ensure the appropriate scale of the RID plume to correspond to the scale of the site map.

To continue our example, Figure 6 shows the groundwater source receptor identification plume for non-drinking water wells overlain on our example site. All the plumes in this User's Manual, shown overlain on the example site, were generated by saving the receptor identification plume as a DXF file, then merging the DXF file with a CAD drawing for the example site.

We will assume we have checked for all non-drinking water wells, using a plot at a smaller scale, and the only non-drinking water well found within the plume is shown on Figure 6. The non-drinking water well receptor located at (40, -45).

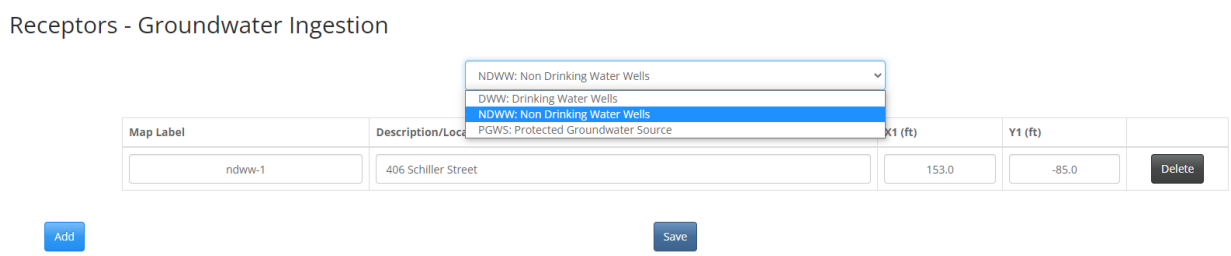
Entering Receptors

When working with your site you may wish to identify all the receptors within the actual/RID plumes first, and then enter them into the application. All receptors are entered into the application using the buttons in the "Receptors" frame.



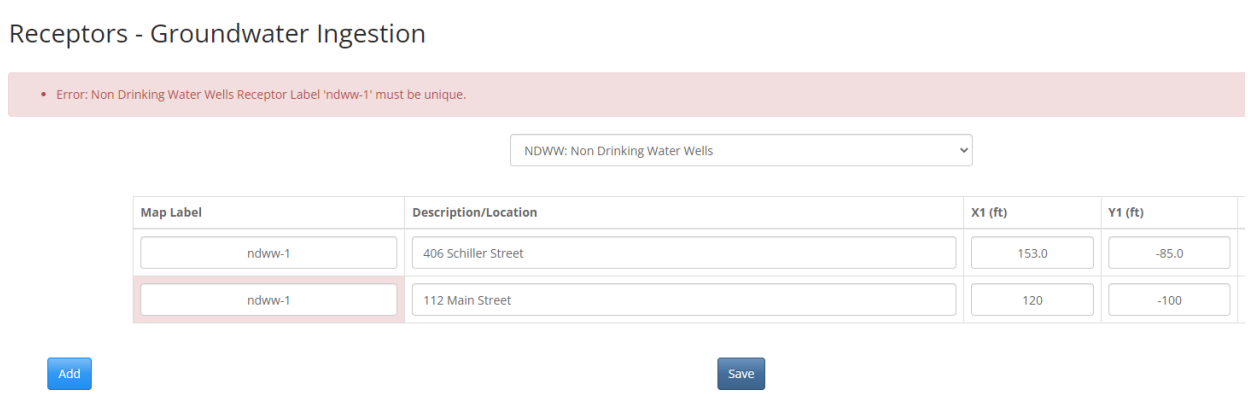
Click the “GW Ingestion” button in the “Receptors” frame to activate the “Receptors - Groundwater Ingestion” form. The form is used to enter drinking water well (DWW), non-drinking water well (NDWW), and protected groundwater source (PGWS) receptors.

The “Receptor Type” is selected from the drop list box. Select “NDWW: Non-Drinking Water Wells” in the dropdown list box, and the grid appears for non-drinking water well receptors.



A receptor should only be entered once, even if it falls in the receptor identification plume for more than one pathway. However, a receptor identified by any receptor identification plume must be entered in the application.

Use unique receptor labels:
The short label you assign to each receptor should be unique. No two receptors should have the same short label. If you have duplicate short labels, the application will not allow to save data and an error appear indicating that a duplicate name exists.



To emphasize, the short label for every receptor entered into the application should be unique. The short label is used

on plots and in tables. The difference in short labels can be minor (i.e., NDWW-1, NDWW-2, NDWW-a, etc.), but no two receptors should have the same short label. This applies both to receptors of the same type and to different receptor types.

The long label should be descriptive and does not have to be unique. **You should not use a quote (“) in any information you enter in the Tier 2 application.**

Don’t forget to “Save” the data.

Protected Groundwater Source: PGWS
Click “Groundwater RID Map” in the “RID Maps” frame, to activate the “Groundwater RID” form.

Use the drop-down list box in the upper left corner of the “Groundwater RID” form to select a receptor type.

Select “PGWS.” Click “Plot” to generate the “Groundwater Source Receptor Identification Map” for “Protected Groundwater Source.” “Protected Groundwater Source” has the same target levels as non-drinking water well, so the receptor identification plumes are the same. Figure 7 shows the receptor identification plume for groundwater ingestion to protected groundwater source (PGWS) overlain on the site.

A PGWS is a potential receptor. All areas within the receptor identification plume not subject to an institutional control prohibiting use of the PGWS are points of exposure. The source is a potential area of exposure, unless an institutional control is in-place.

Source locations are automatically evaluated by the application as points of exposure for potential receptors. You should not input the source locations (as shown using the “Sources” button in the Main Form) as the location for a potential receptor (i.e., you should not input a PGWS receptor at a source location).

The Tier 2 application automatically evaluates the protected groundwater source receptor type for two situations:

1. No institutional control is in-place, and the source locations for each chemical are potential points of exposure. This will happen regardless whether or not you enter any PGWS receptors into the application.
2. An institutional control is in-place between the source location for each chemical and the PGWS receptors you have input. This means the PGWS is evaluated using only the PGWS receptors you have entered into the application (source locations are assumed to be covered by an institutional control).

For example, Figure 7 shows the adjacent property boundaries as PGWS receptors. There are no institutional controls in place off-site. These PGWS receptors represent the nearest adjacent properties lying within the receptor identification plume. The PGWS boundaries take into account the streets and a 10-foot public right-of-way for the adjacent properties. If at a later date, for example, an institutional control were put in place on-site and on an adjacent property, you would need to adjust the adjacent receptor locations to reflect the off-site institutional control. In most cases, you should place potential PGWS receptor(s) at the closest adjacent property boundaries lying within the receptor identification plume even if you know an institutional control is not feasible at the sources.,

With the exception of drinking water and non-drinking water wells (DWW, NDWW), all receptors in the Tier 2 application are represented as line receptors. The location of a line receptor is specified by entering the (x,y) locations of the two end points of the line. You may use as many line receptors as needed to describe receptors. Use a unique short label for every receptor entered into the Tier 2 application even if two lines make up one receptor.

Receptors - Groundwater Ingestion

PGWS: Protected Groundwater Source

Map Label	Description/Location	X1 (ft)	Y1 (ft)	X2 (ft)	Y2 (ft)
pgws-1	west row	-93.0	130.0	-93.0	-54.0
pgws-2	north property	-93.0	130.0	108.0	130.0
pgsw-3	east row	108.0	130.0	108.0	-54.0
pgws-4	south row	108.0	-54.0	-93.0	-54.0

Add Save

Confined Space Receptors

At Tier 2 a confined space is a basement in a building occupied by humans. Buildings constructed with a concrete slab on grade, or buildings constructed without a concrete slab but with a crawl space, are not considered confined spaces.

Actual confined space receptors are actual existing confined spaces. Potential confined space receptors exist where the construction of confined spaces is not prohibited and could occur in the future. The existing zoning is used to define residential or nonresidential for potential confined space receptors. For actual confined space receptors, both the zoning and the occupancy pattern should be considered when determining whether the actual confined space is residential or nonresidential. If the confined space can be occupied by a person on a 24-hour basis, it should be treated as residential. For example, an assisted living facility should be considered residential (for purposes of exposure), even if the property on which it rests is zoned nonresidential.

Confined Space Residential: CSR

Generate the "Groundwater Source, Receptor Identification Plume" for confined space residential (CSR) receptors as was described above for Groundwater Ingestion receptors. The plume is used to identify both actual and potential confined space residential receptors. Figure 8 shows the Receptor Identification Plume for the Groundwater Vapor to Confined Space Residential Pathway overlain on the example site map.

The actual confined space receptors (acsr-) identified are shown on Figure 8. These are residential confined spaces within the receptor identification plume.

Also shown on Figure 8 are the line receptors used to represent potential confined space residential receptors (pcsr-) on adjacent properties. The source locations are automatically assumed to be points of exposure for potential confined space receptors, and should not be entered as potential receptors. You should enter the closest adjacent properties as potential confined space residential receptors, if current zoning allows for any residential land use or have no zoning, fall within the receptor identification plume, and do not have an institutional control in-place prohibiting confined spaces. Roads and public rights-of-way are <u>not</u> considered possible locations for potential confined space receptors.

Note: Even if your site is nonresidential, you can have off-site potential confined space receptors.

Click the "Vapor" button in the "Receptors" frame to activate the "Receptors - Vapor to Enclosed Space" form. Select "ACSR: Actual Confined Space Residential" in the drop-down list box and enter receptors within the RID plume.

Receptors - Vapor to Enclosed Space

ACSR: Actual Confined Space Residential Insert Default

Map Label	Description/Location	X1 (ft)	Y1 (ft)	X2 (ft)	Y2 (ft)	Depth to GW (ft)	Depth to Foundation (ft)	Volume to Area (ft)
acsr-1	528 S. 4th	144.0	80.0	144.0	105.0	6.00	9.84	6.56
acsr-2	300 8th Street	0	0	10	10	6		

Add Save

Depth to groundwater is the estimated shallowest depth to groundwater below the ground surface at the receptor. Two other values need to be entered for actual confined space receptors: depth of the foundation below the ground surface (Depth to Foundation) and ratio of enclosed space volume to infiltration area (Volume to Area, i.e., the volume of the enclosed space below ground divided by the surface area of the walls and floor below ground). At your option, you can measure these values for an actual receptor or you can use the defaults. If you use the defaults, select the receptor. After selecting the area (highlighted in yellow), click the "Insert Defaults" button.

As mentioned, for actual confined space receptors (residential or nonresidential), you have the option of measuring the ratio of enclosed space volume to infiltration area (Volume to Area) for any existing building receptor. The enclosed space volume is a measure of only the subsurface interior portion of the building. The infiltration area is the area of the exterior subsurface portion of the building including the base and all sidewalls.

To view/enter the potential receptors, select "PCSR: Potential Confined Space Residential" in the list box at the top of the form.

Confined Space Nonresidential: CSNR
Generate the Receptor Identification Plume for "Confined Space Nonresidential" receptors. Select "CSNR" in the Receptor Type list box as was discussed previously.

Figure 9 shows the plume overlain on the site. There are no actual confined space nonresidential receptors, but there might be a potential receptor on the west adjacent property. The plume is very close to being beyond the 10-foot public right-of-way. To be on the safe side, we have entered the property as a potential confined space nonresidential receptor (pcsnr-1).

Sanitary Sewer Receptors
The route of exposure for sanitary sewer receptors is inhalation (breathing) of contaminated air in an enclosed space. Our concern is a sanitary sewer acting as a conduit for vapor migration into an enclosed space. Explosive hazards from vapor are also of concern. Because of the difficulty of attempting to model vapor migration in or along a sanitary sewer, the sanitary sewer itself is treated as a receptor. Our objective in limiting the modeled or measured groundwater concentrations in the vicinity of a sanitary sewer is to protect against possible vapor migration into an enclosed space and subsequent inhalation of vapors at unacceptable concentrations by humans in an enclosed space.

In some cases, the same section of a sanitary sewer line or property boundary (the same line) serves as both a residential and nonresidential receptor. In this case, make sure you use unique labels (i.e., ASSR-1, ASSNR-1) for the receptors, even though they represent the same physical location.

Actual Sanitary Sewer Receptors
There are actual sanitary sewer residential receptors and actual sanitary sewer nonresidential receptors. Whether the receptor is residential or nonresidential is determined by the exposure for the enclosed space the sanitary sewer enters, not the zoning where the sanitary sewer receptor itself is located.

The Tier 2 Guidance notes, "Sanitary sewers are also considered confined space receptors and preferential pathways at Tier 2 if an occupied building exists within 200 feet of where the sewer line crosses over or through actual or modeled groundwater contamination which exceeds the target levels calculated for sewers. The 200-foot distance should be a direct measurement from the point(s) of intersection to the occupied building rather than the measure of sewer line length to the building. The sanitary sewer includes its utility envelope. Sanitary sewer lines associated with septic systems must be evaluated the same as those leading to public treatment plants. The evaluation must include the sewer line(s) and associated utility envelope located between an occupied building and the septic tank. Additionally, if it is known a storm sewer is connected to a building, it must be included in the evaluation and treated as a sanitary sewer. The point of exposure is the receptor, and points of compliance include locations from the source to the receptor where actual contamination levels are measured and compared with modeled data for comparison and corrective action evaluation purposes."

Although Chapter 135 and the Tier 2 guidance refer to a sanitary sewer as a confined space receptor, in the application confined spaces and sanitary sewers are treated as separate receptor types. In the application, confined space refers only to a basement in a building occupied by humans, and sanitary sewer is used to refer to sanitary sewer receptors. The sanitary sewer receptor type is also used for septic tank systems and storm sewers. Keep in mind, even if a building is not a confined space (i.e., is slab-on-grade or has a crawl space) the sanitary sewer connected to the building could be a sanitary sewer receptor.

Potential Sanitary Sewer Receptors
There are "Potential Sanitary Sewer Residential" and "Potential Sanitary Sewer Nonresidential" receptors. Potential sanitary sewer receptors are sanitary sewer receptors not presently in existence, but which could exist in the future. A public right-of-way is a possible area of exposure for potential sanitary sewers. The zoning of a public right-of-way should be considered the same as the zoning of the property directly adjacent to the right-of-way.

Sanitary Sewer Residential Receptors, Receptor Identification
Generate the Receptor Identification Plume for Groundwater Vapor to Sanitary Sewer Residential as was discussed previously.

Figure 10 shows an example of the receptor identification plume overlain on the site with some receptors identified to illustrate the process.

Actual Sanitary Sewer Residential: ASSR
The first actual sanitary sewer is assr-1. The sanitary sewer passes through the receptor identification plume within 200 feet of where the sanitary sewer enters a residential enclosed space. Note: The enclosed space itself does not have to be within the receptor identification plume for the sanitary sewer to be an actual receptor. For example, even if the residence directly east of the site did not exist, assr-1 would still be an actual sanitary sewer receptor because of the residence to the southeast of the site.

The sanitary sewer itself is input as a line receptor. The line receptor representing a sanitary sewer receptor is placed where the receptor identification plume intercepts the sanitary sewer. The sanitary sewer is a receptor if it enters an enclosed space within 200 feet of where the receptor identification plume intercepts the sanitary sewer.

The second actual sanitary sewer is labeled, assr-2. It is an actual sanitary sewer receptor because of the residential enclosed spaces (houses) to the south and southwest of the site.

Potential Sanitary Sewer Residential: PSSR
The Receptor Identification Plume for Groundwater Vapor to Sanitary Sewer Residential (SSR) is also used to identify potential sanitary sewer residential receptors (PSSR). For example, two potential sanitary sewer residential (PSSR) receptors, with labels pssr-1 and pssr-2 are shown on the example Figure 10. If you look at Figure 10, you will see they are the closest adjacent properties zoned residential where the receptor identification plume intercepts the properties. The public right-of-way is a possible area of exposure for potential sanitary sewers (since sanitary sewer main lines are often placed in the public right-of-way). The potential sanitary sewer receptors are placed at the edge of the public right-of-way <u>closest to the source</u>.

The application will automatically consider the source locations as potential receptor points of exposure. You do not need to, and should not, enter the source locations as potential receptors.

Sanitary Sewer Nonresidential (SSNR) Receptors, Receptor Identification
Generate the Receptor Identification Plume for Groundwater Vapor to Sanitary Sewer Nonresidential (SSNR) receptors as previously discussed.

Figure 11 shows the receptor identification plume overlain on the site. Receptors for the example problem have been identified. We have not necessarily identified all the receptors, but have selected some receptors to illustrate the

process.

Actual Sanitary Sewer Nonresidential: ASSNR
Actual sanitary sewer nonresidential receptors are existing sanitary sewers entering a nonresidential enclosed space within 200 feet of where they fall within the receptor identification plume.

The actual sanitary sewer nonresidential receptor assnr-1 is selected because it lies within the receptor identification plume within 200 feet of where it enters a nonresidential enclosed space. The same is true for assnr-2. The lines chosen to represent the receptors should be placed and sized to cover where the sanitary sewer intercepts the receptor identification plume. Note: You do not need to determine exactly where the sewer intercepts the edge of the receptor identification plume. The receptor (the line representing the receptor) can extend beyond edge of the plume, if this is more convenient for picking (x,y) locations for end point(s). The application will find the most restrictive point on the receptor and use this point for determining risk and site- specific target levels. The most restrictive point will be some point on the receptor inside the receptor identification plume. Extending a line receptor beyond the edge of the receptor identification plume will not affect the evaluation of the receptor.

Potential Sanitary Sewer Nonresidential: PSSNR
The LUST site for the example is nonresidential. The closest nonresidential potential receptors (which are not the source locations) lying within the receptor identification plume are the public rights-of-way at the edge of the LUST site property. Note: This is the on-site right-of way (we are assuming a 10 foot right-of-way), since the right-of-way is considered a potential receptor point of exposure for sanitary sewers. For the example, we could have omitted the public right-of-way to the south (pssnr-2) as a potential sanitary sewer nonresidential receptor since it does not fall within the receptor identification plume, but no harm would be done by including it.

Water Line: WL
Please review the Tier 2 Guidance.

Generate the Receptor Identification Plume for the applicable type of water line as discussed previously. The receptor identification plume is used to identify actual water line receptors and the area of concern for potential water line receptors.

Actual Water Line: WL
An actual water line receptor for the groundwater pathway is: An existing water line that falls on or within the receptor identification plume, where the highest groundwater elevation is within three feet of the bottom of the water line. If the highest groundwater elevation is more than 3 feet below the bottom of an existing water line, the water line is not a receptor, even if it falls with the receptor identification plume. The highest groundwater elevation is the estimated average of the highest measured groundwater elevations for each year. Only actual water lines are entered into the application as water line receptors. Potential water line receptors are **not** entered into the application.

Figure 12 shows the receptor identification plume overlain on the site. For illustration purposes, it is assumed the only water line within the receptor identification plume is a line running along the public right-of-way on the north side of Fourth Street.

Potential Water Line: PWL
The area of the receptor identification plume for water line where the first encountered groundwater is less than 20 feet below the groundwater surface is the area of concern for the potential water line receptor type. **You do not enter potential water line receptors into the application.** Instead, you are required to provide utility company notification of the area of concern. The potential water line receptor is then no action required (Refer to Tier 2 Guidance). A form for Utility Company Notification (DNR form 542-1531) can be found on the DNR website. The receptor identification plume is part of the material making up the notification.

The potential water line receptor is the only potential receptor where notification alone is necessary and sufficient for no action required.

By mistake, some users assume notification alone is all that is required for other potential receptors (protected groundwater source, potential confined space, and potential sanitary sewer) for no action required. Although notification may be required for other potential receptors, notification alone is not sufficient to receive no action required for other potential receptors.

Surface Water Bodies: SWB

Surface water bodies are actual receptors only if they are designated use or general use that failed visual inspection. Initially, you identify surface water bodies using the default target levels for the receptor type. The default target levels are in-stream concentrations. Once a receptor has been identified and input into the application, a procedure is followed to compute target levels for the groundwater adjacent to the surface water body needed to meet the in-stream target levels (after accounting for in-stream discharge and mixing). The surface water pathway is discussed in the Tier 2 Guidance.

We will use an example to illustrate a surface water body receptor. For the example, let's indicate under the "Questions" section for designated use streams that a B(CW1) designated use surface water body is present within 500 feet.

Generate the Receptor Identification Plume for the B(CW1) as discussed previously. Figure 13 shows the plot overlain on the site. Because of the stream shape where it lies in the receptor identification plume, the stream is defined by two line segments.

The application will generate receptor identification plume based on the type of surface water designation. If the surface water is within the plume follow the procedures for calculating a site specific target level in described in Tier 2 guidance.

9.2 Soil Leaching, Receptor Identification Plumes

We will now look at receptor identification for "Soil Leaching." The procedures are the same as for the groundwater pathways, except for the method used to generate the simulated groundwater plume (the regulatory area of concern). The soil leaching receptor identification plumes are the result of combining two models. Using the measured soil concentration at the soil source the first model simulates the groundwater concentration beneath the soil source from leaching (soil leaching model). The simulated groundwater source concentration is used as the groundwater source concentration to simulate the groundwater plumes. The simulated groundwater concentrations are used to identify receptors, using the risk-based groundwater target levels for each receptor type.

Based on receptor types you need to evaluate for Soil Leaching identified by the Preliminary Pathway Evaluation Requirements, you generate the required receptor identification plumes, overlay the plumes on your site map and identify receptors. Enter the identified receptors into the application, if they have not already been entered due to another pathway.

The receptor-specific criteria are the same for groundwater source and soil leaching. This is because both pathways are concerned with groundwater concentrations. The risk-based target levels for the receptors are groundwater concentrations for both pathways. For example, for both soil leaching and groundwater source, an actual sanitary sewer is a receptor if it enters an enclosed space occupied by humans within 200 feet of the where the sewer is within the receptor identification plume. An existing water line is a receptor if it is within the receptor identification plume and the highest groundwater elevation is within 3.0 feet of the bottom of the water line at the measured or predicted points of exposure (Tier 2 Guidance).

The "Preliminary Pathway Evaluation Requirements Soil Leaching" table shows the receptor types to be evaluated for soil leaching. Because groundwater pathway results are based on groundwater sample data and soil leaching pathways are based on soil sample data, the receptor types to evaluate for the different sources (groundwater, soil leaching) may not be the same.

For our example, the "Preliminary Pathway Evaluation Requirements" Table (Table 1) shows that we need to evaluate

the following receptor types for the “Soil Leaching Pathways”:

- Non-Drinking Water Wells-NDWW
- Protected Groundwater Source-PGWS
- Confined Space Residential-CSR
- Confined Space Nonresidential-CSNR
- Sanitary Sewer Residential-SSR
- Sanitary Sewer Nonresidential-SSNR
- Water line-WL
- DU-Cold Water-B(CW)

Click the “Soil Leaching RID Map” button in the “RID Maps” frame to activate the “Soil Leaching RID” form. Select “NDWW” as the “Receptor Type.” Click the “Plot” button. The Receptor Identification Plume for Soil Leaching to Groundwater Ingestion to Non-Drinking Water Wells is generated. Figure 14 shows the plume overlain on the site.

The soil leaching receptor identification plume only plots the simulated groundwater plumes. It does not contour the measured groundwater concentrations. The non-drinking water well receptor identified by the groundwater receptor identification plume is shown on Figure 14.

The soil leaching plumes may be smaller or larger than the groundwater plumes. If for example the soil leaching to non-drinking water wells plume is larger than the groundwater plume, additional non-drinking water well receptors may need to be added to the existing NDWW receptors (“Groundwater Ingestion” button in the “Receptors” frame).

For our example, Figure 15 displays a Soil Leaching Receptor Identification Plume for Confined Space Residential. If you compare it to Figure 8, the example of a Receptor Identification Plume for Groundwater no new receptors are identified.

The soil leaching plumes for the other receptor types can be generated in the same manner as for the non-drinking water well discussed above. Overlay the plumes on your site and identify any receptors of the appropriate type that fall within the receptor identification plume(s).

As previously noted, the soil leaching plumes may be smaller or larger than the groundwater source plumes and may vary by receptor type. If the soil leaching plumes are larger than the groundwater plumes they may identify new receptors. As such you may need to add more soil leaching receptors after you identify groundwater source receptors.

9.3 Soil Pathways, Receptor Identification Plumes

The receptor identification plumes for soil vapor to enclosed space and soil to water line are generated using “Soil Vapor RID Map” and “Soil-Water Line RID Map” buttons in the “RID Maps” frame.

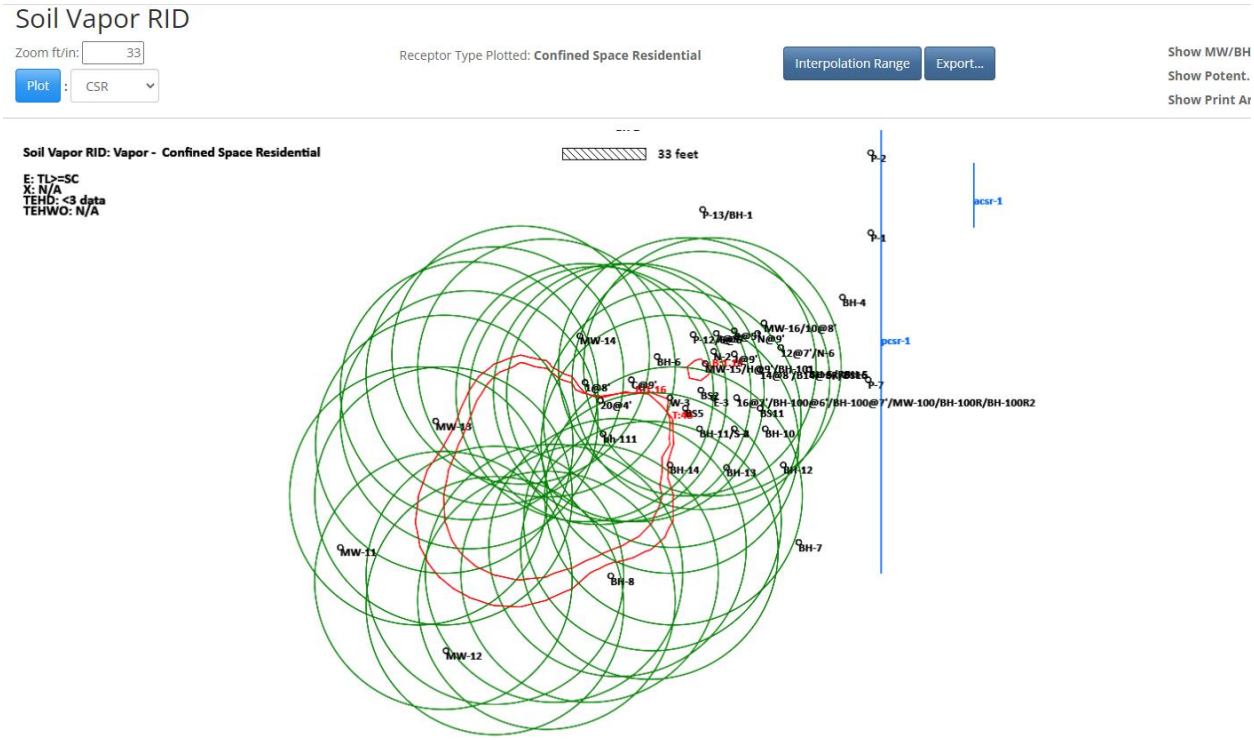
The receptor types to be evaluated are shown in the “Preliminary Pathway Evaluation Requirements” table. For our example problem (Table 1), for Soil Vapor to Enclosed Space, we need to identify the following receptor types:

- Confined Space Residential-CSR
- Confined Space Nonresidential-CSNR
- Sanitary Sewer Residential-SSR
- Sanitary Sewer Nonresidential-SSNR

Table 1 also indicates we need to identify soil to water line receptors.

Confined Space Residential

To identify soil vapor to confined space residential receptors. Click the “Soil Vapor RID Map” button in the “RID Maps” frame to activate the “Soil Vapor RID” form. Select “CSR” as the receptor type. Set the “Interpolation Range” values. Click the “Plot” button to plot the “Soil Vapor to Confined Space Receptor Identification Plume” for “Confined Space Residential Receptors.” Any previously entered potential confined space residential receptors and actual confined space residential receptors are shown on the plot.



Soil vapor receptor identification plumes for vapor receptors are not based on lateral modeling of vapor transport. The soil data are contoured to the target level for the receptor type (red line). The potential receptor area of concern is where soil concentrations exceed the target levels and 50 feet from the edge of the measured soil plume (green contours). Keep in mind the soil source locations are automatically evaluated as points of exposure for potential receptors. You should not enter soil source locations as potential receptor locations. If an adjacent property is zoned residential and lies within the red contour line, it should be entered as a potential confined space residential receptor. Roads and public rights-of-way are not considered points of exposure for potential confined space receptors.

The area of concern for actual receptors is within 50 feet of where soil concentrations exceed the target levels. Existing residential confined spaces are actual receptors if soil concentrations are exceeded *within 50 feet* of the confined space. The area within 50 feet of where soil concentrations exceed the target levels is approximated using the green circles. Each green circle has a radius of 50 feet and is centered on the soil contour (red) line. The area interior to the outer edges of the green circles is the area of concern for actual confined space receptors. Any existing confined space residential receptor lying within the area is an actual confined space residential receptor, and should be entered into the application.

Figure 16 shows the Soil Vapor, Receptor Identification, Confined Space Residential plot overlain for example site. There are no actual receptors. Keep in mind the influence of zoning. The receptor ID plume is for confined space *residential*. The building east of the site is a confined space and within 50 feet of the soil contour line, but it is a *nonresidential* confined space. There are no off-site potential receptors, because the area where the soil concentrations exceed the target level (the contour line, labeled “B, 1.16”) does not contact an off-site residential property. We can see from the plot the previously-entered receptors (entered due to groundwater source receptor identification) will be no action required. The potential receptors do not fall with the red contour, and the actual receptors do not fall within the outer edge of the green circles.

Confined Space Nonresidential

Select “CSNR” as the receptor type. Click “Plot” to plot the “Receptor Identification Plume” for “Confined Space Nonresidential” receptors. Figure 17 shows the plume overlain on the example site.

Figure 17 shows the nonresidential building on the adjacent property to the west falls within the actual receptor area (within 50 feet of the soil target level contour). This is a new actual receptor (acsnr-1). That is, it was not a receptor for groundwater or soil leaching, but is a receptor for soil vapor. It needs to be entered in the “Vapor” form in the

“Receptors” frame.

Sanitary Sewer Receptors
An existing sanitary sewer line is an actual sanitary sewer receptor for the soil vapor to enclosed space pathway, if the sanitary sewer enters an occupied building within 200 feet of where the sewer line crosses over, through, or within 50 feet of soil contamination which exceeds the target levels calculated for sewers. The 200-foot distance is a direct measurement from the point(s) of intersection to the occupied building rather than the measure of sewer line length to the building (Tier 2 Guidance). The zoning for the sanitary sewer receptor is based on the zoning appropriate for the occupied building, not on the zoning where the sanitary sewer line receptor itself is located.

Potential sanitary sewer receptors are locations where sanitary sewers do not currently exist but could exist in the future. Areas within the soil plume defined to the target levels and the 50 foot buffer are considered potential receptor points of exposure. Public rights- of-way are considered points of exposure for potential sanitary sewers. The zoning for a public right-of-way is assumed to be the zoning of the property immediately adjacent to the public right-of-way.

Sanitary Sewer Residential Receptors
Select “SSR” as the receptor type. Click “Plot.” The Receptor Identification Plume for Soil Leaching to Groundwater Vapor to Sanitary Sewer Residential will be generated.

If an existing sanitary sewer passed through the RID plume and entered a residential-occupied building with 200 feet of the edge of the plume, you would need to enter the sewer line as a receptor (use a line receptor(s) where the sewer intercepts the plume).

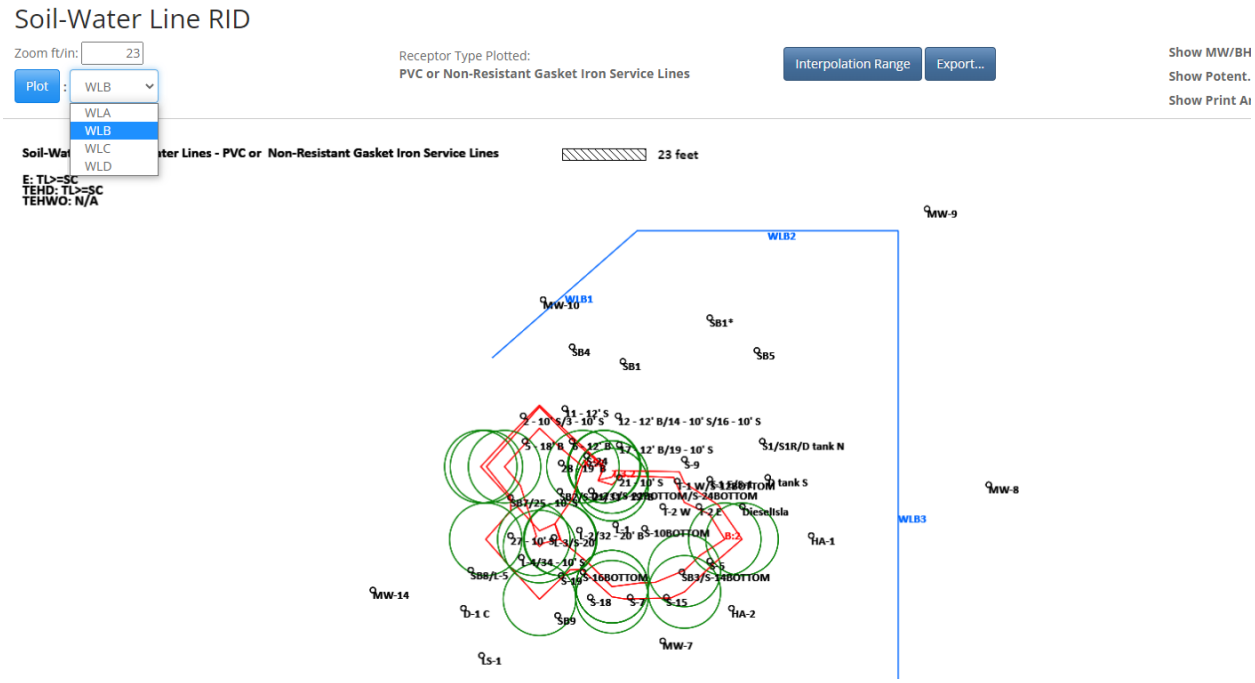
If the RID plume intercepts an off-site residential property, the residential property line should be entered as a potential sanitary sewer (don’t forget the right-of-way <u>does</u> count as a potential sanitary sewer receptor). Do not enter the source location as a potential sanitary sewer. The application will automatically evaluate the source location.

Sanitary Sewer Nonresidential Receptors
Generate the RID plume for “SSNR” receptor type.

If an existing sanitary sewer passes through the RID plume and enters a nonresidential occupied building with 200 feet of the edge of the plume, you need to enter the sewer line as a sanitary sewer nonresidential receptor (use a line receptor(s) where the sewer intercepts the plume).

If the site is nonresidential and RID plume intercepts the public right of way *of the site*, the edge of the public right of way closest to the source should be entered as a potential nonresidential sanitary sewer receptor. If the RID plume intercepts an off-site nonresidential property, the nonresidential property line should be entered as a potential sanitary sewer nonresidential receptor (the right- of-way is a point of exposure for potential sanitary sewer). Do not enter the source location as a potential sanitary sewer receptor. The application will automatically evaluate the source location.

Water line
Click on “Soil-Water Line RID Map” button in the “RID Maps” frame to bring “Soil-Water Line RID” form. Select the appropriate water line type based on water line material (for example, “WLB”) as the “Receptor Type.” Click “Plot” to generate the Soil to Water line Receptor Identification plume.



The Tier 2 Guidance states, “Actual receptors include all existing water lines identified by the receptor survey that fall within the receptor ID plume. The receptor ID plume is the actual soil contaminant plume contoured to the applicable target level plus 10 feet.” The red contour line(s) shows the soil data contoured to the target level for the receptor. The green circles are centered on the contour line, and have a radius of 10 feet. Any existing water line within 10 feet of where soil concentrations exceed the soil target levels (within 10 feet of the red contour or within the outer edge of the green circles) should be entered as a water line receptor. The line receptor should cover where the water line intercepts the plume (including the green circles). See the Tier 2 Guidance for a figure illustrating water line receptor identification. Keep in mind, only actual water line receptors should be entered into the application as water line receptors.

Potential water line receptors exist where soil concentrations exceed the target levels. For potential water lines receptors for the soil to water line pathway, utility company notification of the potential area of concern is required. After notification, the pathway becomes no action required. Do not enter potential water line receptors into the application. The potential water line receptor is the only potential receptor type at Tier 2 for which notification alone is necessary and sufficient for no action required.

9.4 Summary: Receptor Types, Receptor Identification, and Receptors

The “Preliminary Pathway Evaluation Requirements” identify the receptor types you need to evaluate. For the receptor types you are required to evaluate, overlay the appropriate receptor identification plumes over your site map and identify potential and actual receptors. The identified receptors are entered into the Tier 2 application using the buttons in the “Receptors” frame. Each receptor should have a unique short label.

A receptor should only be entered once, even if multiple receptor identification plumes identify it. A receptor identified by any receptor identification plume for that type (groundwater source, soil leaching, soil vapor or soil to water line) needs to be entered.

Once you have entered all the receptors identified for your site, you are ready to move on to evaluation and risk classification for the pathways.

10. PATHWAY EVALUATION

The results of a pathway evaluation are risk classifications for each applicable receptor. The possible risk classifications for a receptor are H (high), L (low), or N (no action required).

There are seven pathways (source of contamination and mechanism of contaminate migration) recognized by the Iowa

RBCA program. The seven pathways are:

- Groundwater Ingestion
- Soil Leaching to Groundwater
- Groundwater Vapor to Enclosed Space
- Soil Vapor to Enclosed Space
- Groundwater to Water line
- Soil to Water line
- Surface Water

For data management purposes, these pathways are grouped into the following categories under the "Preliminary" portion of the Tier 2 application:

- Preliminary Groundwater (Groundwater Ingestion, Vapor, Water Lines, Surface Water)
- Preliminary Soil Leaching (Groundwater Ingestion, Vapor, Water Lines, Surface Water)
- Preliminary Other Soil (Vapor, Water Lines)

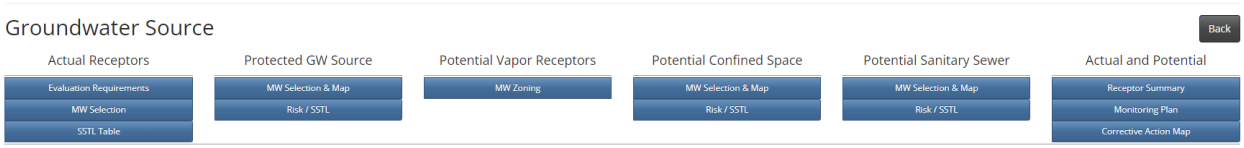
Keep in mind, the risk classification for the same receptor may vary between the pathways. For example, a non-drinking water well may be high risk under groundwater and no action required under soil leaching. An actual vapor receptor will have three risk classifications: one for groundwater source, one for soil leaching, and one for soil vapor.

The buttons in the "Pathway Evaluation" frame on the "Main Form" lead to the risk classification sections for each pathway. Prior to entering pathway evaluations, you should have completed the following:

1. Entered all groundwater, soil and vapor data.
2. If appropriate, set data adjustment (ignore) for selected groundwater or soil data.
3. Determined and entered Sw-W values for groundwater and soil.
4. Entered hydrogeology data.
5. Answered all questions.
6. Determined the receptor types to be evaluated.
7. Generated required receptor identification plumes.
8. Recognized and entered into the application all receptors identified by the receptor identification plumes. If you have not completed these steps, the "Pathway Evaluation" results may be incorrect.

11. GROUNDWATER SOURCE PATHWAY EVALUATION

On the "Main Form," click the "GW Source" button in the "Pathway Evaluation" frame to activate the "Groundwater Source" form.



The steps for evaluating actual receptors and potential receptors differ.

11.1 Groundwater Source, Actual Receptors

The actual receptor types applicable for this pathway are:

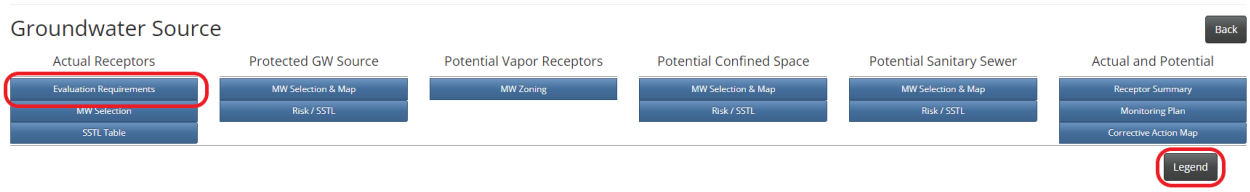
Groundwater Ingestion
Drinking Water Well: DWW
Nondrinking Water Well: NDWW
Water Line: WL (3 receptor types)

Vapor Receptors
- Actual Confined Space Residential: ACSR
- Actual Confined Space Nonresidential: ACSNR
- Actual Sanitary Sewer Residential: ASSR
- Actual Sanitary Sewer Nonresidential: ASSNR

Surface Water Body (9 receptor types)

Actual Receptors: Evaluation Requirements

Click the "Evaluation Requirements" button in the "Actual Receptors" frame to activate the Evaluation Requirements table. The "Legend" button on the top right contains a legend for the main table.



Receptor Type	Label	Short Description	B	T	E	X	TEH-D	TEH-WO
ASSNR	assnr-1	service line 8" PVC	N	N	N/A	N/A	N	N/A
ASSNR	assnr-2	sewer main 15" plastic	N	N	N/A	N/A	N	N/A
ASSNR	assnr-3	main continuing north	N	N	N/A	N/A	N	N/A
ASSNR	ASSNR4	service 6" PVC service line	N	N	N/A	N/A	N	N/A
WLA	WLA1	north of highway	N	N	N	N	N	N
WLB	WLB1	service line - copper with unknown gaskets	Eval	Eval	N	N	N	N/A
WLB	WLB2	same service line named above - as it goes east	N	Eval	N	N	N	N/A
WLB	WLB3	service going north from the main - copper	N	Eval	N	N	N	N/A
(GU)	ditch	hwy ditch	N	N	N	N/A	N	N/A
(GU)	sw-1	w stream	N	N	N	N/A	N	N/A
(GU)	sw-2	nw stream	N	N	N	N/A	N	N/A
(GU)	sw-3	n stream	N	N	N	N/A	N	N/A

The main table lists all the actual receptors. For each actual receptor, the application has determined the receptor-chemical combinations that you are required to evaluate. The key result in the table is "Eval," short for evaluate. An "Eval" means you need to evaluate the receptor-chemical combination. That is, you need to do monitoring well selection for the receptor-chemical.

Any result besides "Eval" means no additional work is necessary for the actual receptor-chemical combination under Groundwater Source; you should not do monitoring well selection. If monitoring well selection is not required (any result other than "Eval"), the symbol used indicates the reason.

To determine the evaluation requirements the application calculates the simulated and contoured groundwater concentrations at each actual receptor. If the simulated or interpolated concentration at the receptor exceeds the target level for a chemical ("Eval"), you need to do additional work (monitoring well selection) to properly complete risk classification.

For some receptor types, the groundwater target level is fixed (i.e., DWW, NDWW, and Water Lines). For such receptor types, "Eval" will result when the receptor falls within the groundwater receptor identification plume (simulated or contoured) for a chemical. "Eval" will not result if the receptor falls outside of the groundwater receptor identification plumes for a chemical.

For actual vapor receptors, it is possible an actual vapor receptor can be in the groundwater receptor identification plumes for a chemical, yet "Eval" does not result. That is, it is possible for an actual vapor receptor to fall within the groundwater source receptor identification plume for a chemical, yet be no action required (N) for the chemical. The groundwater (and soil leaching) receptor identification plumes use the minimum default groundwater concentrations for a vapor receptor type (i.e., 1,540 µg/L benzene for confined space residential). When you enter an actual confined space or sanitary sewer receptor into the application, a receptor-specific target level is computed (based on depth to groundwater, depth to foundation, and volume to area). The receptor-specific target level for a vapor receptor will be

equal to or greater than the minimum default target level. For example, the receptor-specific target level for an actual confined spaced residential receptor could be 2,740 µg/L benzene. Thus, in some situations, an actual vapor receptor may fall within the groundwater (or soil leaching) receptor identification plume for a chemical, yet when the simulated and contoured concentrations at the receptor are compared to the receptor-specific target level, it may no longer be a receptor for the chemical: the simulated and contoured concentrations at the receptor may be less than the receptor-specific target levels.

The "Evaluation Requirements" are important for two reasons: 1) they indicate the actual receptor- chemical combinations for which you are required to do "monitoring well selection." 2) Just as important, they indicate the actual receptor-chemical combinations for which you should not do "monitoring well selection."

The results are receptor- and chemical-dependent. If a receptor-chemical combination has "Eval," you are required to do monitoring well selection for that receptor-chemical combination.

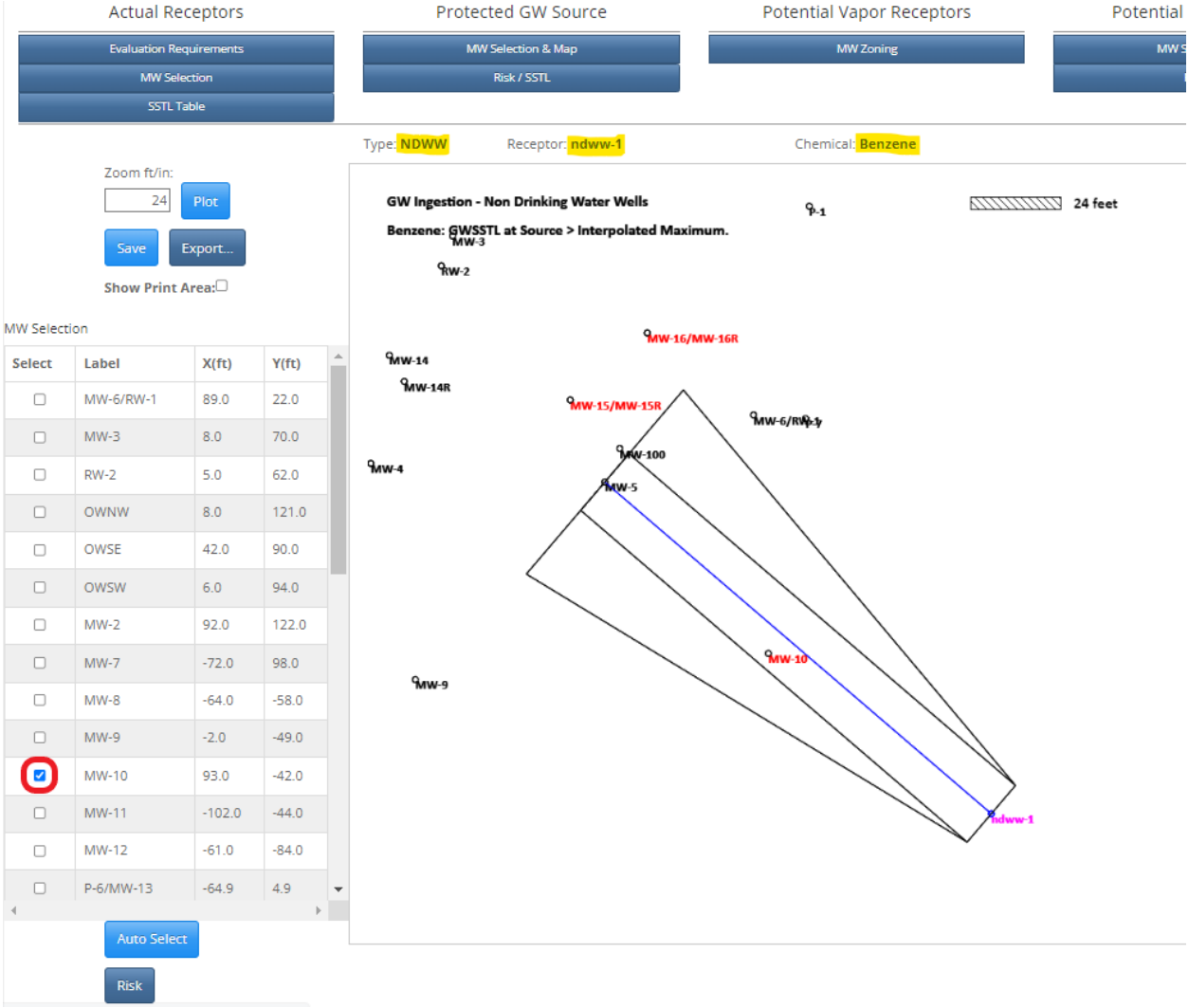
If a receptor-chemical combination does not have "Eval," you should not do monitoring well selection for that receptor-chemical combination. If you do monitoring well selection for a receptor-chemical combination which does not have "Eval," the receptor-chemical can end up having a risk classification of Low or High, whereas the risk classification would have been N (no action required) if you had not done monitoring well selection.

A common mistake for users is to do monitoring well selection for actual receptor-chemical combinations which do not have "Eval."

Actual Receptors: Monitoring Well Selection
Click the "MW Selection" button in the "Actual Receptors" frame to activate the monitoring well selection form. This form is used to do monitoring well selection for the actual receptor- chemical combinations you are required to evaluate ("Eval" for Evaluation Requirements). You need to specify the receptor type, the receptor, and the chemical. To illustrate the process, we will work through some of the required receptor-chemical combinations.

Select "NDWW" as the receptor type. When you select a receptor type, the small table to the right lists all the receptors of that type. Click the circle under the "Selection" column (it will become a blue circle). Set the chemical to benzene. If there are multiple receptors of a type, only one receptor can be selected at a time.

Click "Interpolation Range" and set the ranges. Click "Plot." The receptor type, receptor, and chemical for the plot are shown in the frame above the plot area.



The application determines the site-specific target level (SSTL) at the groundwater source for the receptor and contours the groundwater data to that value. This is the primary area. The secondary (trapezoid shape) area originates from where the contoured SSTL value crosses the source line (a line perpendicular to the receptor passing through the source location). For detailed information refer to Tier 2 Guidance.

Plotted on the screen are the locations of groundwater samples, with labels. Your first task is to select candidate monitoring wells (possible monitoring wells) for the receptor. Generally, these are all the wells in the secondary area (including the source) and “P” wells. “P” wells are wells not in the secondary area, but which have measured concentrations above the groundwater source SSTL for the receptor (a concentration above the contoured concentration shown on the plot). Selected wells are shown on the screen with a red label and in the grid to the left of the plot with a blue check mark in the “Select” column.

To toggle the selection of a well you can click on the label for the well in the grid to the left. As you click the label, it will toggle from red to black on the plot.

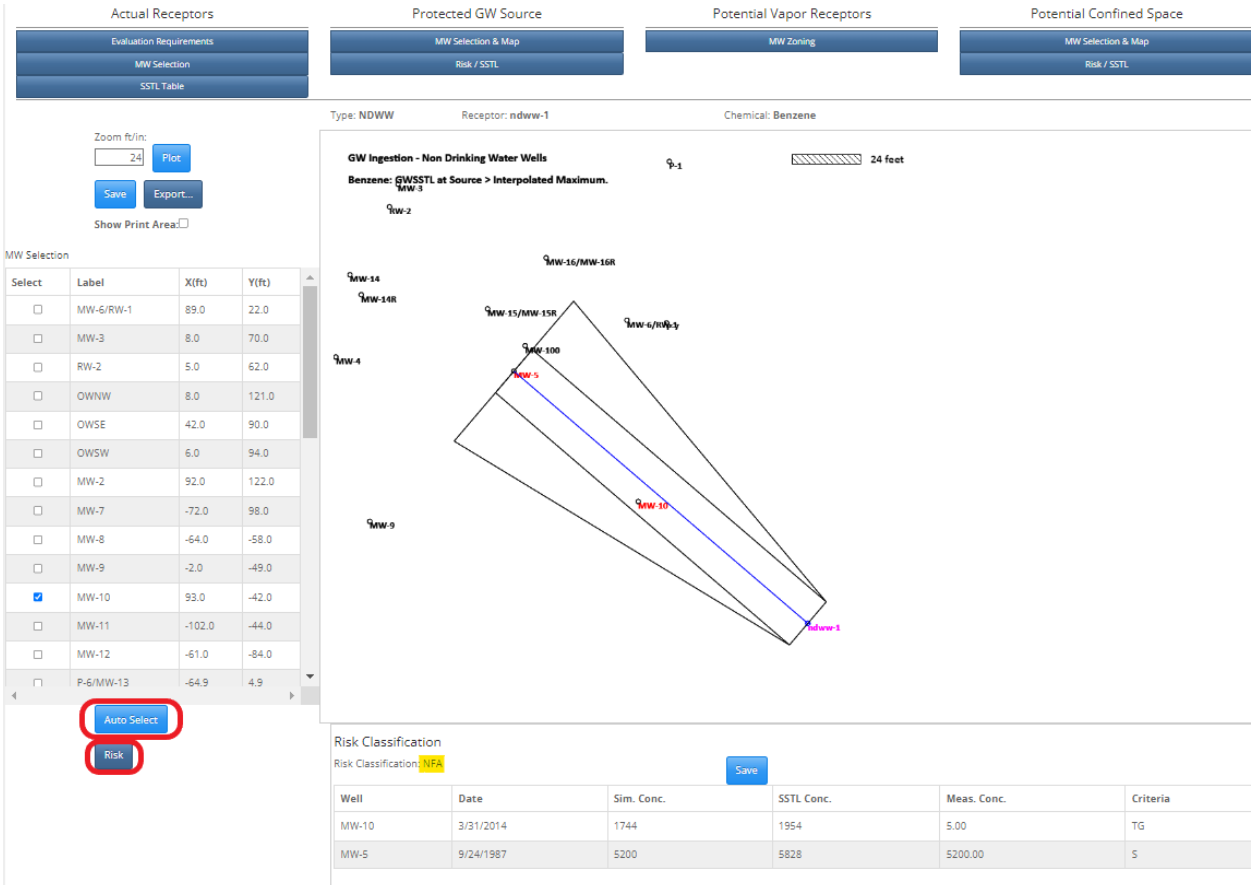
Auto Select

You can use the “Auto Select” button to have the application select the candidate monitoring wells. When you click “Auto Select,” the application will clear the previous selections and select all wells in the secondary area, the SSTL line area, the source well, and all “P” wells.

The wells used to monitor the actual receptor-chemical are chosen from the “candidate” monitoring wells. In some cases, this will include all the “candidate” monitoring wells, in other cases, a subset of the “candidate” monitoring wells. After using “Auto Select,” you can adjust the well selection, if necessary, by clicking individual well labels in the grid to

the left of the plot.

For our example, click “Auto Select.” Now click the “Risk” button on the bottom left side of the form. The application does calculations and evaluation for the receptor- chemical, using the selected wells, and shows the results in a grid at the bottom of the form. The “Risk Classification” is shown above the table.



For each selected well, a row in the grid shows the simulated (modeled) concentration (Sim. Conc.), the SSTL concentration (SSTL Conc)., the concentration which needs to be met at the well, according to the modeling, in order to meet the risk-based target level at the receptor, the measured concentration (Meas. Conc.), and the monitoring criteria for the well (Criteria).

Depending on your screen size and resolution, you may need to scroll the grid to the right to see all the columns.

Well Criteria

Monitoring wells are assigned a monitoring type depending on the criteria they meet. The criteria are discussed in the Tier 2 Guidance.

The symbols and criteria applicable for actual receptors are:

- S: Source well for the chemical
- X: Not the source well. Measured concentrations above the SSTL.
- T: Above the method detection limit, or above “non-detect.”
- G: Measured concentration less than the SSTL.
- P: In the primary area. Not in the secondary area. Concentration greater than the groundwater source SSTL.
- L: For low risk receptor classification only. Measured concentration greater than the simulated concentration.

You Select T and G Wells

Your only *actual task* here is to select a transition (T) and guard well (G) for the receptor. If appropriate, one well may

serve as both a T and G well. The wells meeting transition well criteria show a “T” in the “Criteria” column, and wells meeting guard well criteria show a “G” in the “Criteria” column. You select a transition well by clicking the row for the well in the “T Well” column. For example, to select MW-10 as a T well click the square for MW-10 in the “T Well” column. The entry will change from empty square to blue checkmark, and a T will be shown in the “Monitor” column.

Risk Classification

Risk Classification: NFA

Save

Well	Date	Sim. Conc.	SSTL Conc.	Meas. Conc.	Criteria	T Well	G Well	Monitor
MW-10	3/31/2014	1744	1954	5.00	TG	☑	☑	TG
MW-5	9/24/1987	5200	5828	5200.00	S	NA	NA	S

You select a G well the same way. If a well does not meet G well criteria, NA (not applicable) is shown in the “G Wells” column. The monitor column (Monitor) will always reflect the current selections for T and G wells.

Tier 2 Guidance states, “Provide a justification for any monitoring plan which differs from the minimum (either more wells or fewer wells). Explain any new monitoring wells proposed to meet monitoring requirements.” For example, if the guard well is less than 50 feet from the source well, no transition well is required. If the receptor is less than 50 feet from the transition well, no guard well is required. If the receptor is less than 50 feet from the source well, neither a transition well or guard well is required.

For our example, select MW-10 as both the transition (T) and guard (G) well. The “Monitor” column will show a “T” and “G” for MW-10.

If possible, you should try to pick transition and guard wells as close to being on-line between the source and receptor as possible. There are situations where wells will meet T and G well criteria, but may not be good choices, because they do not represent good locations for measuring groundwater concentrations between the source and receptor.

It is possible wells meeting T and/or G well criteria do not exist in the trapezoid area.

The wells selected for monitoring the receptor are shown in the “Monitor” column, along with their monitoring criteria (S, X, P, L, T, G). The application automatically selects only the source monitoring well S in the “Monitor” column from the candidate monitoring wells.

It may be that not all the wells selected by the “Auto Select” end up included in the groundwater monitoring plan for the receptor (“Monitor” column). The “Auto Select” chooses “candidate” monitoring wells. Refer to Table 3. For example, MW-3 is a candidate well that is not included in the monitoring plan.

The “P” well, MW-12, shows a -1 for the simulated concentration (Sim. Conc.). Because of the way groundwater transport modeling is done at Tier 2, no simulated concentrations are computed for P wells, so the value is shown as -1. This does not affect the risk classification. The SSTL for a “P” well is the groundwater source SSTL. Refer to Table 3.

Your only *task* in this grid is to select T and G wells. You must select T and G wells. The application does not automatically select T or G wells, even if there are candidate monitoring wells meeting T and G well criteria. A common error for users is to not select T and G wells. You may need to scroll the grid to the right to display the appropriate columns.

If you wish to change the T or G well for an actual receptor-chemical at some later time, you will have to return to this grid.

Having selected MW-10 as the T and G well for this actual receptor-chemical, click the “Save” button.

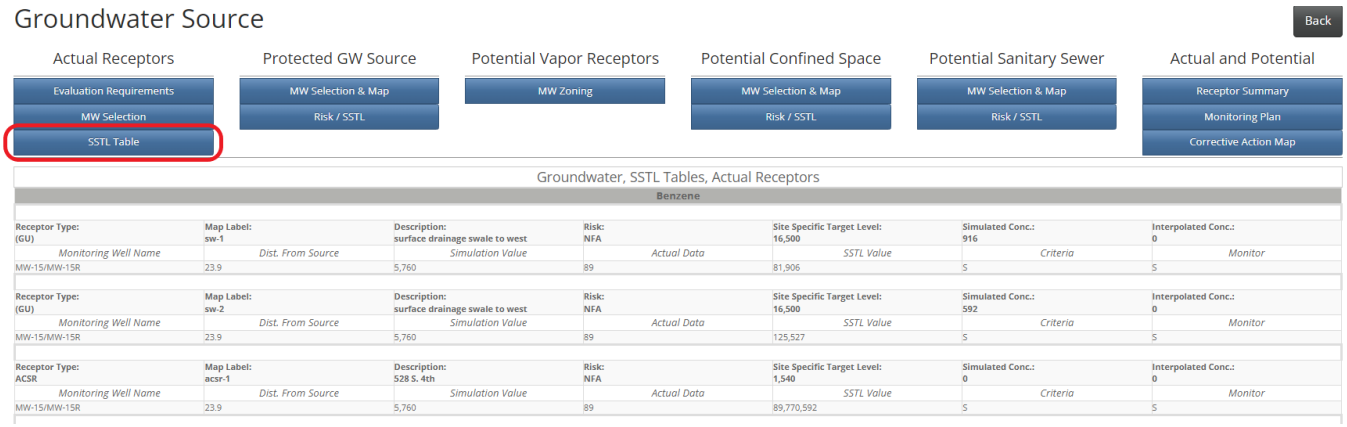
Repeat this process for selecting monitoring wells for all other actual receptor types e.g., ACSR, ACSNR, etc. identified (Eval) in the “Evaluation Requirements” Refer to Table 2.

For your site, you should do monitoring well selection (including T and G well selection) for all actual receptor-chemical combination with “Eval” in the “GW Source, Actual Receptors, Evaluation Requirements” table. Refer to Table 2. If an actual receptor-chemical combination does not have “Eval” for “Evaluation Requirements,” you should not do monitoring well selection.

Groundwater Source, Actual Receptors, SSTL Tables

After you have completed “Monitoring Well Selection” for actual receptor-chemical combinations having “Eval” under “Evaluation Requirements,” you can view the SSTL Tables for the Groundwater Source, Actual Receptors.

From the “Groundwater Source” form, click the “SSTL Table” button to activate the “GW Source, Actual Receptors, SSTL Tables” form. An SSTL Table contains detailed information on risk classification and monitoring for an actual receptor. Monitoring well criteria and risk classification criteria are covered in detail in Chapter 5 of the Tier 2 Guidance.



The receptor types generated for each “Pathway” are:

- Ingestion
  - Drinking Water Wells (DWW)
  - Nondrinking Water Wells (NDWW)
- Confined Space
  - Actual Confined Space Residential (ACSR)
  - Actual Confined Space Nonresidential (ACSNR)
- Sanitary Sewer
  - Actual Sanitary Sewer Residential (ASSR)
  - Actual Sanitary Sewer Nonresidential (ASSNR)
- Water line
  - All Water line Receptor Types (WL)
- Surface Water Receptors
  - All Surface Water Receptor Types (SWB)

The tables for Ingestion and Confined Space are Table 3 and Table 4. Let’s discuss the information in a SSTL Table for Groundwater Source, Actual Receptors (see Table 3 and Table 4 as examples).

The first row shows the receptor type, the receptor short label and description, the chemical, and the groundwater source SSTL. The groundwater source SSTL is the groundwater concentration required at the source in order to meet the risk-based target level at the receptor (according to the simulation model).

The second row shows the risk (H for High, L for Low, N for No Action Required). The application determines the risk

classification, based on the criteria in Chapter 135 and the Tier 2 Guidance. The second row also shows the target level (TL) at the receptor, the simulated (modeled) concentration at the receptor (Simulated), and the interpolated concentration at the receptor based on the measured groundwater concentrations (Interpolated).

The remaining rows show information for each of the candidate monitoring wells selected for the actual receptor-chemical combination ("MW Selection" in the "Actual Receptors" frame).

The information for each candidate monitoring well includes the following:

- The "Location" column - The well label for the monitoring well.
- The "Distance from Source" column - The "projected" distance of the monitoring well from the source. The monitoring well location is "projected" onto a line between the source and the receptor, and this is the distance shown, not the radial distance between the source and the monitoring well. Figure 18 illustrates the "Distance from Source" measurement.
- The "Simulation Value" column - The simulated groundwater concentration at the monitoring well. This is the groundwater concentration at the monitoring well, estimated using the Tier 2 groundwater transport model and site-specific parameters (i.e., source width, hydraulic conductivity, head gradient, main plume flow direction, range of plume flow, source concentration and location, monitoring well distance, and direction from the source). This is the concentration the groundwater model estimates could occur at the monitoring well location under current conditions.
- The "Actual Data" column - The groundwater concentration for the well location. This concentration is the maximum of the last two samples (six-month separation) or the last sample if steady and declining criterion is met.
- The "SSTL Value" column - The concentration to be met at the monitoring well (according to the groundwater transport model) in order to meet the target level at the receptor.

  The risk classification for the receptor is determined from a comparison of the values in the "Simulation Value," "Actual Data," and "SSTL Value" columns. For an actual receptor, if an "Actual Data" value is greater than an "SSTL Value" for any monitoring well, the receptor is high risk. If the receptor is not high risk, but the "Actual Data" is greater than the "Simulation Value" for a monitoring well, the receptor is low risk.
- The "Criteria" column - The monitoring criteria the candidate monitoring well meets (determined by the application).
- The "Monitor" column - The wells to be monitored for the actual receptor-chemical. The source well in the "Monitor" column is automatically selected by the application from the wells in the "Criteria" column. The T and G wells in the "Monitor" column, as well as other monitoring wells, are those selected by you (by selection in "MW Selection"). For example, if there are T and/or G wells in the "Criteria" column, but a T and/or G well is not shown in the "Monitor" column, you probably need to do T and G well selection for the actual receptor-chemical in "MW Selection (if the actual receptor- chemical shows "Eval" in "Evaluation Requirements").

For example, the non-drinking water well, NDWW-1, is high risk. Refer to Table 3. Four wells will be monitored for the receptor: mw-12, mw-1, mw-2, and mw-10. The target levels the monitoring wells will need to meet in order to reclassify the receptor to no action required during site monitoring are shown in the "SSTL Value" column.

Actual Vapor Receptors and Vapor Sampling

Table 4 shows the SSTL tables for confined space vapor receptors. They are both high risk for benzene based on groundwater concentrations. Because they are vapor receptors, one of the options you have is vapor sampling. If you performed vapor sampling (refer to Tier 2 Guidance) at the benzene groundwater source and passed, all vapor receptors under groundwater source would be no action required.

You also have an option of completing vapor sampling between the groundwater source and an actual vapor receptor (confined space or sanitary sewer). This is called an alternative point of compliance. There are restrictions on where the vapor sampling can be done (Refer to Tier 2 Guidance,). The SSTL table contains important information relating to the restriction. If you do soil gas sampling between the source and the receptor, it must be done where *current groundwater concentrations* meet or exceed the simulated groundwater concentration at the receptor. The SSTL table shows the

simulated groundwater concentration at the receptor. It is the "Simulated" value in the second row of the SSTL table.

For example, Table 4 shows the simulated benzene concentration at acsr-1 is 1,881 µg/L, and the simulated benzene concentration at acsr-2 is 2,515 µg/L. If soil gas sampling were to be done between the source and acsr-1 to attempt to clear the receptor, it would need to be done *where current groundwater concentrations* are ≥1,881 µg/L. If soil gas sampling were to be done between the source and acsr-2 to attempt to clear the receptor, it would need to be done where *current groundwater concentrations* are ≥2,515 µg/L.

The vapor sampling option is only applicable for vapor receptors (confined space and sanitary sewer).

11.2 Groundwater Source, Potential Receptors

The process for selecting monitoring wells to monitor "Potential Receptors" under Groundwater Source is not the same as the process for "Actual Receptors." A single set of monitoring wells is selected to monitor all potential receptors of the same type (i.e., protected groundwater source, potential confined space, and potential sanitary sewer).

For example, for protected groundwater source, a set of monitoring wells is selected to monitor the source location and all the protected groundwater source receptors you entered into the application (to represent adjacent property boundaries).

In addition, residential and nonresidential potential confined space receptors are evaluated as a group, with one monitoring plan and risk classification. The same is true for potential sanitary sewer receptors.

11.3 Groundwater Source, Protected Groundwater Source

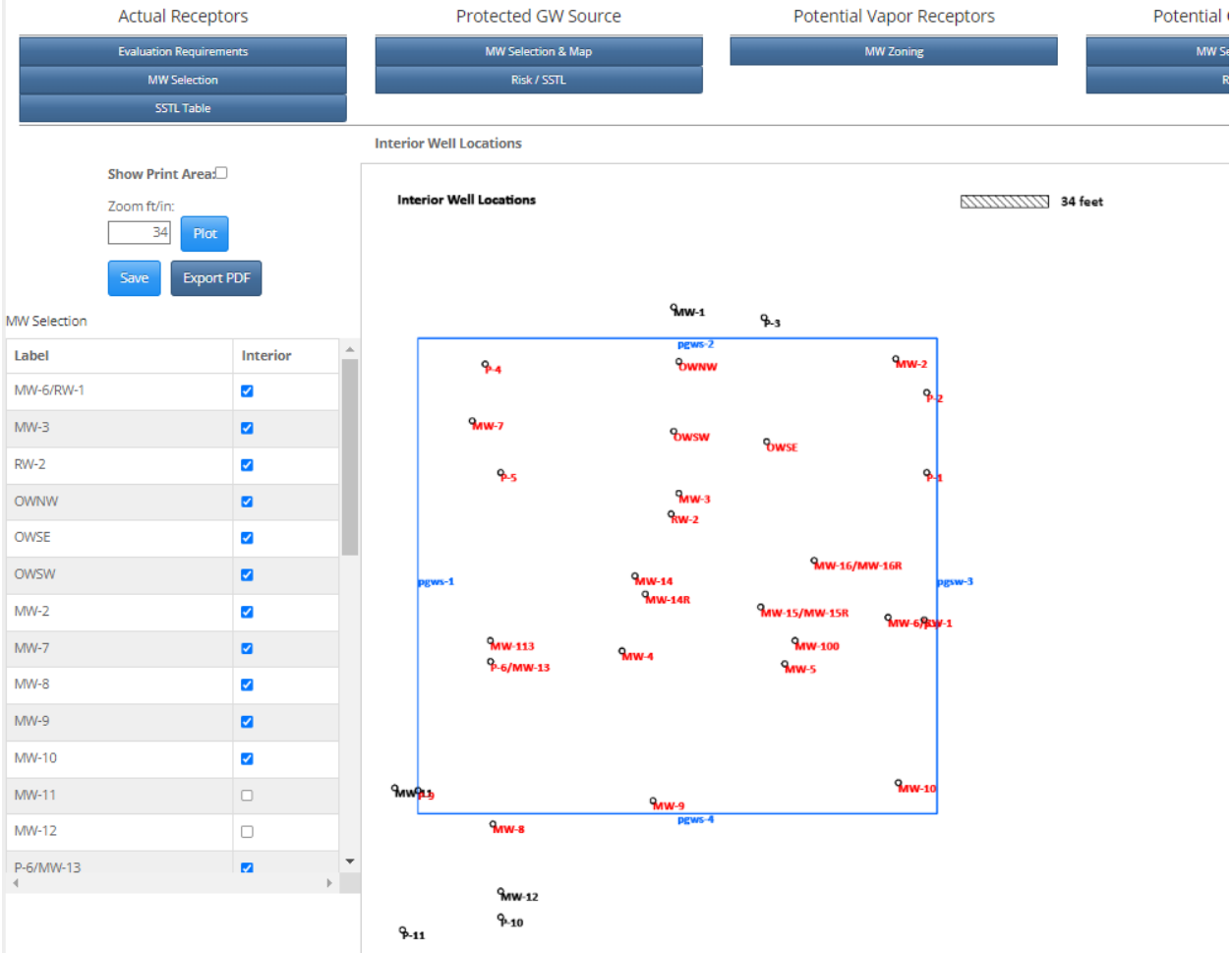
We will now discuss the selection of monitoring wells for Protected Groundwater Source, under Groundwater Source. The chemicals you need to do monitoring well selection for are shown in the "Preliminary Pathway Evaluation Requirements" table. You should select monitoring wells for each chemical with an X for "Protected Groundwater Source-PGWS" under "Groundwater Pathways." For our example (see Table 1), we need to select monitoring wells for benzene (B), toluene (T), and TEH-Diesel (TEHd).

If you are not required to evaluate the Protected Groundwater Source receptor type for Groundwater Source, then you would not do monitoring well selection.

Click the "MW Selection and Map" button in the "Protected GW Source" frame.

Interior Wells

Click the "Interior Wells" button. You will see a plot showing the protected groundwater source receptors you have entered, along with the locations and labels of the monitoring wells. You need to identify the "Interior" wells.



Interior wells are wells lying between the source locations and the protected groundwater source receptors you have entered into the application (generally, the closest adjacent property boundaries). When the application does risk classification, it first does risk classification assuming there is no institutional control and all wells must meet Tier 1 levels. The application also automatically does risk classification under the assumption of an institutional control being in- place and assumes the interior wells are subject to the institutional control. Even if you know you will not be considering an institutional control on-site, you should still select interior wells, based on an assumed institutional control covering from the sources to the adjacent PGWS receptors you have input. If you have not entered any off-site PGWS receptors (the receptor identification plume is entirely on- site), then you should select all on-site wells as "Interior" wells.

An interior well has a red label. You must tell the application which wells are "Interior." To toggle the selection from "Not- Interior" (black label) to "Interior" (red label), click the square box in the Interior column in the grid to the left of the plot.

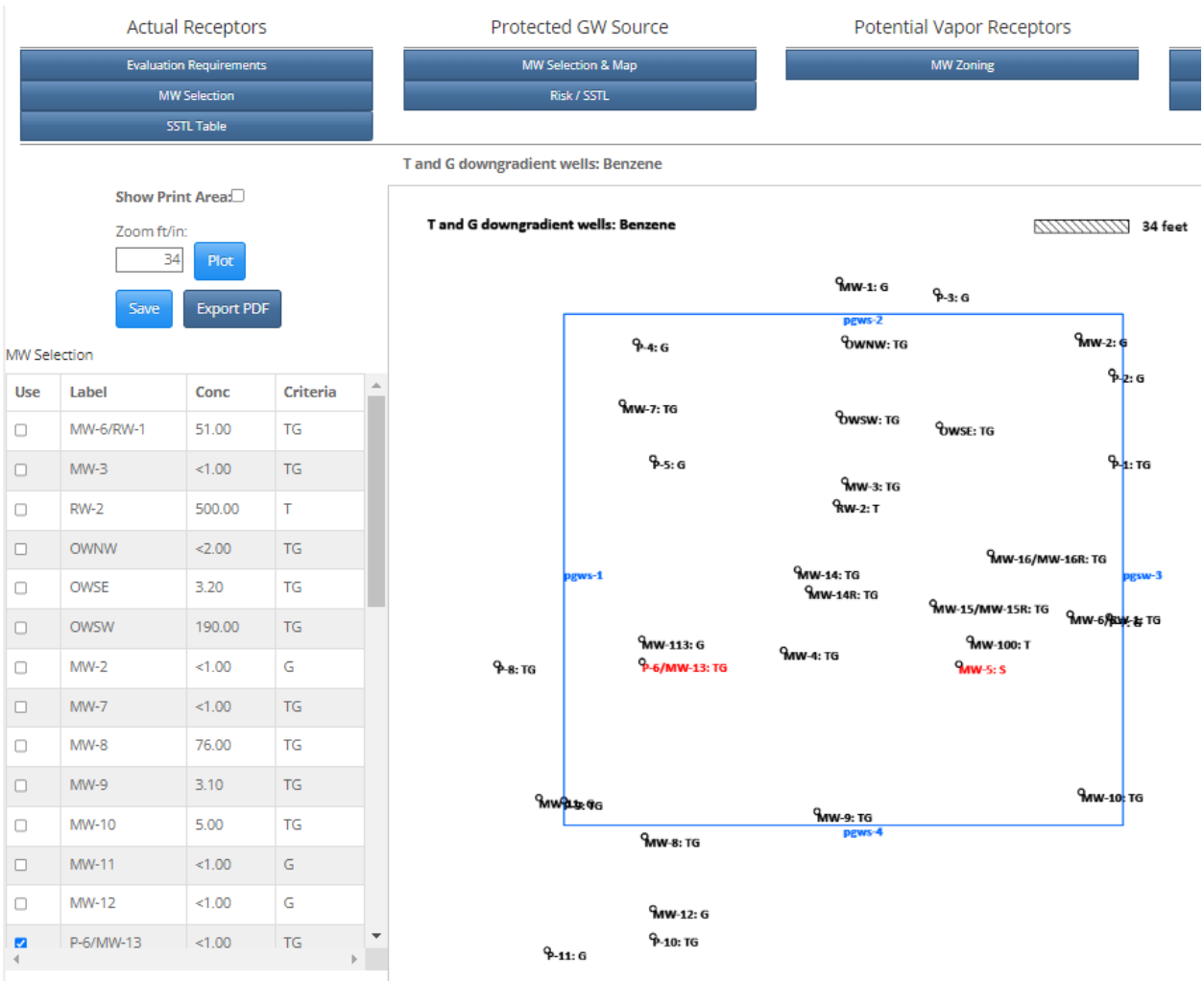
Interior wells are based on spatial location only (i.e., they are not chemical-specific). You only need to do interior well selection once for protected groundwater source.

Downgradient Transition, and Guard Wells

We need to select a downgradient transition (T) and guard (G) well(s) for benzene. This is a well (or wells) meeting transition (T) and guard (G) well criteria that is downgradient from the source location in the estimated travel direction of the plume. The selection is chemical-specific, although it may end up being the same well(s) for different chemicals. You need to do the selection for each chemical you need to evaluate for protected groundwater source.

Select “Benzene” as the “Chemical.” Click the “Down Gradient T, G Wells” button. The plot shows the monitoring wells. The monitoring well label shows if a well meets transition well (T) criteria and/or guard well (G) criteria. A well may meet both criteria. The source well is shown with an S (mw-1, S).

You select the downgradient T and G well(s) by clicking the square box in the “Use” column in the grid to the left of the plot. A selected well is shown with a red label. A well not selected is shown with a black label. To toggle between selected (red) and not-selected (black), click the square boxes in the “Use” column.



For example, there are several wells which meet transition or guard well criteria, but some are not down- gradient. For

example, MW-16 meets T and G criteria, but it is not downgradient from the source. The well(s) selected should be downgradient from the source in the direction the plume appears to be migrating. On-site wells are preferable. It is best to review a plot of the groundwater concentration contours overlain on the site to assist in the selection of a suitable downgradient T and G well(s). It is possible several T or G wells may need to be selected if the plume does not have a definite direction of migration or is migrating in more than one direction.

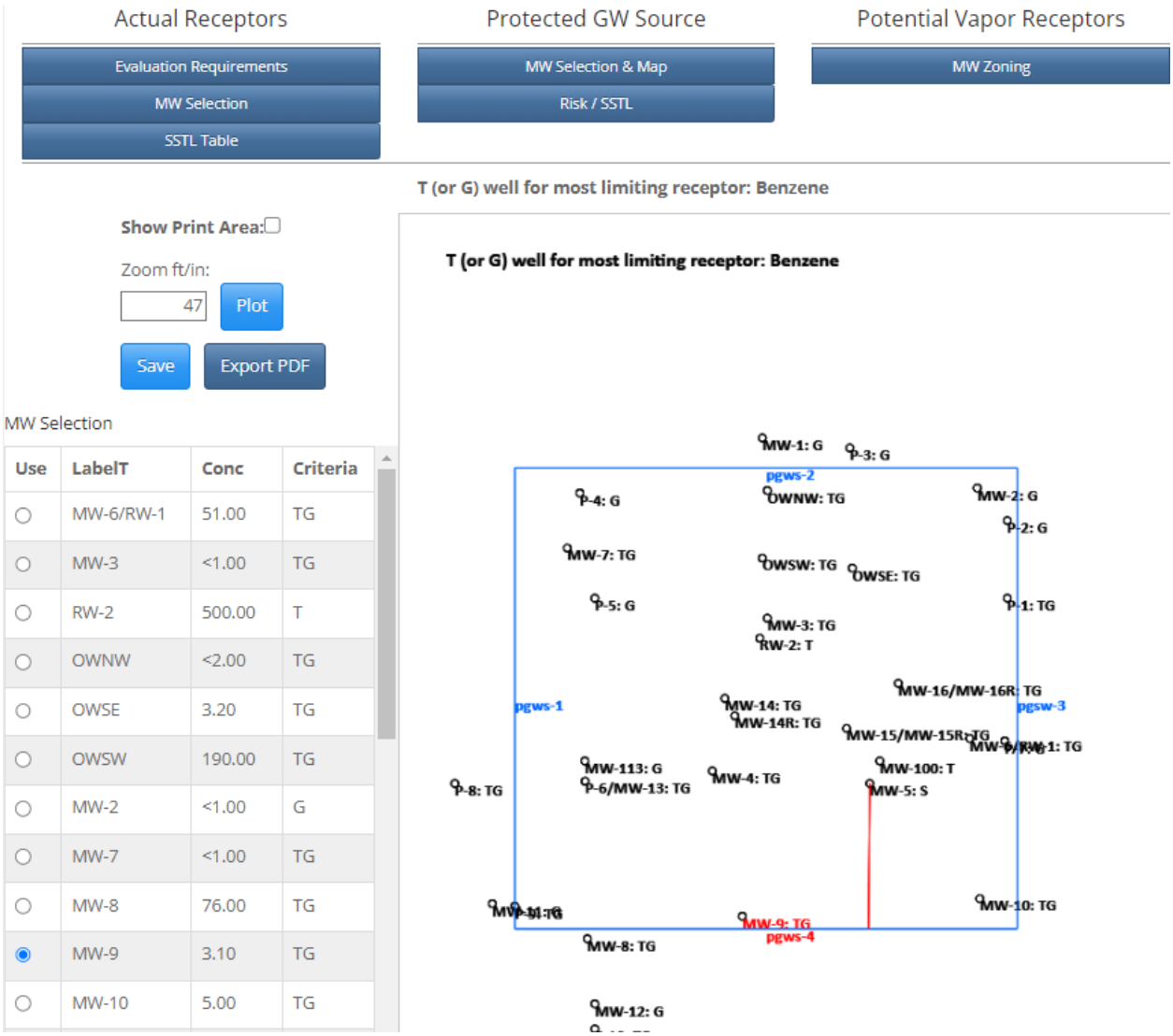
For example, MW-9, MW-4 and MW-10 could serve as the downgradient T and G wells. You might select MW-9 as the T well (because it is on-site) and MW-13 as the G well.

Transition Well-Most Limiting Receptor

For any chemical for which monitoring well selection is required, you also need to select a transition well(s) for the most limiting receptor (T-ML). Click the "Most limiting T Well" button.

The application computes the groundwater source SSTLs for all the protected groundwater source receptors you have entered. A red line is drawn from the source to the most limiting receptor (the receptor with the lowest groundwater source SSTL or most restrictive groundwater cleanup requirement), and the label for the most limiting receptor is shown in red. The T well for the most limiting receptor is intended to monitor groundwater contamination in the direction of the most limiting receptor.

All wells meeting T or G criteria are shown with a T or G appended to the well label. You should first attempt to select a well between the source and the most limiting receptor meeting T well criteria. If a suitable T well is not available, you can select a G well.



For example, MW-9 and MW-10 look like possibilities. We will select MW-9 Looking at the groundwater flow direction, MW-9 would appear to be more representative of potential contaminant migration in the direction of the most limiting receptor (although, it is a judgment call).

Click the circle for MW-9 in the “Use” column in the grid to the left.

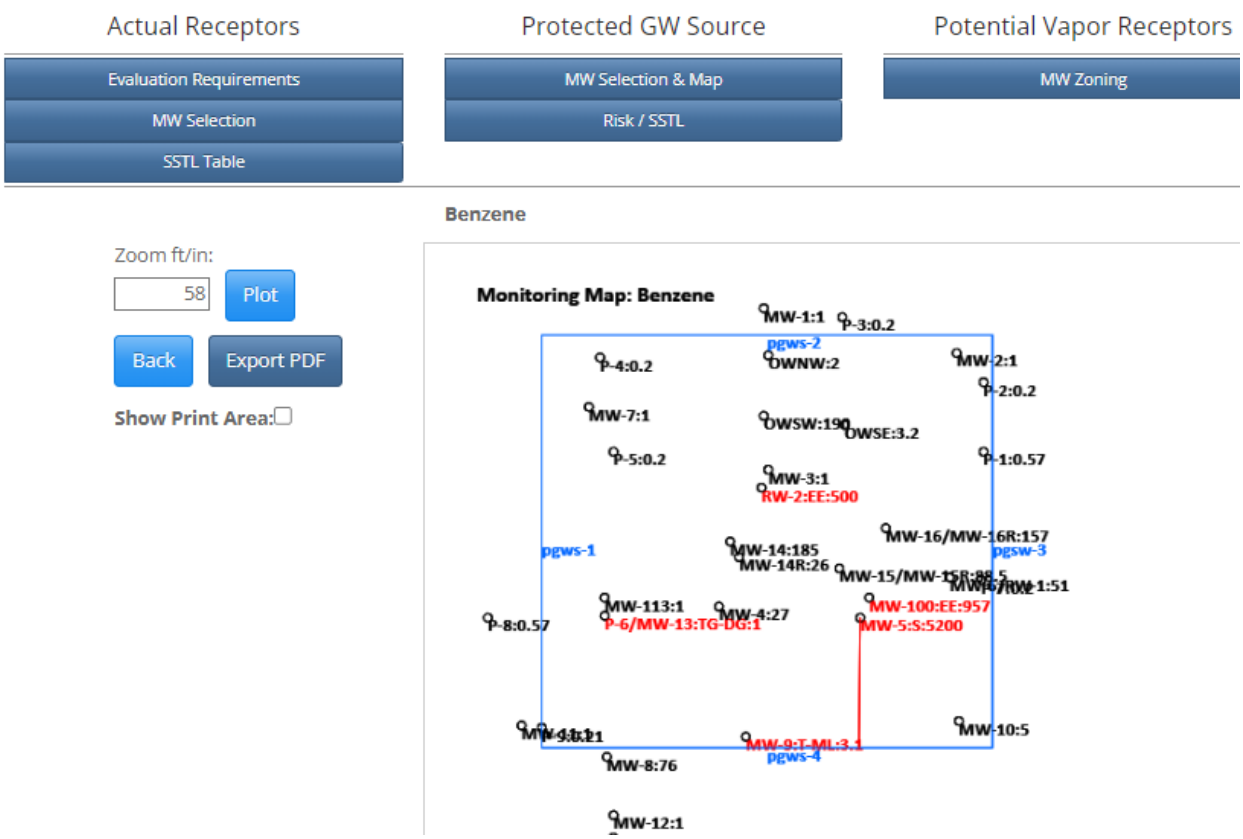
Repeat, if necessary, the same procedure for selecting T and G well(s) for other chemicals of concern. Keep in mind, you should select a downgradient T and G well(s), and T well(s) in the direction of the most limiting receptor for each chemical for which you need to do monitoring well selection. Your selections are chemical-specific. For example, if you select a downgradient T and G well for benzene, the application does not assume the benzene down- gradient T and G well applies for other chemicals (and in some cases, it may not meet downgradient T and G well criteria for other chemicals). It is recommended you take into account the measured groundwater concentrations, groundwater concentration contour plots and apparent direction of plume migration when you make your monitoring well selections.

Remember to save your monitoring well selections.

Monitoring Map (Receptor Evaluation Map)

Click the "Monitoring Map" button in the "Protected GW Source" frame to activate the monitoring map.

The plot is generated which shows the protected groundwater source receptors you have entered and the monitoring wells. The monitoring wells that are part of the monitoring plan for the "Protected Groundwater Source" receptor are shown in red. For each monitoring well in the monitoring plan, the well label is shown, followed by the monitoring criteria, then the concentration. For each well not in the monitoring plan (black), the well label is shown, followed by the concentration. Also shown is a red line drawn from the source well to the most limiting receptor.

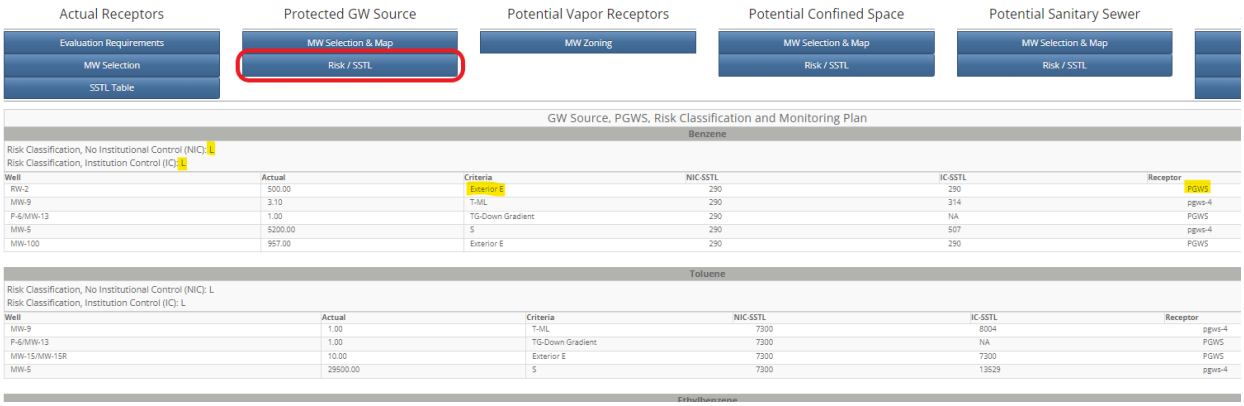


You can print the map or export it as a DXF/PDF file.

Risk Classification and SSTL Table

We will now look at the "Risk Classification" results for Groundwater Source-Protected Groundwater Source. Click the "Risk/SSTL" button in the "Protected GW Source" frame to activate the "GW Source, PGWS, Risk Classification and

Monitoring Plan” table.



For each chemical, the results are shown for two situations: the result with No Institutional Control (NIC) and the result assuming an institutional control (IC).

For the case of no institutional control (NIC), all wells must meet the same target level for the chemical.

In practice, the institutional control case (IC) works like this: groundwater SSTLs are computed for the monitoring wells using only the receptors you have entered into the application. Note: You will still get SSTLs for the wells on-site, but they are based on meeting the target levels for the off-site receptors you have input.

The risk classification for benzene for a case with no institutional control is shown at the top left of the form. The risk is L for Low Risk. The SSTLs to be met at each monitoring well for this situation are shown in the grid in the “NIC-SSTL” column. The target levels are all 290 µg/L benzene.

The risk classification for benzene, assuming an institutional control, is shown at the top left of the form. The risk is L for low risk. The SSTLs to be met at each monitoring well for this situation are shown in the grid in the “IC-SSTL” column. Generally, these SSTLs will be higher than the target level at the receptor, since they are based on meeting the target level at the receptors you have input and not at the monitoring well itself.

As discussed previously, besides the wells you selected for monitoring (T, G, T-ML), the application automatically identifies E wells: wells with concentrations greater than the Tier 1 levels for protected groundwater source. An interior E well is an interior well meeting E well criteria. An exterior E wells is a well which is not- interior, but which meets E well criteria.

A well may have more than one classification (i.e., the same well can be a T-ML well and an interior E well).

To determine the IC-SSTL for interior E wells the application checks the well as a monitoring well for all the PGWS receptors you have input and uses the lowest SSTL. The receptor with the lowest SSTL is shown in the “Receptor” column.

Table 5 is an example of the SSTL Table. We will examine Table 5 in more detail. The top table is a summary risk classification for all chemicals for the case of no institutional control (NIC) and the case of an institutional control (IC). The results are valid for a chemical only if you have previously selected monitoring wells, if required, for the chemical.

The second table gives the chemical-specific results. For the case of no institutional control, all wells must meet the Tier 1 values. For the case of an institutional control, the SSTLs are determined from the PGWS receptors you have input (e.g., the source locations are not the point of exposure). For this example, the PGWS receptor type is low risk both without an institutional control and with an institutional control. However, as expected, the SSTLs are higher with an assumed institutional control on-site preventing exposure at the groundwater source locations.

You can see for the case of toluene and TEH-D an institutional control on-site would result in no further action required.

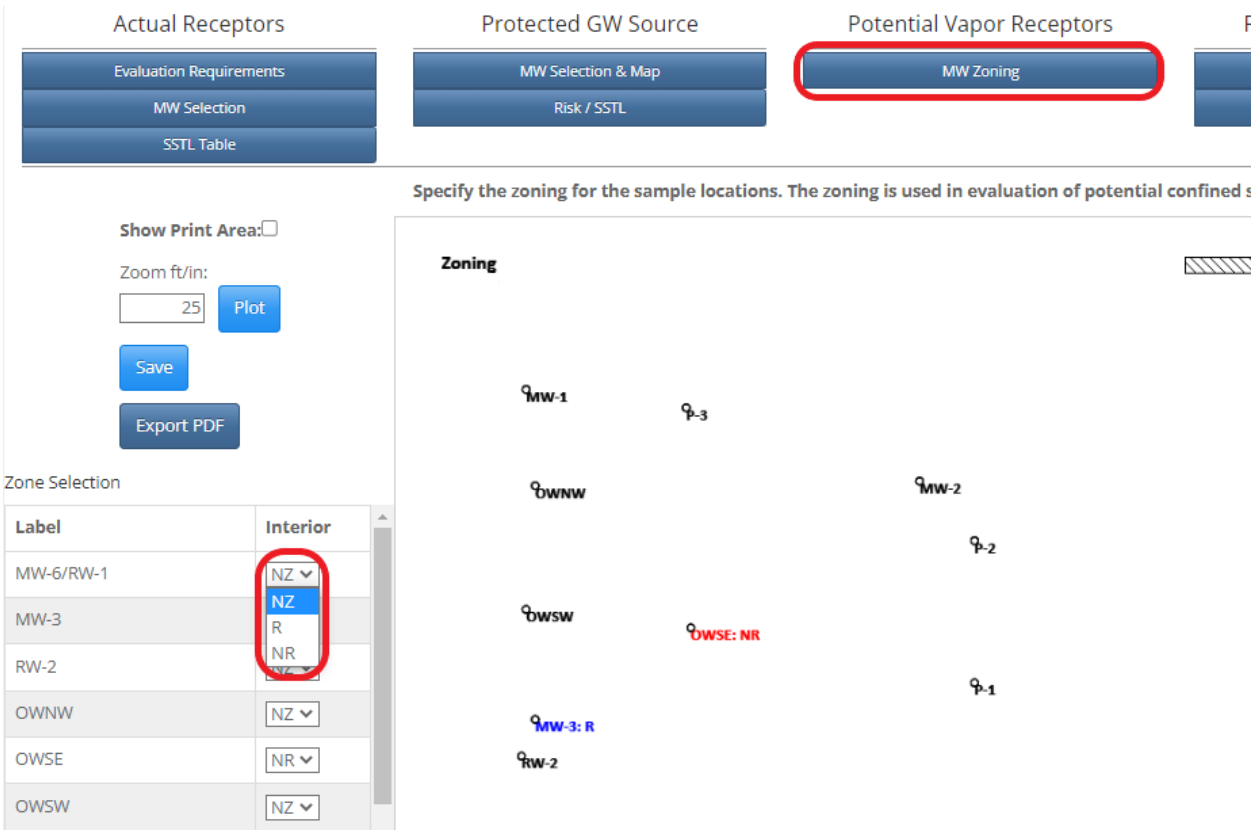
11.4 Groundwater Source, Potential Vapor Receptors

To help simplify the evaluation process for potential vapor receptors, the residential and nonresidential potential confined space (PCS) receptors are monitored and evaluated as a group, and the residential and nonresidential potential sanitary sewer (PSS) receptors are monitored and evaluated as a group. In order to combine residential and non-residential receptors the application needs to know the zoning at each monitoring well.

You should specify "Monitoring Well Zoning" if you need to evaluate any of the vapor receptors for the "Groundwater Pathways" in the "Preliminary Pathway Evaluation Requirements." Check the receptor types under "Groundwater Vapor to Enclosed Space" (Table 1). The relevant receptor types are confined space residential (CSR), confined space nonresidential (CSNR), sanitary sewer residential (SSR), and sanitary sewer nonresidential (SSNR). If you need to evaluate a chemical (X) for <u>any</u> of these receptor types (CSR, CSNR, SSR, SSNR), you need to do monitoring well zoning.

Monitoring Well Zoning

Monitoring well zoning is used as part of evaluating potential confined space (PCS) receptors and potential sanitary sewer (PSS) receptors. Click the "MW Zoning" button in the "Potential Vapor Receptors" frame to activate the "MW Zoning" form.



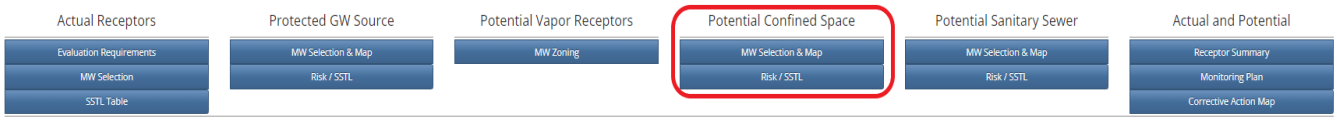
The form shows a plot of the well locations, and labels. You set the zoning by clicking on the drop-down arrows in the "Interior" column in the grid to the left. The drop-down arrow provide a choice of zoning (NZ – no zoning, R – residential, NR – nonresidential). Once you select zoning, it will show on the plot as follows: a black label – no zoning, blue label – residential, red label – nonresidential. **If there is no-zoning, the zoning is treated as residential for the purposes of risk classification.**

Your task is to tell the application the zoning at each well. The zoning is the zoning for the property where the well is located.

11.5 Groundwater Source, Potential Confined Space

You can determine whether you need to evaluate potential confined space by checking the results for confined space residential (CSR) and confined space nonresidential (CSNR) under "Groundwater Pathways" in the "Preliminary Pathway Evaluation Requirements." If any chemical has an X for either receptor type (CSR or CSNR), you need evaluate potential confined space. If you need to evaluate potential confined space, you need to complete the following: 1) identify interior wells, and 2) for each chemical with an X (CSR or CSNR), you need to select a downgradient T and G well(s) and a T well(s) for the most limiting receptor. If you need to evaluate the potential confined space receptor, you should do "Monitoring Well Zoning" beforehand.

For our example problem (Table 1), we need to evaluate potential confined space. In particular, we need to select monitoring wells for benzene.



Repeat the steps with selecting Interior wells, downgradient T and G wells, T well for most limiting receptor, generating a monitoring plan map and Risk Classification and SSTL table as described for the Protected Groundwater Source above.

The application does not assume the interior wells are the same for protected groundwater source, potential confined space, and potential sanitary sewer. Even if you have selected interior wells for protected groundwater source or potential sanitary sewer, you will need to select interior wells for potential confined space, if you need to evaluate potential confined space.

An example of the SSTL Table for GW Source, Potential Confined Space, is shown as Table 6.

The top table in Table 6 is a risk classification summary for each chemical, for the case of no institutional control (NIC) and the case of an assumed institutional control (IC). The receptor type is low risk (L) for benzene and no action required for the other chemicals. "N(PE)" means no action required as determined by the "Preliminary Pathway Evaluation Requirements" (Table 1).

The second table in Table 6 has detailed results for a specific chemical. Results are shown for each monitoring well in the monitoring plan. The same chemical specific results are shown on the screen. The "well" column shows the well label. The "Actual" column shows the Tier 2 concentration at the well (maximum of two most recent samples at the location, or most recent sample if steady and declining). The "Criteria" column shows the monitoring criteria for the well. "S" is the source well. "TG-Down Gradient" is the downgradient transition and guard well. "T-ML" is the transition well in the direction of the most limiting receptor. "Interior E" is an interior E well. You may also have "Exterior E" wells.

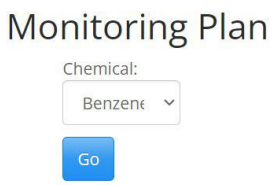
The "NIC-SSTL" column shows the SSTLs, the target levels the wells need to meet, for the case of no institutional control. Since we are combining residential and nonresidential receptor types, the SSTL shown for a well is the minimum of the following: 1) the SSTL for exposure at the well based on the zoning at the well and 2) the SSTL at the well based on the most limiting receptor. The most limiting receptor is shown in the "Receptor" column. For example, if a well is zoned nonresidential and there are residential receptors off- site, the most limiting SSTL for the well may result from meeting the target level for the off-site residential receptor, rather than from exposure at the well.

The "IC-SSTL" column shows the SSTLs for the case of an assumed institutional control. In practice, this is implemented by determining the minimum SSTL for each well, using only the potential confined space receptors you have entered into the application. For example, with an institutional control, the SSTL at the source well is 8,346 µg/L, which is the source concentration required to meet the target level at PCSR-6, an off-site potential confined space residential receptor. In contrast, if an institutional control is not in-place at the source well, the SSTL is 5,195 µg/L, based on exposure at the source well location. Of course, only one situation (NIC or IC) will end up applying to your site. The results show the effect an institutional control would have on monitoring well target levels.

Examine the “Toluene” column in Table 6. We have not selected monitoring wells for toluene (it is not required for our example). The risk classification is “N(PE)” which means the source concentration is lower than the SSTL concentrations at the source.

11.6 Target Levels for Potential Groundwater Vapor Pathways

It has been noted that the target levels generated by the RBCA online application for low risk Potential Groundwater Vapor pathways at some sites do not correspond to the target levels identified in the Iowa Administrative Code and Tier 2 guidance.



Tier 2 Groundwater Monitoring Plan: Groundwater Source and Soil Leaching

Benzene								
Monitoring Well	Actual (ug/L)	SSTL (ug/L)	IC?	Receptor	Description	Type	Risk	Frequency
MW1-TC/MW6	10700							
		2143	No	PCSR1	north	S	L	Annual
		2143	No	SL	PCS	SL	L	Annual
		4287	No	PSSR4		S	L	Annual
		5443	IC	PCSR1	north	S	L	Annual
		6588	IC	PSSR4		S	L	Annual
MW5	168							
		2143	No	PCS	PCS	TG-Down Gradient	L	Annual
		4287	No	PSS	PSS	TG-Down Gradient	L	Annual

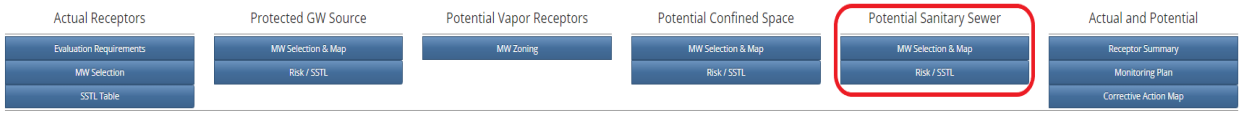
This is a bug in the program which cannot be addressed at this time. Certified groundwater professionals should examine the target levels for potential low risk pathways in the application and manually adjust the SSTLs to the appropriate values based on zoning in the paper copies of reports submitted to the DNR. Provide a description of the adjustment in the Comments/Justification section for the monitoring plan in the application.

11.7 Groundwater Source, Potential Sanitary Sewer

The procedures for evaluating the potential sanitary sewers receptor type for groundwater are similar to potential confined space. The residential and nonresidential potential sanitary sewer (PSS) receptors are monitored and evaluated as a group.

You can determine whether you need to evaluate potential sanitary sewer by checking the results for sanitary sewer residential –(SSR) <u>and</u> sanitary sewer nonresidential (SSNR) under “Groundwater Pathways” in the “Preliminary Pathway Evaluation Requirements.” If <u>any</u> chemical has an X for either receptor type (SSR or SSNR), you need to evaluate potential sanitary sewer. If you need to evaluate potential sanitary sewer, you need to complete the following: 1) identify interior wells, and 2) for each chemical with an X (SSR or SSNR), you need to select a downgradient T and G well(s) and a T well(s) for the most limiting receptor. If you need to evaluate the potential sanitary sewer receptor type, you should have completed “Monitoring Well Zoning” beforehand.

For our example problem (Table 1), we need to evaluate potential sanitary sewer. In particular, we need to select monitoring wells for benzene.



Repeat the steps with selecting Interior wells, downgradient T and G wells, T well for most limiting receptor, generating a monitoring plan map and Risk Classification and SSTL table as described for the Protected Groundwater Source above.

The application does not assume interior wells are the same for protected groundwater source, potential confined space, and potential sanitary sewer. Even if you have selected interior wells for protected groundwater source or potential confined space, if you need to evaluate potential sanitary sewer for groundwater source, you need to select interior wells.

An example of the SSTL Table for GW Source, Potential Confined Space, is shown as Table 7. The top table in Table 7 is a

risk classification summary for all the chemicals, for no institutional control (NIC) and with an institutional control (IC). Potential sanitary sewer is low risk (L) for benzene and no action required for the other chemicals. “N(PE)” means no action required, as determined by the “Preliminary Pathway Evaluation Requirements” (Table 1).

The second table in Table 7 and the grid on the screen show the results for a specific chemical. Results are shown for each monitoring well in the monitoring plan. The “well” column shows the well label. The “Actual” column shows the Tier 2 concentration at the well (maximum of two most recent samples at the location, or most recent sample if steady and declining). The “Criteria” column shows the monitoring criteria for the well. “S” is the source well. “TG-Down Gradient” is the downgradient transition and guard well. “T-ML” is the transition well in the direction of the most limiting receptor. For an actual site, you might also have “Interior E” or “Exterior E” wells.

The “NIC-SSTL” column shows the SSTLs (the target levels the wells need to meet) for the case of no institutional controls. Since we are combining residential and nonresidential receptor types, the SSTLs shown are the minimum of: 1) the SSTL at the well based on the zoning at the well or 2) the SSTL at the well from the most limiting receptor (residential and nonresidential). The most limiting receptor is shown in the “Receptor” column. For example, if a well is zoned nonresidential and there are residential receptors off-site, the most limiting SSTL for the well may result from meeting the target level for the off-site residential receptor.

The “IC-SSTL” column shows the SSTLs for the case of an assumed institutional control. In practice, this is implemented by determining the minimum SSTL for each well, using only the potential sanitary sewer receptors you have entered into the application. For example, with an institutional control, the source well SSTL is 11,465 µg/L, based on meeting the target level at potential sanitary sewer nonresidential receptor PSSNR-4. If an institutional control is not in-place at the source well, the SSTL is 10,390 µg/L: the smallest SSTL from 1) assuming exposure at the well or 2) the SSTL required to meet the target levels at the receptors you have entered. In this example, the lowest SSTL is for exposure at the well (10,390 µg/L). We can tell this because the lowest SSTL for the receptors we have entered is shown in the IC-SSTL column (11,465 µg/L).

Note: For MW-12 for “IC-SSTL,” “Out of Range” is shown. This is because MW-12 does not qualify as a T well for the most limiting receptor. It is a T well, but it is not between the source and the most limiting receptor. This is another indication we may need to install a new well to serve as the T well between the source and the most limiting receptor.

Only one situation (NIC or IC) will end up applying to your site. The results show what the effect of an institutional control would be for your site.

Examine the column for “Toluene” in Table 7. We have not selected monitoring wells for toluene (it is not required for our example). The risk classification is “N(PE)” which means the source concentration is lower than the SSTL concentrations at the source.

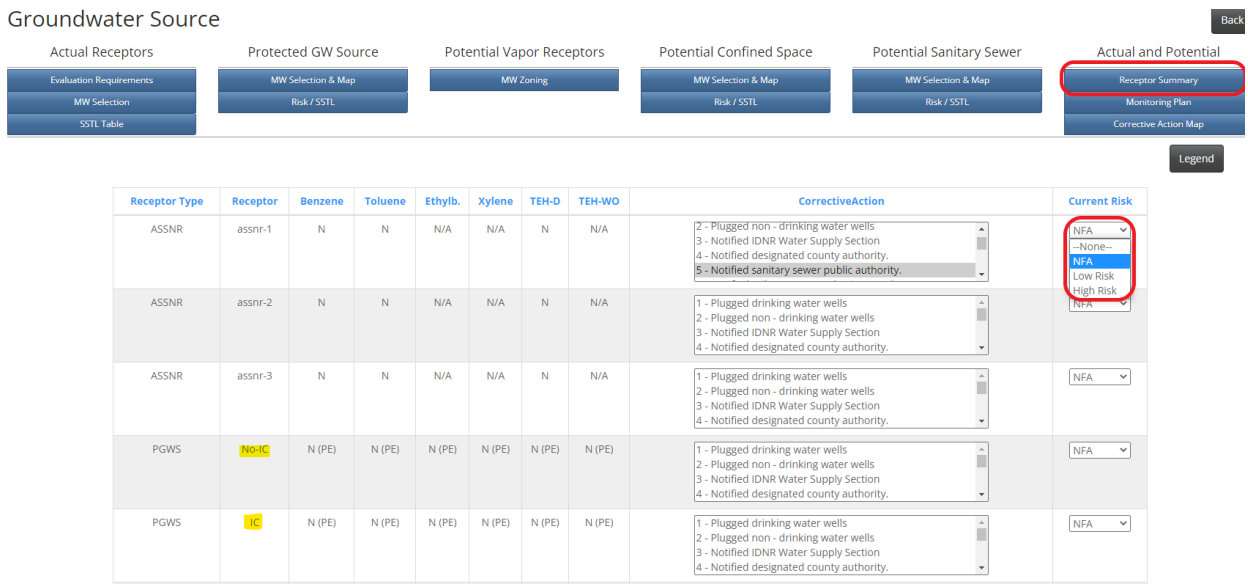
11.8 Groundwater Source, Receptor Summary

We now turn to the “Receptor Summary” for “Groundwater Source.” For the receptor summary to be accurate, you need to have completed any required monitoring well selections for the actual and potential receptors. In practical terms, you need to have completed, if appropriate, the following:

- Actual Receptors frame
  - MW Selection
- Protected GW Source frame
  - MW Selection
- Potential Vapor Receptors frame
  - MW Zoning
- Potential Confined Space frame
  - MW Selection
- Potential Sanitary Sewer
  - MW Selection

For actual receptors, use the “Evaluation Requirements” button to determine the actual receptor-chemical combinations requiring monitoring well selection. For potential receptors, use the “Preliminary Pathway Evaluation Requirements” to determine the receptor types-chemicals requiring monitoring well selection.

Click “Receptor Summary” in the “Actual and Potential” frame to activate the “Groundwater Source” table. The table lists the risk classifications for “Groundwater Source” for the actual and potential receptors. The risk classifications are N/A (chemical is not applicable), N (No action required), L (Low Risk), and H (High Risk). The “Legend” button for risk classifications is at the top right.



The application determines and displays the risk classifications shown in the chemical columns (i.e., Benzene). The actual receptors are listed first, always followed by the potential receptors (always the last six rows). Two rows are shown for each potential receptor: one row for no institutional control (No-IC) and one row for institutional control (IC). PGWS is protected groundwater source, PCS is potential confined space, and PSS is potential sanitary sewer.

The “Corrective Action” column is where you select completed corrective actions. When you print the table the corrective action numbers will be shown the column and the numbers for various corrective actions with the description are shown in the grid at the bottom of the screen. For example, you would select a “1 – Plugged drinking water wells” in the “Corrective Action” column if you plugged a drinking water well. If you have completed more than one corrective action for a receptor, use Ctrl-Mouse click to select completed corrective actions. When you print the table the selected entries will be listed with a comma (i.e., 3,4).

The column for “Current Risk” is used to indicate the overall current risk for the receptor. **The application does not set the current risk for pathways/receptors. You must select the current risk.** The information in the Current Risk column affects the receptors included in the groundwater monitoring plan, the receptors included in the groundwater corrective action map, and the receptors carried over to the SMR portion of the application.

Select the “Current Risk” from the drop-down menu.

If you have not completed corrective actions affecting the risk classification for a receptor, the “Current Risk” you specify should be based on the risk classifications shown for the chemicals. If the risk is high (H) for any chemical, the risk is high for the receptor. If there are no high risk chemicals, but one or more low (L) risk chemicals, the risk is low for the receptor. If there are no high or low risk chemicals, the risk is no further action (NFA).

You also use Current Risk to reflect changes in risk classification resulting from corrective actions. That is, when the chemical risk classifications are no longer applicable you use the “Current Risk” column to specify the new risk

classification.

For example, the non-drinking water well (NDWW-1) is currently high risk (H). If no corrective action were completed, we would set the “Current Risk” to “High Risk.” However, if we properly plugged the well, we would select a “Corrective Action” of “2 - plugged non-drinking water wells” and set the “Current Risk” to NFA.

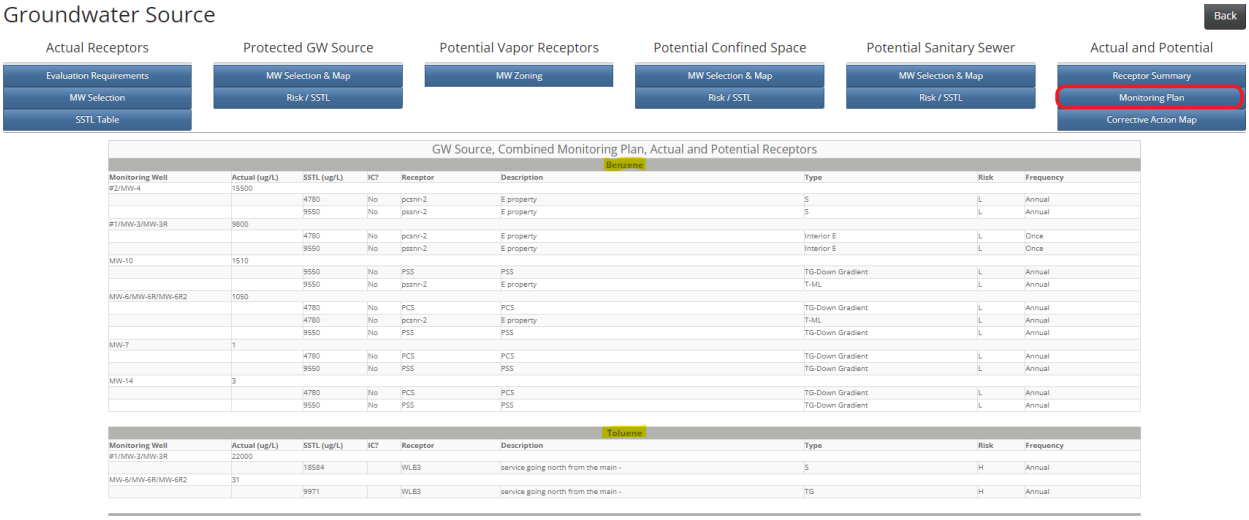
Another example, if we established an institutional control on-site prohibiting use of the protected groundwater source, for the “PGWS-No IC” receptor we would enter a “Corrective Action” of “9 - Established institutional controls” and set the “Current Risk” to NFA.

You may also have completed corrective actions not affecting the risk classification. For example, an actual water line pathway has been identified as high risk and you have notified the utility company supplying water to the area of potential water line impacts (6 – Notified utility company plastic water line). This notification is required, but the notification alone does not clear an actual high risk water line receptor. The correct current risk is the highest chemical risk, unless you have performed corrective actions and the corrective actions affect the risk classification for the receptor.

It is important you properly set the “Current Risk” column. When the application generates the groundwater/soil leaching monitoring plan, if a receptor has an application-computed chemical risk of L or H it will be included in the monitoring plan, *unless the “Current Risk” column is NFA*. If you clear a receptor by corrective action but do not select an NFA in the “Current Risk” column, the receptor may be included in the groundwater/soil leaching monitoring plan (it will be included if any chemical has an L or H).

11.9 Groundwater Source, Groundwater Monitoring Plan

Click the “Monitoring Plan” button in the “Actual and Potential” frame to activate the “GW Source, Combined Monitoring Plan, Actual and Potential Receptors” table.



The groundwater monitoring plan only includes the wells required to monitor receptors for “Groundwater Source.” You do not print the monitoring plan in this frame. This is because the monitoring plan required for the Tier 2 SCR combines the groundwater monitoring required for groundwater source and soil leaching. The combined groundwater source/soil leaching monitoring plan contains all the information in the groundwater source monitoring plan, along with any groundwater monitoring required for soil leaching. Accessing the combined plan is discussed later.

To create the groundwater monitoring plan, the application assembles the monitoring well information for all low and high risk receptors. A receptor having L or H for a chemical in the “Receptor Summary” is included in the groundwater monitoring plan, unless the “Current Risk” has been set to NFA.

The monitoring plan is organized by well location, with the source well listed first, followed by the other wells, listed in

order of increasing radial distance from the source. The wells included in the monitoring plan are those selected by the user or the application (i.e., S) as part of evaluating a receptor. If a monitoring well is not being used to monitor a low or high risk receptor, it will not be included in the monitoring plan.

For each well, the following is shown:

- "Monitoring Well" column - The well label.
- "Actual µg/L" column - The Tier 2 measured groundwater concentration: maximum of two most recent or most recent if steady and declining.
- "SSTL (µg/L)" column - The groundwater site-specific target level (SSTL) at the well for the receptor. The groundwater target level the well needs to meet as part of meeting the target level at the receptor (according to the groundwater modeling). The concentration the well must meet as part of the no action required criteria for the receptor.
- "IC?" column - Applies to potential receptors only (protected groundwater source, potential confined space or potential sanitary sewer). Indicates the situation the SSTL is applicable to: no institutional control (No) or an institutional control (IC).
- "Receptor" column - The short label you assigned to actual receptors. For potential receptor types (protected groundwater source, potential confined space, potential sanitary sewer), this column shows the label of the most limiting receptor, except for downgradient T and G wells. For downgradient T and G wells, this column shows the receptor type (i.e., PGWS, PCS, PSS).
- "Description" column - The description you input for the receptor. For potential receptors, if there is no most limiting receptor, the "Description" will show PGWS for protected groundwater source, PCS for potential confined space, and PSS for potential sanitary sewer.
- "Type" column - The criteria the monitoring well meets for the receptor. "S" is source well. The well criteria have been covered elsewhere in this User's Manual and are also covered in the Tier 2 Guidance.
- "Risk" column - The risk classification for the receptor. This "Risk" is the chemical specific risk determined by the application (shown in the "Receptor Summary"). This column does not show the "Current Risk" assigned by the user in the "Receptor Summary." However, if the Current Risk for a receptor is NFA, the receptor is not included in the monitoring plan.
- "Frequency" column - The frequency of sampling required. Determined from the risk classification for the receptor and the well "Type." E wells do not need to be sampled annually. A minimum of one sample is required for E wells, and the most recent sample must meet the SSTL.

The "GW Source Monitoring Plan" information is used to construct the "Groundwater Corrective Action Map." For each monitoring well in the monitoring plan, the Groundwater Corrective Action Map displays the concentration ("Actual") and the lowest SSTL from among the high risk receptors.

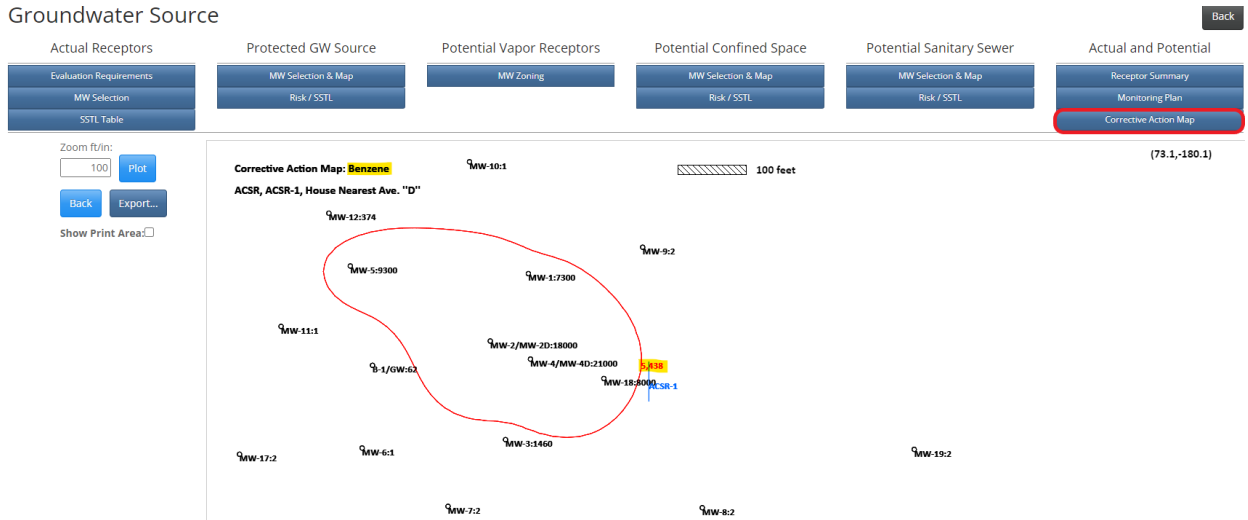
There may be cases where the lowest SSTL for high risk receptors is higher than the current actual concentration at the well. If a well does not have a high risk receptor, no corrective action concentration will be shown for the Corrective Action Map (however, as part of the monitoring plan, the well still needs to be monitored).

Depending on your site, you may also have a monitoring plan for other chemicals generated in the "GW Source, Combined Monitoring Plan, Actual and Potential Receptors" table.

11.10 Groundwater Source, Corrective Action Map

The Groundwater Corrective Action Map displays the lowest SSTL for the high risk receptors associated with a well. The "Corrective Action Map" is a really a "High Risk" corrective action map. The Tier 2 Guidance calls this map the "Groundwater Summary Corrective Action Map."

Click the "Corrective Action Map" button in the "Actual and Potential" frame to activate the "Groundwater, High Risk Corrective Action Map" form.



Select “Benzene” as the chemical and set the “Interpolation Range.”

Each groundwater sample location is shown on the map with a well label and the measured concentration at the well. The lowest SSTL at the source well is contoured (red line) and forms the “Primary Area.” For example, in the picture above, this is 5,438 µg/L benzene for the actual confined space residential receptor, ACSR-1. Keep in mind, corrective action must reduce the maximum groundwater concentration to the lowest source SSTL: the maximum groundwater concentration must be reduced to 5,438 µg/L benzene. The red contour is an estimate of where concentrations currently exceed 5,438 µg/L. All wells need to meet the primary area SSTL.

In addition to all wells meeting the primary source SSTL for a chemical, some wells will have high risk SSTLs specific to the well as presented in the groundwater monitoring plan table. All wells need to meet the lower of the well-specific SSTL or the primary area SSTL (the SSTL for the source well).

You can print the map or export it as a DXF/PDF file.

If there are high risk receptors for other chemicals you can generate a corrective action map for each chemical of concern.

12. SOIL LEACHING PATHWAY EVALUATION

Soil leaching is concerned with the potential for existing soil contamination to produce future groundwater contamination problems. The modeling involves two steps: 1) the soil leaching model uses existing soil contamination to simulate the potential future groundwater concentration beneath a soil source. 2) The simulated groundwater concentration beneath the soil source is used as the groundwater source concentration in the groundwater transport model. The simulations are an estimation of the groundwater concentrations which could occur in the future, as a result of current soil contamination. Soil source site- specific target levels or soil source SSTLs are soil source concentrations which will not result in groundwater concentrations exceeding groundwater target levels at a receptor in the future (according to the modeling). The soil source SSTLs are the soil target levels for the “Soil Leaching” pathway.

The “Groundwater Source” and “Soil Leaching” pathways are both concerned with meeting groundwater target levels at receptors. The “Groundwater Source” pathway is concerned with existing groundwater contamination and produces groundwater cleanup levels (groundwater SSTLs). The “Soil Leaching” pathway is concerned with existing soil contamination becoming groundwater contamination in the future and produces soil cleanup levels (soil SSTLs or soil leaching SSTLs). Hence, a receptor can have groundwater SSTLs that measured groundwater concentrations need to meet, and soil SSTLs that measured soil concentrations need to meet. Both are based on meeting the same groundwater target levels at a receptor.

Prior to doing “Soil Leaching Pathway Evaluation,” you need to have identified and entered all receptors. The “Receptor Types” you need to evaluate for the soil leaching pathway are shown in the “Preliminary Pathway Evaluation

Requirements" under "Preliminary Soil Leaching." The "Soil Leaching: Receptor Identification Plumes" are generated using the "Soil Leaching RID" button in the "RID Maps" frame on the "Main Form."

Click the "Soil Leaching" button in the "Pathway Evaluation" frame to activate the "Soil Leaching" form. Some time may be required for the application to do background calculations before the form is shown.

12.1 Soil Leaching, Monitoring Well Selection

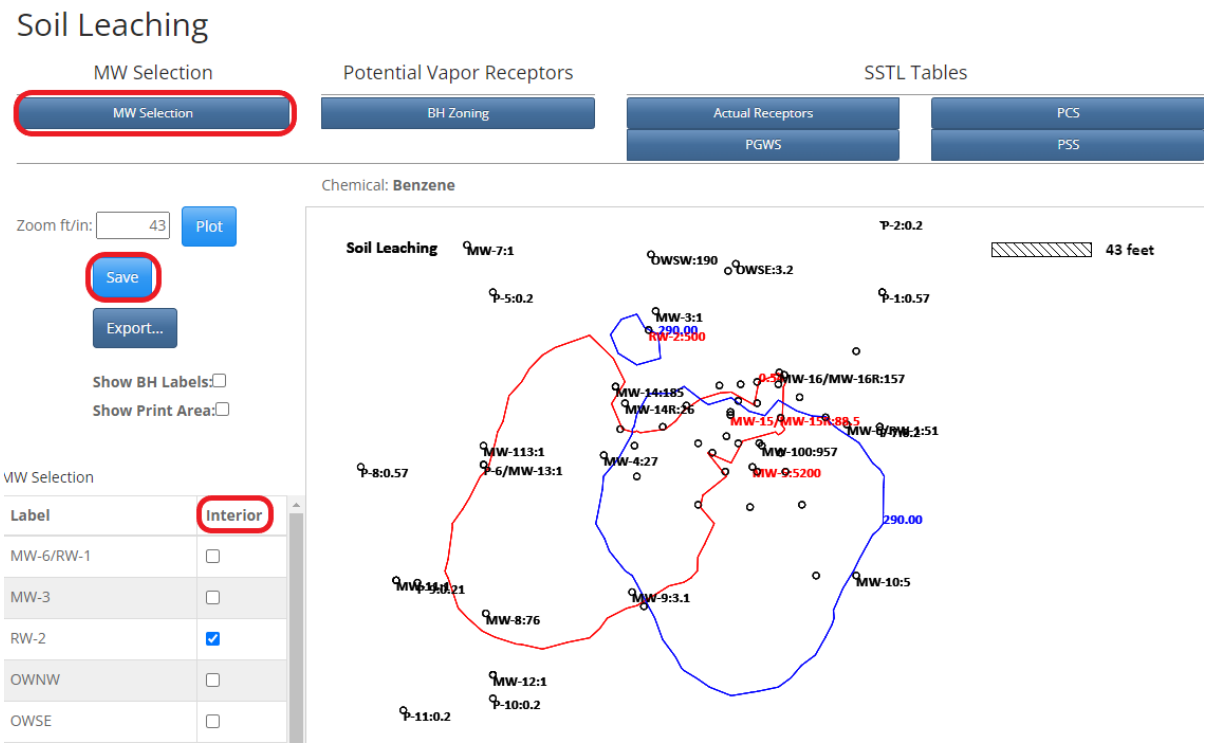
The "groundwater concentration in the vicinity of the soil source" is a factor in risk classification and reclassification during site monitoring of potential receptors for the soil leaching.

You must first determine whether you need to do "monitoring well selection in the vicinity of the soil source(s)." A common error in Tier 2 SCRs is neglecting to do monitoring well selection, when it is required.

If a chemical has an "X" for any of the receptor types in the Preliminary Pathway Evaluation Requirements, you need to evaluate them for that chemical.

Click the "MW Selection" button on the "Soil Leaching" form to activate the monitoring well selection.

Select "Benzene" as the "Chemical." Set the "Interpolation Range." Click "Plot."



The application contours the soil data to the Tier 1 levels for soil leaching to groundwater (red contour, 0.54 mg/kg for benzene) and this defines the vicinity of the soil source for benzene. The application also plots the groundwater data to the Tier 1 levels for protected groundwater source (blue contour, 290 µg/L for benzene).

You are required to identify the groundwater monitoring well locations lying on or within the soil contour (red contour). The blue groundwater data contour is for information only, but is not used to define the area of concern. Only the red soil data contour is used to determine groundwater monitoring wells in the vicinity of the soil source.

Only the labels for groundwater monitoring well locations are shown on the plot. Select the monitoring wells on or within the red contour using the "Interior" column in the grid to the left of the plot. A selected well has a red label. A non-selected well has a black label. Save your selections using the "Save" button.

Select other chemicals of concern if required to be evaluated and repeat the process of selecting monitoring wells. Save the selections.

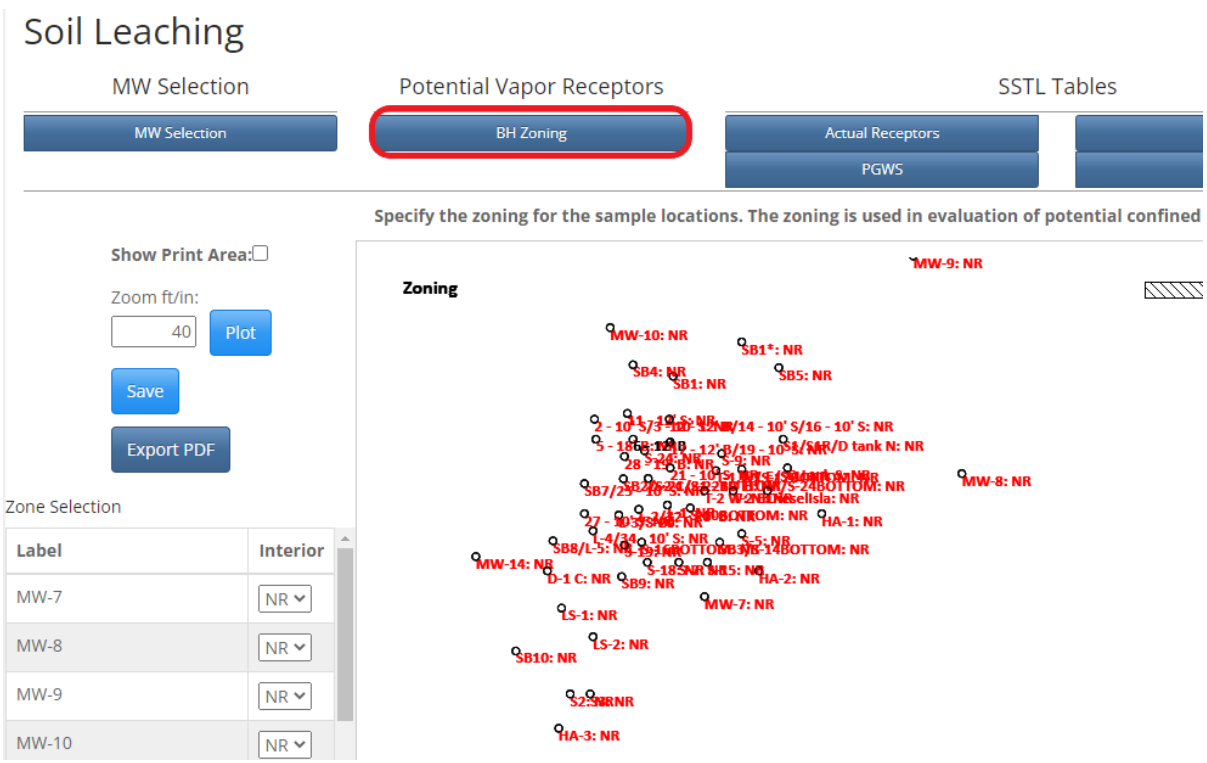
If you select a chemical which is not required to be evaluated, no contour is plotted. In the upper left corner of the plot, you see “Soil: TL>Interp.Max..” This means the soil source concentration is less than the Tier 1 target level for soil leaching to groundwater. This also means you are not required to evaluate this chemical for soil leaching, as indicated in the “Preliminary Pathway Evaluation Requirements” for “Soil Leaching Pathways” and you do not need to do monitoring well selection for the chemical.

12.2 Soil Sample (BH) Zoning

To help simplify the monitoring and risk classification process for potential receptors, residential and nonresidential receptors are combined. Potential confined space residential and nonresidential receptors are monitored and evaluated as a group. Potential sanitary sewer residential and nonresidential receptors are monitored and evaluated as a group. To combine residential and nonresidential receptors the application needs to know the zoning at soil sample locations.

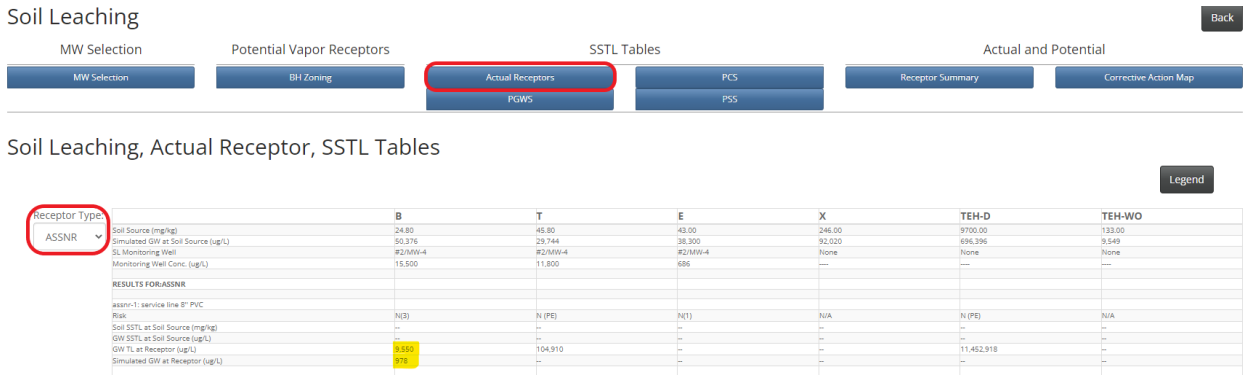
Use the “Preliminary Pathway Evaluation Requirements” to determine if soil sample zoning is required. Examine the vapor receptors under “Soil Leaching Pathways”: “Confined Space Residential-CSR,” “Confined Space Nonresidential-CSNR,” “Sanitary Sewer Residential-SSR” and “Sanitary Sewer Nonresidential-SSNR.” You should do soil sample zoning if *any* chemical has an “X” for any of these receptor types. Soil sample zoning is not chemical-specific.

Click the “BH Zoning” button in the “Potential Vapor Receptors” frame. Repeat zoning designation selection as was described for the Groundwater Vapor pathways.



12.3 Soil Leaching, SSTL Tables for Actual Receptors

To view the risk classification and SSTL results for actual receptors click the “Actual Receptors” button in the “SSTL Tables” frame to activate the “Soil Leaching, Actual Receptor, SSTL Tables” form. The results are displayed by “Receptor Type” which you select to the left of the table.



	B	T	E	X	TEH-D	TEH-WO
Soil Source (mg/kg)	24.80	45.80	43.00	246.00	9700.00	133.00
Simulated GW at Soil Source (ug/L)	50,376	29,744	38,300	92,020	696,396	9,549
SL Monitoring Well	#2/MW-4	#2/MW-4	#2/MW-4	None	None	None
Monitoring Well Conc. (ug/L)	15,500	11,800	686	---	---	---
RESULTS FOR:ASSNR						
assnr-1: service line 8" PVC						
Risk	N(3)	N (PE)	N(1)	N/A	N (PE)	N/A
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	--	--	--	--	--
GW TL at Receptor (ug/L)	9,550	104,910	--	--	11,452,918	--
Simulated GW at Receptor (ug/L)	978	--	--	--	--	--

The first four rows of the grid are the same for all receptor types:

- Soil Source (mg/kg) - The soil source, or maximum soil concentration for a chemical. Determined by the application from the Tier 2 soil sample data. Additional information for the soil source can be viewed using the "Sources" button on the "Main Form."
- Simulated GW at Soil Source (µg/L) - The simulated groundwater concentration beneath the soil source. Computed using the soil source concentration and the soil leaching model. The source width (Sw) used for the soil leaching model is the larger of the groundwater and soil source width. The source length (W) is the larger of the groundwater and soil source length.
- SL Monitoring Well - Used to monitor soil leaching in the vicinity of the soil source. Selected by the application from the monitoring well locations you identified as being in the vicinity of the soil source. The application selects the well with the highest measured concentration for the chemical. It is possible different wells could be used to monitor different chemicals. If a chemical is not required to be evaluated and no monitoring wells selected, the table will show "none" for the chemical.
- Monitoring Well Conc. (µg/L) - The groundwater concentration for the soil leaching monitoring well (maximum of two most recent or most recent if steady and declining).

For the receptor type selected, the grid shows information for each of the receptors of that type you have entered into the application.

For each receptor of a type, the grid shows:

- The short label and description you entered to identify the receptor.
- Risk - The risk classification for each chemical. If the risk classification is N, a reason is identified. The "Legend" button in the right top corner contains description for the risk classification symbols.
- Soil SSTL at Soil Source (mg/kg) - This is the soil concentration needed at the soil source (according to the simulation models) in order to meet the groundwater target level at the receptor: This is the soil remediation target level. The groundwater transport model is used to determine the groundwater concentration at the soil source needed to meet the groundwater target level at the receptor (GW SSTL at Soil Source). The soil leaching model is used to calculate the soil source concentration that would produce the groundwater concentration at the soil source.
- GW SSTL at Soil Source (µg/L) - The groundwater concentration beneath the soil source the application has determined is needed to meet the groundwater target level at the receptor. This value is not used for evaluating actual receptors. This value is compared to the monitoring well concentration in the vicinity of the soil source to determine the risk classification, and for monitoring of low risk potential receptors at the SMR stage.
- GW TL at Receptor (µg/L) - The risk-based groundwater target level at the receptor. This is set or determined by the application. For example, for actual vapor receptors, a receptor-specific target level is computed that incorporates the depth to groundwater entered for the receptor.
- Simulated GW at Receptor (µg/L) - The simulated groundwater concentration at the receptor, using the soil leaching and groundwater transport models. This is the concentration the models predict might occur at the receptor in the future; based on the current soil source concentration, source width, source length, hydraulic conductivity, etc.

In some situations, values are not shown for “Soil SSTL at Soil Source,” “GW SSTL as Soil Source,” or “Simulate GW at Receptor.” This occurs when the values are not needed for risk classification. For example, consider the benzene (B) result for assnr-1 in the picture above. The simulated groundwater concentration at the receptor under current conditions (Simulated GW at Receptor) of 978 µg/L is less than target level at the receptor (9,550 µg/L). No SSTL levels are computed.

Sampling and Actual Vapor Receptors

For soil leaching, vapor receptors can be cleared by passing vapor sampling at the soil source. Actual vapor receptors for soil leaching can be cleared by vapor at an alternative point of compliance, if steady and declining conditions for groundwater can be demonstrated. See the Tier 2 Guidance for more information on the use of soil gas sampling to evaluate vapor receptors for soil leaching.

12.4 Soil Leaching, Protected Groundwater Source, Risk Classification and SSTL Table

To view the risk classification and SSTL Table for protected groundwater source, click the “PGWS” button in the “SSTL Tables” frame to activate the “Soil Leaching, Protected Groundwater Source, SSTL Tables” form.

Protected groundwater source is a potential receptor. **The only situation in which a potential receptor can be high risk is the protected groundwater source receptor under soil leaching**. In all other situations, potential receptors can only be low risk or no action required. For example, protected groundwater source cannot be high risk under “Groundwater Source.” Potential confined space and potential sanitary sewer receptors are never high risk (although actual confined space and actual sanitary sewer receptors can be high risk).

Soil Leaching, Potected Groundwater Source, SSTL Tables

Legend

	B	T	E	X	TEH-D	TEH-WO
Soil Source (mg/kg)	10.00	800.00	63.10	103.00	NSC	NSC
Simulated GW at Soil Source (ug/L)	1,131	28,928	3,129	2,145	NSC	NSC
SL Monitoring Well	MW-5	MW-5	RW-2	None	None	None
Monitoring Well Conc. (ug/L)	5,200	29,500	430	----	----	----
Summary - NO I.C.						
Risk Classification	H	H	N(2)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	2.56	202	--	--	--	--
GW SSTL at Soil Source (ug/L)	290	7,300	--	--	--	--
Summary - I.C., ML Receptor						
Risk Classification	H	H	N	N	N	N
Soil SSTL at Soil Source (mg/kg)	4.18	345	--	--	--	--
GW SSTL at Soil Source (ug/L)	473	12,470	--	--	--	--
ML Receptor	pgws-4	pgws-4	None	None	None	None
RESULTS FOR:PGWS						
pgws-1: west row						
Risk	H	N(3)	N(2)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	8.55	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	967	--	--	--	--	--
GW TL at Receptor (ug/L)	290	7,300	3,700	73,000	75,000	40,000
Simulated GW at Receptor (ug/L)	339	7,117	--	--	--	--

The first four rows are a summary of the soil source data (the same as the actual receptor SSTL Tables, see the previous section for a detailed discussion).

The results for two cases are shown:

- First case - The case of no institutional control (NO I.C.). The soil source SSTLs are based on having to meet the receptor groundwater target levels at all locations. They are also computed assuming the groundwater target levels must be met directly below the soil sources.
- Second case - The case of an institutional control (I.C.). In practice, this is implemented by computing the SSTLs using *only* the protected groundwater source receptors you have entered into the application. That is, you do not need to meet the groundwater target level directly beneath the soil source, but only at the receptors you entered.

The major results are summarized under two headers in the grid, “SUMMARY-NO I.C.” and “SUMMARY- I.C., ML Receptor.”

<u>SUMMARY-NO I.C.</u>: The case of no institutional control. You need to meet the groundwater target levels everywhere.

The soil SSTLs are computed assuming you must meet the groundwater target levels directly beneath the soil sources.

The three rows directly beneath "SUMMARY-NO I.C." give the detailed results:

- Risk Classification - The risk classification for the chemical. The "Legend" button in the right top corner of the form contains description for the risk classification symbols.
- "Soil SSTL at Soil Source (mg/kg)" - The soil concentration (according to the soil leaching model) that would result in the groundwater concentration shown by "GW SSTL at Soil Source."
- "GW SSTL at Soil Source (µg/L)" - The groundwater target level for the receptor type. For the case of no institutional control, the target level for the receptor type.

For example, in the picture above, for benzene, the target level 290 µg/L must the met directly beneath the soil source (GW SSTL at Soil Source). With a soil source concentration of 10 mg/kg, the soil leaching model predicts a groundwater concentration directly beneath the soil source of 1,131 µg/L (Simulated GW at Soil Source).

According to the soil leaching model, a soil concentration of 2.56 mg/kg (Soil SSTL at Soil Source) will result in a groundwater concentration of 290 µg/L. When the "Soil SSTL at Soil Source" is less than the "Soil Source" concentration, the risk classification is either low or high.

The soil SSTL can be computed by multiplying the soil source concentration by the ratio of the groundwater target level to the simulated groundwater concentration beneath the soil source (10*(290/1,131)).

For example, in the picture above, for ethylbenzene, for a soil source concentration of 63.1 mg/kg the simulated groundwater concentration beneath the soil source is 3,129 µg/L (Simulated GW at Soil Source). This concentration is less than the target level for the receptor (3,700 µg/L). The receptor is no action required (N), and no further computations are done. The soil SSTL at the soil source is not computed. If it were computed for this situation, the soil SSTL would be higher than the soil source concentration.

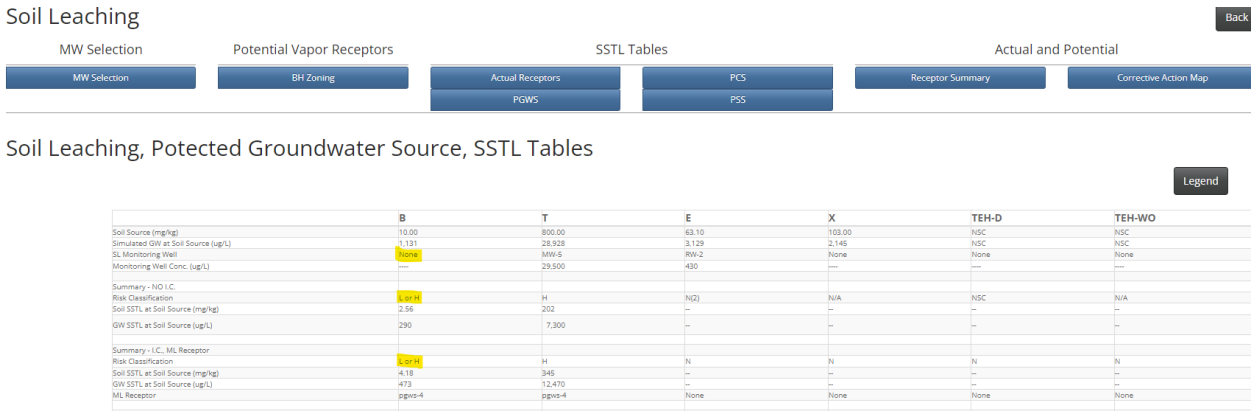
<u>SUMMARY-I.C, ML Receptor</u>: The case of an assumed institutional control covering the soil source. The soil SSTLs needed to meet the groundwater target levels are computed using only the receptors you have entered into the application. The application then finds the most restrictive receptor for each chemical: the receptor having the lowest SSTL at the soil source. The results for the most limiting receptor (ML Receptor) are shown in the four rows beneath "SUMMARY-IC, ML Receptor."

- Risk Classification - The risk classification for the chemical.
- Soil SSTL at Soil Source (mg/kg) - The soil concentration that would produce the "GW SSTL at Soil Source," according to the soil leaching transport model. The soil concentration at the soil source that would produce the groundwater target level at the most limiting receptor (according to the modeling). If the current "Soil Source" concentration is greater than the "Soil SSTL at Soil Source," then the receptor is low or high risk.
- GW SSTL at Soil Source (µg/L) - This is the groundwater concentration beneath the soil source required to meet the groundwater target level at the most limiting receptor, according to the groundwater transport model.
- ML Receptor - The most limiting receptor. Of the receptors you entered, the receptor with the lowest soil SSTL at the soil source. The computations and results for each receptor are shown following "RESULTS FOR: PGWS"

High Risk Classification Criteria

The protected groundwater source receptor (PWGS) for the "Soil Leaching" pathway is the only situation where a potential receptor can be high risk (H). The risk classification is a two-step process. If the "Soil SSTL at Soil Source" concentration is less than the "Soil Source" concentration, the receptor is either low (L) or high (H) risk for the chemical. The receptor is high risk for a chemical if: The measured groundwater concentration in the vicinity of the soil source (Monitoring Well Conc.) is greater than the groundwater site-specific target level at the soil source (GW SSTL at Soil Source). If the receptor is not high risk, it is low risk. Or, if the measured groundwater concentration in the vicinity of the soil source (Monitoring Well Conc.) does not exceed (≤) the groundwater site-specific target level at the soil source (GW SSTL at Soil Source), the receptor is low risk.

At Tier 2, the purpose of selecting groundwater wells in the vicinity of the soil source ("MW Selection" in the "Soil Leaching" form) is to determine the risk classification for protected groundwater source under soil leaching. The monitoring well in the vicinity of the soil source may also be used after completion of the Tier 2 SCR, as part of reclassification of potential receptors during site monitoring.

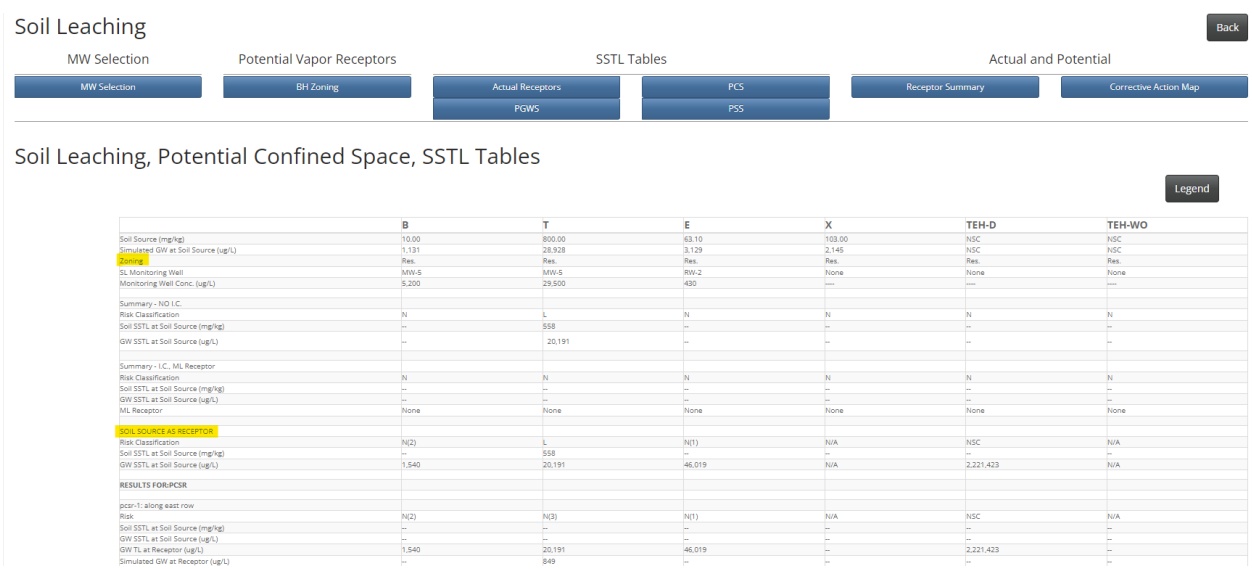


	B	T	E	X	TEH-D	TEH-WO
Soil Source (mg/kg)	10.00	800.00	63.10	103.00	NSC	NSC
Simulated GW at Soil Source (ug/L)	1,131	28,928	3,129	2,145	NSC	NSC
SL Monitoring Well	None	MW-5	RW-2	None	None	None
Monitoring Well Conc. (ug/L)	----	29,500	430	----	----	----
Summary - NO I.C.						
Risk Classification	L or H	H	N(2)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	2.56	202	--	--	--	--
GW SSTL at Soil Source (ug/L)	290	7,300	--	--	--	--
Summary - I.C., ML Receptor						
Risk Classification	L or H	H	N	N	N	N
Soil SSTL at Soil Source (mg/kg)	4.18	345	--	--	--	--
GW SSTL at Soil Source (ug/L)	473	12,470	--	--	--	--
ML Receptor	pgws-4	pgws-4	None	None	None	None

If the "Risk Classification" is "L or H," this means the soil SSTL at the soil source is less than the soil source concentration, but you either have not selected groundwater monitoring wells in the vicinity of the soil source or do not have any. In this situation, you will see there is no "SL Monitoring Well" or "Monitoring Well Conc." shown for the chemical. Without a "SL Monitoring Well," the application cannot determine if the risk classification is L or H. If you see "L or H" listed as the risk classification for a chemical, you need to do monitoring well selection in the vicinity of the soil source.

12.5 Soil Leaching, Potential Confined Space, Risk Classification and SSTL Table

To view the risk classification and SSTL table for potential confined space, click the "PCS" button in the "SSTL Tables" frame. This will activate the "Soil Leaching, Potential Confined Space, Risk Classification and SSTL Tables" form. This form displays the results for potential confined space under soil leaching. The residential and nonresidential potential confined space receptors you have entered are combined and evaluated as a group. The risk classification for *potential* confined space is <u>never</u> high risk (H).



	B	T	E	X	TEH-D	TEH-WO
Soil Source (mg/kg)	10.00	800.00	63.10	103.00	NSC	NSC
Simulated GW at Soil Source (ug/L)	1,131	28,928	3,129	2,145	NSC	NSC
Zoning	Res.	Res.	Res.	Res.	Res.	Res.
SL Monitoring Well	MW-5	MW-5	RW-2	None	None	None
Monitoring Well Conc. (ug/L)	5,200	29,500	430	----	----	----
Summary - NO I.C.						
Risk Classification	N	L	N	N	N	N
Soil SSTL at Soil Source (mg/kg)	--	558	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	20,191	--	--	--	--
Summary - I.C., ML Receptor						
Risk Classification	N	N	N	N	N	N
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	--	--	--	--	--
ML Receptor	None	None	None	None	None	None
SOIL SOURCE AS RECEPTOR						
Risk Classification	N(2)	L	N(1)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	--	558	--	--	--	--
GW SSTL at Soil Source (ug/L)	1,540	20,191	46,019	N/A	2,221,423	N/A
RESULTS FOR:PCSR						
pcsr-1: along east row						
Risk	N(2)	N(3)	N(1)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	--	--	--	--	--
GW TL at Receptor (ug/L)	1,540	20,191	46,019	--	2,221,423	--
Simulated GW at Receptor (ug/L)	--	849	--	--	--	--

The data presented in the table has been discussed under actual receptors and protected groundwater source above. The monitoring well in the vicinity of the soil source (SL monitoring well) is not used for risk classification for potential confined space at Tier 2. However, it is used for reclassification of risk in the SMR phase.

The results are presented for two situations: the results with no institutional control (SUMMARY-NO I.C.) and the results with an assumed institutional control (SUMMARY-I.C., ML Receptor). The major difference from protected groundwater

source is while the target levels are fixed for protected groundwater source, the target levels for potential confined space are variable because they are computed using a receptor-specific depth to groundwater and because we are evaluating residential and nonresidential receptors.

SOIL SOURCE AS RECEPTOR: The results under this heading assume the point of exposure is the soil source, and reflect the zoning for the source location. The application, based on the zoning and the shallowest depth to groundwater, computes the groundwater target level at the soil source. The deeper it is to groundwater the higher the target level will be. The shallowest depth to groundwater used for the calculation can be viewed using the "Before Modeling" button in the "Questions" frame on the "Main Form." It is the depth to groundwater determined by the application from the groundwater sample data.

12.6 Soil Leaching, Potential Sanitary Sewer, Risk Classification and SSTL Table

The potential sanitary sewer receptors (residential and nonresidential) entered into the application are monitored and evaluated together. Click the "PSS" in the "SSTL Tables" frame on the "Soil Leaching Pathway Evaluation" form. This will activate the "Soil Leaching, Potential Sanitary Sewer, Risk Classification and SSTL Tables" form. The risk classification for a potential sanitary sewer is never high risk (H).

Soil Leaching, Potential Sanitary Sewer, SSTL Tables

Legend

	B	T	E	X	TEH-D	TEH-WO
Soil Source (mg/kg)	10.00	800.00	63.10	103.00	NSC	NSC
Simulated GW at Soil Source (ug/L)	1,131	28,928	3,129	2,145	NSC	NSC
Zoning	Res.	Res.	Res.	Res.	Res.	Res.
SL Monitoring Well	MW-5	MW-5	RW-2	None	None	None
Monitoring Well Conc. (ug/L)	5,200	29,500	430	----	----	----
Summary - NO I.C.						
Risk Classification	N	N	N	N	N	N
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	--	--	--	--	--
Summary - I.C., ML Receptor						
Risk Classification	N	N	N	N	N	N
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	--	--	--	--	--
ML Receptor	None	None	None	None	None	None
SOIL SOURCE AS RECEPTOR						
Risk Classification	N(2)	N(2)	N(1)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	3,081	40,390	92,037	N/A	4,442,847	N/A
RESULTS FOR:PSSR						
pssr-1: along east row						
Risk	N(2)	N(2)	N(1)	N/A	NSC	N/A
Soil SSTL at Soil Source (mg/kg)	--	--	--	--	--	--
GW SSTL at Soil Source (ug/L)	--	--	--	--	--	--
GW TL at Receptor (ug/L)	3,081	40,390	92,037	--	4,442,847	--
Simulated GW at Receptor (ug/L)	--	--	--	--	--	--

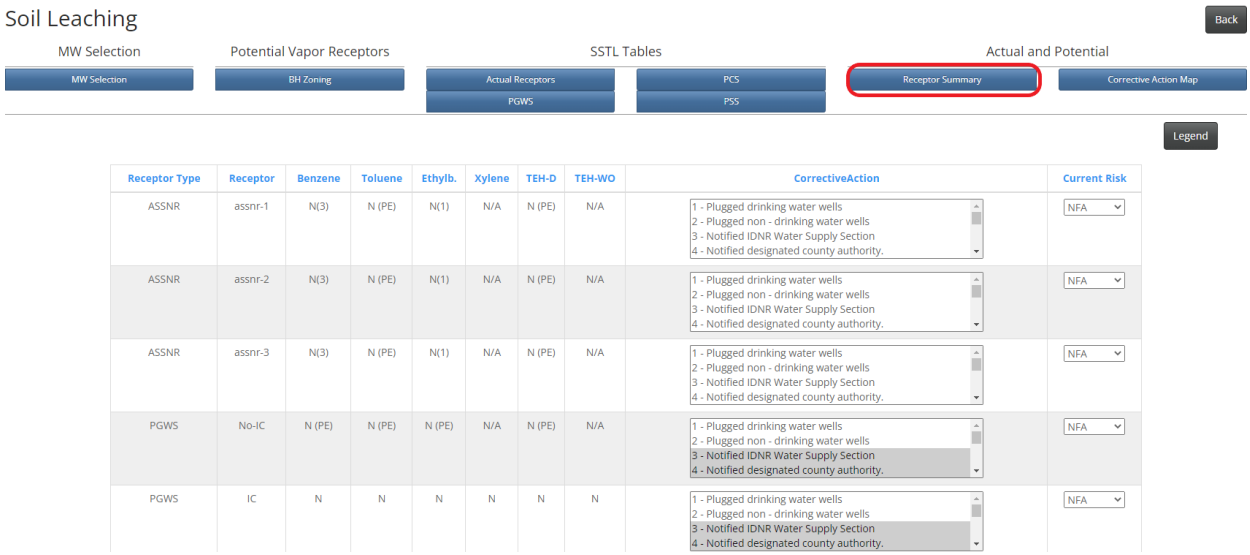
The data presented in the table have been covered under actual receptors and protected groundwater source. The monitoring well in the vicinity of the soil source (SL monitoring well) is not used for risk classification for potential sanitary sewer at Tier 2. It is used for risk reclassification in the SMR phase.

The results for two cases are presented: the results with no institutional control (SUMMARY-NO I.C.) and the results with an assumed institutional control (SUMMARY-I.C., ML Receptor). The major difference from protected groundwater source is the target levels are fixed for protected groundwater source, while the target levels for potential sanitary sewer receptors are variable. They are computed by the application using a receptor-specific depth to groundwater and zoning (residential or nonresidential).

SOIL SOURCE AS RECEPTOR: The results under this heading assume the point of exposure is the soil source. The target level at the soil source is computed, based on the zoning and on the shallowest depth to groundwater. The shallowest depth to groundwater used for the calculation can be viewed using the "Before Modeling" button in the "Questions" frame on the "Main Form."

12.7 Soil Leaching, Receptor Summary

The Tier 2 Soil Leaching Receptor Summary is a summary of the receptor risk classifications. Click the "Receptor Summary" button in the "Actual and Potential" frame. This will activate the "Soil Leaching" Summary table.



Receptor Type	Receptor	Benzene	Toluene	Ethylb.	Xylene	TEH-D	TEH-WO	CorrectiveAction	Current Risk
ASSNR	assnr-1	N(3)	N (PE)	N(1)	N/A	N (PE)	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA
ASSNR	assnr-2	N(3)	N (PE)	N(1)	N/A	N (PE)	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA
ASSNR	assnr-3	N(3)	N (PE)	N(1)	N/A	N (PE)	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA
PGWS	No-IC	N (PE)	N (PE)	N (PE)	N/A	N (PE)	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA
PGWS	IC	N	N	N	N	N	N	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA

The application determines the risk classification results shown in the chemical columns. The results take into account the "Preliminary Pathway Evaluation Results" and the modeling done to evaluate risk (i.e., comparing soil SSTLs at the soil sources to the current soil concentrations at the soil sources). The results are valid if you have correctly completed the previous steps (generated soil leaching receptor identification plumes, identified and entered receptors, selected monitoring well in the vicinity of the soil source for each chemical, if required, specified the zoning for soil sampling location, etc.).

The risk classifications are the same as those shown in the SSTL Tables. The SSTL Tables show detailed results and calculations. The Receptor Summary simply lists the risk classifications.

Refer to the Groundwater Source Receptor Summary section above for instructions on how to identify current risk and complete the table. The Soil Leaching Receptor Summary table is filled similar to the Groundwater Source Receptor Summary table.

Receptor Summary Settings

If you view the "Groundwater Source" and "Soil Leaching" Receptor Summaries, you will see they look essentially the same. The same receptors are shown in both. However, the risk classification can be different for the same receptor. The application stores the "Current Risk" settings for "Groundwater Source" and the "Current Risk" setting for "Soil Leaching" separately.

You have to complete the "Receptor Summary" table for each pathway. In some cases, this may mean you have to repeat information, particularly for corrective actions. For example, if you properly plugged a drinking water well, you will need to select a "Corrective Action" of "1 – Plugged drinking water wells" and a "Current Risk" of NFA in both the "Groundwater Source Receptor Summary" and the "Soil Leaching Receptor Summary" for that receptor.

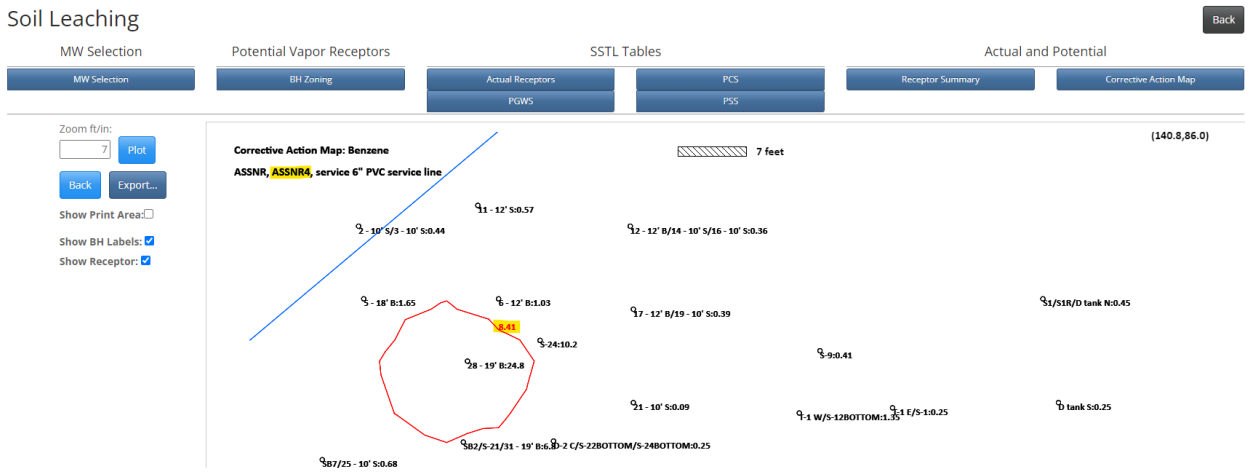
12.8 Soil Leaching, Corrective Action Map

The Soil Leaching Corrective Action Map contours the lowest soil source SSTL concentration (high risk receptors only). A receptor for which you have set the current risk to N in the Receptor Summary is ignored, even if the risk shown for a chemical is H. You should produce a Corrective Action Map for each chemical in the Receptor Summary with a high risk receptor (ignore receptors having a current risk of N).

For example, the Receptor Summary shows we should produce a Corrective Action Map for benzene. Click the "Corrective Action Map" button in the "Actual and Potential" frame. Select benzene as the Chemical and set the interpolation range.

Click "Plot." If a high risk receptor exists for the chemical, the application uses the soil sample data to contour the most restrictive soil source SSTL. The label for the most restrictive receptor is shown at the top of the plot. The most

restrictive receptor is also shown on the plot.



The most restrictive high risk receptor for the example picture is ASSNR4. The most restrictive receptor has a soil source SSTL of 8.41 mg/kg. For soil leaching, the maximum benzene soil concentrations at the site need to be reduced to 8.41 mg/kg. The contour line (red) is an estimate of where soil concentrations are equal to 8.41 mg/kg. Soil concentrations are estimated to exceed 8.41 mg/kg inside the contour line.

You can print the plot directly or export it as a DXF/PDF file.

13. SOIL VAPOR TO CONFINED SPACE/SOIL TO WATER LINE, RISK CLASSIFICATION AND RECEPTOR SUMMARY

The soil vapor to confined space and soil to water lines pathways are evaluated using soil concentrations. The receptors for these pathways are defined by contouring soil data to the target level for the receptor type.

Potential vapor receptors are low risk receptors for the pathway if current soil data exceeds the potential receptor target level (i.e. the area of concern for potential receptors is the area within the RID plume.) Actual vapor receptors are high risk receptors for the pathway if any part of a receptor falls within the soil vapor receptor ID plume (i.e. the actual soil plume contoured to the applicable target level plus the 50 feet buffer zone surrounding the soil plume.)

Water line (actual) receptors are high risk if they are within the water line receptor ID plume (i.e. the actual soil plume contoured to the applicable target levels plus the 10 feet buffer zone of the plume.)

Risk classification procedures for these pathways are not the same as the procedures for groundwater and soil leaching pathways. For groundwater and soil leaching, simulation modeling is used to produce SSTLs: Concentrations that must be met at groundwater wells or the soil source in order (according to the modeling) to meet the groundwater target levels at the receptors.

For soil vapor to confined space and soil to water line pathways, soil SSTLs are not computed, because lateral vapor transport models are not used. For example, for an actual confined space residential receptor which is high risk for soil vapor to confined space, the application does not generate a soil source cleanup level or a soil corrective map. Instead, to clear the receptor by soil remediation, you would reduce soil concentrations such that soil concentrations within the RID plume do not exceed the soil target level for the receptor type (1.16 mg/kg for benzene for confined space residential).

Click the “Soil Vapor” button in the “Pathway Evaluation” frame on the “Main Form.” This will activate the “Soil Vapor” form. This form is the “Tier 2 Receptor Summary” form for the “Soil Vapor” pathway. The receptor types evaluated in this form are:

- Actual and Potential Confined Space, residential and nonresidential
- Actual and Potential Sanitary Sewer, residential and nonresidential

Soil Vapor

Back

Legend

Receptor Type	Receptor	Benzene	Toluene	Ethylb.	Xylene	TEH-D	TEH-WO	CorrectiveAction	Current Risk
PCSR	Source	L	N	N	N/A	N	N/A	9 - Established institutional controls. 10 - Conducted soil excavation 11 - Cleared with soil gas. 12 - Zoning	NFA
PCSNR	Source	L	N	N	N/A	N	N/A	13 - For actual PWL, GW>3 feet. 14 - Have or will conduct a Tier 3 analysis for this receptor. 15 - Receptor Removed 16 - Other	NFA
PSSR	Source	L	N	N	N/A	N	N/A	9 - Established institutional controls. 10 - Conducted soil excavation 11 - Cleared with soil gas. 12 - Zoning	NFA
PSSNR	Source	L	N	N	N/A	N	N/A	13 - For actual PWL, GW>3 feet. 14 - Have or will conduct a Tier 3 analysis for this receptor. 15 - Receptor Removed 16 - Other	NFA
ASSNR	assnr-1	N	N	N	N/A	N	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA

The process of selecting current risk and corrective actions was discussed earlier for the groundwater and soil leaching pathways and is the same for the soil vapor pathway.

Click the “Soil Water Line” button in the “Pathway Evaluation” frame on the “Main Form.” This will activate the “Water Line” form. This form is the “Tier 2 Receptor Summary” form for the soil to water line pathway.

Soil Water Lines

Back

Legend

Receptor Type	Receptor	Benzene	Toluene	Ethylb.	Xylene	TEH-D	TEH-WO	CorrectiveAction	Current Risk
PWL	Source	L	L	N	L	N	N/A	3 - Notified IDNR Water Supply Section 4 - Notified designated county authority. 5 - Notified sanitary sewer public authority. 6 - Notified utility company plastic water line.	NFA
WLA	WLA1	N	N	N	N	N	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA
WLB	WLB1	N	N	N	N	N	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA
WLB	WLB2	N	N	N	N	N	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	NFA

The process of selecting current risk and corrective actions was discussed earlier for the groundwater and soil leaching pathways and is the same for the soil to water line pathway.

Potential Receptors at Soil Sources

The “Receptor Type” and “Receptor” for the first four rows of the grid are generated automatically by the application. Refer to the Soil Vapor picture above. It is assumed a potential receptor of each type is located at the soil source for each chemical. Note: The “Receptor” for all four rows is “Source.” The chemical risk is determined by a simple comparison of the soil source concentration to the soil target level for the receptor type. If the soil source concentration is greater than the soil target level for the receptor type the risk is low (L), otherwise the risk is no action required (N).

The first four rows are the results for all the potential vapor receptor types (PCSR, PCSNR, PSSR, PSSNR). Depending on the zoning at the soil sources, some of the potential receptor types may not be at risk. For example, if the soil source locations at your site are all zoned nonresidential, then the potential confined space residential (PCSR) and potential sanitary sewer residential (PSSR) results will not apply. In that case, you should select “12 – Zoning” in the “Corrective Action” column and choose NFA for “Current Risk.”

Following the first four rows are the results for receptors you entered into the application. This includes the results for all the confined space (actual and potential) and sanitary sewer (actual and potential receptors).

The process of selecting current risk and corrective actions was discussed earlier for the groundwater and soil leaching

pathways and is the same for the soil vapor potential pathway.

Receptor Summary Settings
If you view the "Groundwater Source" and "Soil Leaching," "Soil Vapor" and "Soil to Water line" Receptor Summaries you will see they look essentially the same. Some receptors are shown in multiple summaries. However, keep in mind the risk classification can be different for the same receptor. For example, the actual confined space residential receptor, ACSR-1, is high risk (H) for groundwater, no action required (N) for soil leaching, and no action required for soil vapor. The application stores the "Current Risk" separately for "Groundwater Source," "Soil Leaching," "Soil Vapor" and "Soil to Water line." You have to complete the "Receptor Summary" table for each pathway, including Corrective Action, even if it is the same corrective action.

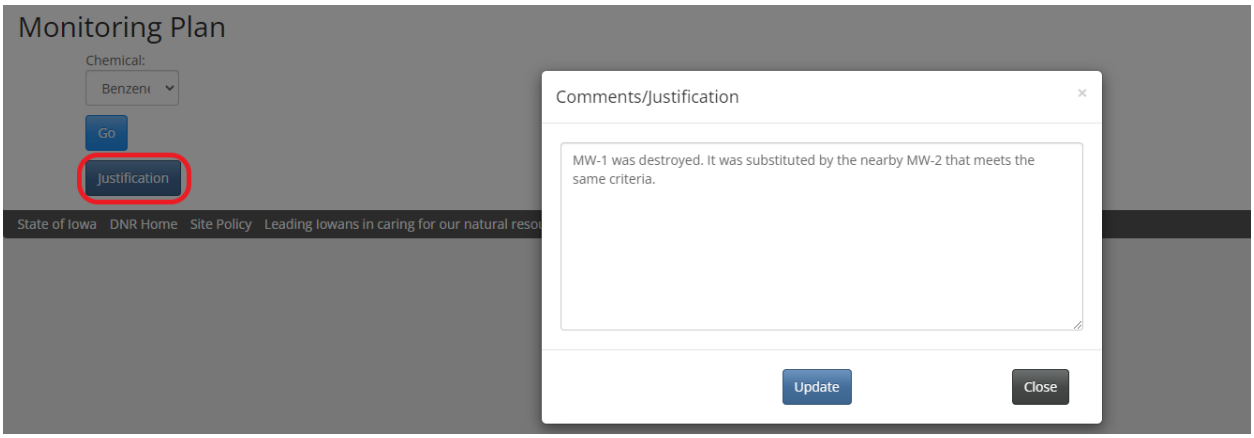
Vapor Sampling for Soil Vapor to Enclosed Space for Actual Receptors
You can clear an actual receptor, even if you fail vapor sampling at the soil source, by passing vapor sampling between the soil source and the receptor (see Tier 2 Guidance, sampling at alternate point of compliance).

14. TIER 2 GROUNDWATER MONITORING PLAN, GROUNDWATER SOURCE AND SOIL LEACHING

The application generates a Groundwater/Soil Leaching Monitoring Plan for Tier 2. This is a list of the wells you need to continue sampling in the future in order to monitor the low and high risk receptors from the groundwater and soil leaching pathways. Prior to generating the Groundwater/Soil Leaching Monitoring Plan, you need to have completed the pathway evaluations for groundwater and soil leaching. The monitoring plan for a chemical combines the monitoring wells from all receptors which are low or high risk for the chemical in the groundwater or soil leaching pathways. A receptor having a current risk of NFA in the receptor summary for a pathway is ignored. This is one reason it is important to correctly set the current risk column in the Groundwater Source and Soil Leaching Receptor Summaries. Soil leaching contributes to the Groundwater Monitoring Plan if you need to monitor groundwater in the vicinity of a soil source.

To view the Groundwater Monitoring Plan, click the "Monitoring Plan" button in the "GW Monitoring" frame on the "Main Form." This will activate the "Monitoring Plan" form.

Justification
Click the "Justification" button. This will activate the "Comments/Justification" form. This form is simply a text box you use to enter any comments or justification required for the Tier 2 Groundwater Monitoring Plan. This information is saved in the site data file and can be printed for inclusion in the Tier 2 SCR.



Select a chemical of concern and click the "Go" button. When you click the "Go" button, the application assembles the monitoring plan.

In the pathway evaluations, you select monitoring wells to evaluate receptors. A monitoring well may be used to monitor several receptors. The monitoring plan might be thought of as the "inverse" of that information. The monitoring plan is organized by monitoring well, and the monitoring well is listed once. For each monitoring well, all the receptors (low or high risk) the monitoring well monitors are listed.

Monitoring Plan

Chemical:

Benzene

Go

Justification

Back

Tier 2 Groundwater Monitoring Plan: Groundwater Source and Soil Leaching

Benzene

Monitoring Well	Actual (ug/L)	SSTL (ug/L)	IC?	Receptor	Description	Type	Risk	Frequency
#2/MW-4	15500							
		4780	No	pcsnr-2	E property	S	L	Annual
		9550	No	pssnr-2	E property	S	L	Annual
		17080		ASSNR4	service 6" PVC service line	SL	H	Annual
#1/MW-3/MW-3R	9800							
		4780	No	pcsnr-2	E property	Interior E	L	Once
		9550	No	pssnr-2	E property	Interior E	L	Once
MW-10	1510							
		9550	No	PSS	PSS	TG-Down Gradient	L	Annual
		9550	No	pssnr-2	E property	T-ML	L	Annual
MW-6/MW-6R/MW-6R2	1050							
		4780	No	PCS	PCS	TG-Down Gradient	L	Annual
		4780	No	pcsnr-2	E property	T-ML	L	Annual
		9550	No	PSS	PSS	TG-Down Gradient	L	Annual
MW-7	1							
		4780	No	PCS	PCS	TG-Down Gradient	L	Annual
		9550	No	PSS	PSS	TG-Down Gradient	L	Annual
MW-14	3							
		4780	No	PCS	PCS	TG-Down Gradient	L	Annual
		9550	No	PSS	PSS	TG-Down Gradient	L	Annual

- "Monitoring Well" column - The well label for the monitoring well. The first monitoring well shown is the source well for the selected chemical. Then, wells are listed by increasing radial distance from the source.
- "Actual (µg/L)" column - The Tier 2 measured groundwater concentration for the well (maximum of two most recent samples, or the most recent sample if steady and declining).

The remaining columns show the receptor information for each receptor (low or high risk) the monitoring well monitors:

- "SSTL (µg/L)" column - The groundwater site-specific target level (SSTL) for the well applicable to the receptor. For each well, the receptors are sorted by increasing SSTL. The groundwater SSTL (SSTL) is the groundwater concentration the well must meet as part of the no further action criteria for the receptor. The SSTLs are receptor- and chemical-specific.
- "IC" column – Institutional control applies to potential receptors only (protected groundwater source, potential confined space, or potential sanitary sewer) and indicates whether the SSTL is applicable for no institutional control (No) or for an assumed institutional control (IC).
- "Receptor" column - For actual receptors, the short label you assigned to the receptor. For potential receptor types (protected groundwater source, potential confined space, potential sanitary sewer), the label for the most limiting (most restrictive) receptor is shown, with the exception of downgradient T and G wells. For downgradient T and G wells, the receptor type label is shown (PGWS, PCS, PSS).
- "Description" column - The description you input for the receptor. If there is no most limiting receptor for a potential receptor, PGWS is shown for protected groundwater source, PCS for potential confined space and PSS for potential sanitary sewer. For downgradient T and G wells, the receptor type label is shown (PGWS, PCS, PSS).
- "Type" column - The monitoring well criteria for the receptor. "S" is source well. "SL" is the soil leaching monitoring well in the vicinity of the soil source. The remaining criteria have been covered in this manual and are also covered in the Tier 2 Guidance.
- "Risk" column - The risk classification for the receptor. This is the "Risk" determined by the application for the chemical (shown in the "Receptor Summary"), not the "Current Risk" assigned by the user. However, if the current risk for a receptor is "NFA," the receptor is not included in the monitoring plan.
- "Frequency" column - The frequency of sampling, based on the receptor risk classification and the "Type" of well. E wells do not need to be sampled annually, but at least one sample must be collected and the most recent sample must meet the SSTL concentration prior to reclassification to no action required (see Tier 2 Guidance).

The Groundwater/Soil Leaching Monitoring Plan is the same as shown under "Groundwater Source Pathway Evaluation," except for the addition of receptors with an "SL" in the "Type" column. An "SL" in the "Type" column indicates monitoring for the "Soil Leaching" pathway. The "SL" will only be present for a single well for a chemical: the well used to assess groundwater concentrations in the vicinity of the soil source. In some cases, the soil leaching monitoring well (SL) may not be the same as the groundwater source well (S).

15. GENERAL CONTOURING, GROUNDWATER, SOIL, VAPOR

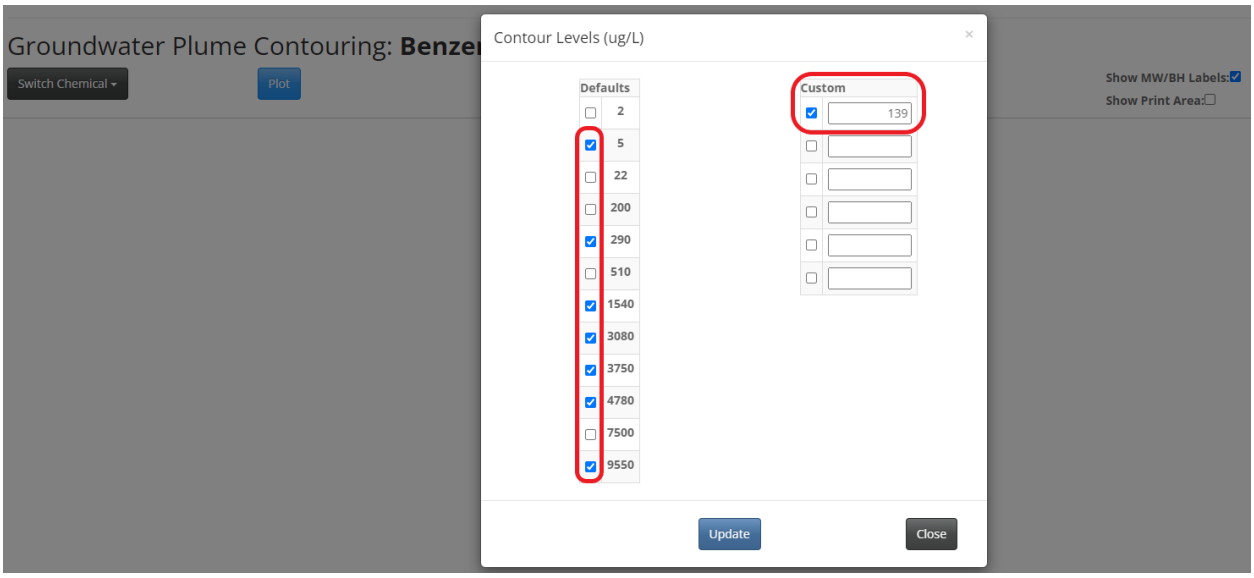
15.1 General Groundwater Contouring

The application provides tools for general contouring of the groundwater concentration data. Click the "Groundwater" button in the "General Contouring" frame on the "Main Form." This will activate the "Groundwater Plume Contouring" form. The default chemical to contour is Benzene. If contouring of a different chemical of concern is needed, select from

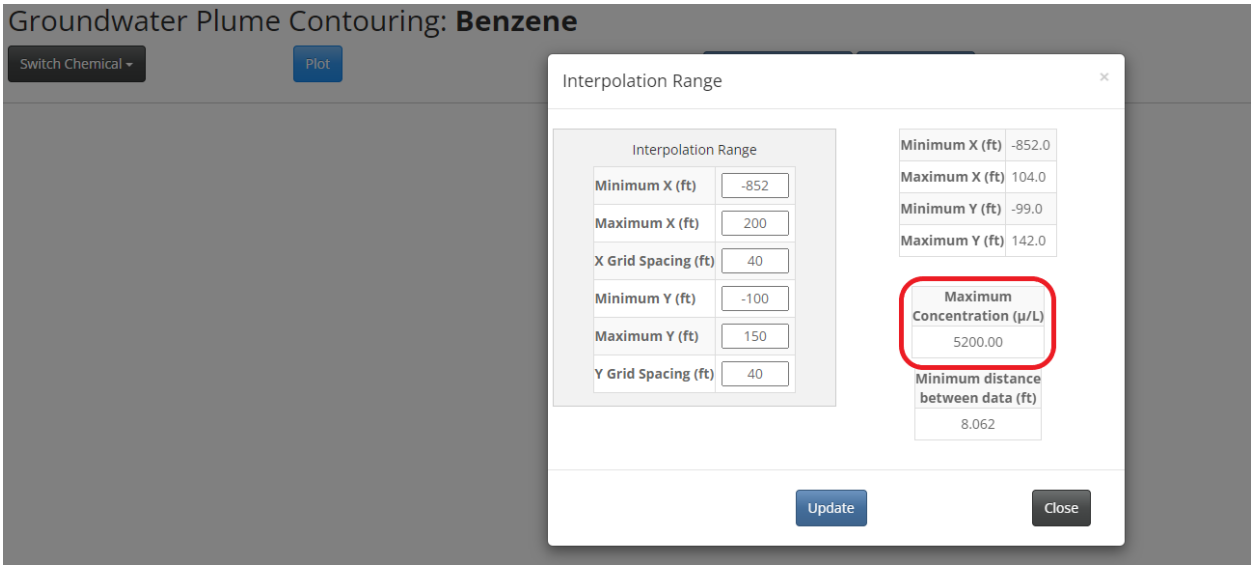
the drop-down menu under “Switch Chemical” button.

Target Levels

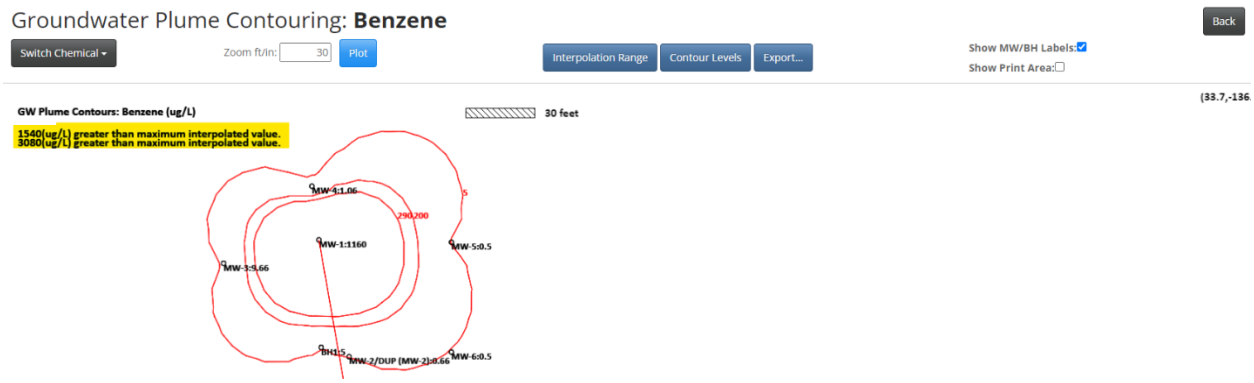
Click the “Contour Levels” button. The application does not automatically set the target levels for general contouring. You select the target levels you want to contour. The default target levels (“Defaults”) are the default groundwater target levels for all the Tier 2 receptor types. Click the check box for each target level you would like to contour. The “Custom” columns on the right allow you to enter other target levels you wish to contour. Enter a value you would like to contour and set the check box to checked.



There is a box in the “Interpolation Range” form showing the “Maximum Concentration” for the chemical. Generally, there is no reason to select a target level greater than the maximum concentration. If you select target levels greater than the maximum concentration, it will not cause a problem, but it may increase the time required for the contouring.



Set parameters in the “Interpolation Range” form Click “Plot”



The application does interpolation calculations, and then displays the results. The contour lines for the specified target levels are shown in red. If a target level cannot be contoured, the reason is shown in the upper left-hand corner of the plot. For example, 1,540µg/L and 3,080 µg/L could not be plotted because they are greater than the maximum interpolated value over the range of interpolation.

The plot also displays the location and label of each groundwater sample location. The concentration shown is the concentration that has been assigned to the location by the application, and used for contouring. If no concentration has been assigned to a location, due to samples being ignored or no measured concentration, then only the well label is shown (no concentration is shown).

You can print the results directly or export them to a DXF/PDF file.

The process is the same for the other chemicals. However, you have to select what target levels you want to contour for each chemical, since the target levels for the receptor types are chemical-specific.

15.2 General Soil Contouring

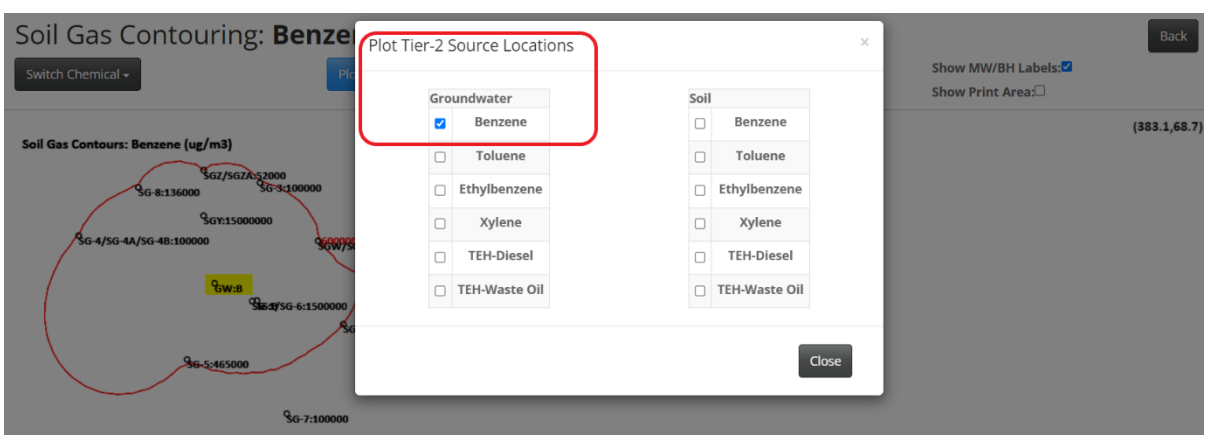
Click the “Soil” button in the “General Contouring” frame on the “Main Form.” This will activate the “Soil Plume Contouring” form. Repeat the same steps for setting target levels and interpolation range as described for the Groundwater contouring above.

NOTE if the soil vapor pathway has a more restrictive SSTLs than the soil leaching pathway the applicable soil summary corrective action map will need to be generated with the General Soil Contouring.

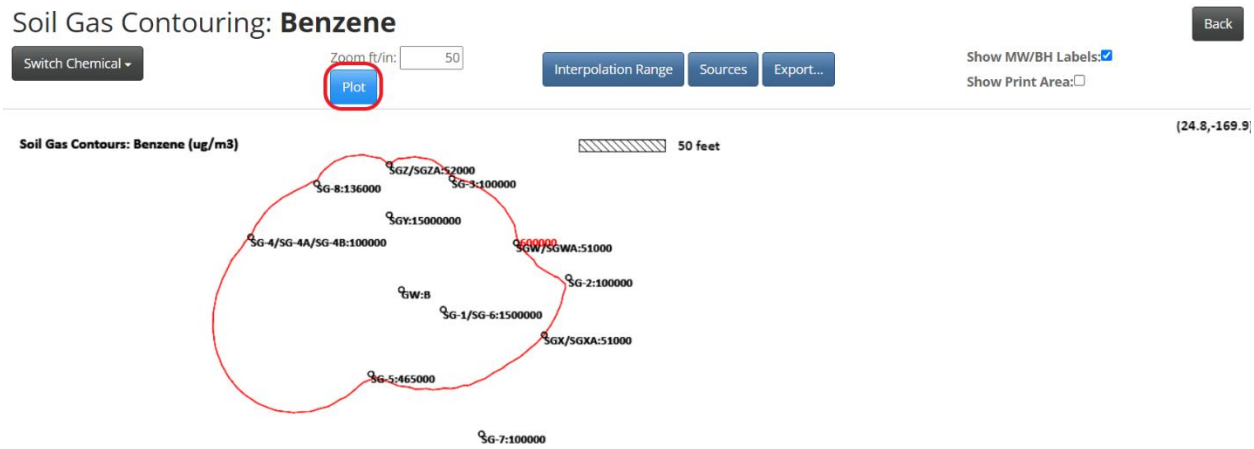
15.3 Vapor Contouring

Click the “Soil Gas” button in the “General Contouring” frame. This will bring up the “Soil Gas Contouring” form.

Set the “Interpolation Range” and click “Sources.” The source locations you select will be displayed on the plot. This is useful for displaying vapor sampling in relation to source locations.



Click “Plot.” The application automatically contours the chemical target level: 600,000 µg/m^3 for benzene; 9,250,000 µg/m^3 for toluene. At a location the application displays the maximum of the two most recent samples at the location (subject to the 14-day, 6-month rules).



For vapor, linear interpolation is <u>not</u> used to define the edge of the plume. Only concentrations less than the target level are used to define the edge of the plume. To approximate this, if a location has a benzene concentration of less than 600,000 µg/m^3, it is assigned a concentration of 599,000 µg/m^3 for contouring (however, the measured concentration is shown on the plot). If a location has a toluene concentration of less than 9,250,000 µg/m^3, it is assigned a concentration of 9,249,000 µg/m^3 for contouring. This has the effect of pushing the contour line out to the first soil gas concentration that is less than the target level.

You can print results directly of export them to a DXF/PDF file.

16. PRINTING

Printing Report Pages, Maps, and Data Tables

- Maps will be available as either a pdf file or a dxf (AutoCAD) file. In order to print a map (pdf), the user will need to:
  1. Click “Plot.”
  2. The map will plot to a scale fitting the screen size. If you have a predetermined scale that you need (1” = 30’ for example), you can enter a scale into the scale box and replot the map.
  3. Toggle the “Show Print Area” feature. Gray lines will appear denoting the area that will be converted to pdf. Move the plot to correspond with the available print area. It may be necessary to adjust the scale to ensure that the entire plot can be printed on a single sheet of paper. The map will move and zoom just like Google Earth (drag and drop, scroll wheel on the mouse).
  4. Click “Export” and choose pdf as the file type.
  5. The user can choose a location on the printed page for the **source well** if desired (for example if you are printing the RID map on an already printed aerial photo). Measure to the desired source well (in inches) from the upper edge and the left edge of the paper. Using this feature, you can accurately print a contour or RID map on an already printed aerial photo.
  6. **Make certain to <u>un</u>-check the “Fit to Page” option** when printing your pdf map (and when printing the aerial photo). If you do not un-check this option, Adobe may scale the map to fit the page and may not print at the desired scale depending on the settings of your individual printer and computer.
  7. If you need an AutoCAD file, simply select “dxf” and the application will deliver this file type.

- Viewing and printing of Monitoring Maps has been conveniently relocated inside the Pathway Evaluation buttons.
- Required elements of the physical Tier 2 SCR *other than maps*, such as sample data, data before modeling, and monitoring plans will be printed directly from the application (from your web browser). To print these items

simply click the right mouse button and select "Print" from the menu displayed. The required items have been optimized to ensure that they will print properly; however, if a page is not printing correctly, you may need to expand the margins of the print area in your browser print settings. The pages have been sized to print correctly with the default settings in the most common web browsers. Some pages (such as data tables) will print more effectively in landscape format and some will be more efficiently printed in portrait format.

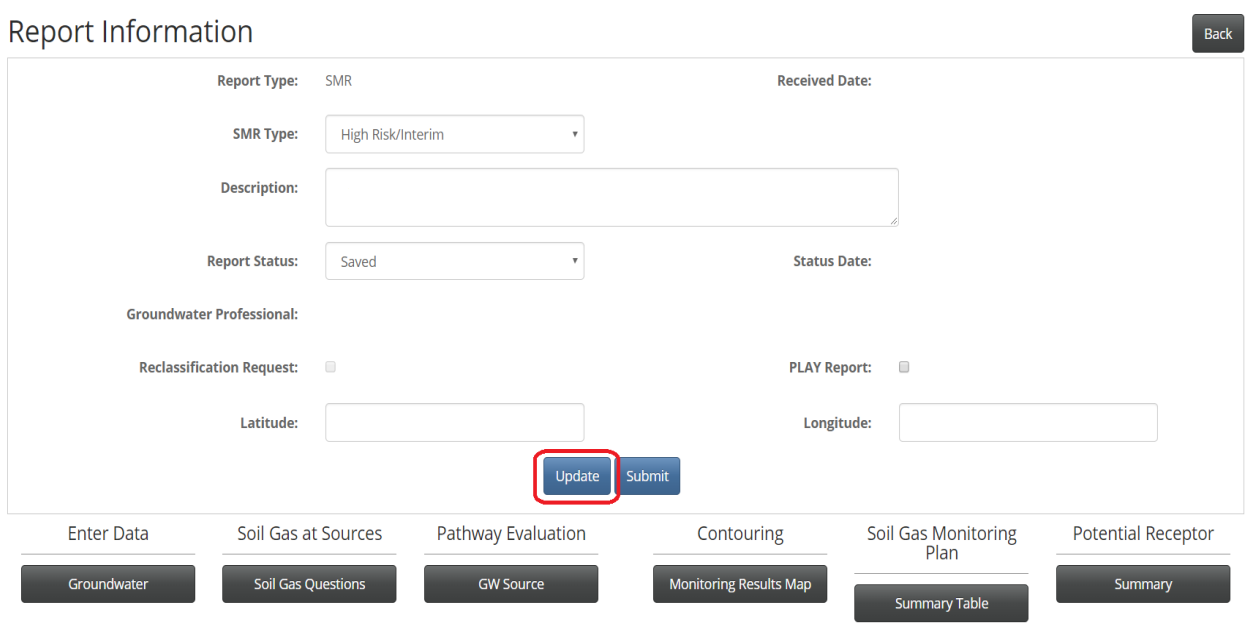
- All maps will default to 10' grid spacing. In many cases, a 10' grid spacing is appropriate; however, there are situations where the grid spacing should be smaller or larger. Since the application is hosted online, a larger grid spacing will speed up the process of calculating and plotting a map. This may be helpful where there are large, complex plumes or large volumes of data. Some situations (small plumes, Sw/W calculations) may benefit from a smaller grid spacing to promote accuracy.
- All pages that do not have an "Export" button should be printed directly from the browser window by right clicking the mouse and selecting "Print."
- It is important that printing of data tables and site information pages be done in **View** mode. Maps that use the "Export" button can be printed from either edit or view mode with equal success. The view mode has been optimized to print the report in an efficient and neat format. Printing pages such as data tables in edit mode will not yield satisfactory results.

In order to increase transparency and public accessibility to reports for Leaking Underground Storage Tank (LUST) sites, the Department of Natural Resources (DNR) is now requiring submittal of an electronic copy and a hard copy of all reports for LUST sites. Electronic copies of reports should be submitted to ust.rbcasoftwaremtbe@dnr.iowa.gov.

Be aware reports for LUST sites may not be considered as "received" by the DNR until both an electronic AND a hard copy of the report is received.

17. EXITING THE TIER 2 APPLICATION

Before you exit the Tier 2 application, click on the "Update" button. The "Update" button is located in the center of the screen next to the "Submit" button when the user is on the main form of a report. The "Update" button is designed to ensure that all equations and algorithms are operating with the most current information. For example, if a user adds soil or groundwater data and saves the data table, the monitoring plan may not "see" the new data unless the user activates one of the interim steps such as pathway evaluation. The user can make sure that risks and SSTLs are always up to date by clicking "Update" at any point.



After using the "Update" button, if you want to exit the application, click the "Back" button on the "Main Form."
NOTE: After you compile the Tier 2 SCR for submission to the DNR for review, use the "Submit" button to submit the Tier 2 application to accompany your Tier 2 SCR. Maps submitted with the Tier 2 SCR must match the maps that are plotted

by the corresponding application submission. If the data in the application are changed after the maps are included in the report for a given submission and new maps aren't substituted before submitting the Tier 2 SCR, the data are inconsistent and the report will be rejected.

SITE MONITORING REPORT (SMR)

18. SMR INTRODUCTION

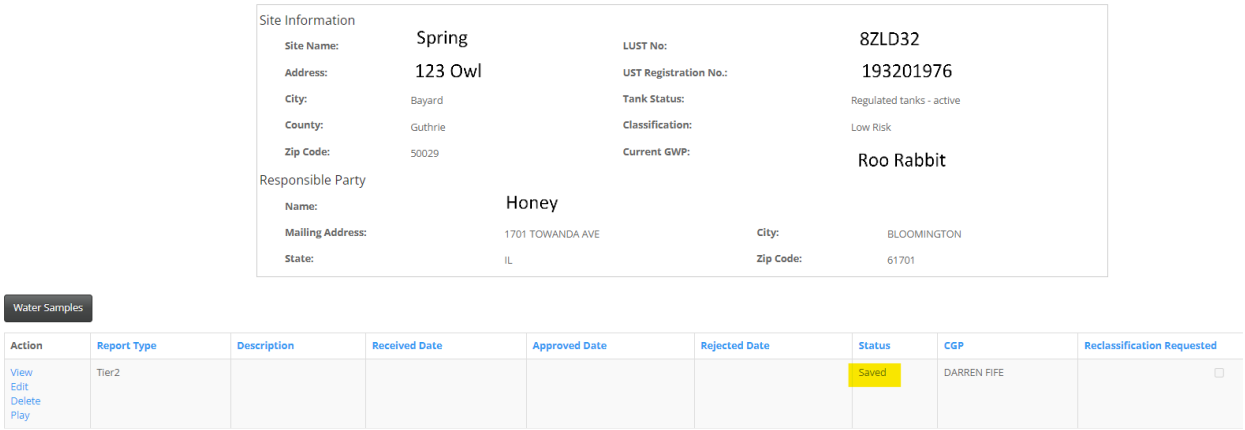
The objective of the SMR application is to assist you with preparation of the "Site Monitoring Report for Leaking Underground Storage Tank Sites." After a Tier 2 analysis has classified a site high or low risk, the site must be monitored annually. One objective of monitoring is to determine whether a receptor meets the criteria for risk reclassification. For example, as a result of annual monitoring a receptor having a low risk classification after a Tier 2 analysis may achieve a risk reclassification of no action required. In many cases, the criteria that must be met for reclassification during post Tier 2 site monitoring are different from the criteria applied to determine the initial Tier 2 classification. Where appropriate the SMR application determines the risk classification, based on data collected during site monitoring, that is subsequent to the Tier 2 analysis. Hence, a major task of the SMR application is the use of groundwater data collected during site monitoring to determine the updated risk classification for groundwater and soil leaching receptors.

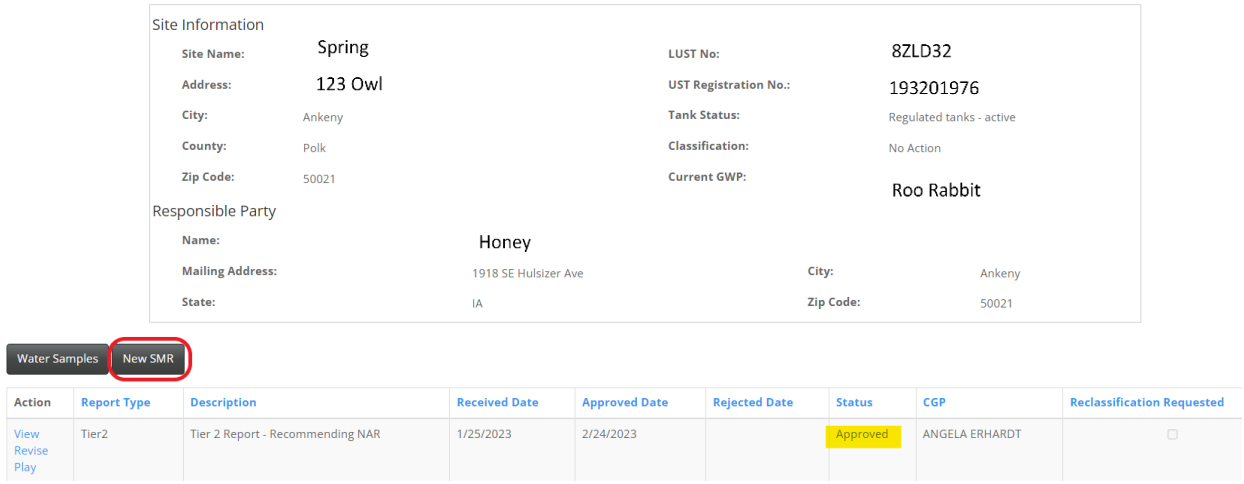
The other major objective of the application is to provide data handling and produce output needed for the SMR. This includes inputting vapor and groundwater monitoring data collected after the Tier 2 analysis; and the production of some of the tables and plots required for the Site Monitoring Report. (Note: Soil data cannot be entered or evaluated in the SMR application, it can only be entered and evaluated in the Tier 2 application.)

19. GETTING STARTED WITH THE SMR APPLICATION

The SMR functions are integrated with the application and Tier 2 site data. Generally, you will need to have a complete Tier 2 analysis in order to successfully use the SMR functions.

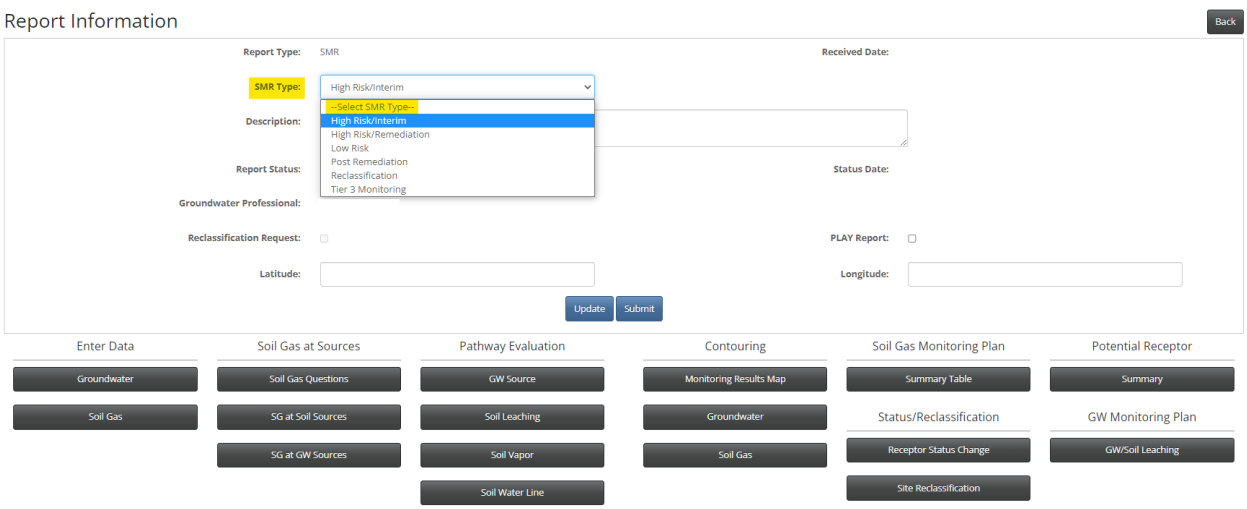
The order of report submission was discussed earlier in this document. If the Tier 2 assessment is saved but not submitted, the application will not allow you to create a SMR file. After you submit your **initial** Tier 2 assessment and it is **"approved,"** a SMR button appears above the table of reports in the left-hand side of the main frame. To do an SMR analysis, you create an SMR file, do your SMR work and save.





19.1 Getting to the SMR

Click the "New SMR" button. The SMR uses Tier 2 information (receptors, SSTLs, risk classification) and must do Tier 2 calculations before proceeding. When the calculations are done, the "Report Information" form is shown. You must select the "SMR Type" or the application will not allow to enter any SMR data/information.



20. SMR SAMPLE DATA

You can enter groundwater sample data and soil gas sample data in the SMR application. This is data collected since the Tier 2 SCR. SMR data is entered and kept separate from data entered as part of the Tier 2 analysis. The data entered for Tier 2 application is used to determine the Tier 2 site-specific target levels (SSTLs) for receptors. The SMR data, collected as part of site monitoring after the Tier 2 analysis, is used to determine whether the Tier 2 SSTLs have been met during site monitoring, which is subsequent to the Tier 2 analysis.

In general, groundwater and soil gas data collected as part of post Tier 2 site monitoring should not be entered in the Tier 2 portion of the application. It should be entered in the SMR portion of the application. However, there may be some cases where site re- evaluation is needed, where you need to redo the Tier 2 analysis and data entry in the Tier 2 portion is appropriate (See SMR Guidance). Also, groundwater data collected and used as part of the Tier 2 analysis should not be entered into the SMR portion of the application.

Generally, SMR groundwater data is obtained during annual or semi-annual sampling, following the Tier 2 analysis. Usually, data collected for remediation monitoring would not be used as part of SMR groundwater data. See the SMR Guidance for further information. If entered in the SMR groundwater data table it must be designated as not used or "ignore" for the purpose of the SMR evaluation and an explanation provided in the report.

20.1 SMR Groundwater Data

Click the "Groundwater" button in the "Enter Data" frame to activate the "Groundwater Data" form. This form functions the same as the form for entering groundwater data in the Tier 2 portion of the application. See data entry and editing previously discussed in this manual.

When you first enter here, no data will be present. The form does not show the groundwater data you entered in the Tier 2 portion of the application. This form is used to enter and save groundwater data collected after the Tier 2. The groundwater data entered into the Tier 2 portion of the application and the groundwater data entered into SMR portion of the application are entered and viewed separately.

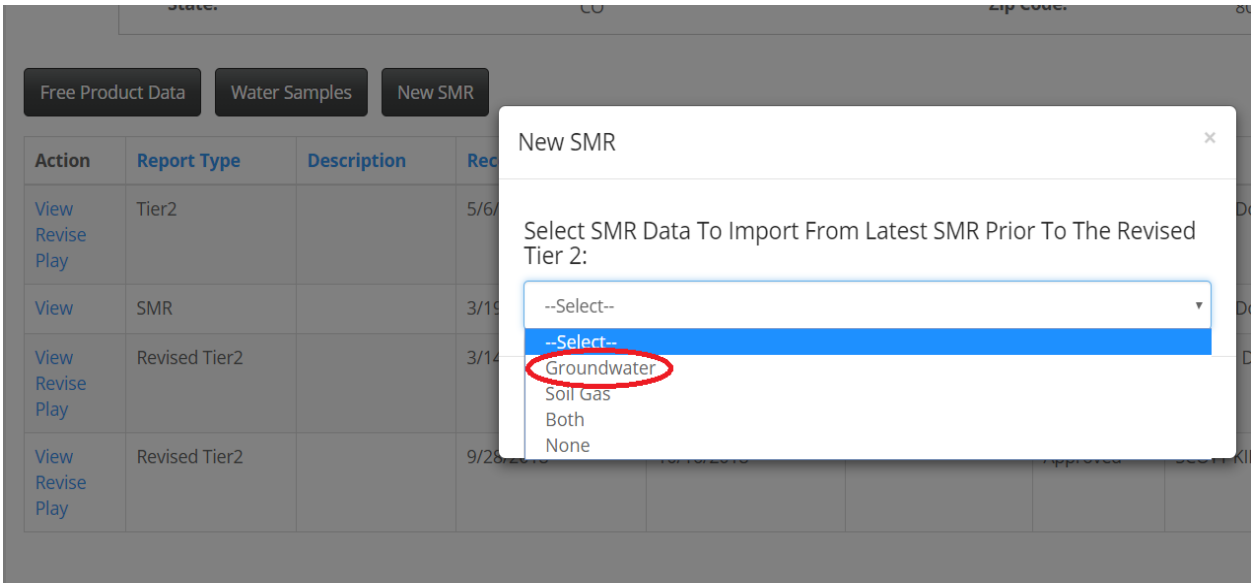
20.2 SMR Soil Data

Soil data collected after the initial Tier 2 (i.e. soil resampling, soil excavation samples, etc.) must be entered in the Tier 2 portion of the application and affected soil pathways reevaluated. See data entry and editing previously discussed in this manual.

Be advised, if you have new soil data that will be handled in the Tier 2 portion of the application, the revised Tier 2 must be completed and submitted prior to the start of the new SMR. Refer to the order of report submission discussed earlier in this manual.

20.3 Vapor (Soil Gas) Data

When creating a new SMR (especially after a revised Tier 2 SCR), you may be asked the question, "Select SMR data to import from latest SMR prior to the revised Tier 2?" Options are "Groundwater," "Soil Gas," "Both," and "None." In almost all situations, the <u>answer should be "Groundwater"</u> and not "Both."



Since soil gas data are automatically transferred to all subsequent SMRs, if "Both" is the selection, there will be a double set of soil gas data in the new SMR. This does not cause any concern as far as risk analysis, but is an unnecessary distraction when printing and reviewing the reports.

Soil Gas Data

Well or Vapor Sample ID Label	Sample Date	X (ft)	Y (ft)	B (µg/m3)	T (µg/m3)	Pathway	Chemicals Of Concern	Purpose of Well or Sample	Receptor Types	Name of Source or Receptor	Ground Level Elevation (ft) E
SV-1	08/19/1997	367	252	5,000,000	1,600,000	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60
SV-1	08/19/1997	367	252	5,000,000	1,600,000	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60
SV-1	09/18/1997	367	252	700,000	2,450,000	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60
SV-1	09/18/1997	367	252	700,000	2,450,000	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60
SV-1	03/19/1999	367	252	<43,500	<43,500	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60
SV-1	03/19/1999	367	252	<43,500	<43,500	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60
SV-1	11/13/2001	367	252	<93,800	<93,800	S	B,T,E	Source	PCS,PSS,ACS,AS	SVES:BTE	711.60

Click the "Soil Gas" button in the "Enter Data" frame to activate the "Soil Gas Data" form. This form functions the same as the form for entering soil gas data, location, and justification in the Tier 2 portion of the application. See data entry and editing previously discussed in this manual.

20.4 Save Your Groundwater and Soil Gas Data

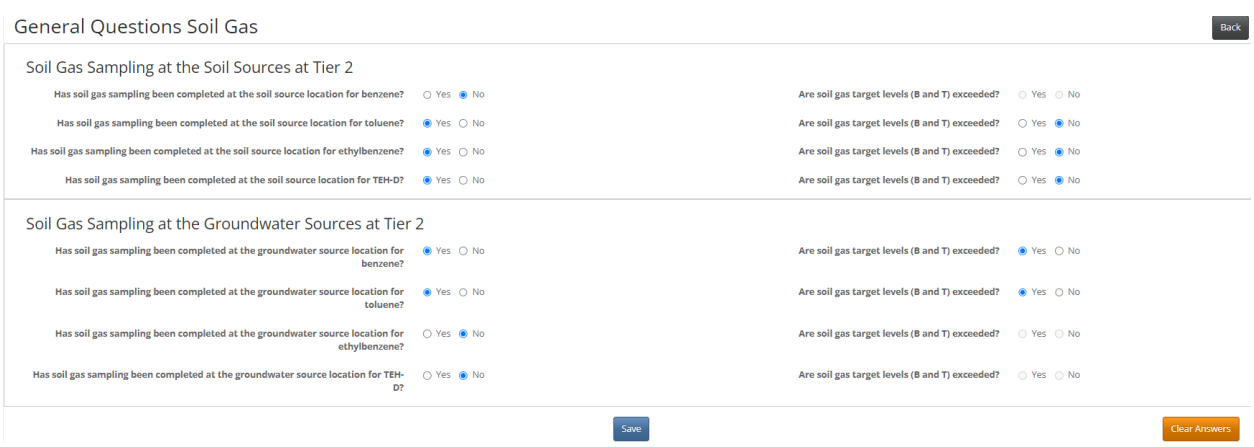
After you have entered and saved new groundwater or vapor data into the SMR portion of the application, **it is strongly recommended to use the "Update" button in the main frame of the SMR**. The importance and function of the "Update" button was discussed earlier in this manual.

21. SOIL GAS AT SOURCES

"Soil Gas at Sources" frame allows you to tell the application if you have passed soil gas sampling at soil or groundwater sources during site monitoring. Your results will be incorporated in risk classification during SMR.

21.1 Soil Gas Sampling at Soil and Groundwater Sources

Click the "Soil Gas Questions" button in the "Soil Gas at Sources" frame, to activate the "General Questions Soil Gas" form. This form is the same as the form at Tier 2. You use this form to input your soil gas sampling results during the SMR stage, that is results obtained after Tier 2.



The application does not determine, based on your vapor samples, the answers to these questions. The application uses your answers to these questions to incorporate the results in the SMR risk classification. You must correctly answer these questions to have the results incorporated in the SMR risk classification.

Note: If you have passed vapor sampling criteria during SMR at a Tier 2 soil source you must answer both questions to

have the application recognize you have passed. For example, you must answer “Yes” to, “Has soil gas sampling been completed at the soil source location for benzene?,” and “No” to “Are soil gas target levels (B and T) exceeded?,” to receive credit for passing vapor at the benzene soil source. If you answered “No” to “Has soil gas sampling been completed at the soil source location for benzene?” and “Yes” to “Are soil gas target levels (B and T) exceeded?,” the application will assume you have not passed vapor sampling at the soil source for that chemical.

21.2 Soil Gas at Tier 2 Soil Sources

Click the “SG at Soil Sources” button in the “Soil Gas at Sources” frame to activate the “SMR, Soil Gas at Tier 2 Soil” form. This form reflects your input for soil gas results at soil sources, the application’s evaluation of soil gas samples at the Tier 2 soil sources, and whether the Tier 2 soil source is submerged at a soil gas sample location.

Soil Gas At Sources

SMR, Soil Gas Samples at Tier 2 Soil

	B	T	E	D
SMR, SOIL GAS AT SOIL SOURCE, USER		PASS	PASS	PASS
SOIL GAS AT SOIL SOURCE, DATA	NS	PASS	PASS	PASS
SUBMERGED SOIL SOURCE	NO	YES	YES	YES

Soil Source: Benzene

Label	Date	X	Y	Sample Elev.	GW Elev.	conc.(mg/kg)
14@8'	04/04/2005	61.0	25.0	606.63		3.40

Soil Gas Data at the Soil Source

NO DATA FOUND

Soil Source: Toluene

Label	Date	X	Y	Sample Elev.	GW Elev.	conc.(mg/kg)
BH-5	01/25/2000	80.0	25.0	603.48		78.60

Soil Gas Data at the Soil Source

Label	Date	X	Y	GW Elev.	Sample Elev.	B (ug/m^3)	T (ug/m^3)
VMW-105	04/20/2018	80.0	28.0	609.45	610.41	<51,000	<4,900
VMW-105	11/09/2018	80.0	28.0	609.63	610.41	140,000	11,000

Soil Source: Ethylbenzene

Label	Date	X	Y	Sample Elev.	GW Elev.	conc.(mg/kg)
BH-5	01/25/2000	80.0	25.0	603.48		77.50

Soil Gas Data at the Soil Source

Label	Date	X	Y	GW Elev.	Sample Elev.	B (ug/m^3)	T (ug/m^3)
VMW-105	04/20/2018	80.0	28.0	609.45	610.41	<51,000	<4,900
VMW-105	11/09/2018	80.0	28.0	609.63	610.41	140,000	11,000

The first row in the top grid (“SMR, SOIL GAS AT SOIL SOURCE, USER”) reflects the results of the answers you have given in the “General Questions Soil Gas” form during SMR, indicating whether, according to you, you have passed or failed soil gas at a Tier 2 soil source during SMR. We can see in our example that we told the application we passed soil gas at the Tier 2 toluene soil source and failed soil gas at the ethylbenzene Tier 2 soil source.

The second row in the top grid (“SOIL GAS AT SOIL SOURCE, DATA”) is an evaluation of your soil gas data against the Tier 2 soil source locations. This is automatically completed by the application, and is an evaluation of whether you have passed or failed soil gas at a Tier 2 soil source based on the soil gas data you have entered into the application. The possible entries are: “N/A” - Not Applicable, “INC.” - Incomplete data (i.e. less than 2 samples), “PASS” - soil gas has passed, “FAIL” - soil gas has failed, “NS” - no soil gas samples found for the soil source.

The data used for the evaluation is shown in the lower table (grid). For each chemical, the Tier 2 soil source data is shown, followed by the all the soil gas data found to be within 5 feet (radial distance) of the Tier 2 soil source.

Note that this is based on the (x,y) location of the Tier 2 soil source and the (x,y) locations of the soil gas samples. Hence, you need to have soil gas samples within 5 feet of a Tier 2 soil source, and have input the correct (x,y) locations.

The PASS/FAIL criteria is based on the two most recent soil gas samples at a soil source, subject to the 14- day, 6-month rules. The soil gas target levels are:

Chemical	Target Level (µg/m3)
Benzene	600,000
Toluene	9,250,000

PASS: Two most recent samples for both Benzene and Toluene do not exceed the soil gas target levels.

FAIL: One or more of the two most recent samples exceeds a soil gas target level.

The third row in the top grid (“SUBMERGED SOIL SOURCE”) is an evaluation by the application of whether a submerged

soil source existed at the time of a soil gas sample. All the soil gas data found within 5 feet of a Tier 2 soil source is examined. If the groundwater elevation for any soil gas sample exceeds the soil sample elevation, “YES” is shown and the groundwater elevation (“GW Elev.”) is shown in red. Note if the soil sample depth is not entered using ASL the application may state the soil source is submerged.

If all the required data is present (a groundwater elevation for each soil gas sample and a sample elevation for the soil source) and no groundwater elevation exceeds the soil gas elevation, “NO” is shown for the chemical. Note that in order to receive a “NO” there must be a groundwater elevation for **all** soil gas samples found within 5 feet of the soil source.

If the result is not “YES” or “NO,” then “???” is shown. This means no data is present (which may be appropriate) or data required for evaluation is missing (i.e. a groundwater elevation is missing for a soil gas sample).

Keep in mind that the risk reclassification is based on your answers for soil gas results during SMR, not on the application analysis of the data.

21.3 Soil Gas at Tier 2 Groundwater Sources

Click the “SG at GW Sources” button in the “Soil Gas at Sources” frame to active the “SMR, Soil Gas Samples at Tier 2 Groundwater” form. This form reflects your input for soil gas results at Tier 2 groundwater sources during SMR and the application’s evaluation of soil gas samples at the Tier 2 groundwater sources.

Soil Gas At Sources

SMR, Soil Gas Samples at Tier 2 Groundwater

	B	T	E	D
SMR, SOIL GAS AT GROUNDWATER SOURCE, USER	FAIL	FAIL		
SOIL GAS AT GROUNDWATER SOURCE, DATA	FAIL	NS	FAIL	NS

Groundwater Source: Benzene

Label	Date	X	Y	GW Elev.	conc.()
MW-15	11/06/2002	39.0	26.0	608.11	5760.00

Soil Gas Data at the Groundwater Source

Label	Date	X	Y	GW Elev.	Sample Elev.	B (ug/m^3)	T (ug/m^3)
VMW-2a	08/13/1997	40.0	23.0	608.60	608.98	13,500,000	2,770,000
VMW-2a	08/13/1997	40.0	23.0	608.60	608.98	13,500,000	2,770,000
VMW-2a	08/13/1997	40.0	23.0	608.60	608.98	13,500,000	2,770,000
VMW-2b	09/05/1997	40.0	23.0	608.60	608.98	15,800,000	14,900,000
VMW-2b	09/05/1997	40.0	23.0	608.60	608.98	15,800,000	14,900,000
VMW-2b	09/05/1997	40.0	23.0	608.60	608.98	15,800,000	14,900,000
VMW-2c	11/20/2002	40.0	23.0	608.09	608.98	3,520,000	8,030,000
VMW-2c	11/20/2002	40.0	23.0	608.09	608.98	3,520,000	8,030,000
VMW-2c	11/20/2002	40.0	23.0	608.09	608.98	3,520,000	8,030,000
VMW-2d	09/29/2004	40.0	23.0	607.11	608.98	2,220,000	150,000
VMW-2d	09/29/2004	40.0	23.0	607.11	608.98	2,220,000	150,000
VMW-2d	09/29/2004	40.0	23.0	607.11	608.98	2,220,000	150,000

Groundwater Source: Toluene

Label	Date	X	Y	GW Elev.	conc.()
MW-5	09/24/1987	49.0	4.0		29500.00

Soil Gas Data at the Groundwater Source

NO DATA FOUND

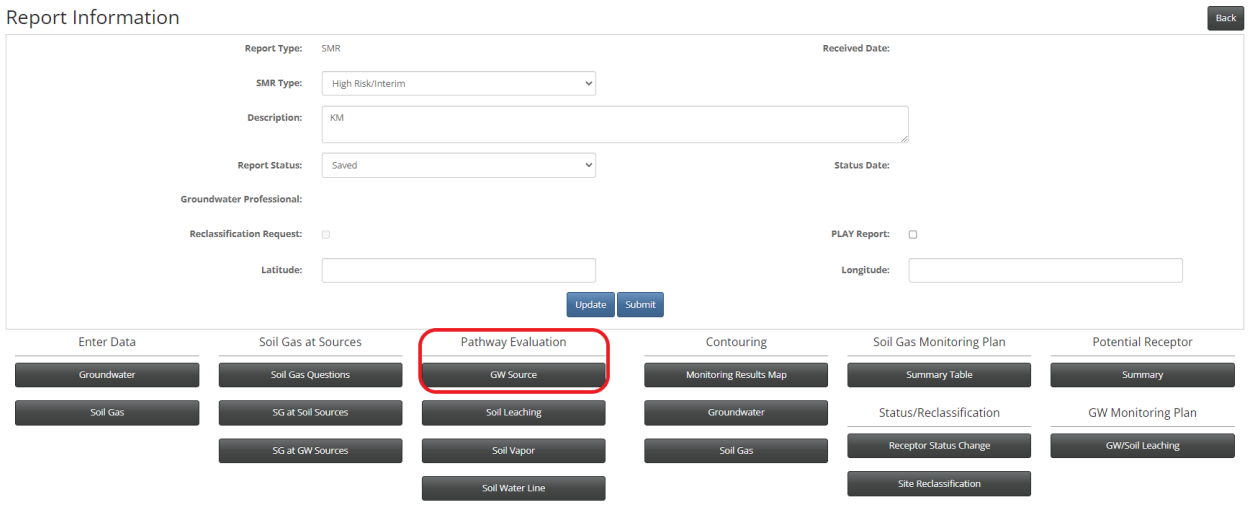
Refer to the Soil Gas at Tier 2 Soil Sources section above for the description of the individual rows in the form. The difference between soil gas sampling at the groundwater source(s) and soil source(s) is that there is no issue of submerged soil source in case of sampling soil gas at the groundwater source(s).

22. PATHWAY EVALUATION

Pathway Evaluations under SMR are similar to pathway evaluations under Tier 2, except the application compares the SMR groundwater data to the Tier 2 SSTLs to determine whether exit monitoring criteria have been met (calculates the current risk classification).

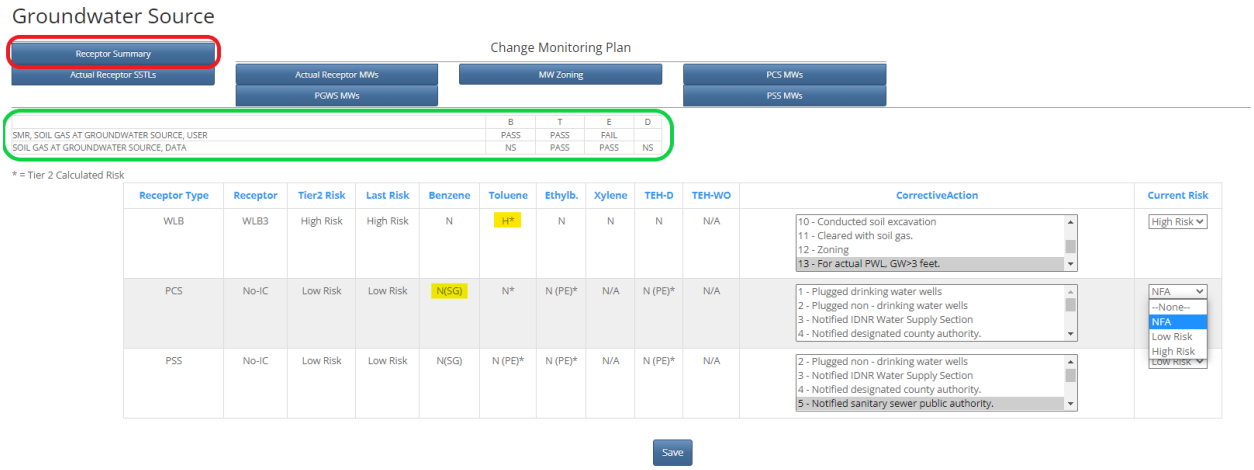
23. GROUNDWATER SOURCE PATHWAY EVALUATION

Click the “GW Source” button in the “Pathway Evaluations” frame to activate the “Groundwater Source” form.



23.1 Receptor Summary

Click the “Receptor Summary” button in the “Receptor Summary” frame to activate the “Groundwater Source” form.



The table at top of the form shows the soil gas results for groundwater sources for SMR. The first row shows the soil gas results you have identified (SMR, SOIL GAS AT GW SOURCE, USER). These are the results used as part of risk classification. The second row shows the application determination of soil gas results at Tier 2 groundwater sources. If the calculated risk for a receptor is not N or N* and you have indicated you have passed soil gas at a Tier 2 groundwater source during SMR, then N(SG) will be shown in the receptor summary for the chemical, to indicate you have passed soil gas during SMR.

If you have indicated you have failed soil gas, this is not reflected in the receptor summary. The risks in the receptor summary are based on groundwater concentrations, unless you have passed soil gas. However, if you have failed soil gas at a groundwater source you will still need to address this issue, even if the vapor receptors are no further action based on groundwater concentrations.

The Receptor Summary lists all receptors that do not have a current risk of NFA for Groundwater Source Receptor Summary in the Tier 2 portion of the application. The “Tier2 Risk” risk column shows the current risk that was assigned at Tier 2. The “Last Risk” column shows the previous SMR risk classification for the receptor.

The columns for the chemicals (Benzene, Toluene, Ethylb., Xylene, TEH-D, TEH-WO) show the “computed” risk. The computed risks are based on the groundwater concentrations. If the SMR groundwater sampling to date is not sufficient

to determine a new risk (e.g., not enough sampling events have occurred), the Tier 2 computed risk for the chemical is shown (an asterisk, "*" is used to indicate when this is the case). For example, H* means the SMR data is not sufficient for reclassification, and the Tier 2 chemical risk is H (refer to the picture above). If the SMR groundwater sampling is sufficient to result in a reclassification of risk for the chemical this is shown by an N, L, or H, without an asterisk, "*." If the computed risk for a chemical for a vapor receptor is L, L*, H or H*, but you have indicated you passed soil gas at the Tier 2 groundwater source during SMR, then N(SG) is shown.

For example, consider the receptor type "PCS" on the picture above. You will note the risk classifications are all "N(SG)," "N*," "NA," or do not need to be evaluated based on the Tier 2 preliminary evaluation, "N(PE)." This means based on the groundwater and soil gas sampling data collected as part of SMR, the risk classification for this receptor is now No Action Required (N). Hence, the "Current Risk" column for this receptor should be set to "NFA."

Your task in this form is to set the columns: "Corrective Action" and "Current Risk." If corrective action is completed, the corrective action completed should be selected using the drop-down list boxes in the corrective action column. When corrective action is conducted which results in receptor reclassification, a narrative description of the corrective actions may be input under "Status/Reclassification."

In some cases, the current risk may be the same as the last (previous) risk. If there is **not** an "L," "L*," "H" or "H*" in one or more of the chemical columns, then the application has determined, based on SMR groundwater samples or the soil gas sampling results you have identified, that the receptor is now No Action Required, and the "Current Risk" column should be set to NFA for the receptor. Otherwise, the current risk should be set to the highest chemical risk (i.e., if one chemical is L (or L*) and another is H (or H*), the receptor risk is High Risk).

There may be situations where the current risk is NFA regardless of the computed risk for the chemicals. For example, if a drinking water well or non-drinking water well receptor has been properly plugged, then the current risk should be set to NFA for the receptor. Or, if vapor sampling has been used to clear a vapor receptor, then the current risk should be set to NFA, regardless of the computed risk for the chemicals.

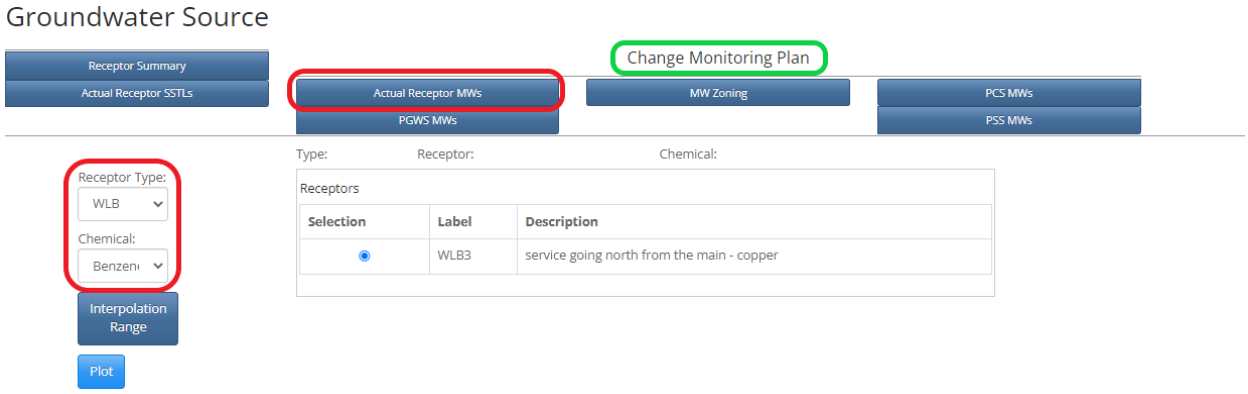
23.2 Changing the Monitoring Plan

You will note there are a number of buttons in the frame "Changing the Monitoring Plan." You only need to use the buttons in this frame if you need to make a change in the wells assigned to monitor a receptor or receptor type.

By default, the SMR application continues to use the wells you selected for monitoring a receptor at Tier 2 (i.e., X, T, G). If you need to make a change in the monitoring plan (add or delete a well, perhaps a new receptor), you use the appropriate button in the "Changing the Monitoring Plan" frame.

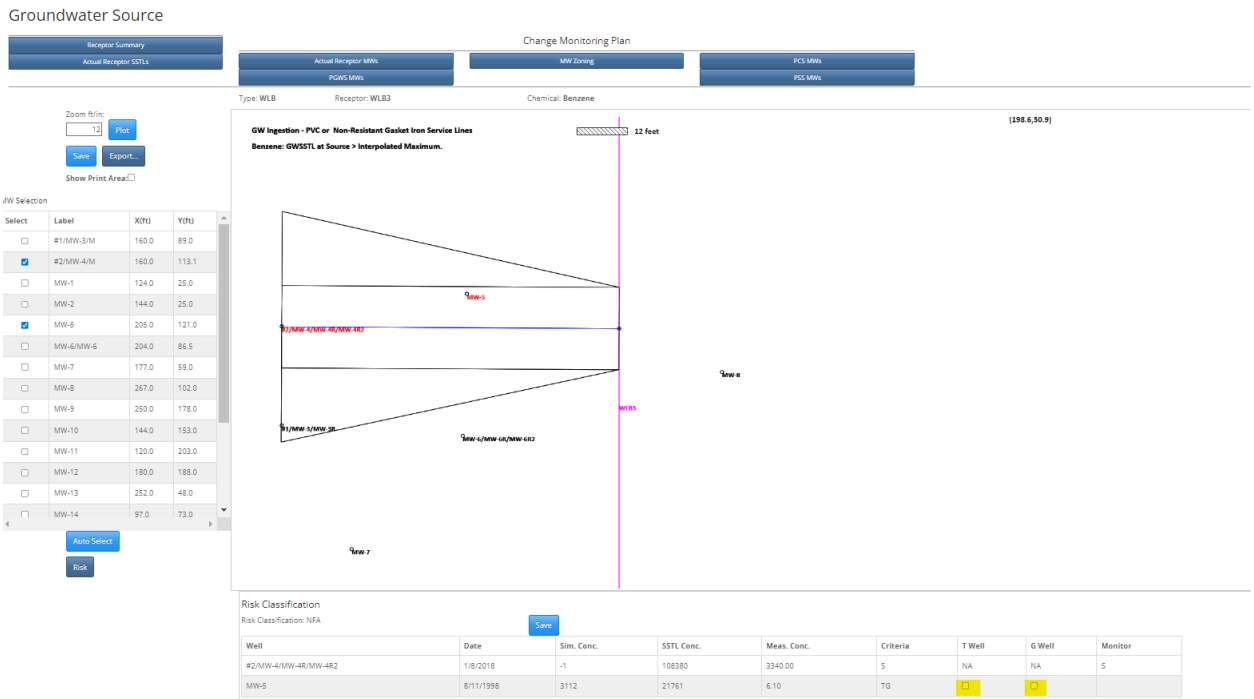
23.3 Actual Receptors, Monitoring Plan

Click the "Actual Receptor MWs" button to activate the "SMR, GW, Actual Receptors, Monitoring Well Selection" form.



Use the drop-down list boxes to the left to select the chemical and receptor type. The "Interpolation Range" button works the same as under Tier 2 for specifying the interpolation range.

For the picture below, benzene and the “WLB” receptor were used to illustrate the monitoring well selection. The results look very similar to the results for monitoring well selection in Tier 2. The contouring and groundwater source SSTL are based on the Tier 2 data. The groundwater sampling locations are shown as black circles, along with the label for the location (including any new locations if new wells where added at the SMR stage).



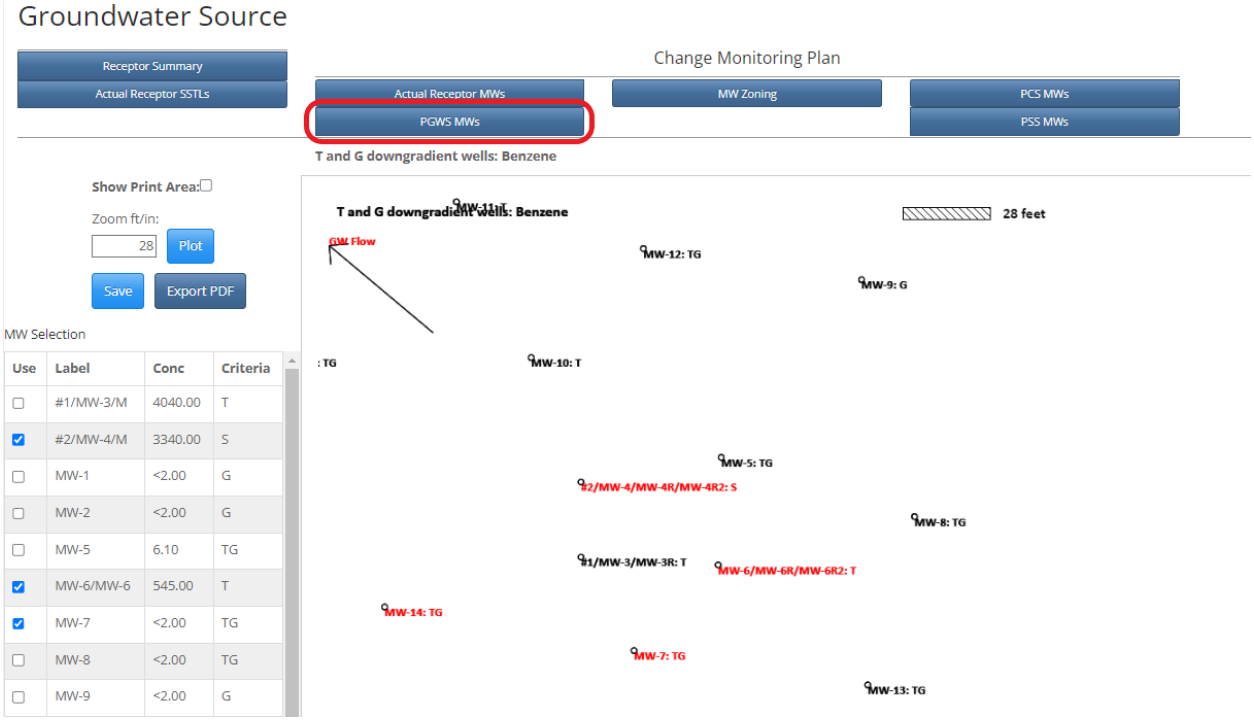
Wells currently selected for the receptor are shown with red labels, while wells not selected are shown with black labels. To select/deselect a well, use the check boxes to the left of the plot. You can zoom in to an area, as needed.

The grid on the bottom shows information for each selected well. Shown for each sampling location are the well label, the SSTL concentration “SSTL Conc.” at the well for the receptor, and the most recent sample concentration for the chemical (“Meas. Conc.”). Also shown is the Tier 2 criteria for the well (” Criteria”), if the well was selected as a candidate monitoring well for the receptor-chemical at Tier 2. You can check/uncheck the boxes for T and G wells to include or remove a well from the monitoring plan.

The selected wells are shown by the red label, and well selection/de-selection is done by clicking on the check boxes of the well labels to left of the plot. Remember to Save before leaving this screen.

23.4 Protected Groundwater Source, Monitoring Wells

Click the “PGWS MWs” button to activate the “SMR, GW, PGWS Monitoring Well Selection” form. This form is used if you need to change the monitoring plan for protected groundwater source receptors during SMR.



The process of selecting/deselecting monitoring wells is similar to the Tier 2 and was discussed earlier in this document.

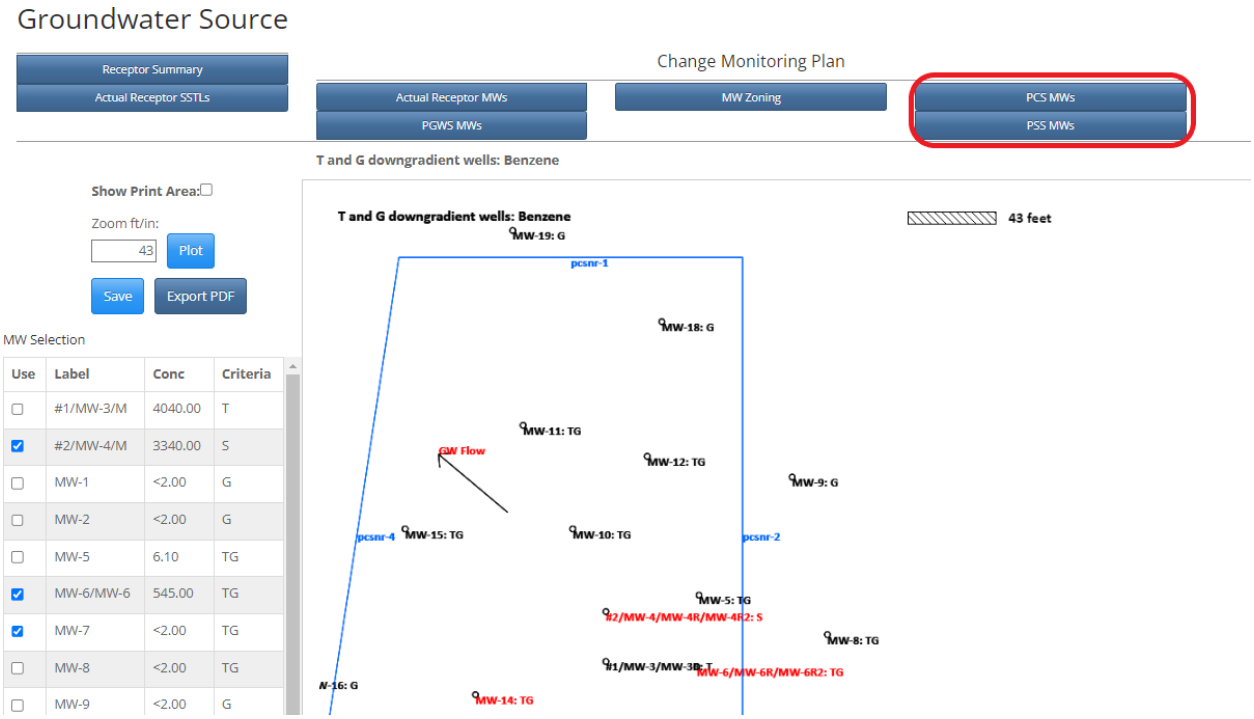
23.5 Potential Vapor Receptors, Monitoring Well Zoning

Click the "MW Zoning" to activate the "SMR, Monitoring Well Zoning" form. You use this form if you need to change or confirm the zoning specified for monitoring well locations at Tier 2. Any setting you made at Tier 2 is automatically carried over to the SMR.

If you added a new well during SMR, you need to come here and set the zoning for the well. You set the zoning from the dropdown menu to the left of the plot. It is similar to the Tier 2 and was discussed earlier in this document A black label means no zoning, a red label means nonresidential zoning, and a blue label means residential zoning. For risk classification purposes, no zoning will be treated as residential.

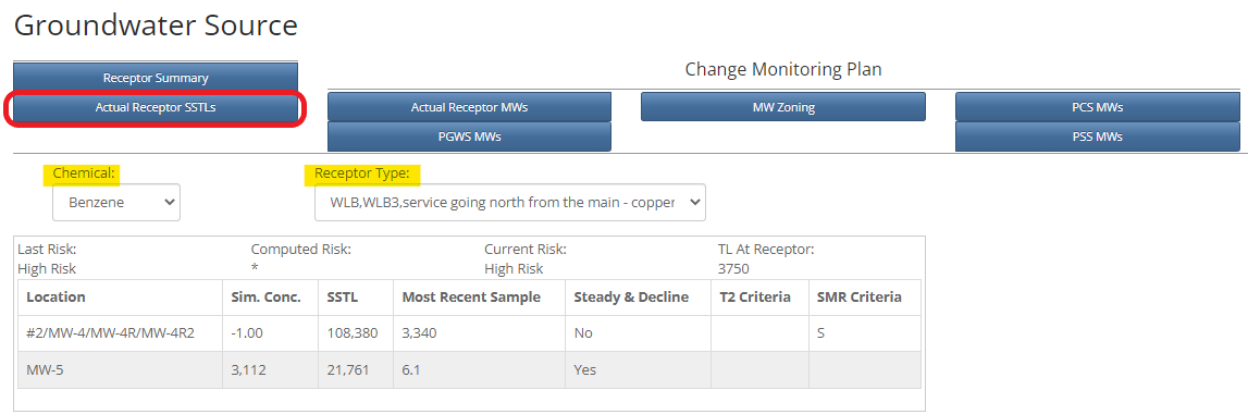
23.6 Potential Confined Space and Potential Sanitary Sewer Monitoring Plan

If you need to change the monitoring plan for potential confined space or potential sanitary sewer receptors, use the "PCS MWs" and "PSS MWs" buttons. These forms function in the same manner as protected groundwater source, discussed above.



23.7 Actual Receptor SSTLs and SMR Receptor Evaluation

Click the "Actual Receptor SSTLs" button to activate the "SMR, GW, Actual Receptors, SSTLs" form. This form is for information only, but can be used to see how the SMR evaluates actual receptors for reclassification.



Select the chemical and receptor using the dropdown list boxes at the top of the form. The grid shows last risk, computed risk, current risk and the target level for the chemical at the receptor ("TL at Receptor").

The grid also shows the wells in the monitoring plan. One column shows the Tier 2 simulated concentration at the well (Sim. Conc.), one column shows the SSTL value for the well (SSTL), one column shows the most recent sample concentration (Most Recent Sample), and one column shows whether the samples at the well meet steady or declining criteria (Steady & Decline). In order to receive No Action Required for the receptor, each well in the monitoring plan must meet steady and declining criteria, and the most recent sample must be less than or equal to the SSTL value. This is the SMR exit monitoring criteria and what the SMR application examines to determine reclassification under SMR.

Steady and declining means the three most recent samples (separated by at least six months) do not increase more than 20% from sample to sample and cannot increase more than 20% from the first (oldest) to the third (last or most recent)

sample.

The last two columns (“T2 Criteria” and “SMR Criteria”) show the criteria for the monitoring wells.

A “-1” in the “Sim. Conc.” column means a simulated concentration cannot be computed for the well. This is because the well is not between the source and receptor. Generally, this would be a P well.

For potential receptors, the main difference for risk reclassification is E wells do not need to meet steady and declining, and three samples are not required. For an E well, a minimum of one sample is required and the most recent sample must be less than or equal to the SSTL.

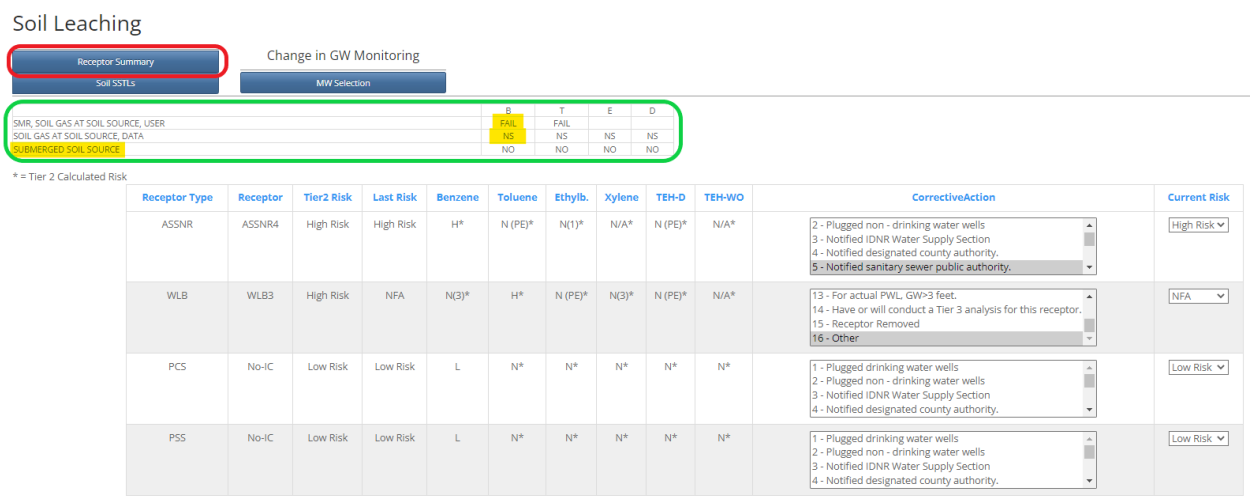
In most cases you only need to address the last risk and receptor summary forms. You do not need to use the other forms unless you need to make a change in the monitoring plan, or have added a well during SMR and need to set the well zoning.

24. SMR SOIL LEACHING PATHWAY EVALUATION

Click the “Soil Leaching” button in the “Pathway Evaluations” frame to activate the “Soil Leaching” form.

24.1 Soil Leaching, Receptor Summary

Click the “Receptor Summary” button to activate the “SMR, Soil Leaching, Receptor Summary” form. This form is similar to groundwater source.



The top table shows the soil gas results for SMR. Line 1 (“SMR, SOIL GAS AT SOIL SOURCE, USER”) is the results you have identified for soil gas sampling at Tier 2 soil sources during SMR. If you have indicated you passed soil gas sampling at a soil source, and the chemical risk is not N, the risk will be shown as N(SG) for vapor receptors, to indicate no further action due to soil gas during SMR.

If you have failed soil gas this does not directly affect the risk classification. The risk classification is based on soil and groundwater data, if you fail soil gas, but you will still need to address the failed soil gas.

The second line (“SOIL GAS AT SOIL SOURCE, DATA”) shows the application evaluation of soil gas data at Tier 2 soil sources. If an inconsistency is present between the information you provided (“USER”) and the “DATA” you will need to provide an explanation. Again, the risk classification is based on the results you have indicated, not on the results the application has determined. If you have a submerged soil source, as indicated by the third row, your soil gas results may not be applicable to the pathway. If you have incomplete data (“???”) for a chemical for which you have indicated soil gas has passed, you will need to provide a justification or additional data. See the Tier 2 Guidance for additional information on submerged soil sources and the soil leaching pathway.

The receptors that do not have their current risk set to N in the Tier 2 Receptor Summary for the Soil Leaching Pathway are listed in the second table, the Receptor Summary.

For each receptor, the Tier 2 risk and last risk are shown. The computed risk is shown for each chemical. If the computed risk was not N for a vapor receptor, but you have indicated soil gas was passed at the Tier 2 soil source during SMR, N(SG) is shown.

There is an important difference in the results for the actual and potential receptors.

For **actual** receptors, only the Tier 2 computed risk is shown (except for passing soil gas during SMR, where N(SG) is shown). At the SMR stage, the risk is not reclassified for actual receptors for soil leaching, except for passing soil gas at a soil source during SMR. This is because for actual soil leaching receptors, the risk is either high or no further action at Tier 2. If the risk is high, corrective action is required and there are no criteria for monitoring groundwater to clear a high-risk receptor for soil leaching at the SMR stage. Hence, the Receptor Summary Table will always show the risk computed based on Tier 2 criteria for soil leaching for actual receptors (unless, for actual vapor receptors, you have indicated you passed soil gas at a Tier 2 soil source during SMR). If corrective action is completed to address a soil leaching receptor (e.g. plug a drinking water well), the corrective action completed should be selected using the drop-down list boxes in the corrective action column. When corrective action is conducted which results in receptor reclassification, a narrative description of the corrective actions may be input under "Status/Reclassification."

For **potential** receptors (PGWS, PCS, PSS), the risk shown for the chemicals is based on evaluating the measured groundwater concentrations for the monitoring well in the vicinity of the soil source against the groundwater SSTL for the receptor and the exit monitoring criteria. Exit monitoring criteria for soil leaching is three years of annual sampling post Tier 2 acceptance with the measured groundwater concentrations less than or equal to the groundwater SSTL at the soil source for all three years. Then the potential receptor(s) may be reclassified as no action required.

The chemical columns show the results of comparing the groundwater samples for potential receptors. If data is not sufficient for reclassification (e.g., only two years of sampling data), then the Tier 2 risk is shown and marked with an asterisk (*). If a potential receptor does not have an "L," "L*," "H," or "H*" in one of the chemical columns, then the receptor has been reclassified as No Action Required based on groundwater sampling, and the Current Risk column should be set to NFA for the receptor. If an "L," "L*," "H," or "H*" is shown for one or more of the chemicals, then the current risk, based on groundwater samples, should be set to the highest risk. If the chemical risk for a potential vapor receptor (PCS, PSS) is not N, and you have indicated you have passed soil gas at a Tier 2 soil source during SMR, then N(SG) will be shown to indicate the risk is now N for the chemical, based on soil gas. The application does not examine soil concentrations as part of risk reclassification for potential receptors during SMR.

Complete the Corrective Action and Current Risk columns as described for the Groundwater Source Pathways Evaluation above.

24.2 Soil Leaching, Soil SSTLs

Click the "Soil SSTLs" button to activate the "SMR, Soil Leaching, Soil SSTLs" form. This form simply lists the soil source SSTLs for the soil leaching receptors that are low or high risk. The table shows the soil SSTL (concentration) that is to be met if a receptor is going to be addressed by soil remediation.

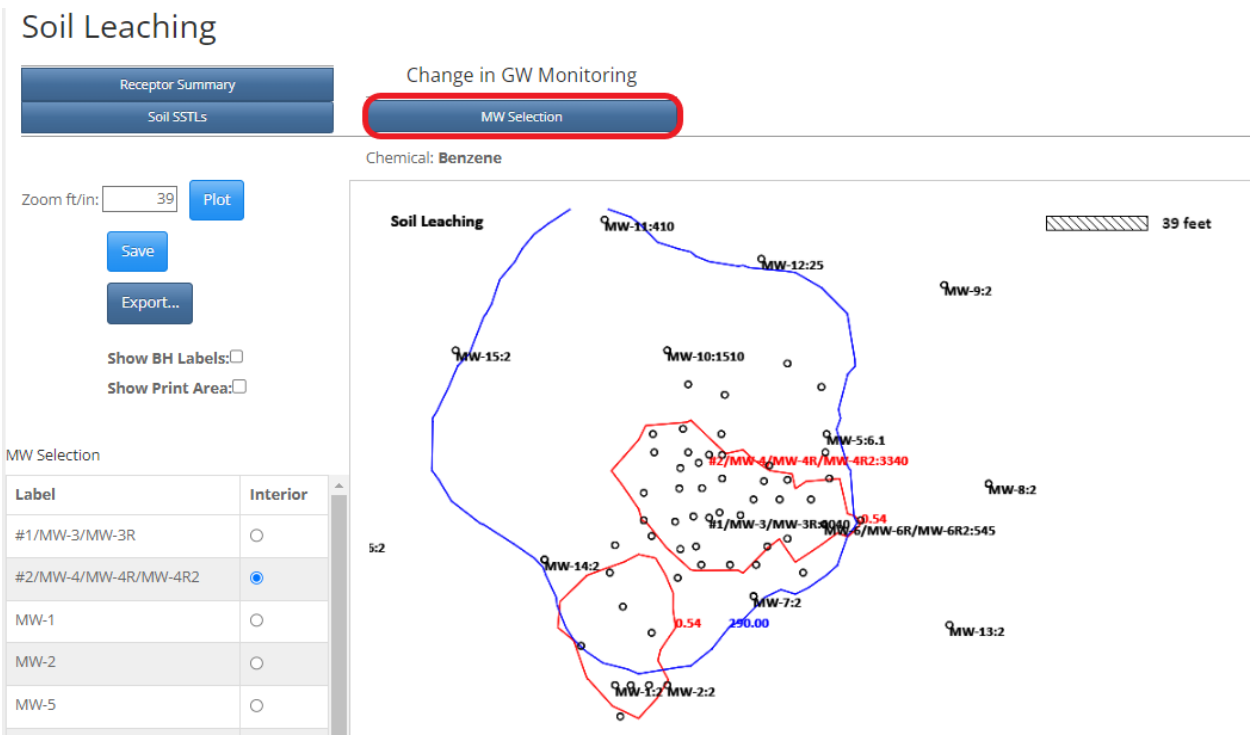
Receptor Type	Receptor	Benzene	Toluene	Ethylbenzene	Xylene	TEH-D
PCS	No-IC	2.35	N	N	N	N
PSS	No-IC	4.70	N	N	N	N
ASSNR	ASSNR4	8.41	N (PE)	N(1)	N/A	N (PE)
WLB	WLB3	N(3)	19	N (PE)	N(3)	N (PE)

24.3 Change in Groundwater Monitoring for Soil Leaching

Click the “MW Selection” button in the “Change in GW Monitoring” frame to activate the “SMR, Soil Leaching, GW Monitoring in Vicinity of Soil Source(s)” form. You use this form to change or select the monitoring well used to evaluate groundwater concentrations in the vicinity of soil sources. The measured concentrations at the well are used for reclassification of potential receptors for soil leaching.

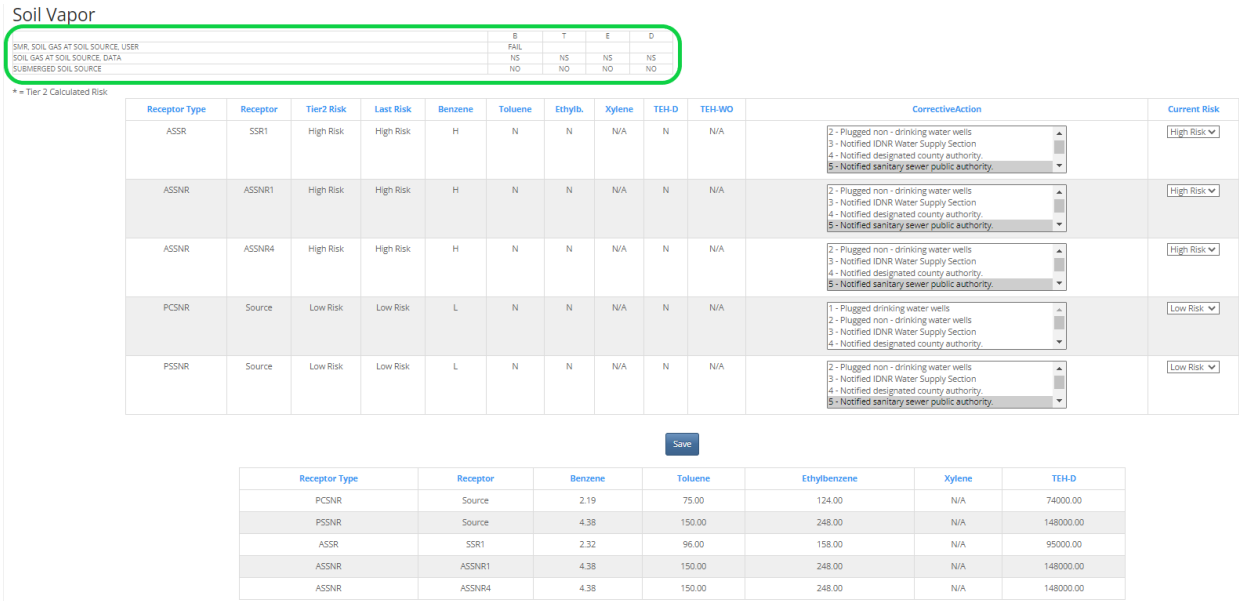
Any monitoring wells selected for this task at Tier 2 are automatically carried over to the SMR. If you had the appropriate wells selected at Tier 2, you will probably not need to use this form, unless you want to review the well selection. If you installed a new well for the purpose of monitoring soil leaching during SMR or need to change the soil leaching monitoring well, you would use this form to select the well.

To review or select a well, click “Plot.” The application will contour the Tier 2 soil data. Candidate monitoring wells are those within the red contour line. At Tier 2, the well with the maximum groundwater concentration within the red contour is selected. This well will be shown with a red label. To pick a well or change the well, click the checkbox to the left of the plot. The selected well is shown with a red label. At the SMR stage, you directly select the well to be used for monitoring soil leaching. For a particular chemical, only one well can be selected. If no well has been selected at Tier 2, you should generally select the well inside the red contour with the highest groundwater concentration. The most recent groundwater sample concentration for the well is shown as part of the label. The well selection is chemical specific.



25. SOIL VAPOR PATHWAY EVALUATION

Click the “Soil Vapor” button in the “Pathway Evaluations” frame to activate the “SMR, Soil Vapor” form.



Soil Vapor

	B	T	E	D
SMR, SOIL GAS AT SOIL SOURCE, USER	FAIL			
SOIL GAS AT SOIL SOURCE, DATA	NS	NS	NS	NS
SUBMERGED SOIL SOURCE	NO	NO	NO	NO

* = Tier 2 Calculated Risk

Receptor Type	Receptor	Tier2 Risk	Last Risk	Benzene	Toluene	Ethylb.	Xylene	TEH-D	TEH-WO	CorrectiveAction	Current Risk
ASSR	SSR1	High Risk	High Risk	H	N	N	N/A	N	N/A	2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority. 5 - Notified sanitary sewer public authority.	High Risk
ASSNR	ASSNR1	High Risk	High Risk	H	N	N	N/A	N	N/A	2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority. 5 - Notified sanitary sewer public authority.	High Risk
ASSNR	ASSNR4	High Risk	High Risk	H	N	N	N/A	N	N/A	2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority. 5 - Notified sanitary sewer public authority.	High Risk
PCSNR	Source	Low Risk	Low Risk	L	N	N	N/A	N	N/A	1 - Plugged drinking water wells 2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority.	Low Risk
PSSNR	Source	Low Risk	Low Risk	L	N	N	N/A	N	N/A	2 - Plugged non - drinking water wells 3 - Notified IDNR Water Supply Section 4 - Notified designated county authority. 5 - Notified sanitary sewer public authority.	Low Risk

Save

Receptor Type	Receptor	Benzene	Toluene	Ethylbenzene	Xylene	TEH-D
PCSNR	Source	2.19	75.00	124.00	N/A	74000.00
PSSNR	Source	4.38	150.00	248.00	N/A	148000.00
ASSR	SSR1	2.32	96.00	158.00	N/A	95000.00
ASSNR	ASSNR1	4.38	150.00	248.00	N/A	148000.00
ASSNR	ASSNR4	4.38	150.00	248.00	N/A	148000.00

25.1 Receptor Summary

The Receptor Summary form is similar to the Receptor Summary forms for Groundwater Source and Soil Leaching. It is different from the others, in that the application does not do risk reclassification for the chemicals, except for the case of passing soil gas at a Tier 2 soil source during SMR. This is because this pathway does not compute soil and groundwater SSTLs in the usual manner. In this form, if risk reclassification is appropriate, you need to enter the appropriate reclassification result yourself. If you reclassify the risk you will need to provide justification for receptor reclassification under “Status/Reclassification.”

The top table shows the soil gas results for SMR. Line 1 (“SMR, SOIL GAS AT SOIL SOURCE, USER”) is the results you have identified for soil gas sampling at Tier 2 soil sources during SMR. If you have indicated you passed soil gas sampling at a soil source, and the chemical risk is not N as a receptor, the risk will be shown as N(SG) for vapor receptors to indicate no further action. If you have failed soil gas during SMR, this will not be shown in the chemical risk classification columns for the receptors. However, you will need to address this situation.

The second line (“SOIL GAS AT SOIL SOURCE, DATA”) shows the application evaluation of soil gas data at Tier 2 soil sources. If an inconsistency is present between the information you provided (“USER”) and the “DATA,” you will need to provide an explanation. Again, the risk classification is based on the results you have indicated, not on the results the application has determined. If you have a submerged soil source, as indicated by the third row, your soil gas results may not be applicable to the pathway. If you have incomplete data (“???”) for a chemical for which you have indicated soil gas has been passed, you will need to provide a justification or additional data. See the Tier 2 Guidance for additional information on submerged soil sources and the soil vapor pathway.

The receptors included in the list are the receptors which have not had their current risk set to N in the Tier 2 Receptor Summary for the Soil Vapor pathway.

The chemical columns show the Tier 2 risk unless you have passed soil gas during SMR, then N(SG) will be shown. Except for passing soil gas a soil source during SMR, the Tier 2 risk is shown.

Complete the Corrective Action and Current Risk columns as described for the Groundwater Source and Soil Leaching Pathway Evaluations above.

“The Soil Vapor Tier 2 Defaults” form is located below the Receptor Summary form. This form simply displays the soil

target levels for receptors that are low or high risk. The units are in milligrams per kilogram (mg/kg). If soil remediation is undertaken as a corrective action, these are your soil target levels.

26. SOIL TO WATER LINE PATHWAY EVALUATION

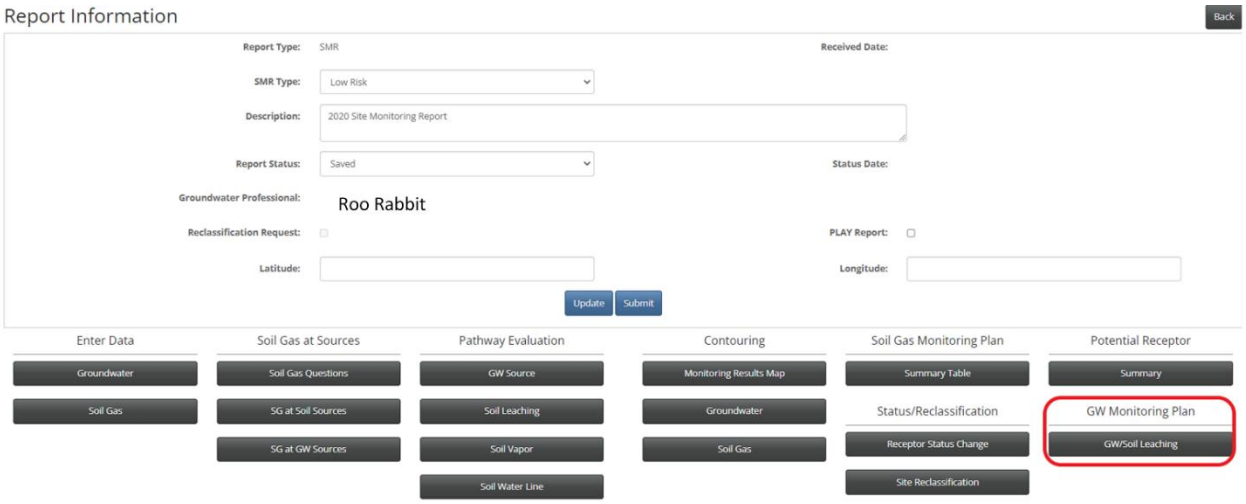
Click the “Soil Water Line” button in the “Pathway Evaluations” frame to activate the “SMR, Soil Water Lines” form.

The Receptor Summary form is similar to the Receptor Summary form for Soil Vapor. The only difference is that there is no information about soil gas sampling because it doesn’t apply to water lines. Complete the Corrective Action and Current Risk columns as described for the Groundwater Source and Soil Leaching Pathways Evaluation above.

“The Soil to Water Line Tier 2 Defaults” form is located below the Receptor Summary form. This form simply displays the soil target levels for receptors that are high risk. The units are in milligrams per kilogram (mg/kg). If soil remediation is undertaken as a corrective action, these are your soil target levels.

27. SMR GROUNDWATER/SOIL LEACHING MONITORING PLAN

Click the “GW/Soil Leaching” button in the “GW Monitoring Plan” frame to activate the form. This form displays the SMR Groundwater Monitoring Plan, similar to the Tier 2 Monitoring Plan. The wells selected at Tier 2 are automatically carried over to the SMR, so a plan will be present even if no monitoring wells have been changed or added during SMR.



The plan for each chemical has two sections: “Groundwater/Soil Leaching Monitoring Plan Summary,” followed by “NFA Results”

Monitoring Plan

Chemical:

Benzen

Go

SMR Groundwater/Soil Leaching Monitoring Plan Summary and NFA GW/SL Monitoring Results

Benzene

Monitoring Well	Most Recent Sample	SSTL	SSTL Met	Steady Decline / 3 Year	Mon. Type (T2)	Recept. Type	Recept. Label	Recept. Descrip.	Chem. Risk	Curr. Risk	Min. Freq.
MW1	2										
		290	Yes	Yes	S/S	PGWS	No-IC		L	L	Annual
		509	Yes	Yes	S/S	PGWS	IC		L	L	Annual
MW3	<2.00										
		290	Yes	Yes	TG/TG	PGWS	No-IC		L	L	Annual
MW4	5										
		290	Yes	No	T-ML/T-ML	PGWS	No-IC		L	L	Annual
		290	Yes	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		1064	Yes	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
MW5	24										
		290	Yes	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		1305	Yes	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
MW6/MW6A	768										
		290	No	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		509	No	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
RW1	2										
		290	Yes	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		1303	Yes	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
MW7	<0.50										
		290	Yes	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		507	Yes	N/A	Int.E/Int.E	PGWS	IC		L	L	Once

NFA Results

Monitoring Well	Most Recent Sample	SSTL	SSTL Met	Steady Decline / 3 Year	Mon. Type (T2)	Recept. Type	Recept. Label	Recept. Descrip.	Chem. Risk	Curr. Risk	Min. Freq.
MW1	2										
		3431	Yes	Yes	S/S	ASSR	SS#1	Lynd Street	N	N	
		7735	Yes	Yes	S/S	WLA	CI MAIN-2	NORTH LYND MAIN	N	N	
		3088	Yes	Yes	S/S	PSS	IC		N	N	
		2704	Yes	Yes	S/S	PCS	IC		N	N	
MW6/MW6A	768										
		3429	Yes	Yes	X/X	ASSR	SS#1	Lynd Street	N	N	
		9550	Yes	N/A	Ext.E/Ext.E	PSS	IC		N	N	
		2703	Yes	N/A	Int.E/Int.E	PCS	IC		N	N	

"Groundwater/Soil Leaching Monitoring Plan Summary"

The first part of the table reflects the groundwater and soil leaching monitoring plan: The wells that need to be monitored for the SMR. The monitoring plan does not necessarily reflect all receptors. The monitoring plan is compiled by combining the wells for receptors which are high or low risk for groundwater source, and the receptors which are high or low risk for soil leaching. If a receptor has a current risk of N at Tier 2 or has a current risk of N in the SMR Receptor Summary, it will not appear in the plan. If the chemical risk for a receptor is N, the well will not appear in the plan for that chemical. As an example, if you had cleared a vapor receptor using soil gas sampling and set the current risk to N, the receptor will not appear in the monitoring plan, regardless of the computed chemical risk.

"NFA Results"

Following the groundwater/soil leaching monitoring plan are the groundwater monitoring results for receptors that are no further action (N). The results for a receptor are shown in the "NFA Results" for a chemical if,

a. A receptor has a user assigned current risk of NFA and the chemical risk is N, L, L*, H or H*, or
b. A receptor does not have a current risk of NFA, none of the chemicals are L, L*, H or H*, and the chemical risk is N (i.e. Not shown in NFA results if receptor is still being monitored for a chemical).

Note that a receptor is not included for a chemical if the risk is N due to a reason other than a computed risk. For example, N* (N at Tier 2 and has not changed) or N(SG), the user has indicated soil gas passed at a source during SMR or N(PE), due to preliminary evaluation.

The "NFA Results" allow a review of results for receptors that have a computed chemical risk of N, or for which you, the user, has specified a current risk of N. Also, if all receptors are NFA, then this provides a final review of the data.

Note that the wells in the "NFA Results" are not part of the future monitoring plan of the SMR. However, note that a well could be in both the "GW/SL Monitoring" plan (needs additional monitoring) and in the "NFA Results," because a well may be used to monitor more than one receptor.

Data Displayed

Table 8 is an example of a printout of an SMR Groundwater Monitoring Plan for toluene. The data does not reflect our example problem, but we will use it for discussion purposes. It will used to describe the printed results and the results shown on-screen.

The first column shows the monitoring well label. The second column shows the most recent measured concentration at the well.

S well flagged: You will note MW-3 has 60,000** in the column. The ** for the Tier 2 source well for the chemical (S in Monitor Type column), means the concentrations for the well have exceeded the Tier 2 source concentration for this well by more than 20% for each of the two most recent samples. In other words, the source concentration has increased since the Tier 2 was completed. You may need to perform a re-evaluation of the Tier 2 analysis. See the SMR Guidance

for more information.

Other wells flagged: Also note well MW-10, which is not the source well, shows 60,000**/33,645. This means the concentration has increased more than 20% at the well since the Tier 2 was completed, **and** exceeds the Tier 2 modeled (simulated) concentration at the well. The number after the "/" is the Tier 2 simulated concentration at the well. This is an indicator the plume may be undergoing significant migration and a re-evaluation of the Tier 2 may be needed. See the SMR Guidance for more information.

If neither of these indicators are present, there will be no ** in the "Most Recent Sample" column.

The SSTL column shows the SSTL value to be met for the well, for each receptor associated with the well. The "SSTL Met" column simply shows whether the most recent concentration at the well is greater than the SSTL value (No) or less than or equal to the SSTL value (Yes). The exception to this is the soil leaching monitoring well(s) (SL in Monitor Type). For "SSTL Met" to be Yes for the soil leaching monitoring well, the three most recent samples must all be less than or equal to the SSTL.

The "Steady Decline/3 year" shows whether the sampling at the well meets steady and declining criteria. "Yes" means the well has three samples and steady and declining criteria are met. If the well is a soil leaching well (SL in Monitor Type), the three-year criteria is used and Yes means there are three years of sampling (i.e., steady and declining is not required). For E wells, the column shows "N/A" for not applicable. E wells do not need to meet steady and declining criteria, and three samples are not required. For an E-well a minimum of one sample is required and the most recent sample must be below the SSTL.

The "Monitor Type (T2)" column shows the well monitoring criteria. The symbols before the "/" show the Tier 2 criteria, if the well was a well selected at Tier 2. The symbols after the "/," if any, show the well criteria, input by the user, for a well selected during SMR.

G well flagged: If a well which was a G well at Tier 2 no longer meets G well criteria (exceeds the SSTL), this is indicated by "**" in the Monitor Type column. It means the most recent sample is above the SSTL for a Tier 2 G well.

The "Receptor" columns identifies the receptors. For potential receptors, the "Type" column shows the receptor type, and the "Label" column shows whether the SSTL is applicable for no institutional control (No-IC) or for an institutional control (IC).

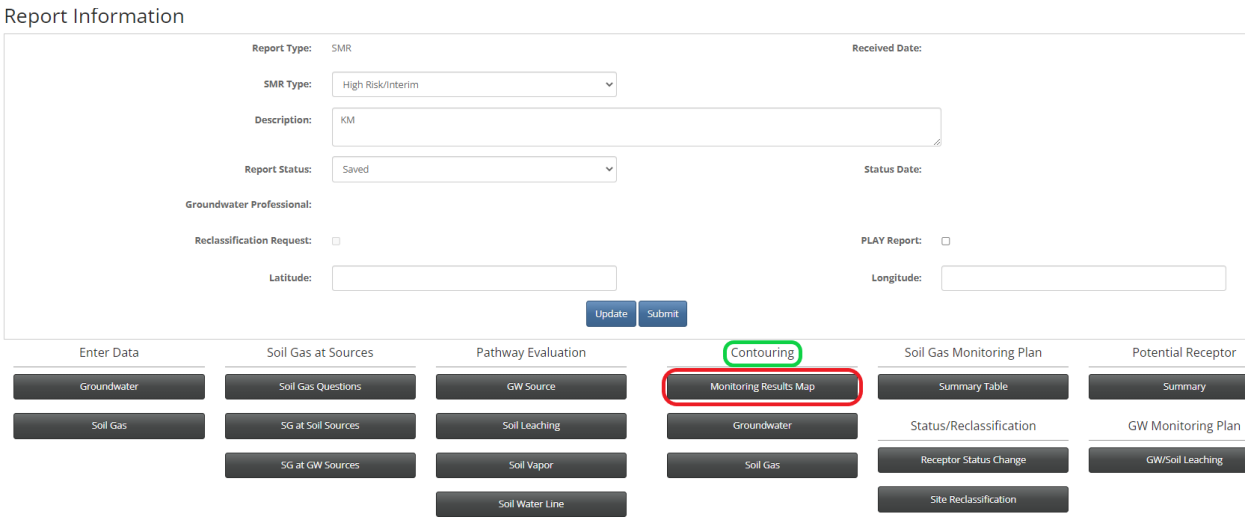
The "Chem. Risk" column shows the computed risk for the chemical for the receptor, based on groundwater monitoring. An asterisk "*" means the data is not sufficient for reclassification during SMR, and the risk shown is the Tier 2 risk for the receptor-chemical.

The "Recept Curr. Risk" column shows the Current Risk for the receptor, as set by you, the user, in the Receptor Summary for the Groundwater Source or Soil Leaching Pathway.

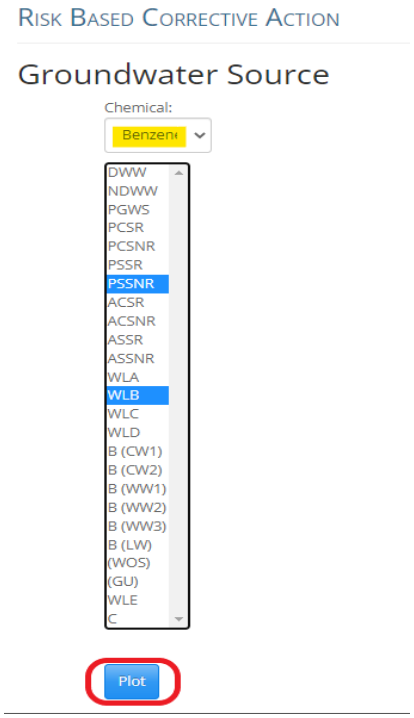
The "Min. Freq." column is the minimum sampling frequency for the well-receptor. The frequency is always annual, except for E-wells, where the minimum required sampling is once (but the most recent sample must meet the SSTL).

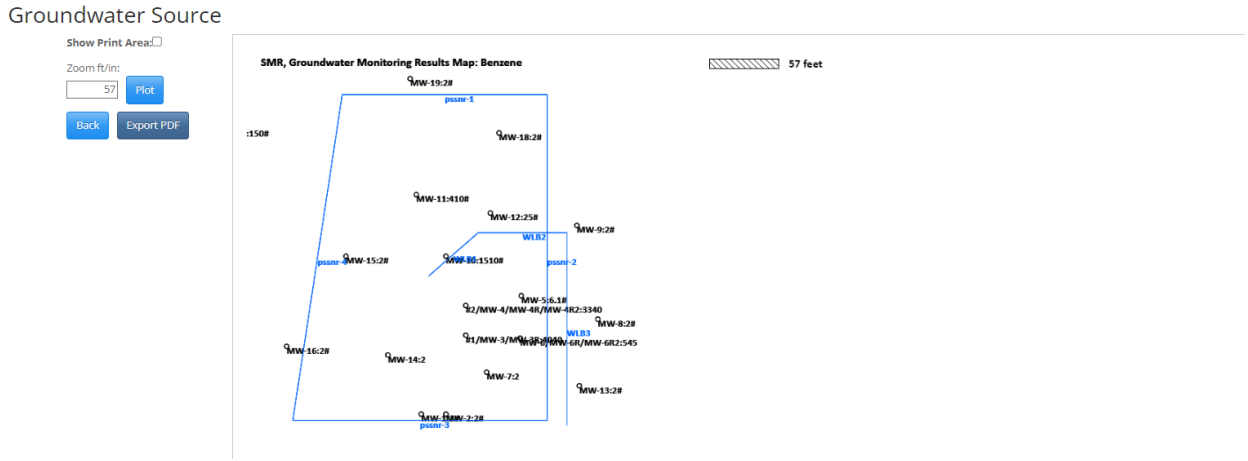
28. MONITORING RESULTS MAP

Click the “Monitoring Results Map” button in the “Contouring” frame to activate the “SMR, Groundwater Monitoring Results Map” form.



You may plot any combination of receptor types on the map by selecting the appropriate receptors on the left. For the example on the picture below, PSSNR and WLB were selected, along with the chemical benzene. Click the “Plot” button. The selected receptor types are plotted, along with the monitoring well labels (see the second picture below). No contouring or modeling is done, because the concentrations shown may be from different sampling events/dates.



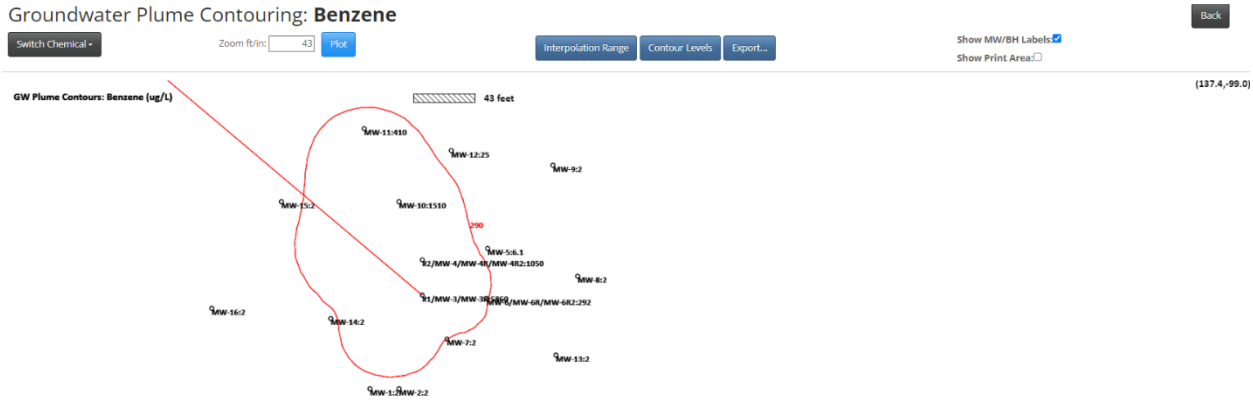


The Monitoring Results Map should reflect the most recent measured concentrations for the wells in the SMR Groundwater Monitoring Plan.

If a measured concentration is displayed and the date for the most recent sample is more than six months prior to the current risk date, a "#" is shown as part of the well label, following the concentration. That is, older data are flagged on the map.

29. GENERAL CONTOURING - GROUNDWATER

Click the "Groundwater" button in the "Contouring" frame to activate the "SMR Groundwater Contouring" form. This form provides a visual picture of the groundwater contamination at your site during site monitoring.



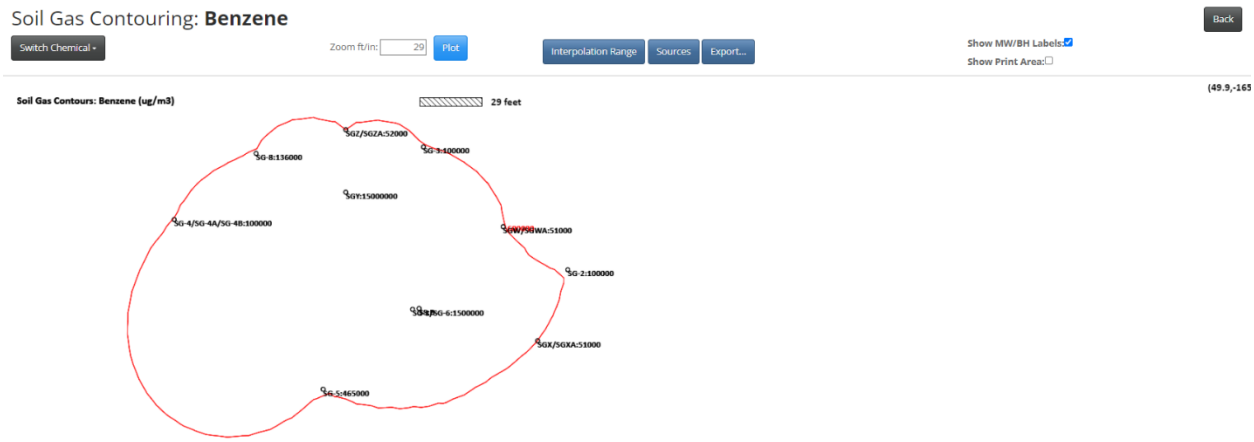
This form contours <u>the most recent valid groundwater sample</u> at each location. The Tier 2 and SMR groundwater data are combined, and the most recent valid sample is assigned to each location for plotting and contouring. This plot represents the groundwater contamination at your site, using the most recent data at each monitoring location, including wells that are not in the SMR monitoring plan. Note that this means, for example, if a location was last sampled 5 years ago, such data is used and plotted. If no concentration has been assigned to a location, due to samples being ignored or no measured concentrations, then the well/borehole label is shown, followed by "NVS" (No valid sample).

This form functions in the same manner as the groundwater contouring form for Tier 2. The steps for selecting Contour Levels and setting Interpolation Range were discussed for Tier 2 earlier in this document.

Click the "Plot" button. The most recent valid groundwater sample at each location is plotted and contoured. You can print the results to a printer or export as a PDF/DXF file. The map is part of the SMR.

30. VAPOR MONITORING PLAN

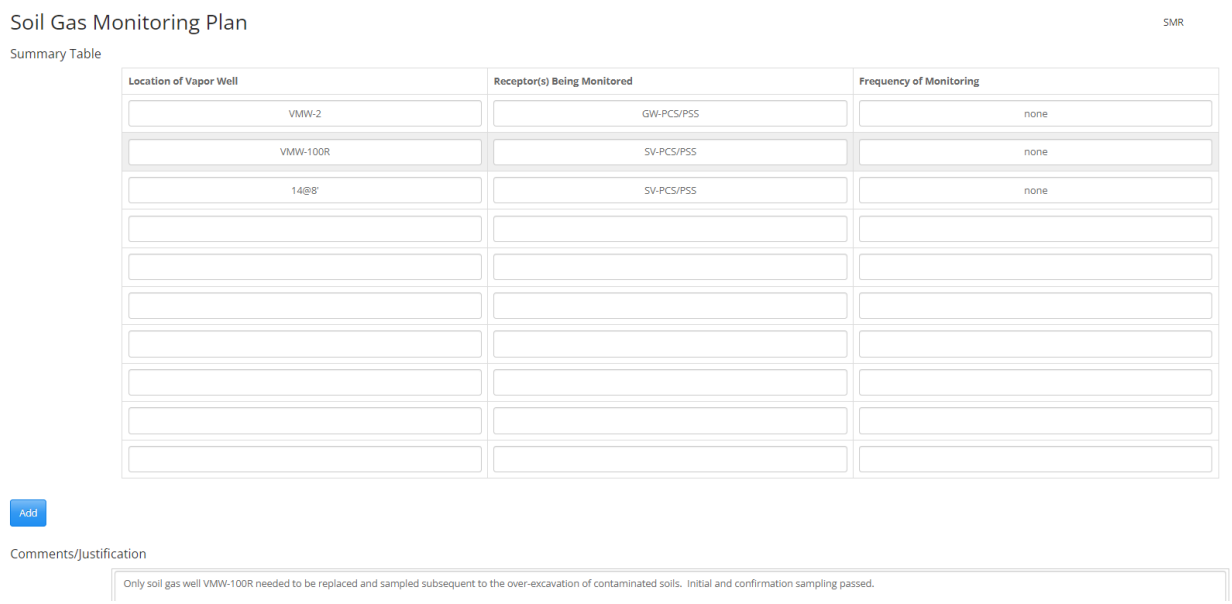
Click the “Soil Gas” button in the “Contouring” frame to activate the “SMR Soil Gas Contouring” form. This form provides a visual picture of the soil gas plume at your site during site monitoring.



This form functions in the same manner as the soil gas contouring form for Tier 2. The steps for selecting Sources and setting Interpolation Range were discussed for Tier 2 earlier in this document.

Click the “Plot” button. The most recent valid soil gas sample at each location is plotted and contoured. You can print the results to a printer or export as a PDF/DXF file. The map is part of the SMR.

The Soil Gas Monitoring Plan Summary information is entered using the “Summary Table” button in “Soil Gas Monitoring Plan” frame.



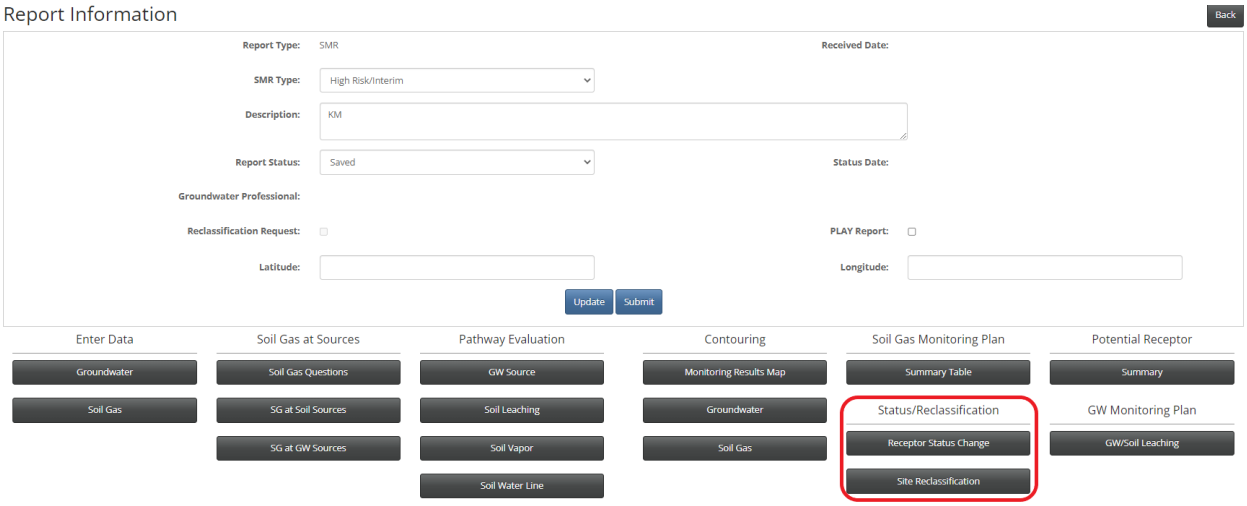
Click the “Summary Table” button in the “Soil Gas Monitoring Plan” frame to activate the “Soil Gas Monitoring Plan” form. Enter the required information.

Use the “Comments/Justification” text box at the bottom to explain changes in the monitoring plan or provide other relevant information. This frame is part of the SMR and must be included in the report.

31. RECEPTOR STATUS CHANGE AND SITE RECLASSIFICATION

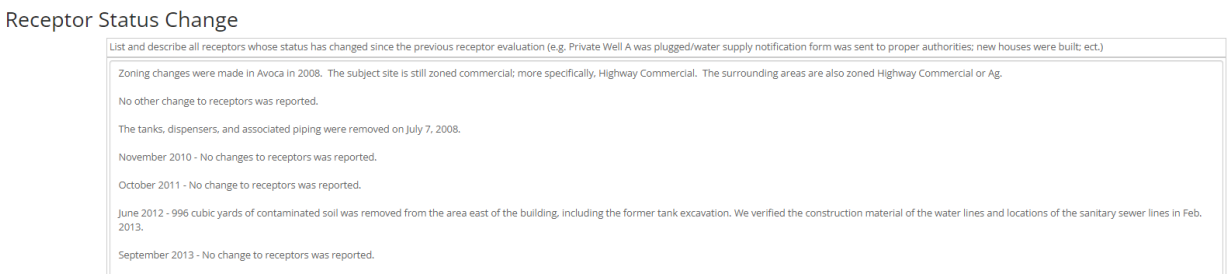
You can enter, save, and print information on changes in receptor status and site reclassification. The information for receptor status change and site reclassification is entered and printed using the buttons in the “Status/Reclassification”

frame.



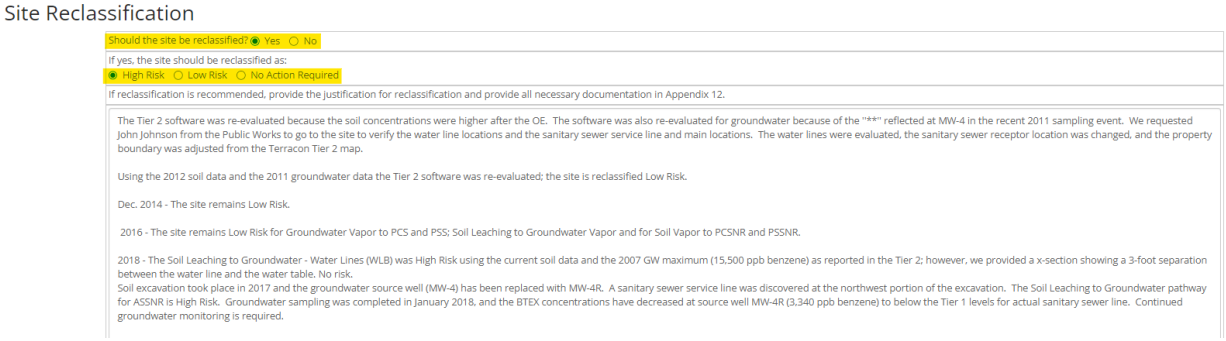
Receptor Status Change

Click the "Receptor Status Change" button in the "Status/Reclassification" frame to activate the "SMR, Receptor: Status Change" form. See SMR Guidance for the required information to be presented in this form.



Site Reclassification:

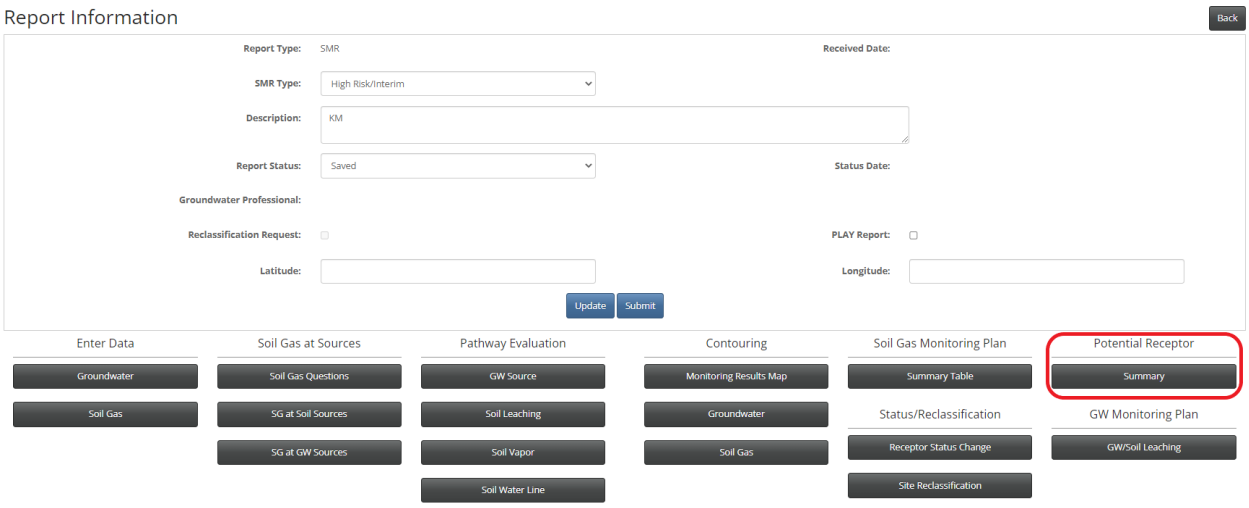
Click the "Site Reclassification" button in the "Status/Reclassification" frame to activate the "SMR, Site Reclassification" form.



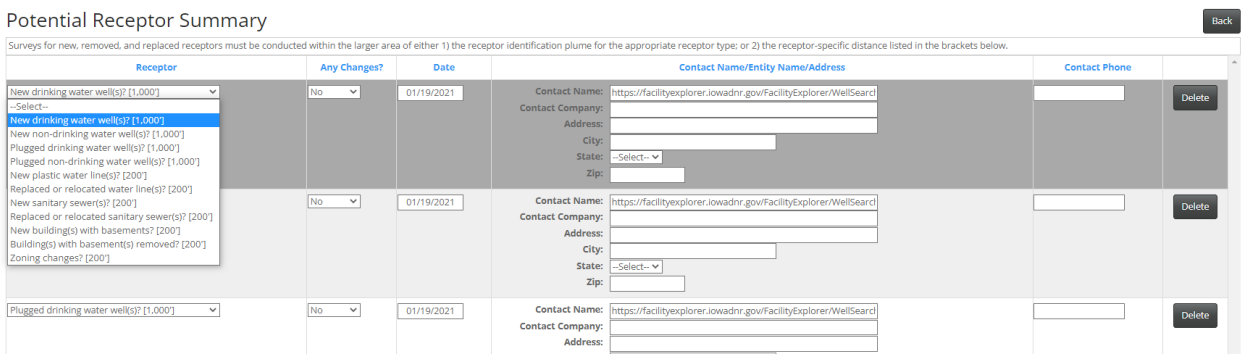
You must answer "Yes" or "No" to "Should the site be reclassified?" question. If you don't answer this question and don't indicate the proposed reclassification (high risk, low risk, no action required), the application will not allow you to submit the SMR in the main frame. Provide an explanation/justification for reclassification of pathways and receptors in the text box below the questions.

32. POTENTIAL RECEPTOR SUMMARY

You can complete, save, and print the "Potential Receptor Summary" information for the SMR.



Click the "Summary" button in the "Potential Receptor" frame to activate the "SMR, Potential Receptor Summary" form. There is an example of the printout in the SMR Guidance.



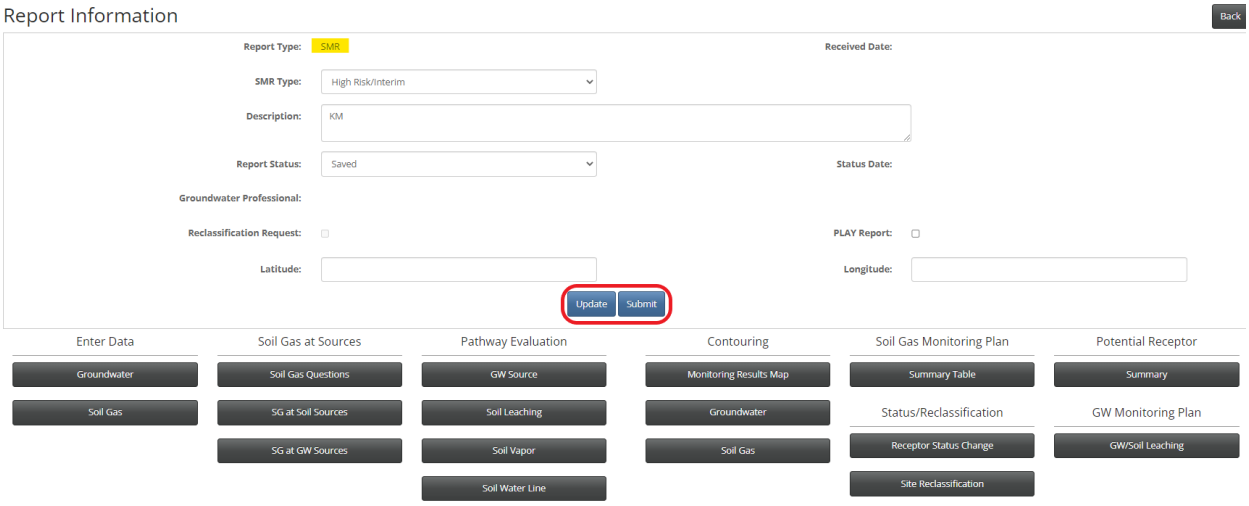
You can enter the required information into this form. The drop down menu in the "Receptor" column is used to select the different receptor types. You need to complete contact date and information for all receptors in the drop-down menu. For each receptor type you can enter up to 10 contacts.

33. COVER PAGE AND REPORT CHECKLIST PRINTING

The SMR cover page and report checklist are not printed from the application. They are fillable PDF forms and are located on the UST web site.

34. SAVING, UPDATING AND SUBMITTING THE SMR DATA

While completing/filling different forms in the SMR application, you were saving data using the "Save" button. Before submitting the SMR it is recommended to click the "Update" button.



- Update: This button will update all site parameters and equation results with the most recently entered data and selections. It is recommended that a user clicks the Update button before exiting the application to make sure that all work is saved and up to date.
- Submit: The Submit button will only be available to CGPs and is the final step in the process of completing a report in the RBCA application. After all data is entered and you are satisfied with the results, click the Submit button to complete the online report process. This will automatically send an email to the DNR PM alerting them that a RBCA application report has been submitted for the site. **This action is a signal that the report is finished and no more work will be completed in the RBCA application before DNR review.**

35. ADDING RECEPTORS AT THE SMR STAGE

If you need to add a receptor at the SMR stage, you will have to add the receptor in the Tier 2 application. Create a revised Tier 2 and enter new receptors and relevant information. You must complete the evaluation of the new receptor in the Tier 2 and submit the revised Tier 2 application prior to creating a new SMR. After the revised Tier 2 is submitted, the newly created SMR will recognize receptor changes and changes in the monitoring plan. Refer to the order of report submission discussed earlier in this document.

Figures and Tables

The following figures and tables are derived from previous software versions, not the application.

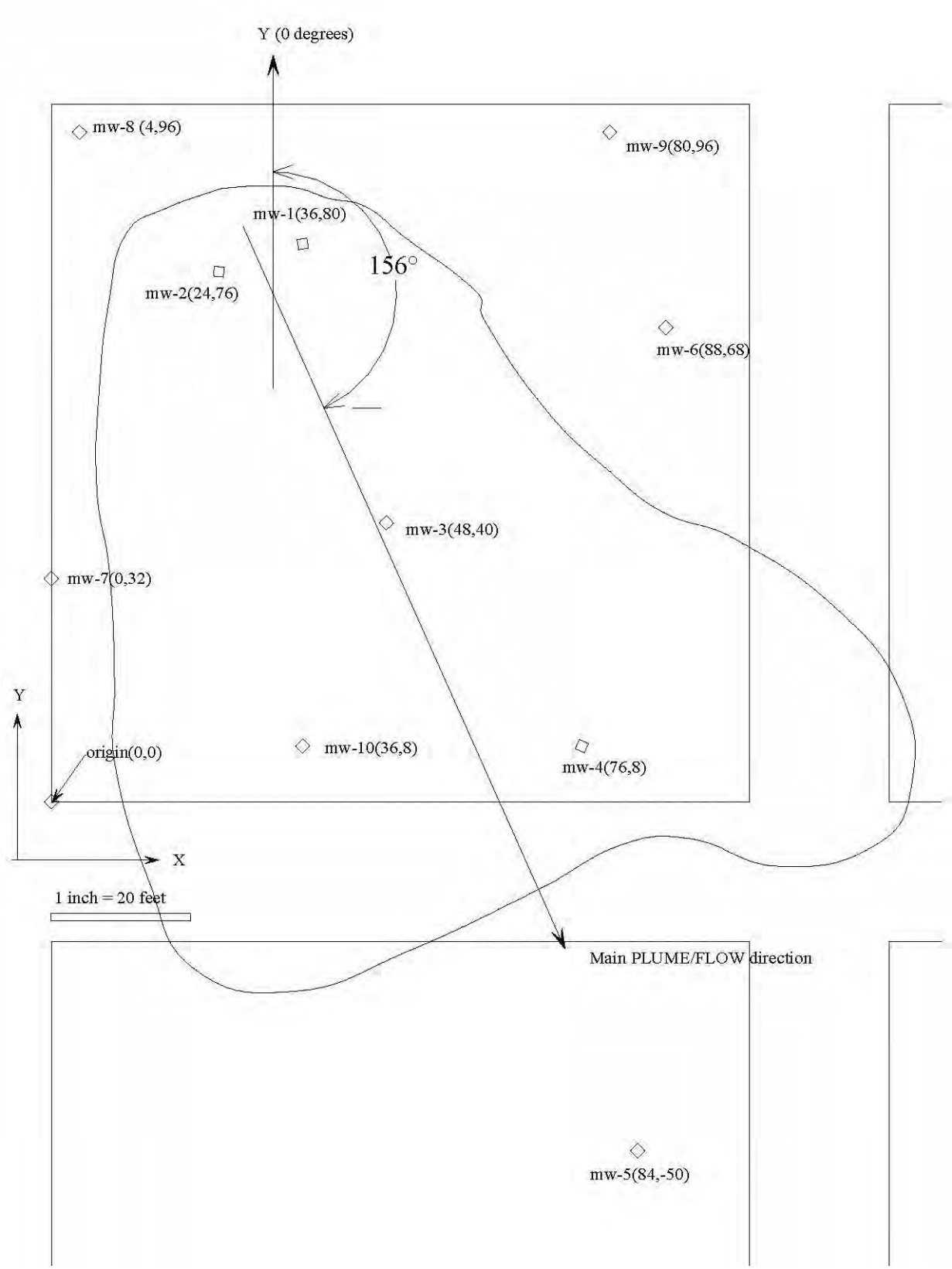


Figure 1. Cartesian Coordinate System and Main Plume Flow Direction

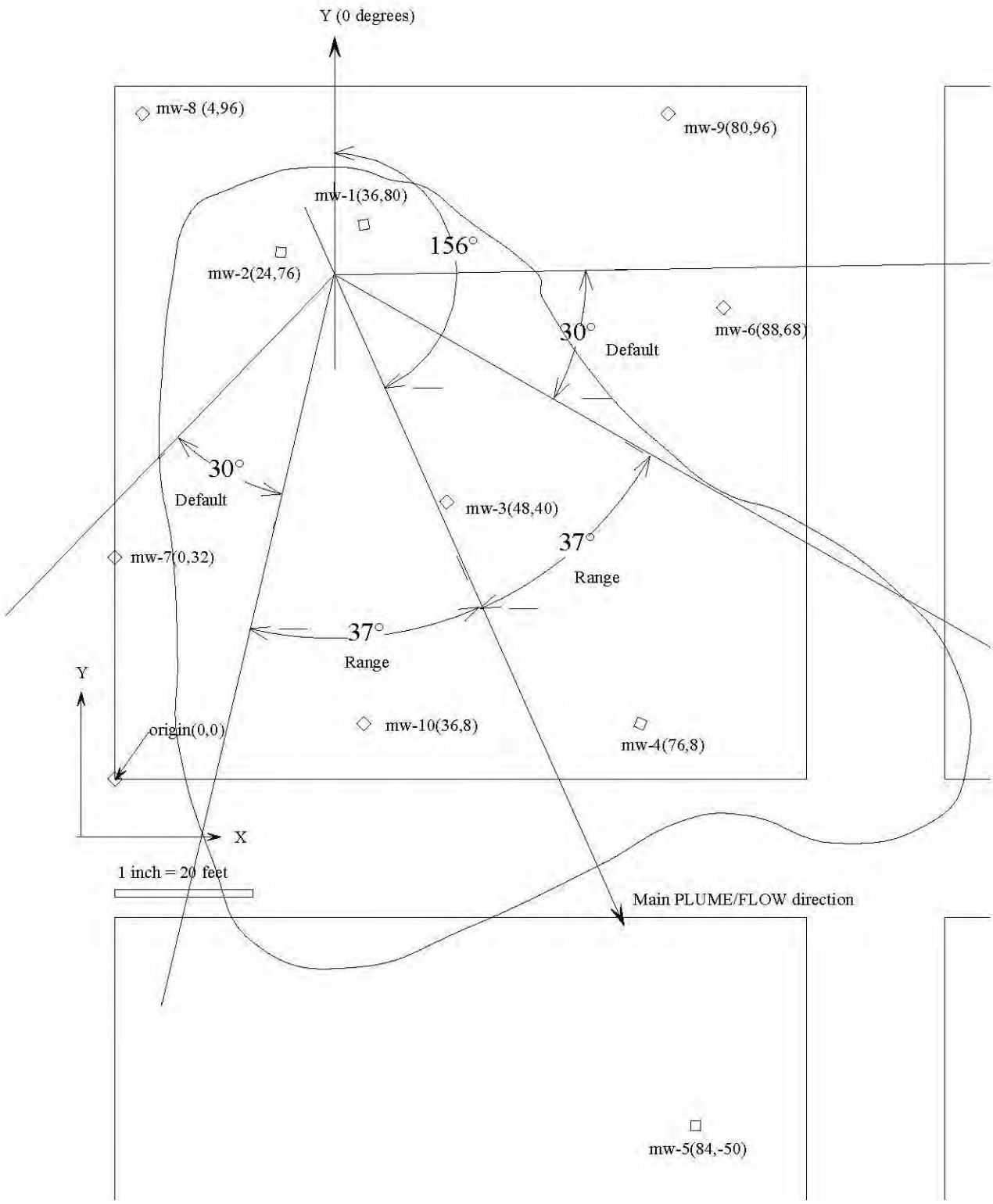


Figure 2. Range of Plume/Flow

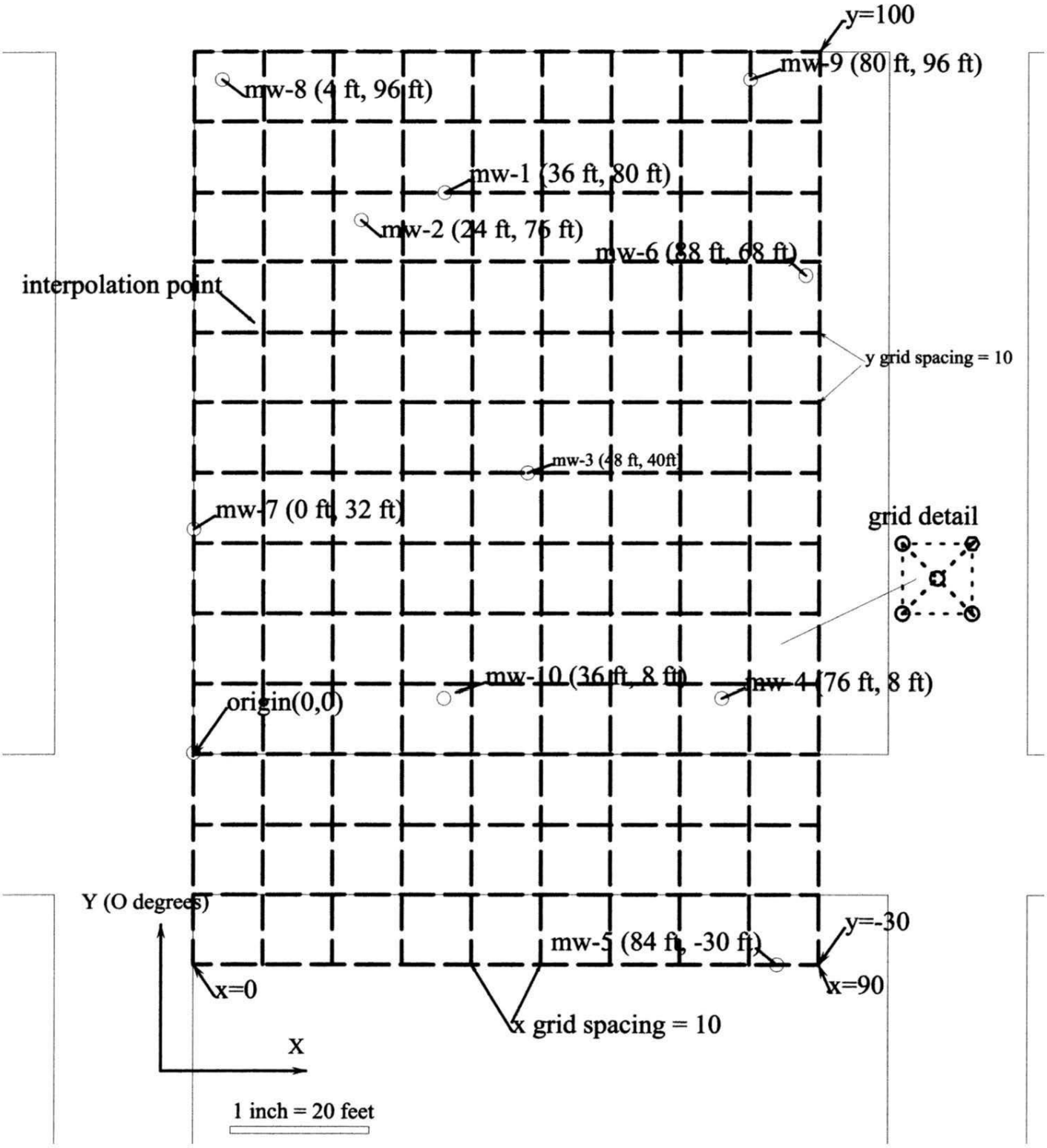
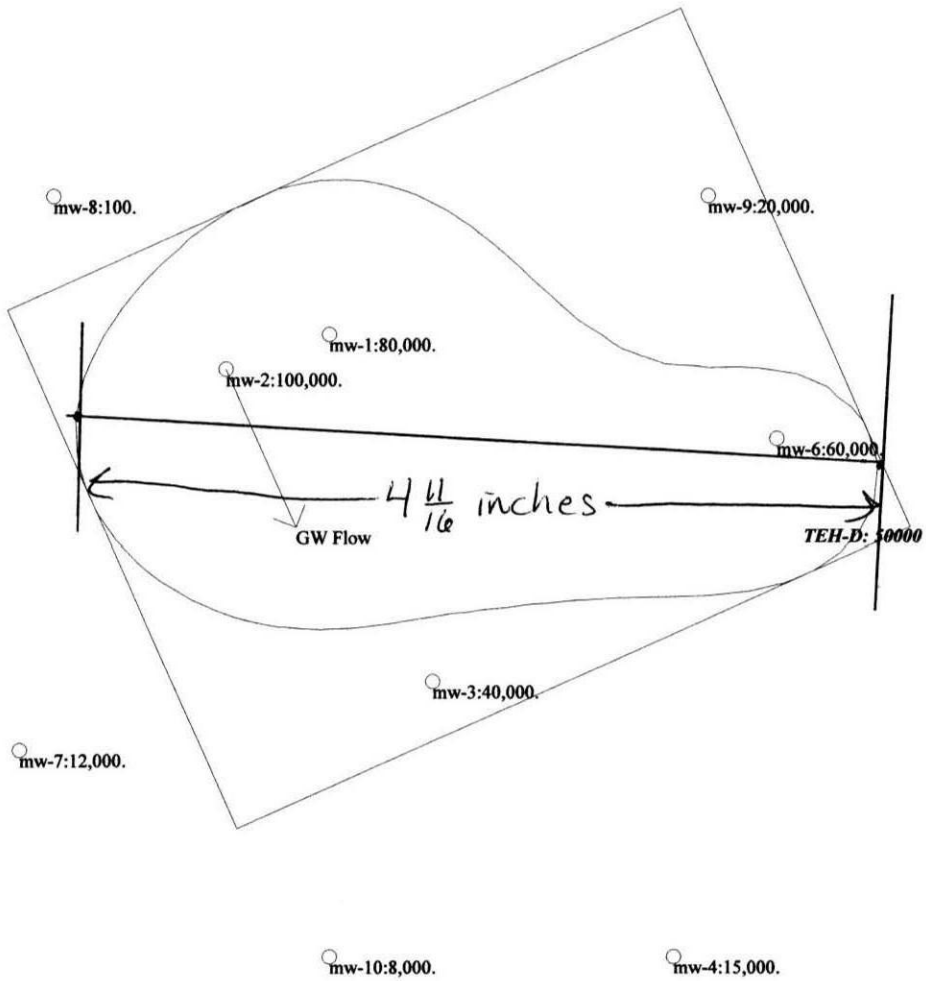


Figure 3. Interpolation Grid Example

GW: Source Width and Length Estimation: TEH-D V-2.50, 87lt89

Source: GW (ug/L)
Maximum Concentration: 100000
Contour Concentration: 50000
Source Width (Sw): 86. feet
Source Length (W): 66. feet

$4\frac{11}{16}$ inches $\times \frac{20 \text{ feet}}{\text{inch}} = 93.75 \cong 94$ feet



1 inch = 20 feet

Figure 4. Sw-W estimation with a range of 150 degrees

GW: Source Width and Length Estimation: TEH-D

V-2.50, 8ZLD32

Source: GW (ug/L)
Maximum Concentration: 100000
Contour Concentration: 50000
Source Width (Sw): 89. feet
Source Length (W): 90. feet

$Sw = 2\frac{5}{16}'' + \frac{10}{16}'' = 2\frac{15}{16}'' * \frac{20ft}{inch} = 58.75 \cong 59 feet$

$W = 2\frac{5}{16}'' + \frac{9}{16}'' = 2\frac{14}{16}'' * \frac{20ft}{inch} = 57.5 \cong 58 feet$

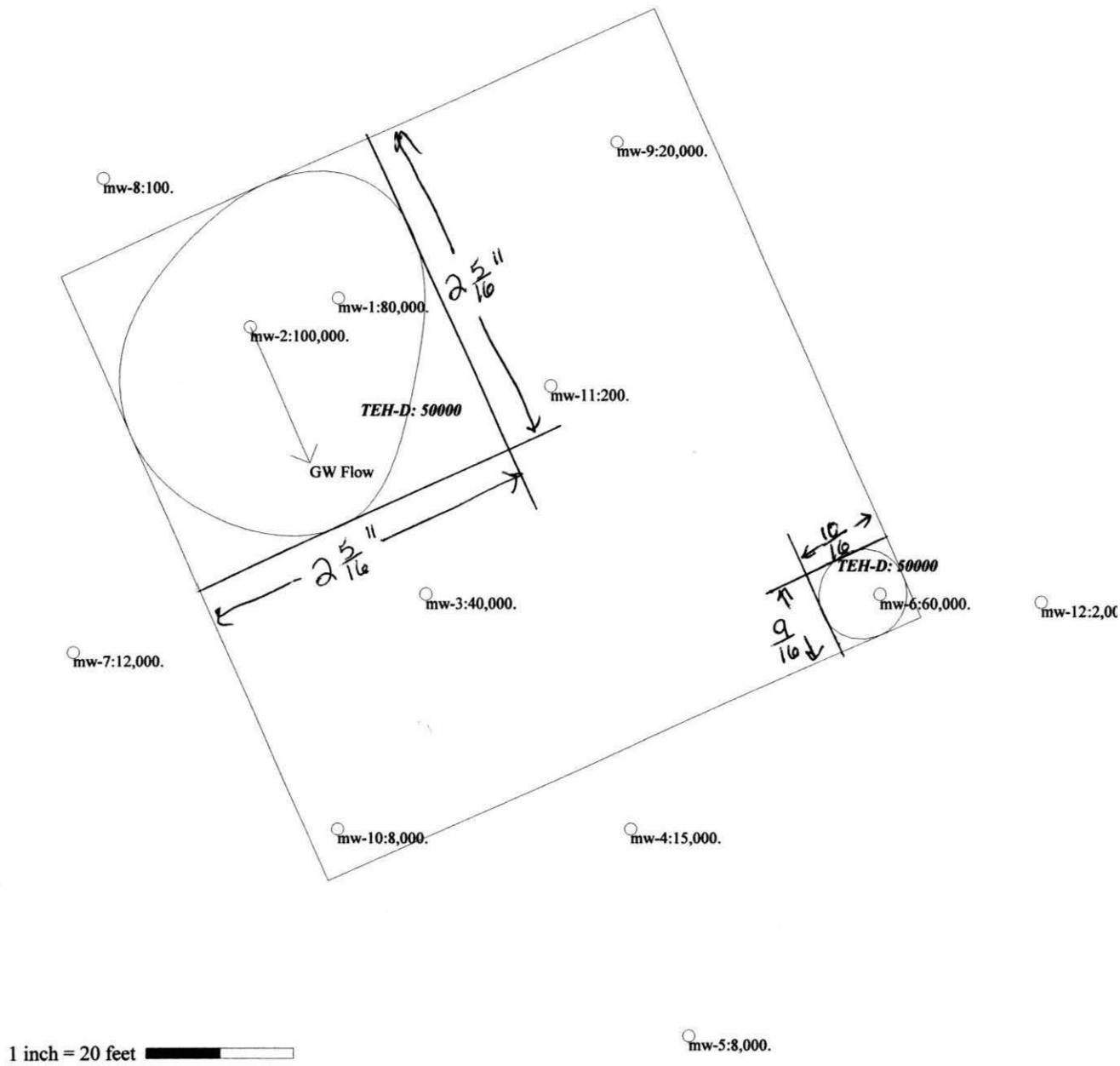


Figure 5. Sw-W estimation with multiple closed contours

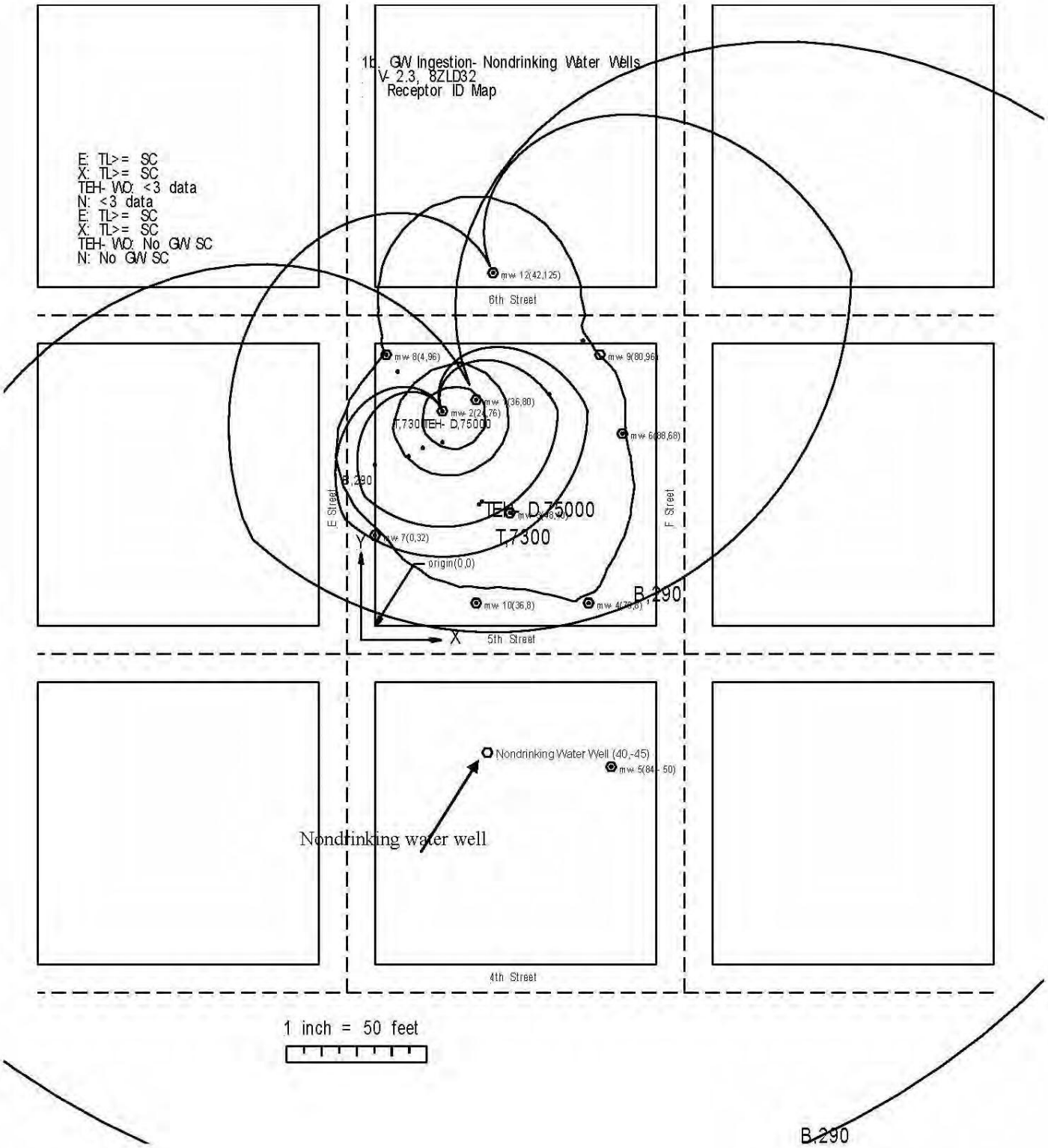


Figure 6. Groundwater Source, Receptor Identification, Nondrinking Water Wells

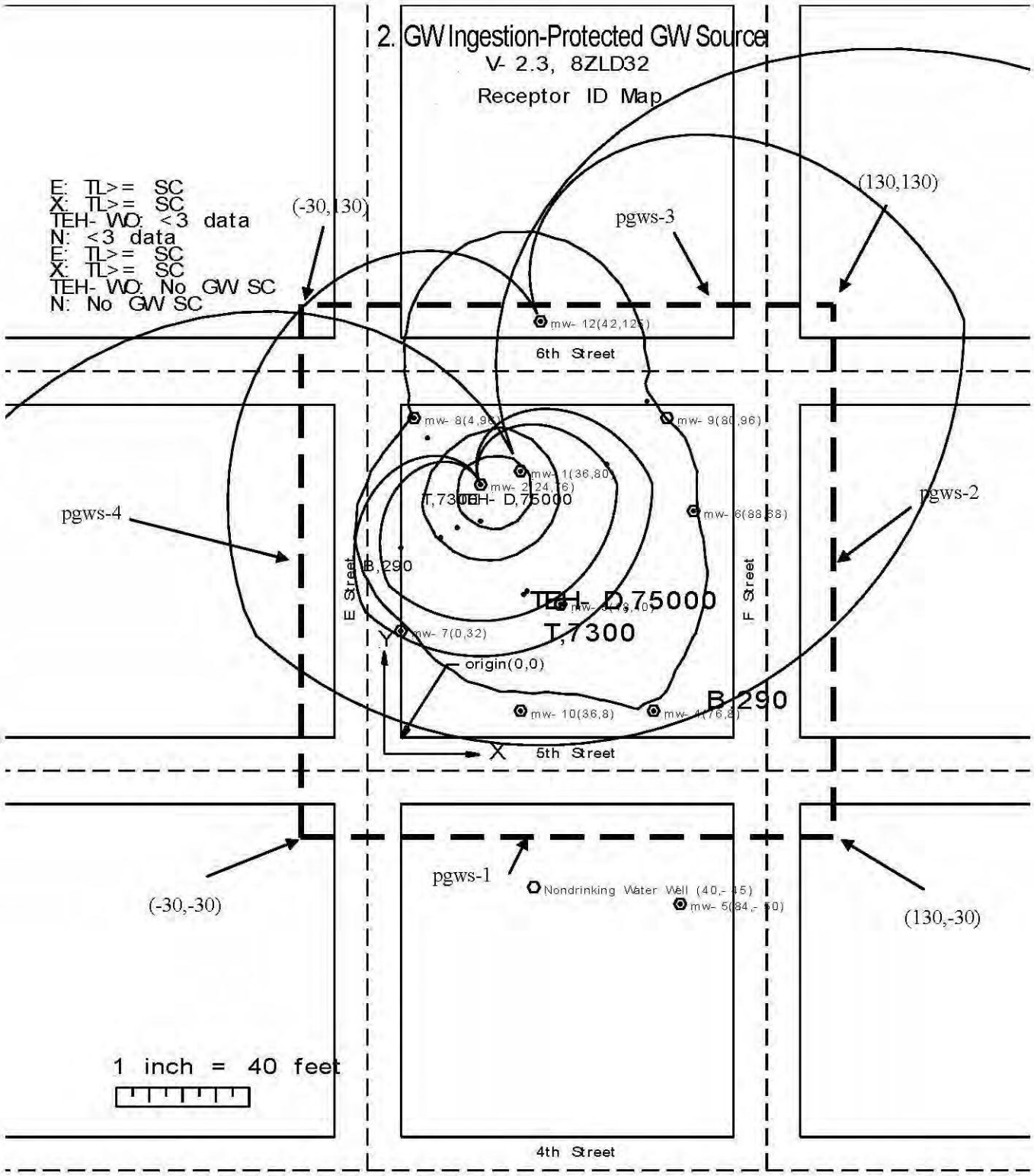


Figure 7. Groundwater Source, Receptor Identification, Protected Groundwater Source

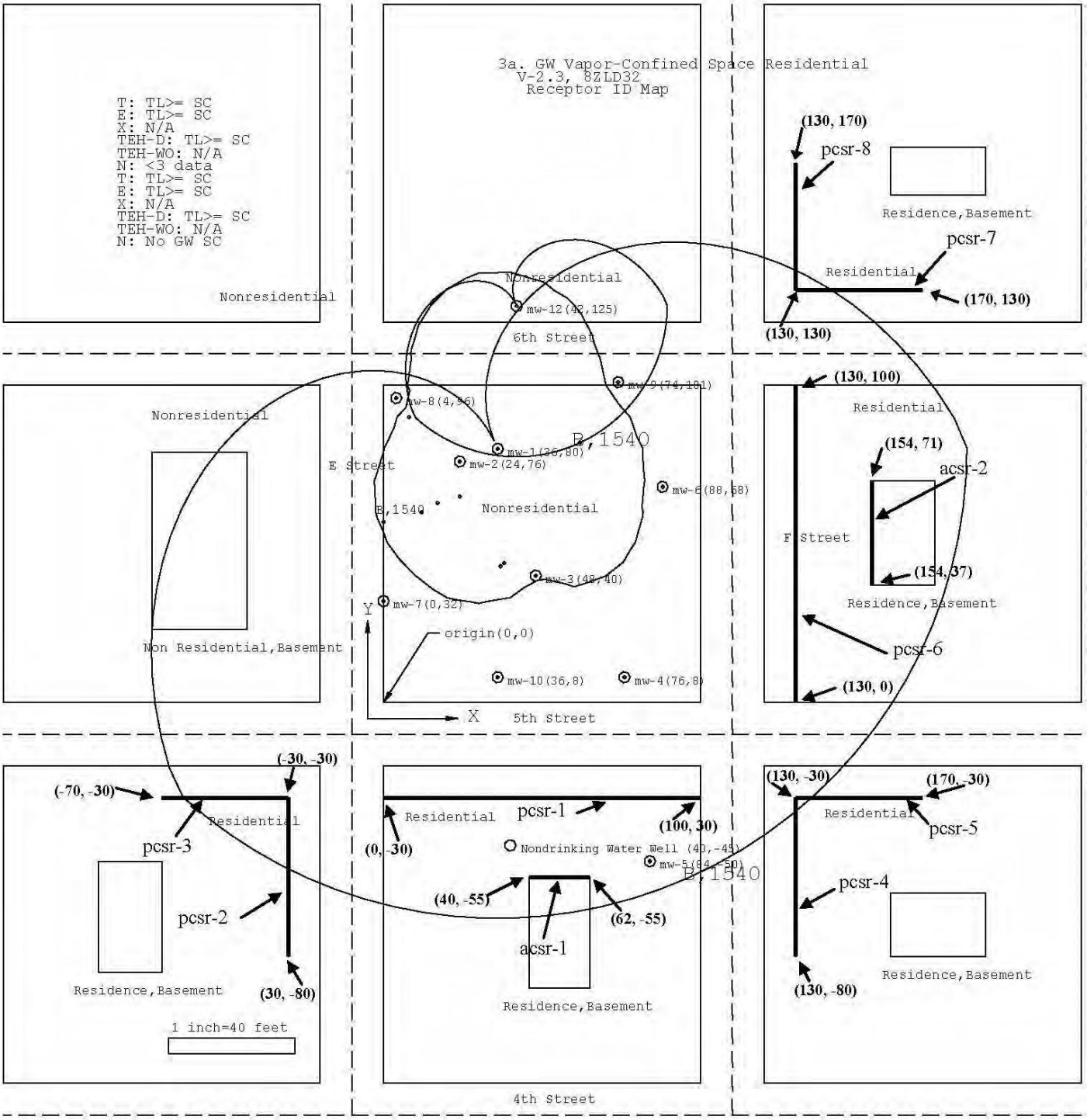


Figure 8. Groundwater Source, Receptor Identification, Confined Space Residential

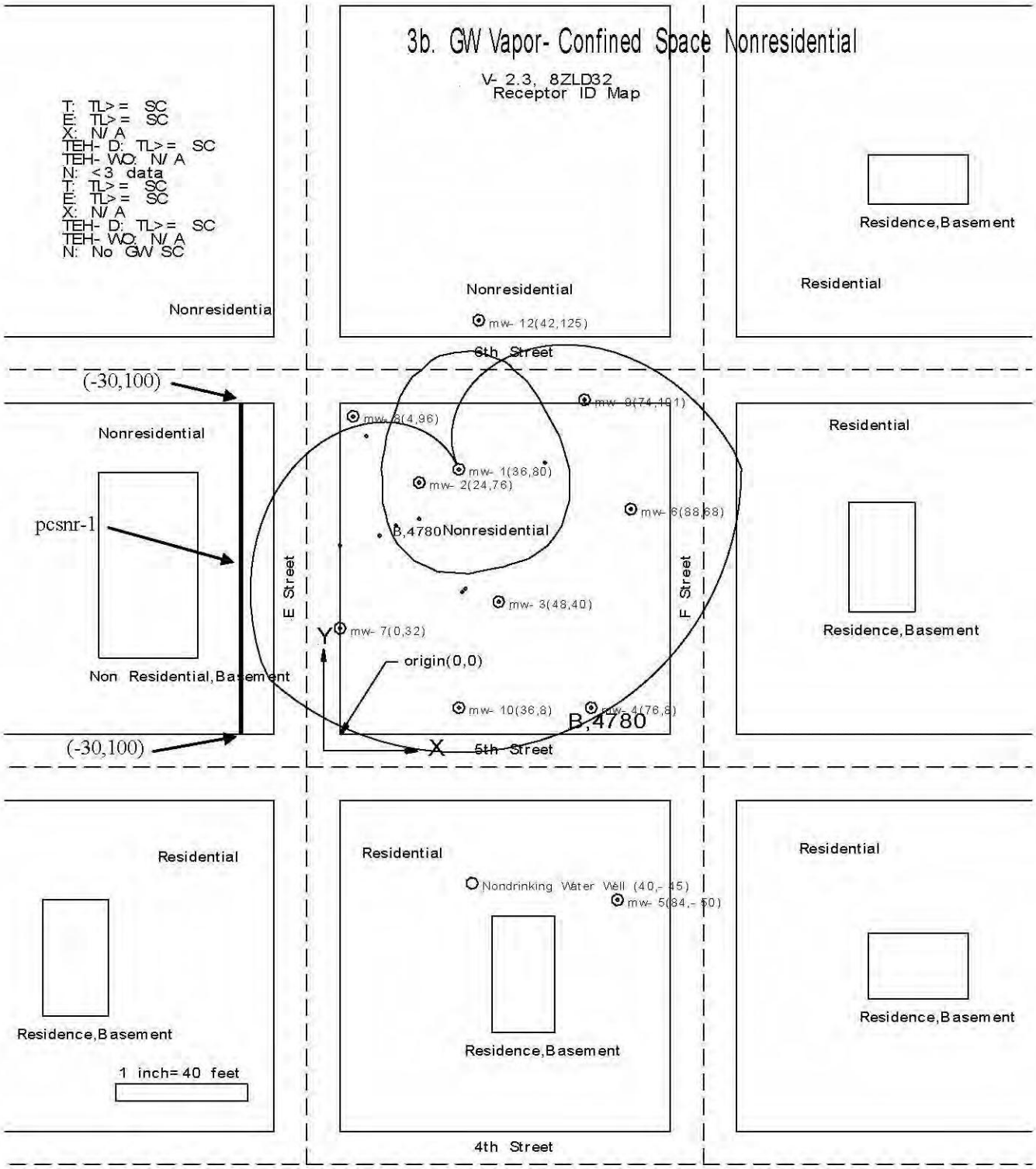


Figure 9. Groundwater Source, Receptor Identification, Confined Space Nonresidential

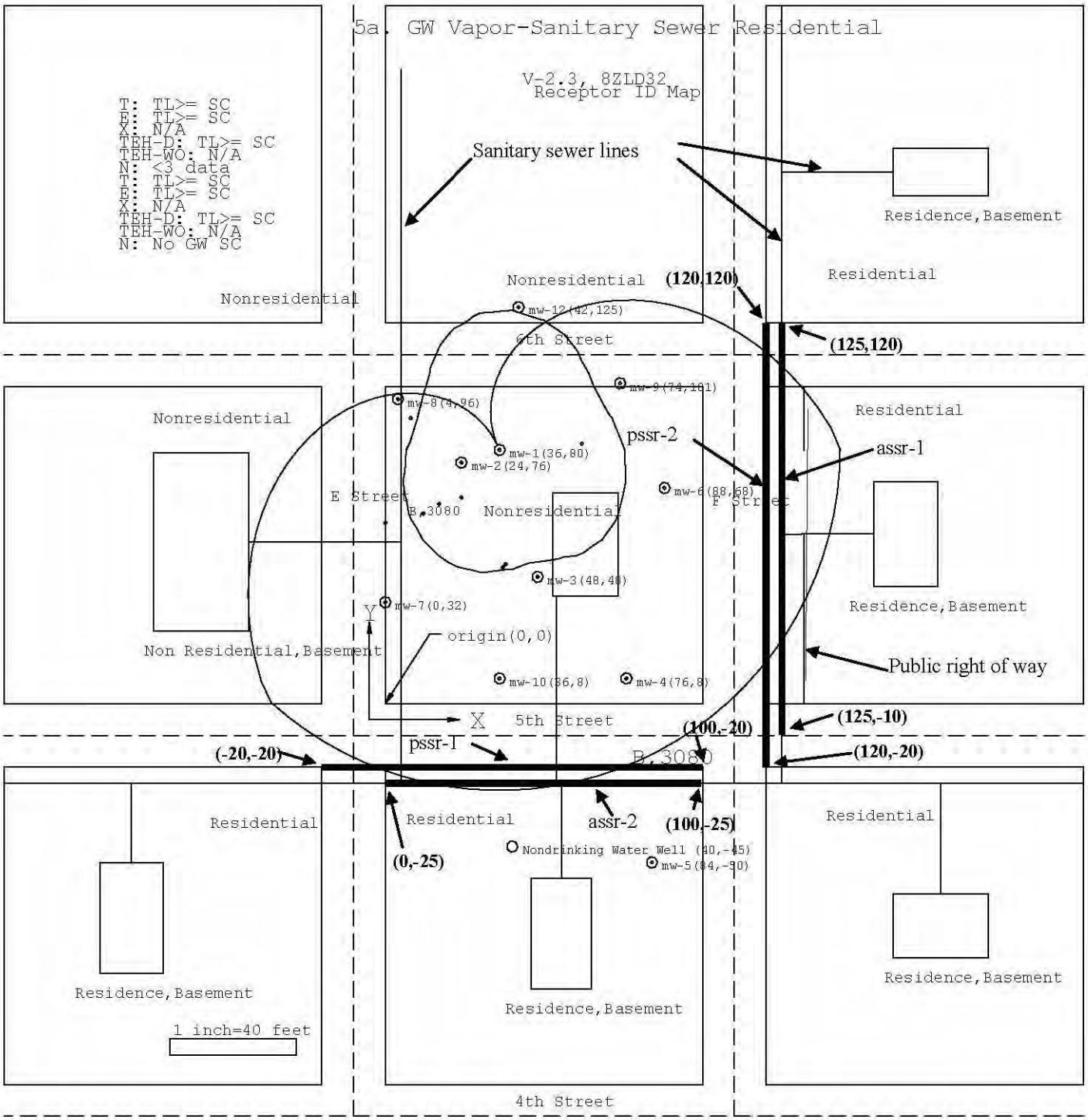


Figure 10. Groundwater Source, Receptor Identification, Sanitary Sewer Residential

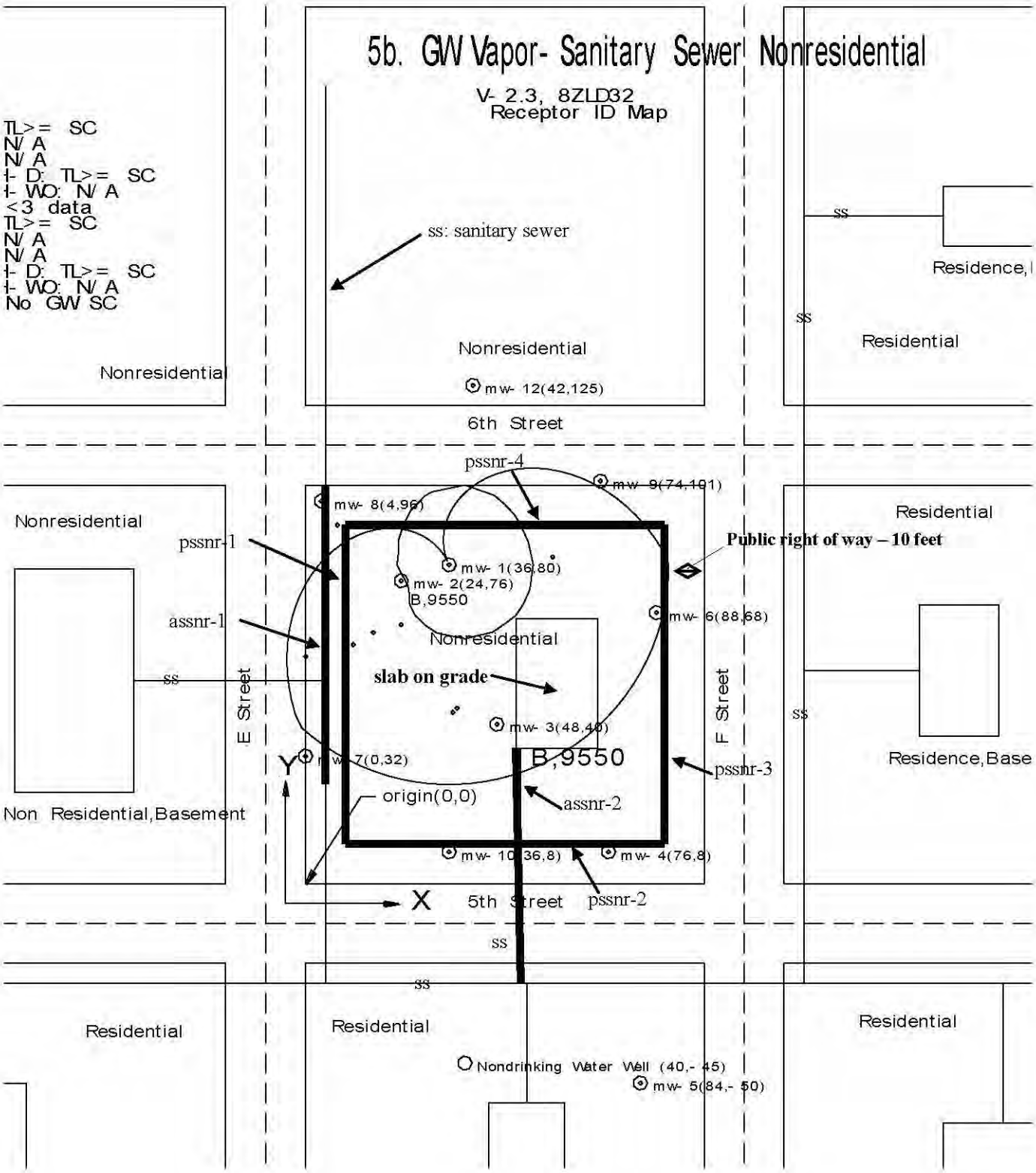


Figure 11. Groundwater Source, Receptor Identification, Sanitary Sewer

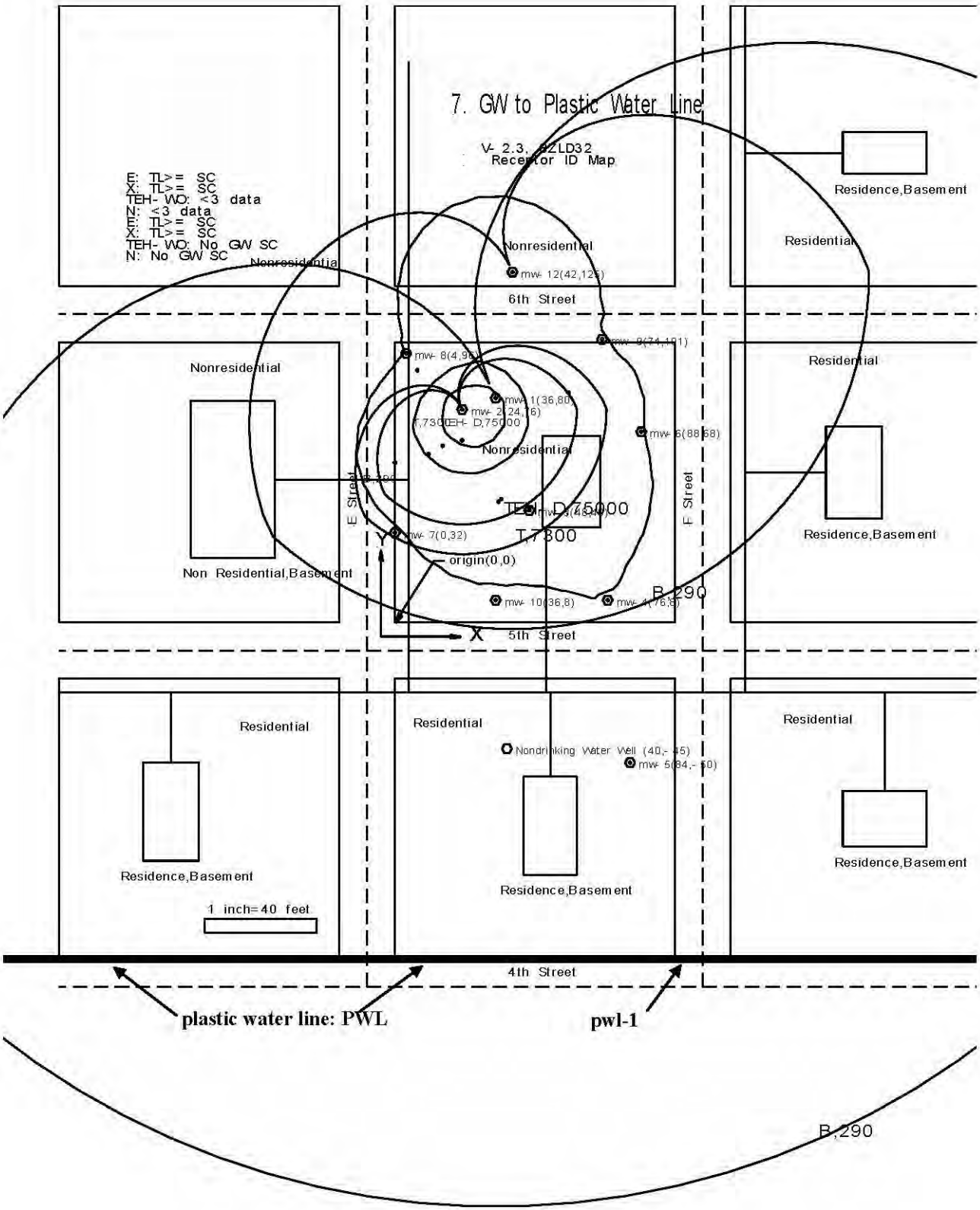


Figure 12. Groundwater Source, Receptor Identification, Water line

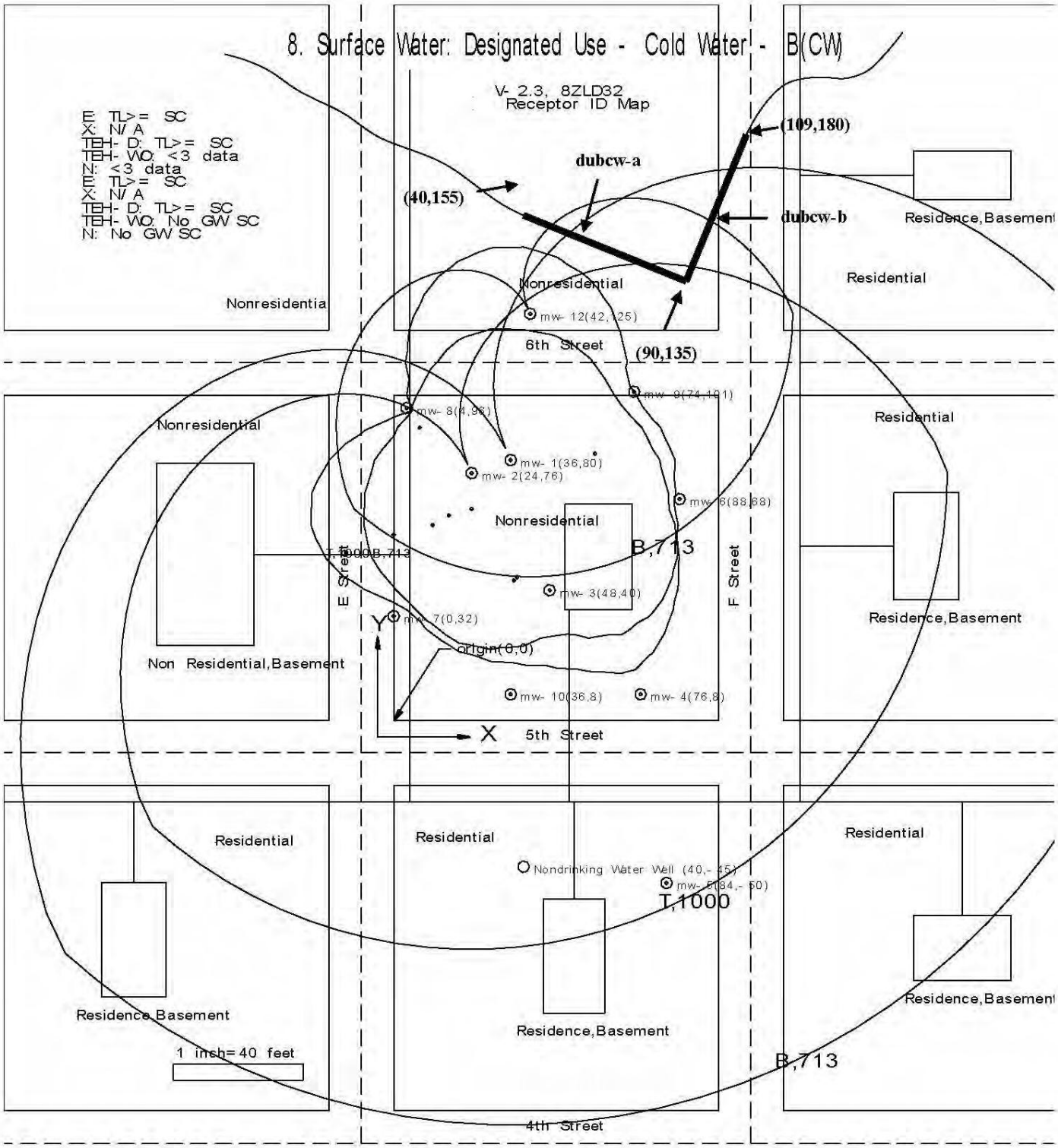


Figure 13. Groundwater Source, Receptor Identification, Surface Water, B(CW)

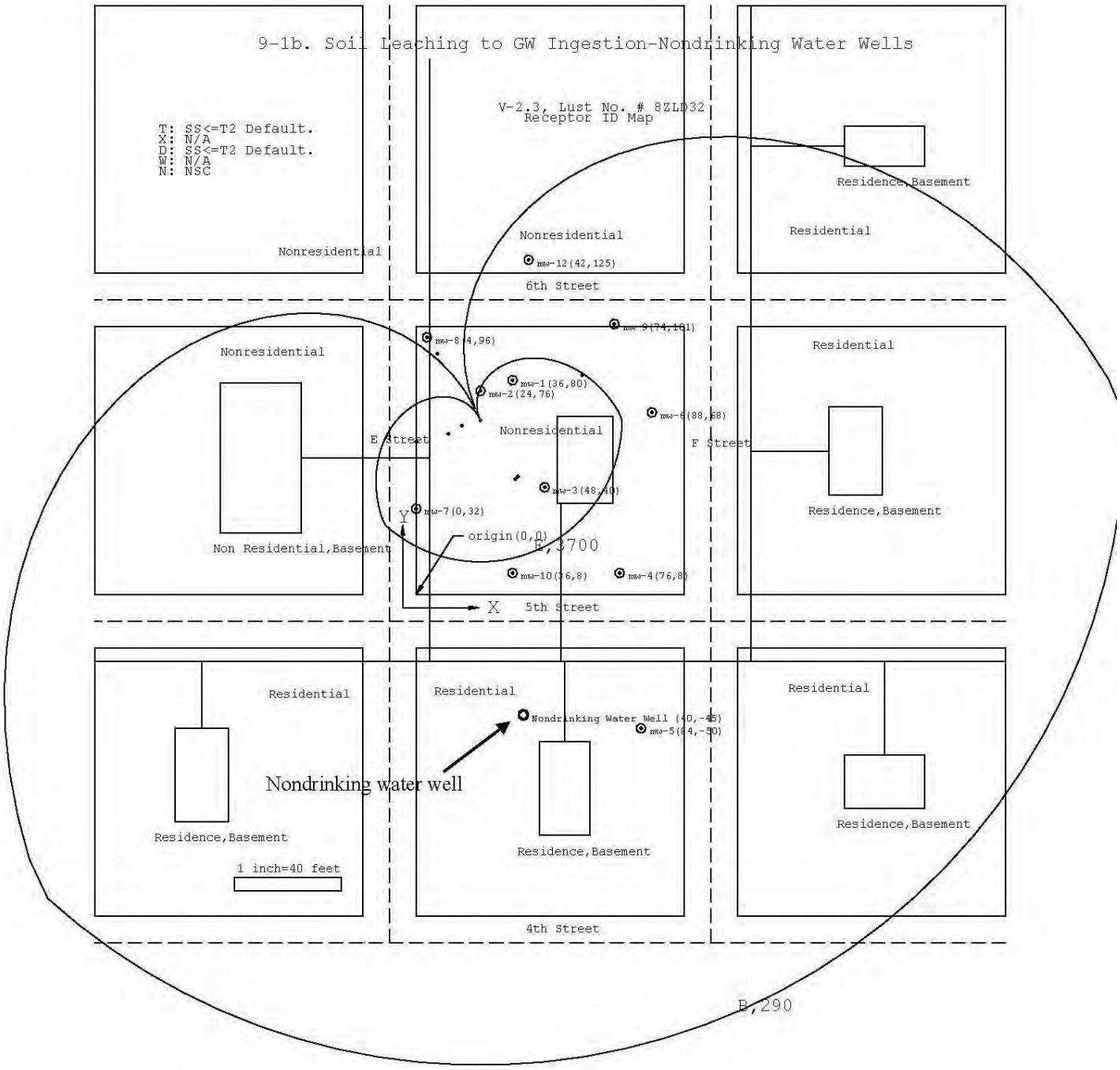


Figure 14. Soil Leaching, Receptor Identification, Nondrinking Water Well

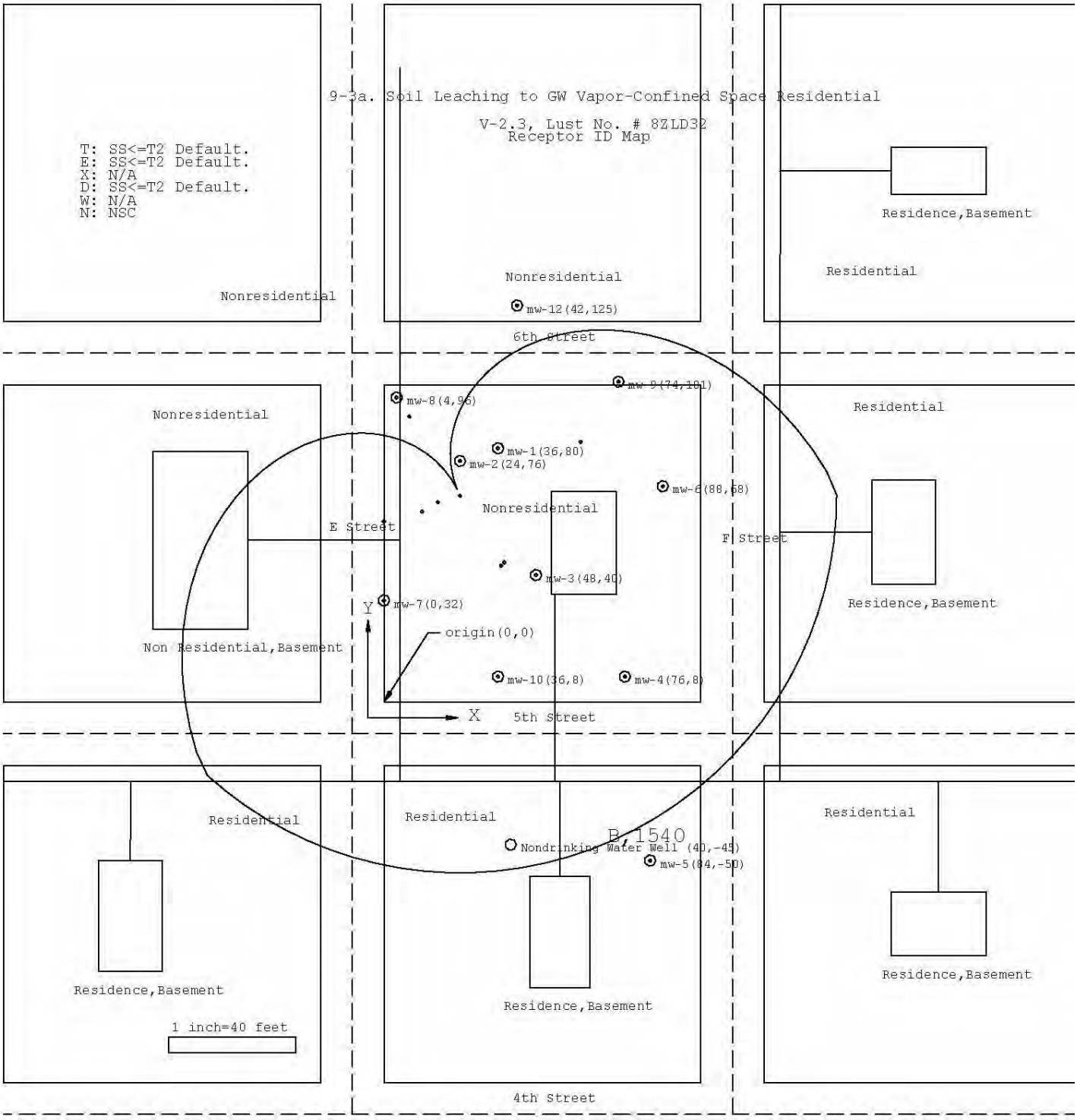


Figure 15. Soil Leaching, Receptor Identification, Confined Space Residential

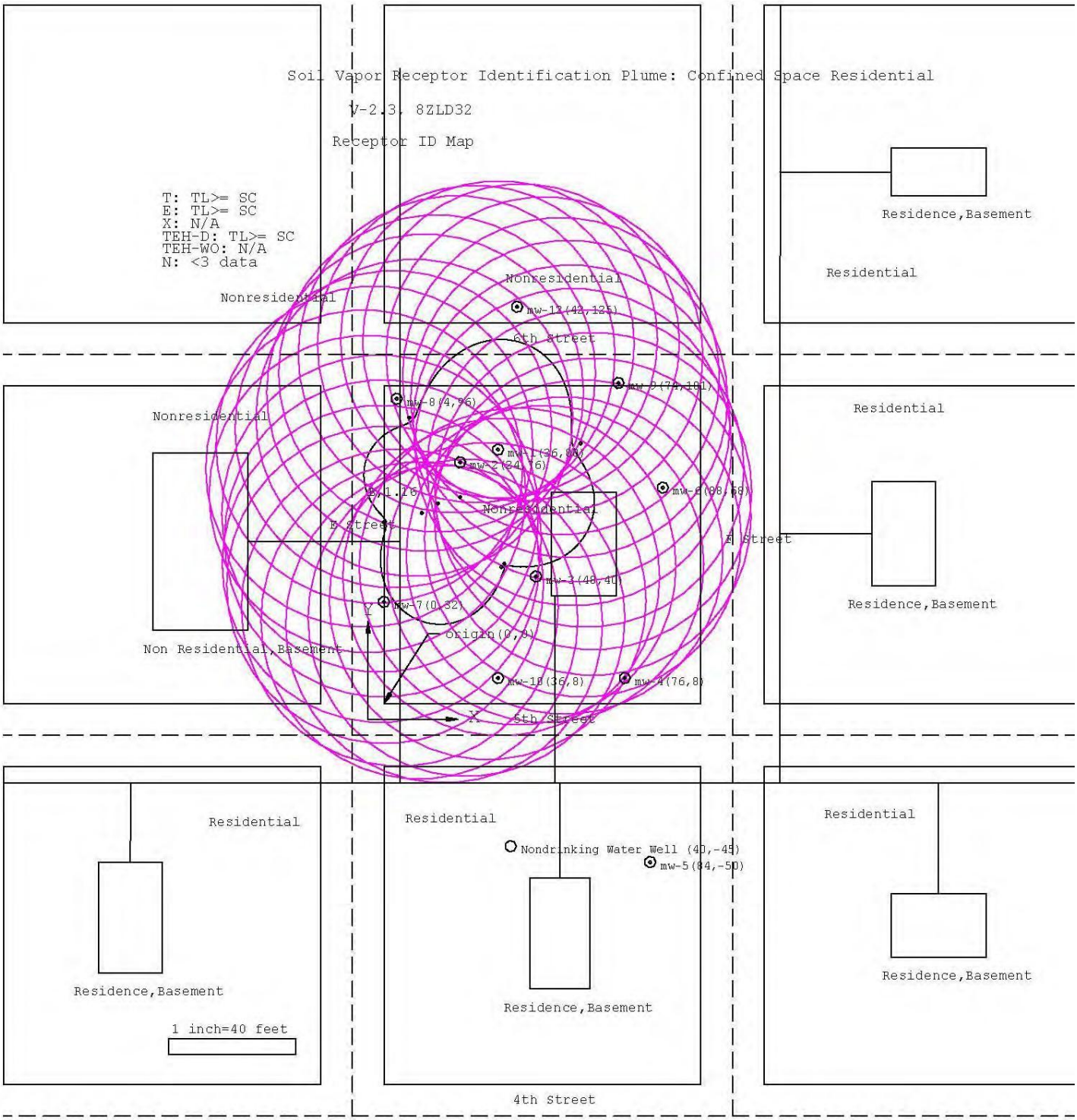


Figure 16. Soil Vapor, Receptor Identification, Confined Space Residential

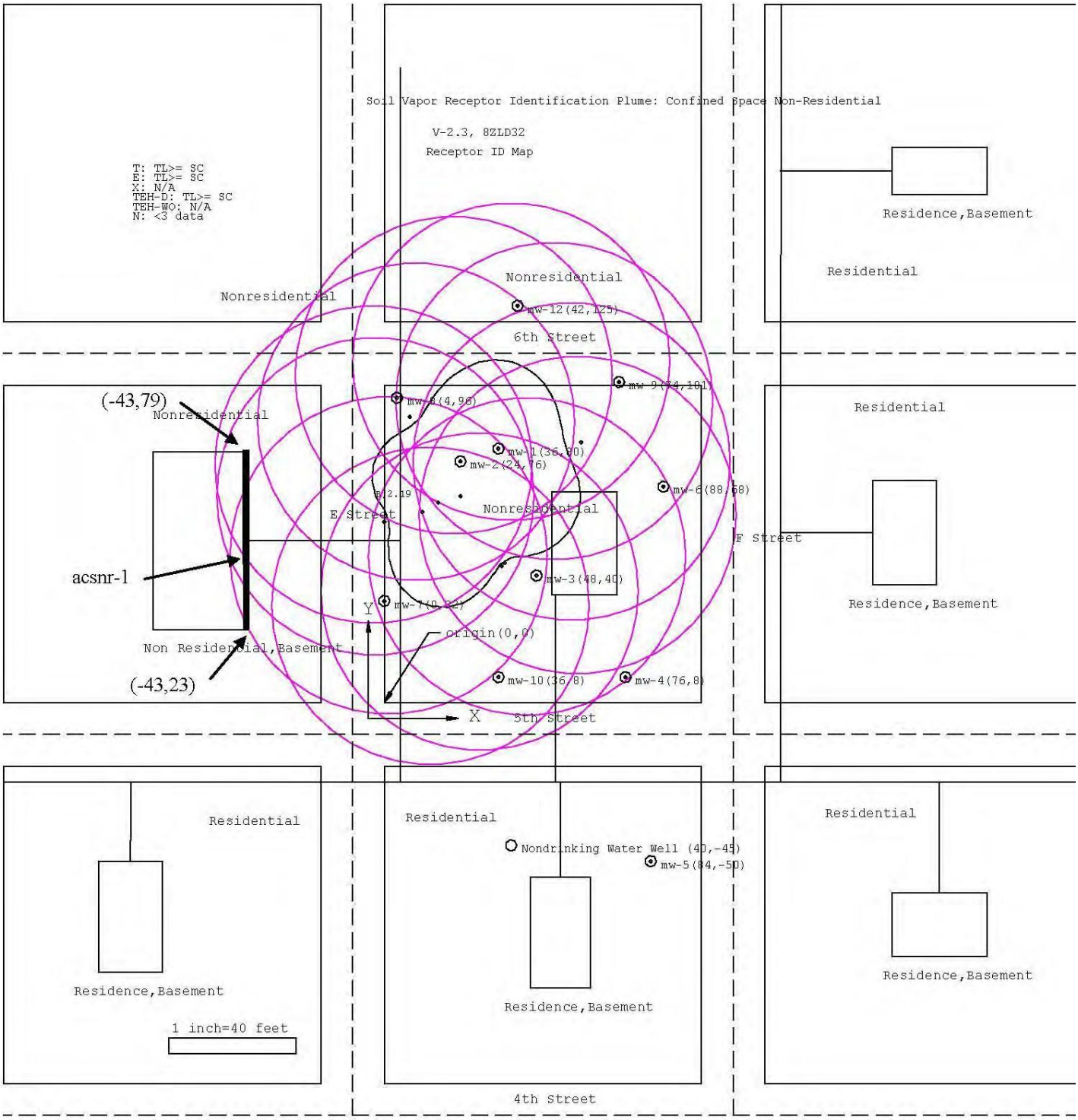


Figure 17. Soil Vapor, Receptor Identification, Confined Space Nonresidential

3a GW Vapor- Confined Space Residential V-2.50, 87LT89
Receptor Evaluation Map, Benzene
acsr-2, Jim and Mary Hart, SSTL: 12,248

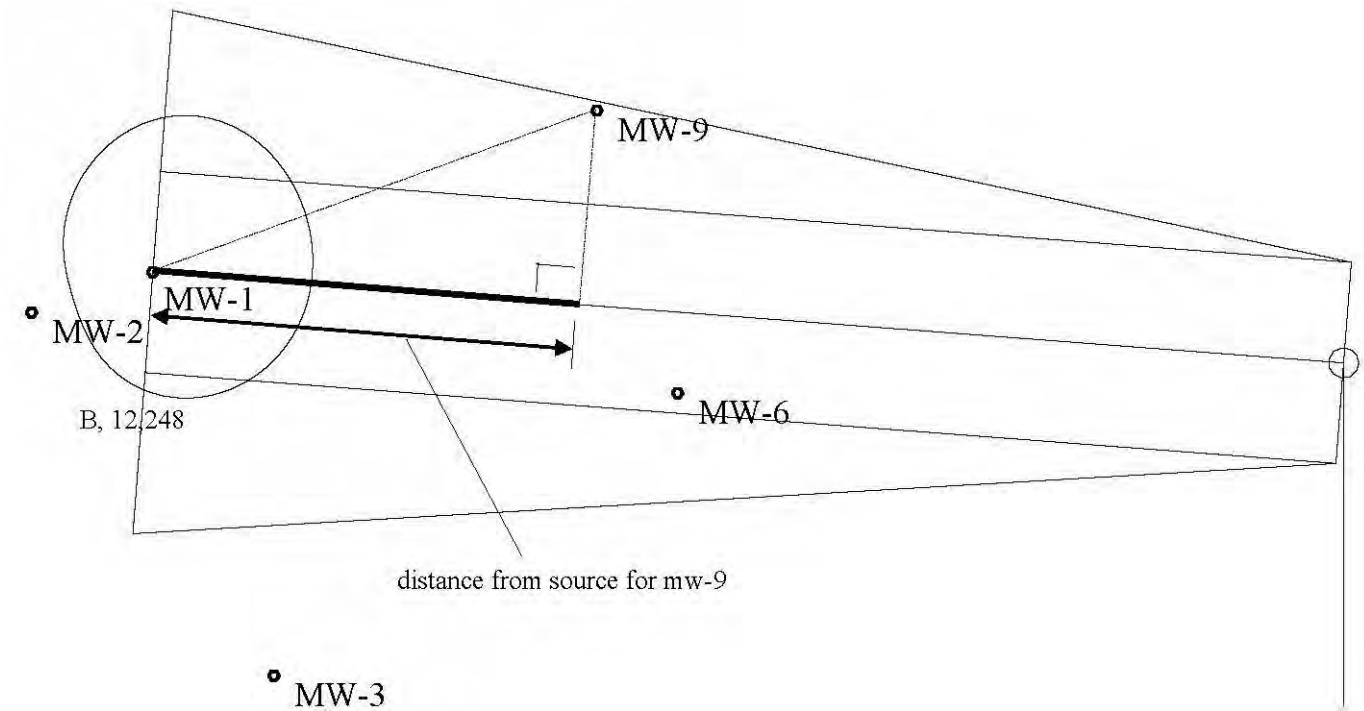


Figure 18. Monitoring well distance from source, for receptor evaluation

GW Plume Contours Benzene(µg/L) V-2.50,8ZLD32

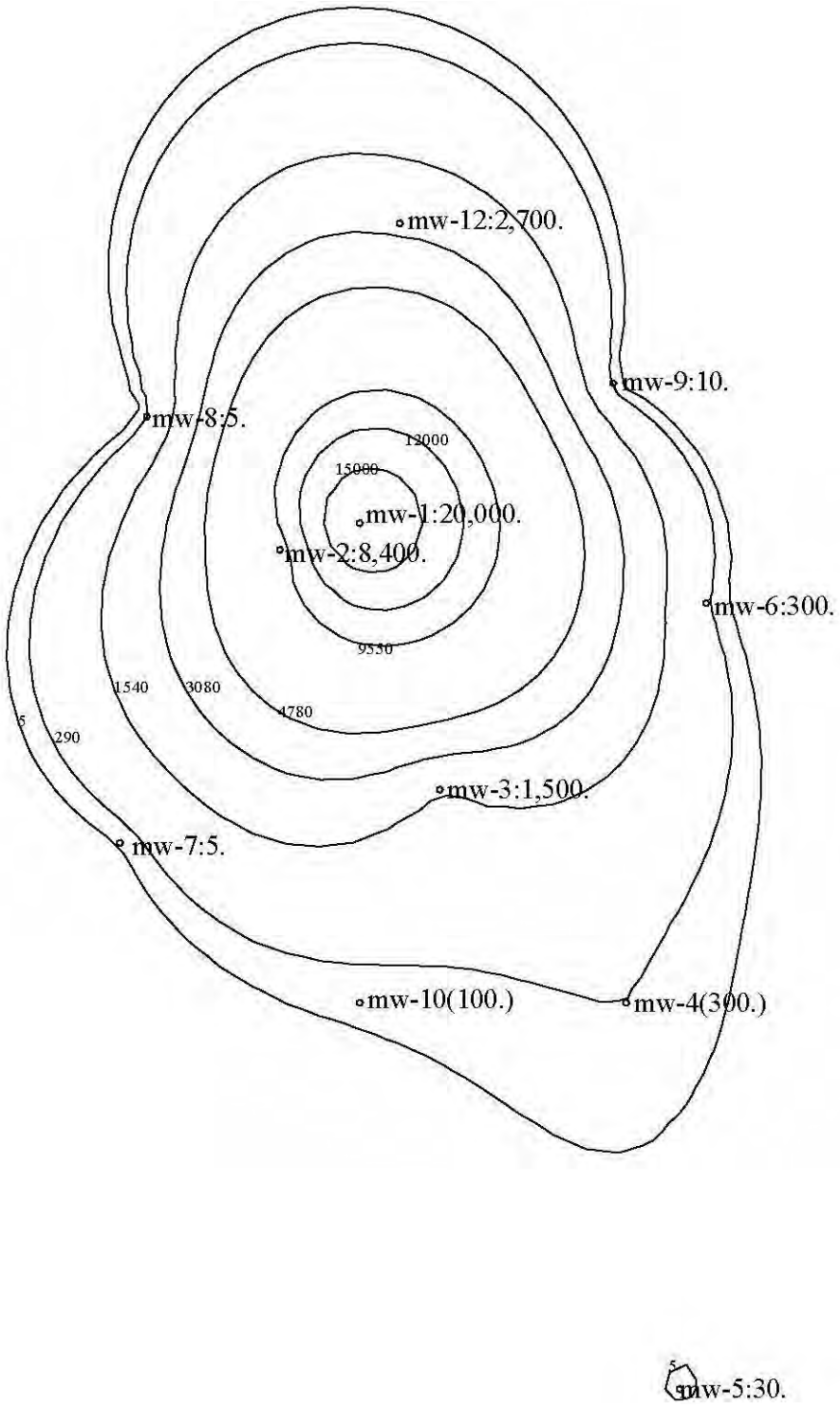


Figure 19. Groundwater Concentrations, Benzene

GW Plume Contours Toluene(µg/L) V-2.50,8ZLD32

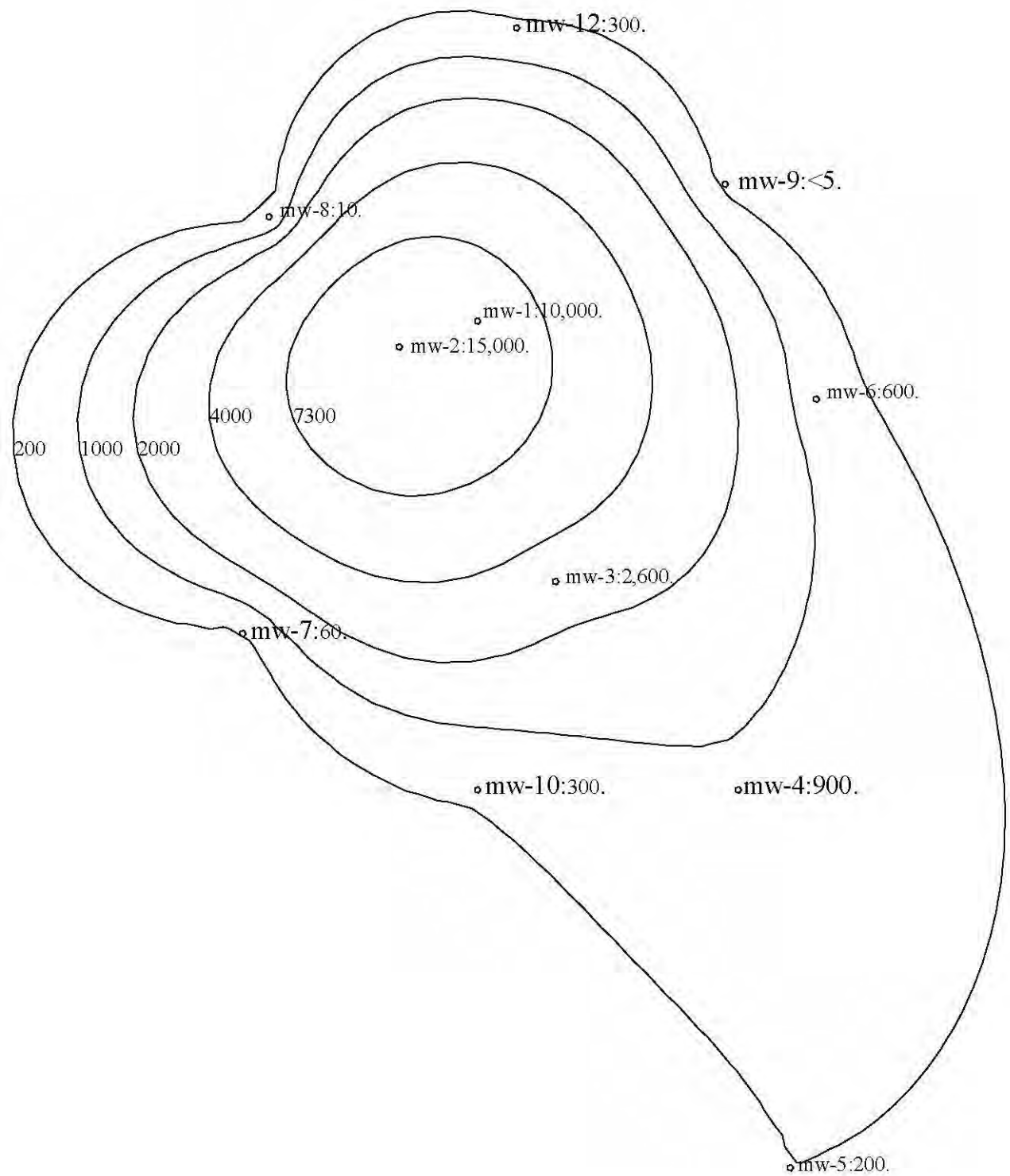


Figure 20. Groundwater Concentrations, Toluene

GW Plume Contours TEH-D(µg/L) V-2.50,8ZLD32

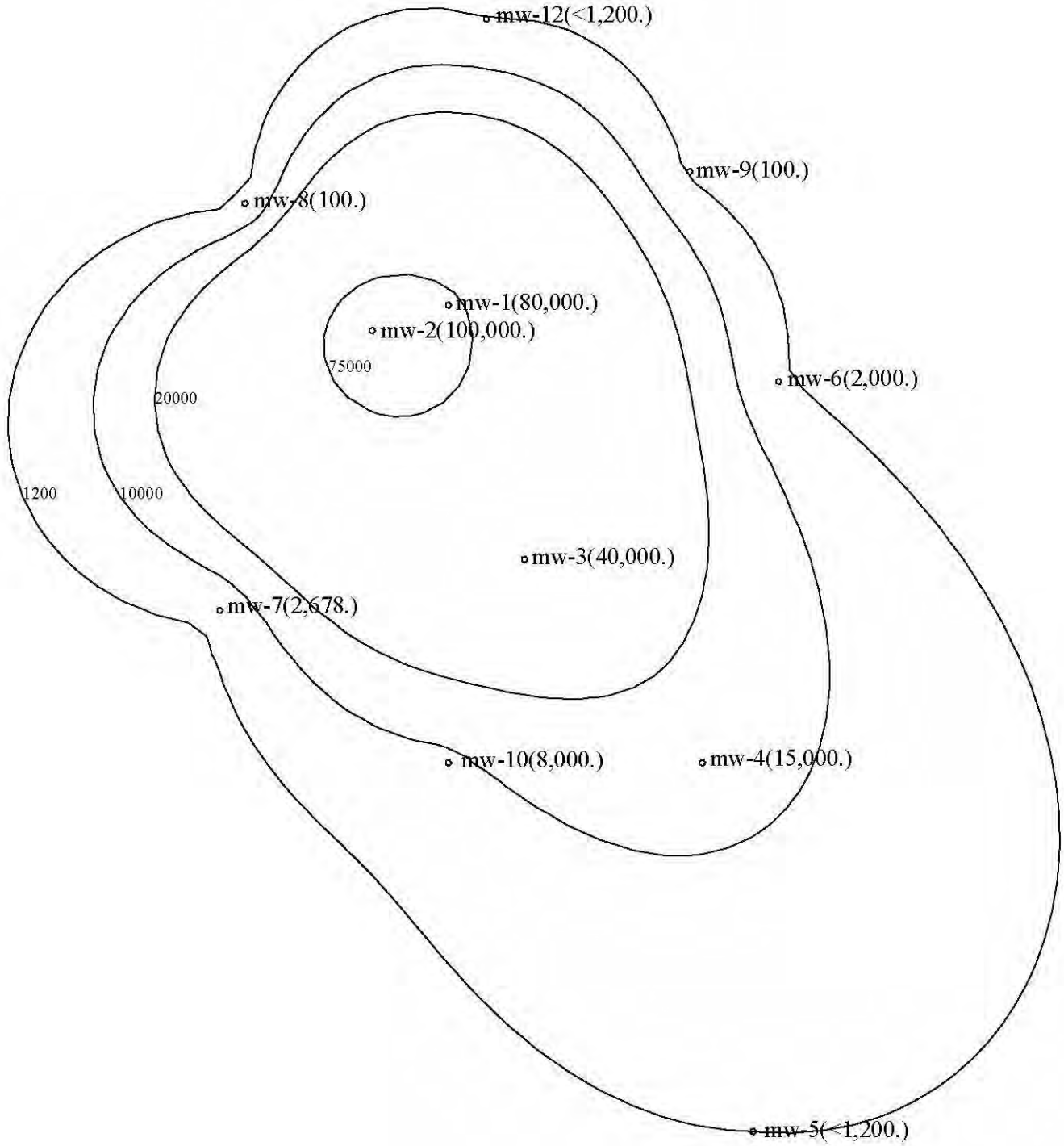


Figure 21. Groundwater Concentrations, TEH-D

Table 1. Preliminary Pathway Evaluation Requirements

8ZLD32

X = Evaluation Required *(A receptor identification plume must be generated.)*

Pathway	Receptor Type	B	T	E	X	TEHd	TEHwo
Groundwater Pathways							
Groundwater Ingestion	Drinking Water Wells (DWW)=	NAR(P3)	NAR(P3)	NAR(P3)	NAR(P3)	NAR(P3)	NSC
	Nondrinking Water Wells-NDWW	X	X	S<TL	S<TL	X	NSC
	Protected Groundwater Source-PGWS	X	X	S<TL	S<TL	X	NSC
Groundwater Vapor to Enclosed Space	Confined Space Residential-CSR	X	S<TL	S<TL	N/A	S<TL	N/A
	Confined Space Nonresidential-CSNR	X	S<TL	S<TL	N/A	S<TL	N/A
	Sanitary Sewer Residential-SSR	X	S<TL	S<TL	N/A	S<TL	N/A
	Sanitary Sewer Nonresidential-SSNR	X	S<TL	N/A	N/A	S<TL	N/A
Groundwater to Water line	Water lines (PWL)	X	X	S<TL	S<TL	X	NSC
Surface Water	DU-Cold Water-B(CW)	X	X	S<TL	N/A	S<TL	NSC
	DU-Warm Water-B(WW)	RNP	RNP	RNP	RNP	RNP	RNP
	DU-Limited Resources-B(LR)	RNP	RNP	RNP	RNP	RNP	RNP
	DU-Lakes & Wetlands-B(LW)	RNP	RNP	RNP	RNP	RNP	RNP
	DU-Drinking Water-C	RNP	RNP	RNP	RNP	RNP	RNP
	DU-State-Owned Lake	RNP	RNP	RNP	RNP	RNP	RNP
	AT-All Surface Water	VIP	VIP	VIP	VIP	VIP	VIP
	AT-Ponds & Lakes	VIP	VIP	VIP	VIP	VIP	VIP
Soil Leaching Pathways							
Soil Leaching to Groundwater Ingestion	Drinking Water Wells-DWW	NAR(P3)	SS<STL	NAR(P3)	N/A	SS<STL	N/A
	Nondrinking Water Wells-NDWW	X	SS<STL	X	N/A	SS<STL	N/A
	Protected Groundwater Source-PGWS	X	SS<STL	X	N/A	SS<STL	N/A
Soil Leaching to Groundwater Vapor to Enclosed Space	Confined Space Residential-CSR	X	SS<STL	SS<STL	N/A	SS<STL	N/A
	Confined Space Nonresidential-CSNR	X	SS<STL	SS<STL	N/A	SS<STL	N/A
	Sanitary Sewer Residential-SSR	X	SS<STL	SS<STL	N/A	SS<STL	N/A
	Sanitary Sewer Nonresidential-SSNR	X	SS<STL	N/A	N/A	SS<STL	N/A
Soil Leaching-GW to Water line	Water lines (PWL)	X	SS<STL	SS<STL	N/A	SS<STL	N/A
Soil Leaching to Surface Water	DU-Cold Water-B(CW)	X	SS<STL	S<TL(GW)	N/A	SS<STL	N/A
	DU-Warm Water-B(WW)	RNP	RNP	RNP	RNP	RNP	RNP
	DU-Limited Resources-B(LR)	RNP	RNP	RNP	RNP	RNP	RNP
	DU-Lakes & Wetlands-B(LW)	RNP	RNP	RNP	RNP	RNP	RNP
	DU-Drinking Water-C	RNP	RNP	RNP	RNP	RNP	RNP
	DU-State-Owned Lake	RNP	RNP	RNP	RNP	RNP	RNP
	AT-All Surface Water	VIP	VIP	VIP	VIP	VIP	VIP
	AT-Ponds & Lakes	VIP	VIP	VIP	VIP	VIP	VIP
Other Soil Pathways							
Soil Vapor to Enclosed	Confined Space Residential-CSR	X	SS<STL	SS<STL	N/A	SS<STL	N/A

Space	Confined Space Nonresidential-CSNR	X	SS<STL	SS<STL	N/A	SS<STL	N/A
	Sanitary Sewer Residential-SSR	X	SS<STL	SS<STL	N/A	SS<STL	N/A
	Sanitary Sewer Nonresidential-SSNR	X	SS<STL	N/A	N/A	SS<STL	N/A
Soil to Water line	Water lines (PWL)	X	SS<STL	SS<STL	N/A	SS<STL	N/A

Version 2.50-Mat 2002

Table 2. Groundwater Source, Actual Receptors, Evaluation Requirements

GW Source, Actual Receptors, Evaluation Requirements V-2.50, 8ZLD32

Type	Label	Description	Benzene	Toluene	Ethylb.	Xylenes	TEH-D	TEH-WO	Naph.
NDWW	ndww-1	Bib Villa	Eval(1)	N	N	N	N	NSC	NSC
ACSR	acsr-1	Ghengas Khan	Eval(1)	N	N	N/A	N	N/A	NSC
ACSR	acsr-2	Jim and Mary Hart	Eval(1)	N	N	N/A	N	N/A	NSC
ACSNR	acsnr-1	West Manufacturing	N	N	N	N/A	N	N/A	NSC
ASSR	assr-1	East	Eval(1)	N	N	N/A	N	N/A	NSC
ASSR	assr-2	South	N	N	N	N/A	N	N/A	NSC
ASSNR	assnr-1	West	Eval(1)	N	N/A	N/A	N	N/A	NSC
ASSNR	assnr-2	On-site	Eval(1)	N	N/A	N/A	N	N/A	NSC
PWL	pwl-1	Transfer line-south	Eval(1)	N	N	N	N	NSC	NSC
DU-B(CW)	dubcw-a	Jones creek, part a	Eval(1)	N	N	N/A	N	NSC	NSC
DU-B(CW)	dubcw-b	Jones creek, part b	Eval(1)	N	N	N/A	N	NSC	NSC

N: No further action required for the chemical
*: less than 3 samples, no contoured plum
N(PE): No further action based on Preliminary Pathway Evaluation
N/A: Chemical is not applicable
NSC: No source concentration for the chemical
Eval: Rosl evaluation required for the chemical
Eval(1): Receptor in modeled plume only
Eval(2): Receptor in contoured plume only
Eval(3): Receptor in modeled and contoured plumes

Table 3. Groundwater Source, Groundwater Ingestion, SSTL Tables, Actual Receptors

GW Ingestion, SSTL Tables, Actual Receptors V-2.50, 8ZLD32

NDWW	ndww-a, Bib Villa		Benzene	GW Source SSTL: 2,5995
Risk: H	At receptor: TL: 290	Simulated: 2,235	Interpolated: 0	

Location	Distance from Source (ft)	Simulation Value	Actual Data	SSTL Value	Criteria	Monitor
mw-12	-44.8	-1	2,700	2,595	P	P
mw-1	0.	20,000	20,000	2,595,	S	S
mw-2	3.6	19,772	8,400	2,565	XT	X
mw-3	40.4	13,374	1,500	1,735	TG	
mw-10	72.	6,443	100	836	TG	TG

Table 4. Groundwater Source, Groundwater Vapor to Enclosed Space, Confined Space, SSTL Tables, Actual Receptors

GW Vapor- Confined Space, SSTL Tables, Actual Receptors V-2.50, 8ZLD32

ACSR	acsr-1, Ghengas Khan	Benzene	GW Source SSTL: 17,753
Risk: H	At receptor: TL: 1,670	Simulated: 1,881	Interpolated: 0

Location	Distance from Source (ft)	Simulation Value	Actual Data	SSTL Value	Criteria	Monitor
mw-1	0.	20,000	20,000	17,753	S	S
mw-2	3.1	19,804	8,400	17,579	TG	
mw-3	40.8	,13,256	1,500	11,767	TG	
mw-10	71.8	6,466	100	5,740	TG	TG

ACSR	acsr-2, Jim and Mary Hart	Benzene	GW Source SSTL: 13,278
Risk: H	At receptor: TL: 1,670	Simulated: 2,515	Interpolated: 0

Location	Distance from Source (ft)	Simulation Value	Actual Data	SSTL Value	Criteria	Monitor
mw-1	0	20,000	20,000	13,278	S	S
mw-6	52.8	10,093	300	6,701	TG	TG

Table 5. Groundwater Source, Protected Groundwater Source, Benzene

GW Source, Protected Groundwater Source, Benzene V-2.50, 8ZLD32

Risk Classification Summary

	Benzene	Toluene	EthylBen.	Xylenes	TEH-D	TEH-WO	Naph.
NIC	L	L	N(PE)	N(PE)	L	NSC	NSC
IC	L	N	N(PE)	N(PE)	N	NSC	NSC

Monitoring Summary for Benzene

Well	Actual	Criteria	NIC-SSTL	IC-SSTL	Receptor
mw-1	20,000	S	290	1,319	pgws-4
mw-4	300	T-Down Gradient	290	NA	PGWS
		Interior E	290	643	pgws-4
mw-5	30	TG-Down Gradient	290	NA	PGWS
mw-7	5	T-ML	290	501	pgws-4
mw-2	8,400	Interior E	290	1,258	pgws-4
mw-3	1,500	Interior E	290	1,273	pgws-4
mw-6	300	Interior E	290	745	pgws-2
mw-12	2,700	Interior E	290	812	pgws-3

Table 6. Groundwater Source, Potential Confined Space, Benzene

GW Source, Potential Confined Space, Benzene V-2.50, 8ZLD32

Risk Classification Summary

	Benzene	Toluene	EthylBen.	Xylenes	TEH-D	TEH-WO	Naph.
NIC	L	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)
IC	L	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)

Monitoring Summary for Benzene

Well	Actual	Criteria	NIC-SSTL	IC-SSTL	Receptor
mw-1	20,000	S	5,195	8,346	pcsr-6
mw-4	300	TG-Down Gradient	5,195	NA	PCS
mw-6	300	T-ML	5,195	4,288	pcsr-6
mw-2	8,400	Interior E	5,195	11,257	pcsr-1

Table 7. Groundwater Source, Potential Sanitary Sewer, Benzene

GW Source, Potential Sanitary Sewer, Benzene V-2.50, 8ZLD32

Risk Classification Summary

	Benzene	Toluene	EthylBen.	Xylenes	TEH-D	TEH-WO	Naph.
NIC	L	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)
IC	L	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)	N(PE)

Monitoring Summary for Benzene

Well	Actual	Criteria	NIC-SSTL	IC-SSTL	Receptor
mw-1	20,000	S	10,390	11,465	pssnr-4
mw-4	300	TG-Down Gradient	10,390	NA	PSS
mw-12	2,700	T-ML	10,390	Out of Range	pssnr-4

Table 8. SMR, Groundwater/Soil Leaching Monitoring Plan Summary, Toluene

GW/SL Monitoring Plan

MW	Most Recent Sample	SSTL	SSTL Met	Steady Decline/ 3 Year	Monitor Type (T2)	Receptor			Chem. Risk	Recept. Curr. Risk	Min. Freq
						Type	Label	Description			
MW-1	380	7,300	Yes	N/A	/Ext.E	PGWS	No-IC		L	L	Once
		7,300	Yes	N/A	/Ext.E	PGWS	IC		L	L	Once
MW-3	60,000**	67,685	Yes	No	S/	DWW	CW-1	Klemme WW #1	H	H	Annual
		103,965	Yes	No	S/	DWW	CW-2	Klemme WW #2	L*	H	Annual
		296,780	Yes	No	S/	ACSR	House 2 N	House 2 North Wal	L*	L	Annual
		534,867	Yes	No	S/	ACSR	House 3 N	House 3 North Wal	L*	L	Annual
		849,918	Yes	No	S/	ACSR	House 4 N	House 4 North Wal	L*	L	Annual
		1,061,065	Yes	No	S/	ACSR	House 5 N	House 5 North Wal	L		Annual
		155,710	Yes	No	S/	ASSR	2nd St SS	2nd St sanitary	L*	H	Annual
		119,182	Yes	No	S/	ASSR	Townmart SS	Townmart Store sa	L*	H	Annual
		493,862	Yes	No	S/	ASSR	City Hall SS	City Hall/Library s	L*	L	Annual
		34,313	No	No	S/	PWL	PWL-N	North PL a/ROW	H	H	Annual
		7,300	No	No	S/	PGWS	No-IC		L	L	Annual
		20,119	No	No	S/	PGWS	IC		L	L	Annual
		52,280	No	No	S/	PCS	No-IC		L	L	Annual
		7,300	No	Yes	SL	PGWS	No-IC		H	H	Annual
		21,316	No	Yes	SL	PGWS	IC		H	H	Annual
		52,280	No	Yes	SL	PCS	No-IC		L	L	Annual
MW-8	40,500	39,751	No	No	X/	DWW	CW-1	Klemme WW #1	H	H	Annual
		63,890	Yes	No	L/	DWW	CW-2	Klemme WW #2	L*	H	Annual
		187,318	Yes	No	L/	ACSR	House 2 N	House 2 North Wal	L*	L	Annual
		96,848	Yes	No	L/	ASSR	2nd St SS	2nd St sanitary	L*	H	Annual
		7,300	No	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		17,606	No	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
MW-10	60,000** /33,645	63,211	Yes	No	L/	DWW	CW-1	Klemme WW #1	H	H	Annual
		99,283	Yes	No	LTG/	DWW	CW-2	Klemme WW #2	L*	H	Annual
		285,240	Yes	No	/	ACSR	House 2 N	House 2 North Wal	L*	L	Annual

MW	Most Recent Sample	SSTL	SSTL Met	Steady Decline/ 3 Year	Monitor Type (T2)	Receptor			Chem. Risk	Recept. Curr. Risk	Min. Freq
						Type	Label	Description			
		509,044	Yes	No	L/	ACSR	House 3 N	House 3 North Wal	L*	L	Annual
		649,652	Yes	No	L/	ACSR	House 4 N	House 4 North Wal	L*	L	Annual
		1,044,174	Yes	No	/	ACSR	House 5 N	House 5 North Wal	L		Annual
		149,168	Yes	No	/	ASSR	2nd St SS	2nd St sanitary	L*	H	Annual
		73,600	Yes	No	L/	ASSR	Townmart SS	Townmart Store sa	L*	H	Annual
		283,280	Yes	No	L/	ASSR	City Hall SS	City Hall/Library s	L*	L	Annual
		7,300	No	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		18,430	No	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
MW-11	33,400	7,300	No	N/A	Int.E/Int.E	PGWS	No-IC		L	L	Once
		23,850	No	N/A	Int.E/Int.E	PGWS	IC		L	L	Once
		52,280	Yes	No	T-ML/T-ML	PCS	No-IC		L	L	Annual
MW-12	4,430	7,300	Yes	Yes	TG/TG	PGWS	No-IC		L	L	Annual
		52,280	Yes	Yes	TG/TG	PCS	No-IC		L	L	Annual

Appendix A – Revision Dates

12/2023 - General updates and Groundwater Professional Bulletin Board postings inserted

1/2025 - Groundwater Professional Bulletin Board posting Target Levels for Potential Groundwater Vapor Pathways inserted

3/2025 - Links updated

9/2026 - Updated Iowa Administrative Code references resulting from 2023 Executive Order 10