APPENDIX F

HYPOTHETICAL CASE STUDY DEMONSTRATING SOURCE WATER ASSESSMENT TECHNIQUES

INTRODUCTION

The following case study is presented to help demonstrate the source water assessment methodologies that have been proposed and will be utilized by the State and its contractor(s) in assessing the vulnerability of a given public water system (PWS) to potential sources of contamination (PSOCs) within their source water assessment area (SWAA). The primary focus of this case study will be a discussion on the methodologies involved with the susceptibility analysis, as this tends to be the most complex of the three concepts. As a lead-in to the susceptibility analysis discussion, the case study will also provide a brief discussion on the watershed setting, the PWS setting, the delineation of the SWAAs, and the contaminant inventory.

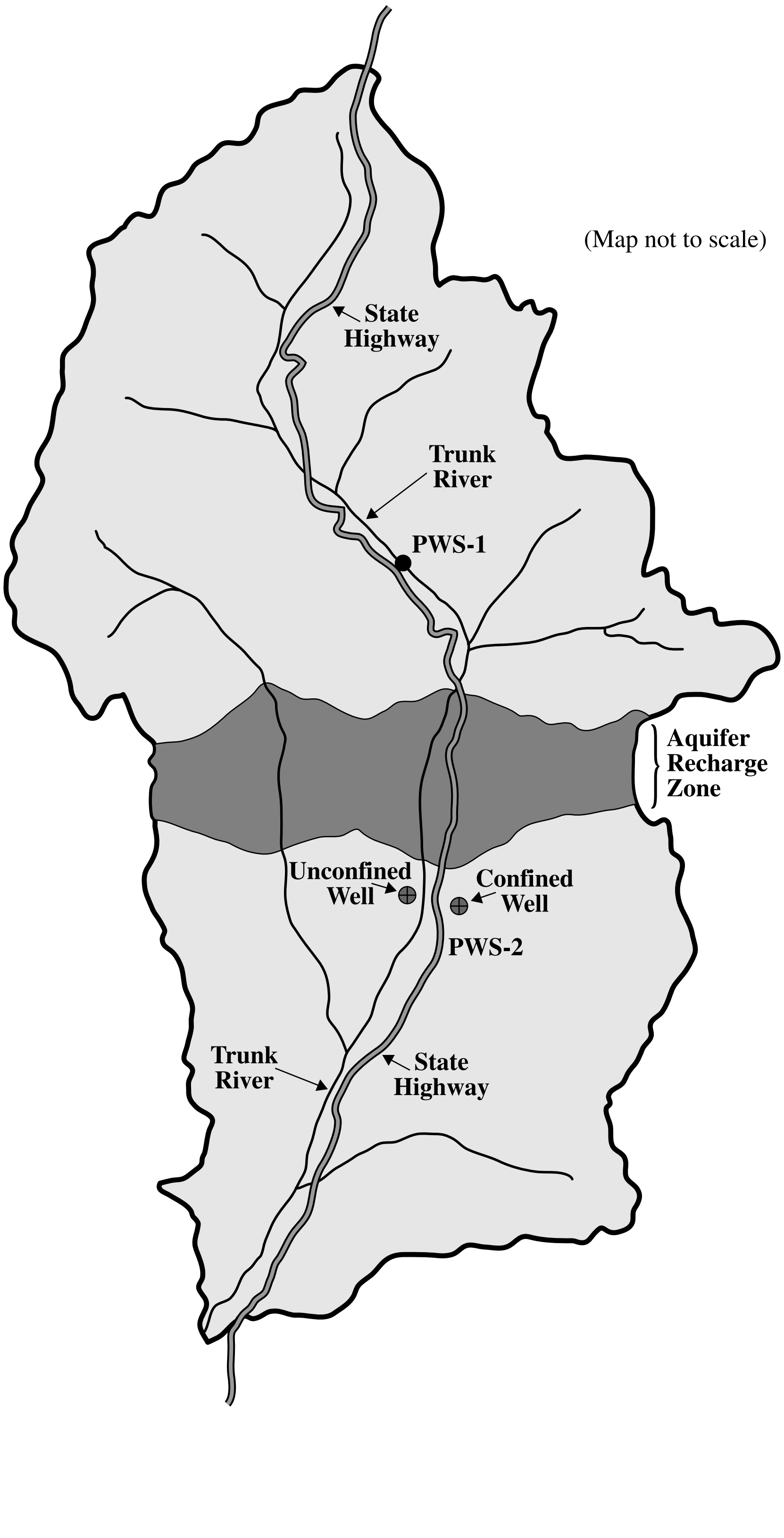
In the case study, two hypothetical PWSs are examined; one system is supplied by surface water and the other system by ground water. Several commonly occurring PSOCs have been identified which could potentially impact the PWSs. The susceptibility analysis will present a brief discussion on some of the various factors that could effect the analysis. The susceptibility analysis discussion is structured to help guide the person conducting the analysis through the eight steps discussed earlier in Chapter 5.0. The discussion is also structured to help the public understand the process of rating the various PSOCs.

It should be noted that the case study is not intended to be a complete study of all the possible scenarios that could arise during a given assessment. The study presents a small selection of the many possible scenarios that are likely to present themselves. In some of the scenarios, final guidance on the factors which could potentially impact the analysis still needs to be finalized and will be presented in the State guidance document. Where this occurs in the case study, generalizations have been made about the factors, until these factors can been finalized. The ratings used in each of the steps are based on the revised ratings presented by the State in the addendum to the final SWAP program plan.

WATERSHED SETTING

For this case study, the two PWSs are contained within a secondary watershed whose boundary is defined by an 8-digit hydrologic unit code (HUC), which is contained within the headwater region of a larger major watershed (e.g., Platte River watershed). The larger major watershed, in turn, is comprised of several other 8-digit HUCs. An analogous situation was illustrated previously in Figure 3.3 (Section 3.0), in which the smaller secondary watershed might represent HUC #1, HUC #2, or HUC #3. The upper half of this hypothetical secondary watershed extends into a mountainous headwater region, while the lower half of the watershed extends out onto a large valley floor. The trunk river of this small watershed is fed by several small tributary streams in the headwater area and on the valley floor. The trunk river exits the mountains and flows out onto the valley floor where it joins the primary river of the major watershed at the downstream end of the smaller secondary watershed. In addition, the lower half of this small watershed is underlain by a shallow, unconfined aquifer and a deeper, confined aquifer. Studies have identified the alluvial fan areas bordering the valley and the mountains as the aquifer recharge zone for the confined aquifer, and that the two aquifers are separated by a thick clay aquitard below the recharge area. **Figure F.1** illustrates the hypothetical setting described above.

Figure F.1 Hypothetical Watershed Setting.



PUBLIC WATER SYSTEM SETTING

PWS-1 is a community water system that is supplied by water from the trunk river of the small watershed. The water system supplies water to a town and surrounding community of approximately 500 residents. The community was founded in the early 1900s during a local mining boom period. While mining has continued to supplement the local economy through the years, the community has evolved into a ranching and recreational-based economy. PWS-1 has one intake structure, which is located on the trunk stream within the town boundaries. PWS-1 also provides the local wastewater treatment services for the community, and oversees the operation of a small wastewater treatment plant near the downstream end of town. The location of PWS-1 is shown in Figure F.1.

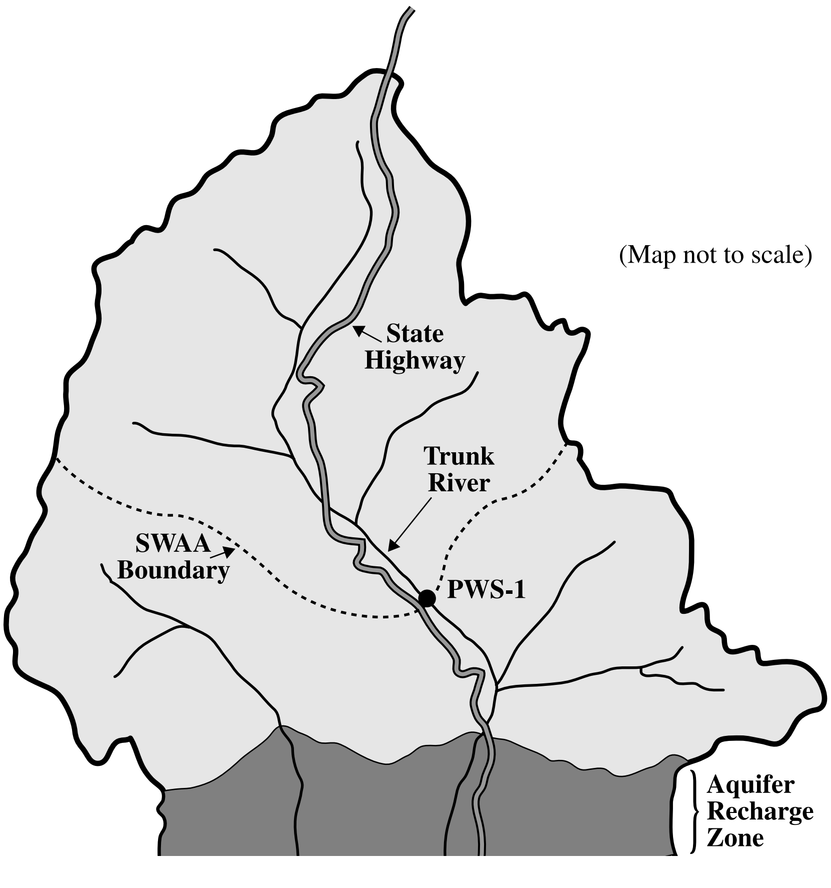
PWS-2 is a community water system supplied by ground water. The system consists of two wells: a shallow well completed in the unconfined alluvial aquifer and a deeper well located in the confined aquifer. Both wells are high capacity wells, providing water to a local community of approximately 2,000 residents. The community economy is primarily agricultural-based and light industrial-based. Both wells are located approximately two miles downstream of where the trunk stream exits the mountains and approximately one mile below the recharge area for the confined aquifer. In addition, both wells are located approximately 12 valley miles below the intake for PWS-1. Furthermore, the shallow well is approximately 150 feet from the trunk stream, and it has been demonstrated that the shallow well is in hydraulic communication with the trunk stream. Therefore, the shallow well comes under the special case of "ground water under the influence of surface water," and, with minor exceptions, will be treated as a surface water system in the assessment process. The location of PWS-2 is shown in Figure F.1.

DELINEATION OF SOURCE WATER ASSESSMENT AREAS (SWAAs)

As noted in Chapter 3.0 of the program plan, the SWAA for the PWS-1 would be delineated as that portion of the entire watershed area upstream of PWS-1's surface water intake that actually drains to the intake. This region extends from PWS-1's intake up to the headwater boundary of the secondary watershed. **Figure F.2** illustrates what the SWAA might look like for this particular water system. The SWAA for this water system would be similar to the example presented for PWS-1 in Figure 3.3 (Section 3.4).

Delineation of SWAAs for the two wells for PWS-2 would be different than the situation described above. For the situation of the shallow unconfined aquifer well where "ground water is under the influence of surface water," a 5-year time of travel (TOT) zone was delineated around the well head using the WHPA 2.2 ground water model. Using the delineation methodology described in Section 3.4 for this special case, a substitute intake point would be defined on the adjacent stream. This substitute intake point would be used to delineate the SWAA for the contributing watershed. Similar to the situation described above for PWS-1, the SWAA for the shallow unconfined aquifer well would be delineated as that portion of the entire watershed area upstream of the substitute intake point that actually drains to the substitute intake point. This region extends from the substitute intake point up to the headwater boundary of the secondary watershed. This situation is illustrated in **Figure F.3** and would be similar to the situation previously illustrated in Figure 3.4 (Section 3.4).

Figure F.2 Source Water Assessment Area for PWS-1.



Delineation of the SWAA for the confined aquifer well was accomplished using the WHPA 2.2 model to define the 5-year TOT zone around the wellhead. As a result of the delineation, it was observed that the 5-year TOT zone intercepted the recharge area for the confined aquifer. Like the situation described above for the unconfined aquifer well, this situation also represents a special case in which the contributing watershed will need to be considered with respect to delineating additional sensitivity zones for the well during the susceptibility analysis. For this case, additional delineation was performed to verify that the 5-year TOT zone (i.e., Zone 3) was the only zone intercepting the recharge area. As a result, the sensitivity zone closest to the contributing segment of the trunk river (i.e., Zone 1) was added to the SWAA for the confined aquifer well **(Figure F.4)**. This situation is similar to the example previously illustrated in Figure 5.6 (Section 5.5). PSOCs located within this additional sensitivity zone may pose a threat to PWS-2 with respect to that portion of the water supplied by the confined aquifer well.

Figure F.3 Source Water Assessment Area for Unconfined Aquifer Well (PWS-2).

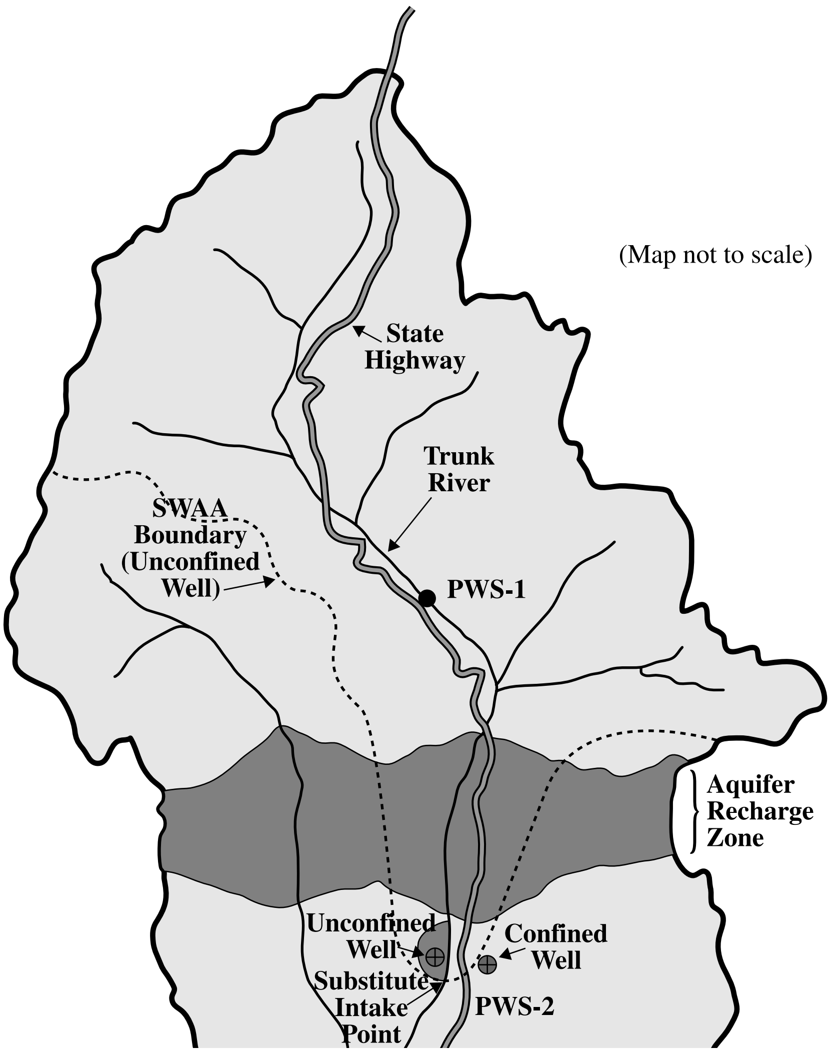
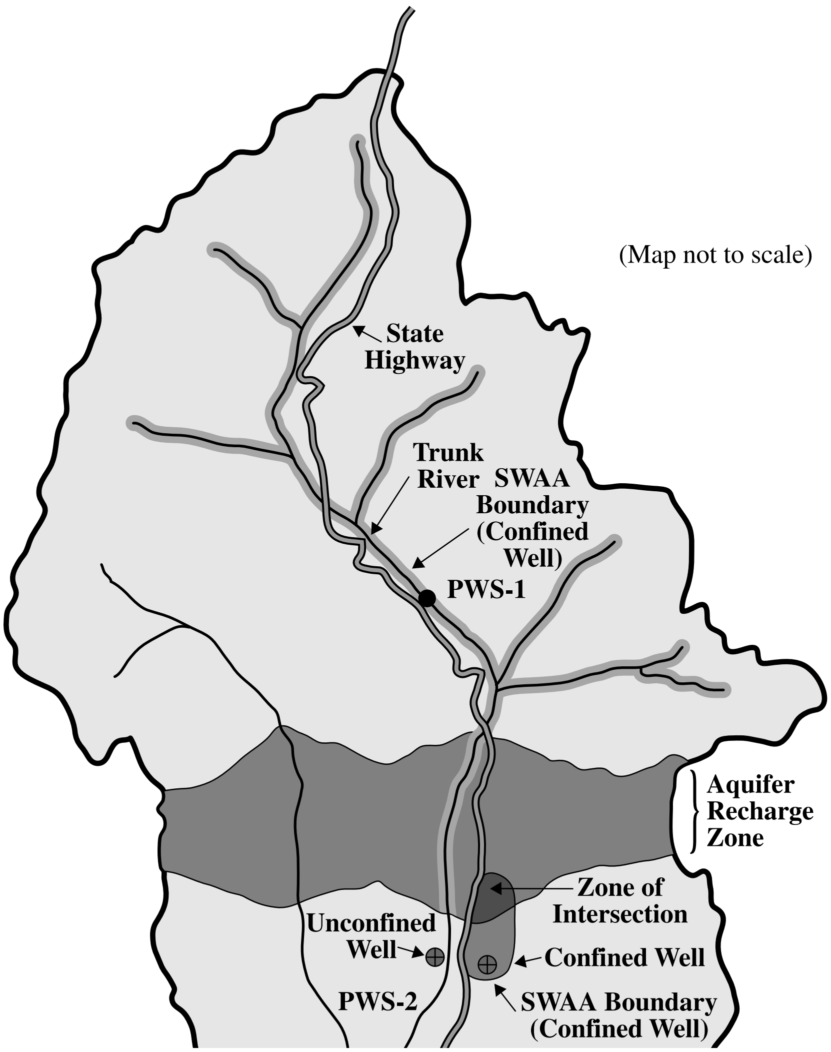


Figure F.4 Source Water Assessment Area for Confined Aquifer Well (PWS-2).



CONTAMINANT INVENTORY

A contaminant inventory was completed for the secondary watershed in this hypothetical case study. Several PSOCs were located within the SWAAs for both water systems. For this case study, the PSOCs that are presented would have been identified from searching existing state and federal data bases containing information on the most significant PSOCs, which the State identified previously in **Table 4-1** (Chapter 4.0), and from searching local data bases and public input. In many instances, these PSOCs are shared between the SWAAs, while in some cases they are unique to a particular SWAA. Again, only a few examples are given to help illustrate some of the likely PSOCs that might be encountered.

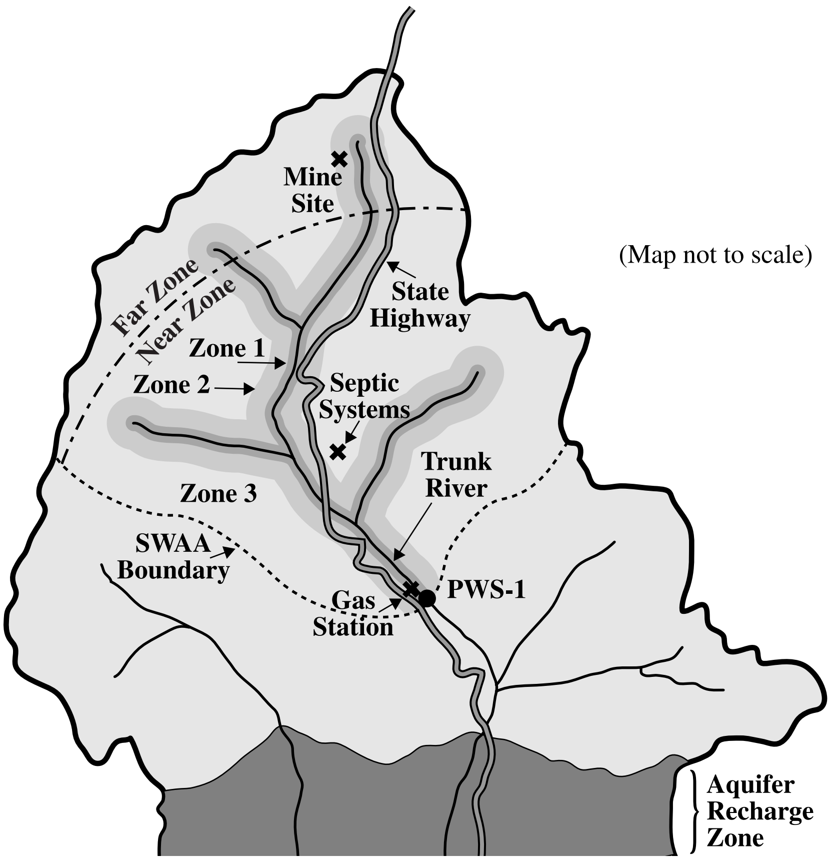
Within the SWAA for PWS-1, the following PSOCs were inventoried:

- An auto repair/gas station facility is located approximately 1/4 mile upstream of the intake and 250 feet from the trunk river. Records indicate that Class A contaminants and lesser amounts of Class B contaminants are in use or are stored at the facility. The facility is known to have two large underground gasoline/diesel storage tanks (10,000 gallon and 5,000 gallon capacity, respectively) and two small above ground waste oil and solvent storage tanks (~ 250 gallons and 100 gallons each, respectively). The underground storage tanks are older tanks. Neither is double-lined nor has a leak detection system in place. The above ground tanks do not have a secondary containment system in place. Inventory records indicated that the old gasoline tank might be leaking a small quantity of gas. A preliminary monitoring study indicated that gasoline had been released to the soil and ground water. Plans are in place to remove the old tanks, upgrade with new tanks, and remediate the soil and ground water contamination.
- The inventory showed a high concentration of septic systems within an older unincorporated housing development located approximately 4 miles upstream of the intake and approximately ½ mile from the trunk river. Class B contaminants (i.e. microbial contaminants) and lesser amounts of Class A and C contaminants are historically associated with this type of PSOC. While many of the septic systems are old, local records and surveys of the residents indicate that the systems were properly permitted and installed, and are maintained on a regular basis. Most of the houses within town are on the local sewer system.

- Review of State and federal data bases indicated that an inactive open pit mine site was located approximately 17 miles upstream of the intake and about 1/4-mile from a tributary stream to the trunk river. This mine site is located within an old mining district that resulted from mining activity in the area around the early 1900s. The open pit mine site has been in operation more or less continuously for the last 10 years but is temporarily shut down at present. Records indicate that Class B and lesser amounts of Class C contaminants are associated with the open pit mine site and the older abandoned mines within the historic mining district. Abandoned underground shaft mines and old unlined tailings piles associated with the early mining period have been discharging acidic, metal-laden drainage to the tributary stream for years. Since these features pre-dated the present-day mining operations, minimal protective/preventative measures are in place to control the release of this drainage. Compliance records and site surveys indicate that at the newer open pit mine site, a properly constructed lined tailings facility and heap leach facility is in place. A ground water monitoring well system is in place to monitor discharge of pollutants from these facilities. Sediment and erosion control measures are in place but need improving. Spill containment and prevention plans are in place at the mine site.

The location of these PSOCs within the SWAA of PWS-1 is shown in **Figure F.5**.

Figure F.5 Contaminant Inventory Map for PWS-1.



Within the SWAA for PWS-2, PSOCs were inventoried for both the unconfined aquifer well and the confined aquifer well. For the unconfined aquifer well, since the SWAA includes the SWAA for PWS-1, the PSOC inventory will also include the same PSOCs identified above for PWS-1. In addition, PSOCs were inventoried for the unconfined aquifer well within its area of responsibility. To reiterate, the area of responsibility in this case would be that portion of the watershed, between PWS-1's intake and the substitute intake point on the trunk stream associated with the shallow unconfined aquifer well, which actually drains to the substitute intake point. The area of responsibility was previously illustrated in Figure 3.3 (Chapter 3.0). Within the area of responsibility for the unconfined aquifer well, the following PSOCs were inventoried:

- Land use maps indicate that agricultural crop areas are located approximately 3/4 mile upstream of the substitute intake point and ½ mile from the trunk river. Class B contaminants (i.e. pesticides/fertilizers) and lesser amounts of Class A contaminants are historically associated with this type of PSOC. Visits to these areas by personnel from

PWS-2 indicate that farmers could improve their best management practices with respect to their application of the pesticides/fertilizers. However, their irrigation and tillage practices would appear to help reduce the potential for contaminant release to the shallow unconfined aquifer.

- The community landfill is located approximately ½ mile upstream and 1 mile from the trunk stream. Historically, the landfill had received waste that is likely to contain Class B contaminants and to a lesser degree some Class A and Class C contaminants. The landfill is older and unlined, and therefore susceptible to contaminant releases. However, due to existing regulations, a monitoring well system has been installed to monitor possible contaminant releases to both the unconfined and confined aquifer that may have occurred over the years. Monitoring records indicate that Class B and Class C contaminants have been detected in the unconfined aquifer but not the confined aquifer.

- A primary state highway (i.e., transportation corridor) runs along the axis of the secondary watershed from the mountainous headwater area down through the valley portion of the watershed, connecting the two communities in this case study. This road is known to transport Class B and lesser amounts of Class A hazardous materials from time to time. The highway generally parallels the trunk stream within a distance of 300 to 500 feet and also crosses the recharge area for the confined aquifer. Within the mountains between the two communities, the road contains curves that sometimes are sharp and have no guardrails to protect vehicles from leaving the road. This stretch of the highway (approximately 5 to 7 miles upstream of the substitute intake point) has experienced a couple of accidents in which trucks carrying hazardous materials have left the road and spilled some of their contents. In one case, a small amount of pesticide did reach the trunk stream. Records indicated that the spills were subsequently remediated.

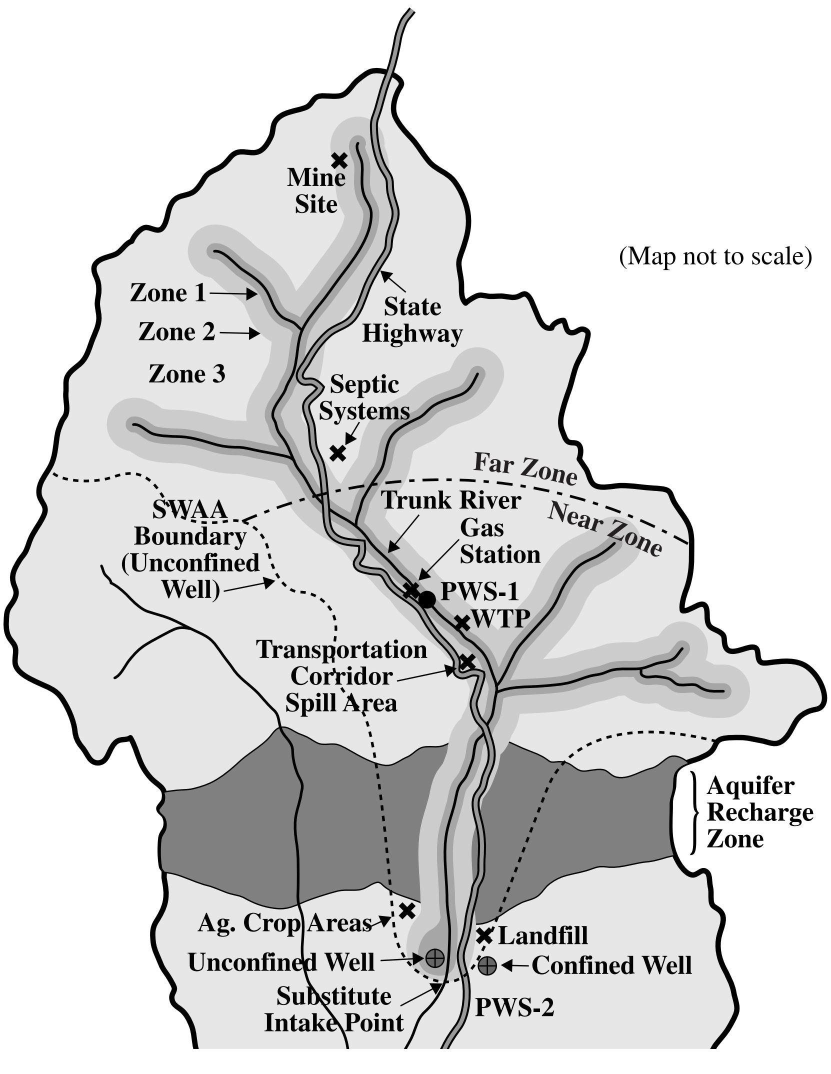
- As mentioned earlier, PWS-1 also operates the wastewater treatment plant for its community. This plant is located downstream of it's own intake and approximately 9 miles upstream of the substitute intake point for the unconfined aquifer well. The treatment plant is located approximately 500 feet from the trunk river. The treatment plant has a permit to discharge it's treated effluent to the trunk river. Historically, Class A contaminants (i.e. microbial contaminants) and lesser amounts of Class B and C contaminants are associated with this type of PSOC. Compliance records indicate that the plant has had a few minor discharge violations in the past 3 years. Site surveys indicate that best management practices are being followed, but could be improved.

Figure F.6 illustrates the PSOCs identified within the SWAA of the unconfined well.

As was noted earlier for the case of the confined aquifer well, since the 5-year TOT zone intercepted the recharge area for this aquifer, the closest portion of the contributing watershed above the recharge zone needed to be considered when identifying PSOCs that could potentially impact the confined aquifer well. Additional delineation was performed to verify that the 5-year TOT zone (i.e., Zone 3) was the only zone intercepting the recharge area. As a result, the sensitivity zone closest to the contributing segment of the trunk river (i.e., Zone 1) was added to the SWAA for the confined aquifer well. Based on the preliminary and refined delineation of the

SWAA for the confined aquifer well, the PSOC inventory for this well will also include some of the same PSOCs identified above for PWS-1 and the unconfined aquifer well. Specifically, these PSOCs include the gas station, the wastewater treatment plant operated by PWS-1 and the community landfill. Within the SWAA for the confined aquifer well, the following additional PSOC was inventoried:

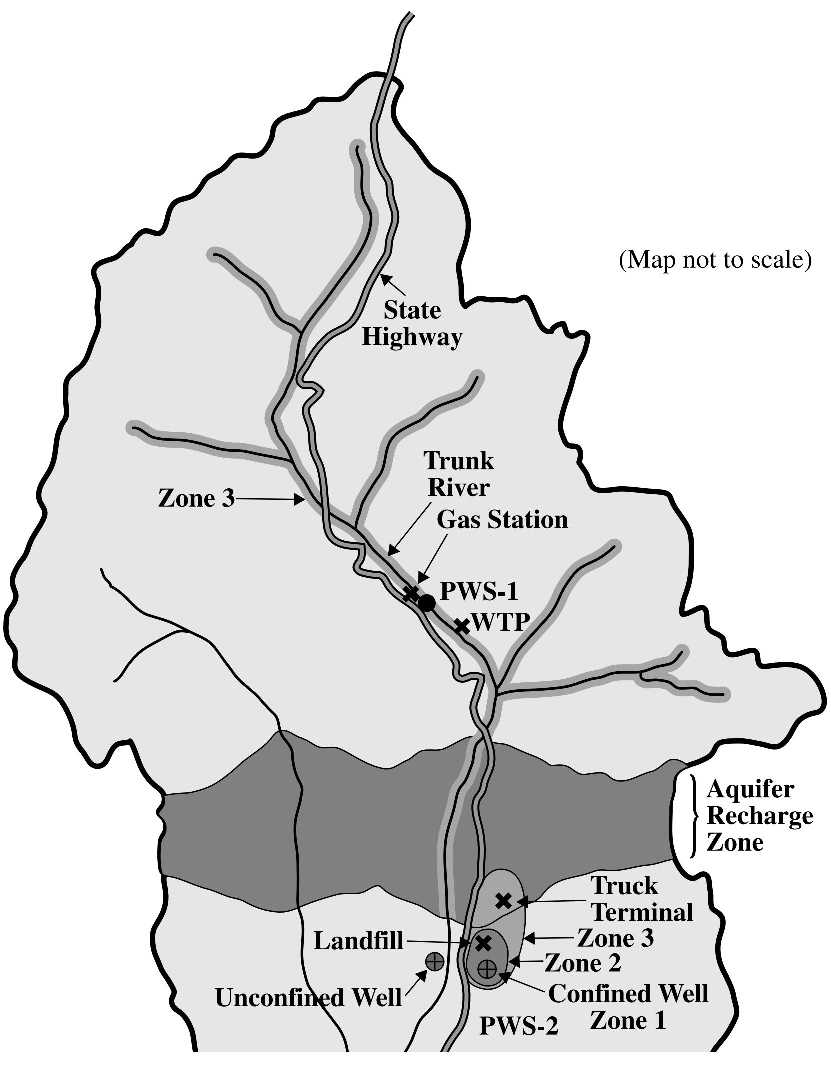
Figure F.6 Contaminant Inventory Map for Unconfined Aquifer Well (PWS-2).



- A small trucking terminal is located within the zone where the 5-year TOT intercepts the recharge area (i.e., the zone of interception). This terminal contains a maintenance facility and a fueling area for its trucks. Records indicate that Class B and lesser amounts of Class A contaminants are stored or used at the terminal. The fueling area contains two large (10,000-gallon) underground diesel storage tanks. Records indicate these tanks are in compliance and that no leaks have been reported. Site surveys by PWS-2 personnel of the maintenance area indicates that best management practices are in place to store waste chemicals and to control accidental releases of potential contaminants.

Figure F.7 illustrates the PSOCs identified within the SWAA of the confined well.

Figure F.7 Contaminant Inventory Map for Confined Aquifer Well (PWS-2).



SUSCEPTIBILITY ANALYSIS

A susceptibility analysis was completed for the two PWSs in this hypothetical case study. The purpose of this section is to demonstrate the threat, risk and vulnerability rating process for the susceptibility analysis. The susceptibility analysis utilizes the eight-step process discussed in Chapter 5.0 to assess the various threat and risk factors that could effect the vulnerability of a public water system to potential sources of contamination located in its source water assessment area. Each step of the process will be discussed briefly with respect to the threat or risk factors analyzed and/or the rating selection that results for each PSOC. Tables summarizing the results will be utilized to help clarify the process.

Threat Identification

The first three steps of the process involve identifying the threat that a PSOC poses to the public water system. This involves assessing two threat factors: the hazard posed by the contaminants and the likelihood that these contaminants will be released from the source. These two factors are assessed for each PSOC and rated based on available or historical information. The overall threat rating for each PSOC is then obtained by combining the contaminant hazard and likelihood of release ratings using the threat rating table (Table 5.3) provided in Section 5.6.

Step 1. Identify the Contaminant Hazards

As noted in Section 5.6 of the program plan, this process entails identifying the contaminants from the inventory and the hazard classes they fall into, and then assigning an overall hazard classification to the PSOC. In general, this classification will be based on the prevalence of Class A, B or C contaminants, with respect to each other, which are confirmed or suspected to be present. Based on the total number of potential contaminants identified from the database searches or community-bases surveys, if Class contaminants comprise 25% or more of the total, the PSOC will be ranked as a Class A contaminant hazard. If Class B contaminants comprise more than 25% of the total, and Class A and C contaminants comprise less than 25% of the total, respectively, the PSOC will be ranked as a Class B contaminant hazard. Similarly, if Class C contaminants comprise more than 25% of the total, while Class A and B contaminants comprise less than 25% of the total, respectively, the PSOC will be ranked as a Class C contaminant hazard.

If information on the types of potential contaminants for a given PSOC is not available from searches of the state and federal databases or is not collected through community-based surveys, then a default rating will be used to classify the PSOC. The State has provided a default contaminant hazard ranking for each PSOC listed in Table E.1 of Appendix E. The default rating was based, in general, on the prevalence of the different classes of contaminants (A, B, or C) with respect to each other, as defined above.

Since prioritization will be given within the current time frame of the SWAP program to analyzing the vulnerability of community and non-community water systems to Class A and Class B contaminants, the examples used in this case study reflect PSOCs that are most likely to contain a prevalence of Class A or Class B contaminants. For illustrative purposes in this case study, generalizations have been made in deriving the overall hazard classification for a PSOC.

Based on the information presented in the contaminant inventory, the following overall hazard classifications have been assigned to the PSOCs:

PWS-1 PSOCs:

- Gas Station *(CLASS A)*
- Septic Systems *(CLASS B)*
- Inactive Mine Site *(CLASS B)*

PWS-2 PSOCs:

Unconfined Aquifer Well:

- Agricultural Crop Areas *(CLASS B)*
- Landfill *(CLASS B)*
- Transportation Corridor *(CLASS B)*
- PWS-1 Treatment Plant *(CLASS A)*

Confined Aquifer Well:

- Trucking Terminal *(CLASS B)*

Step 2. Determine the Likelihood of Release

The likelihood of release will be determined by an evaluation of the compliance history (if applicable and/or available), and/or protective/preventative measures or best management practices (BMPs) that could affect whether contaminants might be released. In the initial iteration conducted by the State for regulated PSOCs, the likelihood of release will be based primarily on available compliance history information contained in the regulated state and federal databases. Where information on protective/preventative measures or BMPs can be obtained from the databases, it will be utilized in helping to determine the likelihood of release rating in the initial iteration.

In the second iteration, where the PWS potentially supplies additional information obtained at the local level, information on protective/preventative measures or BMPs will be incorporated into the analysis, where this information can be obtained by searching local databases or conducting site surveys of the PSOCs. Criteria checklists will be developed by the State and included in the state guidance document to aid the PWS and/or citizen volunteer groups in collecting this information. In developing these checklists, many of these measures and/or BMPs will be referenced by the State from available information sources.

If information on the compliance history and/or protective/preventative measures or BMPs is available and indicates that a release has occurred or is possible, a likelihood of release rating of KNOWN RELEASE or LIKELY will given to the PSOC. If this information indicates that a release has not occurred and that a release is not imminently indicated, a rating of UNLIKELY will be given to the PSOC. If information on compliance history, and protective/preventative measures or BMPs for a given PSOC cannot be determined by searches of the state and federal databases or through community-based surveys, then a default rating of UNKNOWN will be utilized to classify the PSOC. In this case, until information can be obtained to make a determination, the State has elected to be conservative and assume the "worst case scenario," and treat the PSOC as if a release has occurred or is likely.

Since the State is still in the process of finalizing a list of the most significant protective/preventative measures and BMPs, generalized examples have been used in this case study to help illustrate some of the measures and practices that are likely to be considered. As a result, the ratings presented are merely for illustration, and may or may not be the ratings that result from the finalized list which ultimately will be presented in the State guidance document for conducting SWAP assessments.

Based on the information presented in the contaminant inventory, the following overall likelihood of release ratings have been assigned to the PSOCs:

PWS-1 PSOCs:

- Gas Station *(KNOWN RELEASE)*
- Septic Systems *(LIKELY)*
- Inactive Mine Site *(UNLIKELY)*

PWS-2 PSOCs:

Unconfined Aquifer Well:

- Agricultural Crop Areas *(UNLIKELY)*
- Landfill *(KNOWN RELEASE)*
- Transportation Corridor *(KNOWN RELEASES)*
- PWS-1 Treatment Plant *(LIKELY)*

Confined Aquifer Well:

- Trucking Terminal *(UNLIKELY)*

Step 3. Derive the Threat

The threat posed by a PSOC is determined by comparing the overall contaminant hazard classification with the overall likelihood of release rating for the PSOC and assigning the corresponding threat rating proposed by the State. **Table F.1** is a reproduction of Table 5.3, which contains the threat ratings proposed by the State.

Table F.1 Threat as a Combination of Hazard and Likelihood of Release

	CONTAMINANT HAZARD RATING		
LIKELIHOOD OF RELEASE	**A**	**B**	**C**
Unlikely	Moderate	Low	Low
Unknown / Known Release or Likely	High	High	Moderate

Based on the ratings presented above in Steps 1 and 2, the following overall threat ratings have been assigned to the PSOCs:

PWS-1 PSOCs:

- Gas Station *Class A / Known* *(HIGH)*
- Septic Systems *Class B / Likely* *(HIGH)*
- Inactive Mine Site *Class B / Unlikely* *(LOW)*

PWS-2 PSOCs:

Unconfined Aquifer Well:

- Ag. Crop Areas *Class B / Unlikely* *(LOW)*
- Landfill *Class B / Known* *(HIGH)*
- Transportation Corridor *Class B / Known* *(HIGH)*
- PWS-1 Treatment Plant *Class A / Likely* *(HIGH)*

Confined Aquifer Well:

- Trucking Terminal *Class B / Unlikely* *(LOW)*

Risk Identification

Steps four through six of the process involve identifying the risk that a PSOC poses to the public water system. This involves assessing two risk factors: the structural integrity of the water system and the setting sensitivity of the water system to the potential source of contamination. The structural integrity and sensitivity setting factors are assessed for each PWS and each PSOC, respectively, and rated based on available or historical information, and using the sensitivity setting rating tables (Tables 5.4 and 5.5) provided in Section 5.6. The overall risk rating for each PSOC is then obtained by combining the structural integrity and sensitivity setting ratings using the risk rating tables (Tables 5.6 and 5.7) provided in Section 5.6.

Step 4. Determine Structural Integrity of Water System

The integrity of the water system refers to assessing the structural soundness and maintenance of the surface water intake, diversion, and conveyance system or the soundness and maintenance of the ground water well(s). Factors common to the structural soundness evaluation of surface water systems and ground water systems include age, construction, length (surface water conveyance/storage structures only), and maintenance history. In addition, surface water systems will be evaluated for problems associated with the possible exposure of the water to the outside environment during open-channel conveyance and storage between the point of diversion from the watershed and the point of treatment.

Properly drilled, sealed and maintained wells will receive a rating of OK, as will sound and properly maintained surface water intake, diversion and conveyance structures. Wells and surface water intake, diversion and conveyance structures with documented structural and/or maintenance problems will receive a KNOWN PROBLEMS rating. If the structural integrity of the well(s) or surface water intake, diversion or conveyance structures cannot be assessed due to a lack of records, and/or the inability to make a site visit, a rating of UNKNOWN PROBLEMS will be assigned. As noted earlier in Section 5.6, the State will be providing checklists of these evaluation factors in the guidance document to aid in assessing the structural integrity of the water system. Since the State is still in the process of finalizing the checklists, generalized examples have been used in this case study to help illustrate some of the factors that are likely to be considered. As a result, the ratings presented are merely for illustration, and may or may not be the ratings that result from the finalized checklists.

Based on the information presented below, the following overall structural integrity ratings have been assigned to the PWSs:

<u>PWS-1:</u> A site visit could not be arranged to observe the structural integrity of the water system. PWS-1 personnel indicated in a short written communication that the intake and conveyance structures were approximately 50 years old; however, no further description on their physical soundness or maintenance history was given. Additionally, it is not known whether the conveyance system is open-channel or a closed pipeline.

RATING: UNKNOWN PROBLEMS

<u>PWS-2:</u> A site visit could not be arranged to observe the structural integrity of the water system. However, well records from the State Engineer's Office and written correspondence from PWS-2 personnel provided enough information to assign a rating to each well. The following information is known about the wells:

Unconfined Aquifer Well: Well records indicate that while the well is approximately 25 years old, it was not drilled and constructed to similar standards in place today. Up until three years ago, a regular maintenance program for the well had not been established. A video survey of the well at that time by their water consultant indicated that the lower portion of the well screen area was damaged due to a partial collapse of the screen. Pictures provided by PWS-2 personnel of the wellhead area also indicate the area is not properly graded to prevent water from collecting around the wellhead.

RATING: KNOWN PROBLEMS

Confined Aquifer Well: Well records indicate that the well is 3 years old, and was drilled and constructed in accordance with the standards established by the State Engineer's Office. PWS-2 personnel provided a maintenance plan developed by their water consultant indicating that inspection and maintenance of the well screen will be performed when the pump is periodically removed for servicing. Pictures provided by PWS-2 personnel of the wellhead area also indicate the area is properly graded to prevent water from collecting around the wellhead.

RATING: OK

Step 5. Determine Setting Sensitivity

As noted in Section 5.6, setting sensitivity attempts to assess, in very general terms, the risk factor posed by the contaminant transport differences with the SWAA. The risk was assessed by determining the relative proximity of a PSOC to the PWS intake or well by defining sensitivity zones upstream from the intake or around the well. Determining the sensitivity zones involved a second phase of delineation. Depending on which zone the PSOC was located in, a sensitivity rating of LOW, MODERATE or HIGH was assigned to the PSOC indicating the general risk.

With respect to ground water supply systems, the setting sensitivity analysis attempted to take into account the hydrogeologic characteristics of the SWAA and other factors that might effect the movement of a contaminant from a source toward a PWS well(s). Determination of the sensitivity setting involved: (1) refining the SWAA to include sensitivity zones around the PWS well(s), (2) identifying the PSOCs within each of the zones and assigning a preliminary sensitivity rating to the PSOCs which will represent the general risk posed to the PWS well(s), and (3) adjusting this preliminary rating based on additional factors that could affect the movement of contaminants within the aquifer. **Table F.2** is a reproduction of Table 5.4 (Section 5.6) and presents the sensitivity setting rating table that should be used in this assessment. A list of the most significant factors that could affect contaminant transport is still being developed by the State and will be finalized for inclusion in the State guidance document for conducting a SWAP assessment. Generalized examples have been used in this case study to help illustrate some of the factors that are likely to be considered. As a result, the ratings presented are merely for illustration, and may or may not be the ratings that result from the finalized checklists.

Table F.2 Setting Sensitivity Determination for Ground Water Systems

	PROXIMITY TO WELL		
RATING & ADJUSTMENT FACTORS	**Zone 1**	**Zone 2**	**Zone 3**
Preliminary Sensitivity Rating:	***High***	***Moderate***	***Low***
Other Factors Are Present Enhancing Transport	High	High	Moderate
Other Factors Are Present Slowing Transport	Moderate	Low	Low

The setting sensitivity analysis for surface water systems in this case study evaluated the proximity of the PSOCs to both the intake point (real and substitute) and the drainage network within the PWSs area of interest. With respect to evaluating the proximity of the PSOCs to the drainage network, three sensitivity zones (Zones 1, 2 and 3) were defined around the drainage network upstream of the intake point (real or substitute). The proximity of the PSOCs to the intake point was defined as either NEAR (located upstream from the intake point within a radial distance of 15 valley miles) or FAR (located upstream the intake point beyond a radial distance of 15 valley miles). The sensitivity zones defined for PWS-1 would look similar to those depicted in Figure F.5. Using the sensitivity rating table for surface water systems, **Table F.3** (reproduction of Table 5.5), sensitivity ratings were assigned to each PSOC based on its proximity to the stream network and the PWS intake.

Table F.3 Determining Setting Sensitivity for Surface Water Systems

DISTANCE FROM INTAKE	**DISTANCE TO DRAINAGE NETWORK**		
	Zone 1	***Zone 2***	***Zone 3***
Near (<15 valley mi.)	High	Moderate	Low
Far (>15 valley mi.)	Moderate	Low	Low

PWS-1 PSOCs:

Based on the information presented previously in the case study, the following overall setting sensitivity ratings have been assigned to the PSOCs associated with SWAA for PWS-1 using Table F.3:

- Gas Station *Zone 1 & Near Zone* *(HIGH)*
- Septic Systems *Zone 3 & Near Zone* *(LOW)*
- Inactive Mine Site *Zone 2 & Far Zone* *(LOW)*

PWS-2 PSOCs:

Unconfined Aquifer Well: As was stated earlier in the case study, it has been demonstrated that the unconfined aquifer well is in hydraulic communication with the trunk stream. Therefore, this situation comes under the special case of “ground water under the influence of surface water,” and, with one minor exception, was treated as a surface water system in the susceptibility analysis. Since this case still involves the extraction of ground water from the aquifer, the exception in this case includes the element of adjusting the sensitivity setting rating based on additional factors that could effect the movement of contaminants within the aquifer, just as one would for a ground water system.

The setting sensitivity analysis started by defining the sensitivity zones and evaluating the proximity of the PSOCs to both the substitute intake point and the drainage network within the PWS’s area of interest. In this case, additional factors that could effect the movement of contaminants within the unconfined aquifer were evaluated. Available hydrogeologic information for the region underlying the sensitivity zones, defined within the SWAA, indicated that potential contaminants would be transported through a small alluvial aquifer associated with the trunk river, then through the alluvial fan deposits associated with the recharge area, and finally through the alluvial sediments comprising the unconfined aquifer. Since the hydraulic properties of all these alluvial sediments are similar, it was felt that migration would be neither significantly enhanced nor slowed within the SWAA for the unconfined well. As a result, the preliminary sensitivity setting ratings for the PSOCs, defined using Table F.3, were not adjusted. If additional factors had been identified, the preliminary sensitivity setting ratings would have been adjusted in accordance with the corresponding ratings in Table F.2.

As was noted earlier in the contaminant inventory for the unconfined aquifer well, since the SWAA includes the SWAA for PWS-1, the PSOC inventory will also include the same PSOCs identified above for PWS-1. In addition, PSOCs were inventoried for the unconfined aquifer well within its area of responsibility.

Based on the information presented, the following overall setting sensitivity ratings have been assigned to the following PSOCs associated with SWAA for the unconfined aquifer well using Table F.3:

- Gas Station *Zone 1 & Near Zone* *(HIGH)*
- Septic Systems *Zone 3 & Far Zone* *(LOW)*
- Inactive Mine Site *Zone 2 & Far Zone* *(LOW)*

- Ag. Crop Areas *Zone 3 & Near Zone* *(LOW)*
- Landfill *Zone 3 & Near Zone* *(LOW)*
- Transportation Corridor *Zone 2 & Near Zone* *(MODERATE)*
- PWS-1 Treatment Plant *Zone 1 & Near Zone* *(HIGH)*

Confined Aquifer Well: As noted earlier in the contaminant inventory discussion, the 5-year TOT boundary for the confined aquifer well intercepted the recharge zone. Like the situation described above for the unconfined aquifer well, this situation also represents a special case in which the portion of the watershed most likely to contribute water to the recharge zone will need to be considered with respect to delineating additional sensitivity zones for the well during the susceptibility analysis. In this case, however, the setting sensitivity analysis will be treated as a ground water system.

Additional delineation was performed to verify that the 5-year TOT zone (i.e., Zone 3) was the only zone intercepting the recharge area. As a result, the sensitivity zone closest to the contributing segment of the trunk river (i.e., Zone 1) was added to the SWAA for the confined aquifer well. For the purpose of determining the preliminary setting sensitivity rating, this zone was treated as an extension of Zone 3 for the well and, therefore, received the same preliminary sensitivity setting rating from Table F.2. Similarly, if it had been shown that the 2-year TOT boundary (Zone 2) had intersected the recharge zone, the two sensitivity zones closest to the contributing segment of the trunk river (i.e., Zones 1 and 2) would have been added to the SWAA for the confined aquifer well. In that example, Zone 1 around the contributing segment of the trunk river would have been treated as an extension of Zone 2 of the well, and Zone 2 around the contributing segment of the trunk river would have been treated as an extension of Zone 3 of the well. As a result, Zones 1 and 2 around the contributing segment of the trunk river would have received the same sensitivity setting rating as Zones 2 and 3 of the well, respectively.

A similar procedure would apply if the 500-foot boundary (Zone 1) around the confined aquifer well had intercepted the recharge zone.

Based on the preliminary and refined delineation of the SWAA for the confined aquifer well, the PSOC inventory for this well included some of the same PSOCs identified above for PWS-1 and the unconfined aquifer well. Specifically, these PSOCs included the gas station and the wastewater treatment plant operated by PWS-1 in the region above the recharge area, and the community landfill in the region below the recharge area. The landfill is located within Zone 2 of the confined aquifer well. In addition to these PSOCs, the truck terminal was located within the zone of intersection between Zone 3 of the well and the recharge area. Based on the proximity of these PSOCs to the well, preliminary sensitivity setting ratings were assigned to each using the corresponding ratings in Table F.2.

Available hydrogeologic information for the region underlying the sensitivity zone surrounding the contributing segment of the trunk river indicated that potential contaminants would be transported through the small alluvial aquifer associated with the trunk river and then through the alluvial fan deposits associated with the recharge area. Since the hydraulic properties of these alluvial sediments are similar to those sediments comprising the unconfined and confined aquifers, it was felt that migration would be neither enhanced nor slowed for the area above the recharge area. As a result, the preliminary sensitivity setting ratings for the gas station, the treatment plant and the truck terminal were not adjusted.

With respect to additional factors that could enhance or slow the transport of contaminants for the region within and below the recharge area, a couple of factors were identified. Within the recharge area, mountain front faults were identified which could help to enhance downward transport of potential contaminants into the confined aquifer. As a result, the preliminary sensitivity setting rating for the truck terminal was increased one rating level in accordance with the corresponding ratings in Table F.2. For the region of the watershed below the recharge area, a thick clay aquitard is present between the two aquifers, as mentioned earlier in this case study. It was felt that this aquitard would slow the transport of contaminants between the two aquifers in this region, most notably contaminants potentially released from the landfill. As a result, the preliminary sensitivity setting rating for the landfill was reduced one rating level in accordance with the corresponding ratings in Table F.2.

Based on the information presented, the following overall setting sensitivity ratings have been assigned to the PSOCs associated with confined aquifer well SWAA using Table F.2:

- Gas Station — *Zone 3 & No Additional Factors* — *(LOW)*
- PWS-1 Treatment Plant — *Zone 3 & No Additional Factors* — *(LOW)*
- Landfill — *Zone 2 & Factors Slowing Transport* — *(LOW)*
- Truck Terminal — *Zone 3 & Factors Enhancing Transport* — *(MODERATE)*

Step 6. Derive the Risk

Risk was determined by comparing the setting sensitivity rating with the structural integrity rating of the PWS and assigning a risk rating of LOW, MODERATE, or HIGH proposed by the State in **Tables F.4 and F.5** (reproduction of Tables 5.6 and 5.7).

Table F.4 Risk as a Combination Of Setting Sensitivity and System Integrity – Ground Water Supply Systems.

SYSTEM INTEGRITY	SETTING SENSITIVITY Rating (Setting)	RISK RATING
Known/Unk. Problems	High [1] (Zone 1 & Enhancement)	HIGH [1]
OK	High [1] (Zone 1 & Enhancement)	HIGH [1]
Known/Unk. Problems	**High (Zone 1)**	**HIGH**
OK	**High (Zone 1)**	**MODERATE**
Known/Unk. Problems	Mod. [2] (Zone 1 & Slowing)	MODERATE [2]
OK	Mod. [2] (Zone 1 & Slowing)	LOW [2]
Known/Unk. Problems	High [1] (Zone 2 & Enhancement)	HIGH [1]
OK	High [1] (Zone 2 & Enhancement)	HIGH [1]
Known/Unk. Problems	**Mod. (Zone 2)**	**MODERATE**
OK	**Mod. (Zone 2)**	**MODERATE**
Known/Unk. Problems	Low [2] (Zone 2 & Slowing)	LOW [2]
OK	Low [2] (Zone 2 & Slowing)	LOW [2]
Known/Unk. Problems	Mod.[1] (Zone 3 & Enhancement)	HIGH [1]
OK	Mod.[1] (Zone 3 & Enhancement)	MODERATE [1]
Known/Unk. Problems	**Low (Zone 3)**	**MODERATE**
OK	**Low (Zone 3)**	**LOW**
Known/Unk. Problems	Low [2] (Zone 3 & Slowing)	LOW [2]
OK	Low [2] (Zone 3 & Slowing)	LOW [2]

[1] Corresponding preliminary rating (in bold) was increased one level due to presence of factors that could enhance the transport of contaminants.

[2] Corresponding preliminary rating (in bold) was decreased one level due to presence of factors that could slow the transport of contaminants.

Table F.5 Risk as a Combination of Setting Sensitivity and System Integrity – Surface Water Supply Systems.

SYSTEM INTEGRITY	SETTING SENSITIVITY Rating (Setting)	RISK RATING
Known/Unk. Problems	High (Zone 1 & Near)	HIGH
OK	High (Zone 1 & Near)	HIGH
Known/Unk. Problems	Mod. (Zone 2 & Near)	HIGH
OK	Mod. (Zone 2 & Near)	MODERATE
Known/Unk. Problems	Mod. (Zone 1 & Far)	MODERATE
OK	Mod. (Zone 1 & Far)	MODERATE
Known/Unk. Problems	Low (Zone 3 & Near)	MODERATE
OK	Low (Zone 3 & Near)	LOW
Known/Unk. Problems	Low (Zone 2 & Far)	MODERATE
OK	Low (Zone 2 & Far)	LOW
Known/Unk. Problems	Low (Zone 3 & Far)	LOW
OK	Low (Zone 3 & Far)	LOW

Based on the ratings presented above in Steps 4 and 5, the following overall risk ratings have been assigned to the PSOCs:
PWS-1 PSOCs:

- Gas Station *Unknown Problems / Zone 1 & Near (High)* *(HIGH)*
- Septic Systems *Unknown Problems / Zone 3 & Near (Low)* *(MODERATE)*
- Inactive Mine Site *Unknown Problems / Zone 2 & Far (Low)* *(MODERATE)*

PWS-2 PSOCs:

Unconfined Aquifer Well:

- Gas Station *Known Problems / Zone 1 & Near (High)* *(HIGH)*
- Septic Systems *Known Problems / Zone 3 & Far (Low)* *(MODERATE)*
- Inactive Mine Site *Known Problems / Zone 2 & Far (Low)* *(LOW)*

- Ag. Crop Areas *Known Problems / Zone 3 & Near (Low)* *(MODERATE)*

- Landfill *Known Problems / Zone 3 & Near (Low)* *(MODERATE)*
- Transportation Corridor *Known Problems / Zone 2 & Near (Mod)* *(HIGH)*
- PWS-1 Treatment Plant *Known Problems / Zone 1 & Near (High)* *(HIGH)*

Confined Aquifer Well:

- Gas Station *OK / Zone 3 & No Add. Factors (Low)* *(LOW)*
- PWS-1 Treatment Plant *OK / Zone 3 & No Add. Factors (Low)* *(LOW)*

- Landfill OK / Zone 2 & Factors Slowing Transport (Low) (LOW)

- Truck Terminal *OK / Zone 3 & Factors Enhancing Transport (Mod)* *(MODERATE)*

Step 7. Determine the Vulnerability

Vulnerability of the surface and ground water systems to their respective PSOCs was determined by comparing the threat ratings (Step 3) with the risk ratings (Step 6) for each PSOC and assigning a vulnerability rating of LOW, MODERATE, or HIGH as proposed by the State in Tables 5.8 and 5.9 (Section 5.6). These tables have been reproduced as **Tables F.6 and F.7** in this appendix.

Based on the ratings presented above in Steps 3 and 6, the following overall vulnerability ratings have been assigned to the PSOCs:

PWS-1 PSOCs:

- Gas Station
  THREAT: Class A / Known = HIGH
  RISK: Unknown Problems / Zone 1 & Near (High) = HIGH
  *VULNERABILITY: HIGH + HIGH = **HIGH***

- Septic Systems
  THREAT: Class B / Likely = HIGH
  RISK: Unknown Problems / Zone 3 & Near (Low) = MODERATE
  *VULNERABILITY: MODERATE + MODERATE = **MODERATE***

- Inactive Mine Site
  THREAT: Class B / Unlikely = LOW
  RISK: Unknown Problems / Zone 2 & Far (Low) = MODERATE
  *VULNERABILITY: LOW + MODERATE = **LOW***

Table F.6 Vulnerability as a Combination of Threat and Risk – Ground Water Supply Systems.

		Contam. Hazard:	Class A	Class A	Class B	Class B	Class C	Class C
		Likelihood of Release:	Unlikely	Unk/Known or Likely	Unlikely	Unk/Known or Likely	Unlikely	Unk/Known or Likely
		THREAT RATING:	MODERATE	HIGH	LOW	HIGH	LOW	MODERATE
System Integrity	**Setting Sensitivity**	**RISK RATING**						
Known/Unk. Problems	High[1] (Zone 1/Enhance.)	HIGH[1]	**HIGH**	**HIGH**	**HIGH**	**HIGH**	**HIGH**	**HIGH**
OK	High[1] (Zone 1/Enhance.)	HIGH[1]	**HIGH**	**HIGH**	**HIGH**	**HIGH**	MODERATE	**HIGH**
Known/Unk. Problems	High (Zone 1)	HIGH	**HIGH**	**HIGH**	MODERATE	**HIGH**	MODERATE	**HIGH**
OK	High (Zone 1)	MODERATE	MODERATE	**HIGH**	MODERATE	**HIGH**	LOW	MODERATE
Known/Unk. Problems	Mod.[2] (Zone 1/Slow.)	MODERATE[2]	MODERATE	MODERATE	LOW	MODERATE	LOW	MODERATE
OK	Mod.[2] (Zone 1/Slow.)	LOW[2]	LOW	MODERATE	LOW	MODERATE	LOW	LOW
Known/Unk. Problems	High[1] (Zone 2/Enhance.)	HIGH[1]	**HIGH**	**HIGH**	**HIGH**	**HIGH**	**HIGH**	**HIGH**
OK	High[1] (Zone 2/Enhance.)	HIGH[1]	**HIGH**	**HIGH**	MODERATE	**HIGH**	MODERATE	**HIGH**
Known/Unk. Problems	Mod. (Zone 2)	MODERATE	MODERATE	**HIGH**	MODERATE	MODERATE	MODERATE	MODERATE
OK	Mod. (Zone 2)	MODERATE	MODERATE	MODERATE	LOW	MODERATE	LOW	MODERATE
Known/Unk. Problems	Low[2] (Zone 2/Slow.)	LOW[2]	LOW	MODERATE	LOW	LOW	LOW	LOW
OK	Low[2] (Zone 2/Slow.)	LOW[2]	LOW	LOW	LOW	LOW	LOW	LOW
Known/Unk. Problems	Mod.[1] (Zone 3/Enhance.)	HIGH[1]	**HIGH**	**HIGH**	MODERATE	**HIGH**	MODERATE	**HIGH**
OK	Mod.[1] (Zone 3/Enhance.)	MODERATE[1]	MODERATE	**HIGH**	MODERATE	**HIGH**	MODERATE	MODERATE
Known/Unk. Problems	Low (Zone 3)	MODERATE	MODERATE	MODERATE	LOW	MODERATE	LOW	MODERATE
OK	Low (Zone 3)	LOW	LOW	MODERATE	LOW	MODERATE	LOW	LOW
Known/Unk. Problems	Low[2] (Zone 3/Slow.)	LOW[2]	LOW	LOW	LOW	LOW	LOW	LOW
OK	Low[2] (Zone 3/Slow.)	LOW[2]	LOW	LOW	LOW	LOW	LOW	LOW

[1] Corresponding preliminary rating (shaded) was increased one level due to the presence of factors that could enhance contaminant transport.
[2] Corresponding preliminary rating (shaded) was decreased one level due to the presence of factors that could slow contaminant transport.

Table F.7 Vulnerability as a Combination of Threat and Risk – Surface Water Supply Systems.

		Contam. Hazard:	Class A	Class A	Class B	Class B	Class C	Class C
		Likelihood of Release:	Unlikely	Unk/Known or Likely	Unlikely	Unk/Known or Likely	Unlikely	Unk/Known or Likely
		THREAT RATING:	MODERATE	HIGH	LOW	HIGH	LOW	MODERATE
System Integrity	**Setting Sensitivity**	**RISK RATING**						
Known/Unk. Problems	High (Zone 1 & Near)	HIGH	**HIGH**	**HIGH**	MODERATE	**HIGH**	MODERATE	**HIGH**
OK	High (Zone 1 & Near)	HIGH	MODERATE	**HIGH**	MODERATE	**HIGH**	MODERATE	MODERATE
Known/Unk. Problems	Mod. (Zone 2 & Near)	HIGH	MODERATE	**HIGH**	MODERATE	**HIGH**	MODERATE	**HIGH**
OK	Mod. (Zone 2 & Near)	MODERATE	MODERATE	**HIGH**	MODERATE	MODERATE	LOW	MODERATE
Known/Unk. Problems	Mod. (Zone 1 & Far)	MODERATE	MODERATE	**HIGH**	MODERATE	**HIGH**	LOW	MODERATE
OK	Mod. (Zone 1 & Far)	MODERATE	MODERATE	MODERATE	LOW	MODERATE	LOW	MODERATE
Known/Unk. Problems	Low (Zone 3 & Near)	MODERATE	MODERATE	**HIGH**	LOW	MODERATE	LOW	MODERATE
OK	Low (Zone 3 & Near)	LOW	LOW	MODERATE	LOW	MODERATE	LOW	LOW
Known/Unk. Problems	Low (Zone 2 & Far)	MODERATE	MODERATE	MODERATE	LOW	MODERATE	LOW	MODERATE
OK	Low (Zone 2 & Far)	LOW	LOW	MODERATE	LOW	MODERATE	LOW	LOW
Known/Unk. Problems	Low (Zone 3 & Far)	LOW	LOW	MODERATE	LOW	MODERATE	LOW	LOW
OK	Low (Zone 3 & Far)	LOW	LOW	MODERATE	LOW	LOW	LOW	LOW

PWS-2 PSOCs:

Unconfined Aquifer Well:

- Gas Station — *THREAT: Class A / Known = HIGH*
  RISK: Known Problems / Zone 1 & Near (High) = HIGH
  *VULNERABILITY: HIGH + HIGH = **HIGH***

- Septic Systems — *THREAT: Class B / Likely = HIGH*
  RISK: Known Problems / Zone 3 & Far (Low) = LOW
  *VULNERABILITY: HIGH + LOW = **MODERATE***

- Inactive Mine Site — *THREAT: Class B / Unlikely = LOW*
  RISK: Known Problems / Zone 2 & Far (Low) = MODERATE
  *VULNERABILITY: LOW + MODERATE = **LOW***

- Ag. Crop Areas — *THREAT: Class B / Unlikely = LOW*
  RISK: Known Problems / Zone 3 & Near (Low) = MODERATE
  *VULNERABILITY: LOW + MODERATE = **LOW***

- Landfill — *THREAT: Class B / Known = HIGH*
  RISK: Known Problems / Zone 3 & Near (Low) = MODERATE
  *VULNERABILITY: HIGH + MODERATE = **MODERATE***

- Transportation Corridor — *THREAT: Class B / Known = HIGH*
  RISK: Known Problems / Zone 2 & Near (Mod) = HIGH
  *VULNERABILITY: HIGH + HIGH = **HIGH***

- PWS-1 Treatment Plant — *THREAT: Class A / Likely = HIGH*
  RISK: Known Problems / Zone 1 & Near (High) = HIGH
  *VULNERABILITY: HIGH + HIGH = **HIGH***

Confined Aquifer Well:

- Gas Station — *THREAT: Class A / Known = HIGH*
  RISK: OK / Zone 3 & No Additional Factors (Low) = LOW
  *VULNERABILITY: HIGH + LOW = **MODERATE***

- PWS-1 Treatment Plant — *THREAT: Class A / Likely = HIGH*
  RISK: OK / Zone 3 & No Additional Factors (Low) = LOW
  *VULNERABILITY: HIGH + LOW = **MODERATE***

- Landfill — *THREAT: Class B / Known = HIGH*
  RISK: OK / Zone 2 & Factors Slowing Transport (Low) = LOW
  *VULNERABILITY: HIGH + LOW = **LOW***

• Truck Terminal *THREAT: Class B / Unlikely = LOW*
RISK: OK / Zone 3 & Factors Enhancing Transport (Mod) = (MODERATE)
VULNERABILITY: LOW + MODERATE = ***MODERATE***

Step 8. Determine the Susceptibility

The relative susceptibility of a water system to different categories of PSOCs and, therefore, to different classes of contaminants is determined by the outcomes of the vulnerability assessment. To illustrate the relative susceptibility of PWS-1 and PWS-2 to their respective PSOCs, the results of the vulnerability assessment were tabulated in two different ways. The first table (**Table F.8**) summarizes the outcomes by listing the number of vulnerability ratings for each contaminant hazard rating given to a PSOC, similar to the format presented for Table 5.10 (Section 5.6). Table F-8 summarizes the number of LOW, MODERATE, and HIGH vulnerability ratings that Class A, B, and C PSOCs in the different SWAAs received during the susceptibility analysis.

The second table (**Table F.9**) groups the number of vulnerability ratings by general PSOC category (e.g., commercial / industrial, agricultural / rural, etc.), in a format similar to Table 5.11 (Section 5.6). Table F.9 summarizes the number of LOW, MODERATE, and HIGH vulnerability ratings received by the different categories of PSOCs.

NARRATIVE SUMMARY OF SUSCEPTIBILITY STUDY

As discussed earlier in Section 5.6, once the susceptibility analysis was completed, the analysis would be narratively summarized in a general and concise manner. The narrative report should include brief discussions on the factors that impacted the analysis (i.e., contaminant hazards, likelihood of release, structural integrity of the PWS, and setting sensitivity) and the outcome of the susceptibility analysis. The State envisions presenting summary maps showing the distribution of PSOCs within the SWAA that received a HIGH and/or MODERATE vulnerability rating in the susceptibility analysis. Presumably, these would include the PSOCs of greatest concern (i.e., Class A and B). With respect to surface water system analyses (e.g., PWS-1 and PWS-2 (unconfined well)), the map would include PSOCs located within each PWS's area of responsibility and area of interest. For the area of responsibility, only PSOCs receiving a HIGH or MODERATE vulnerability rating would be shown. For the area of interest, only PSOCs receiving a HIGH vulnerability rating would be shown. Based on the summary tables and maps for the narrative report, general statements should be made about system susceptibility to classes of contaminants and contaminant sources, as well as identification of possible cumulative effects, if possible.

Table F.8 Summary of Vulnerabilities by Contaminant Class

CONTAMINANT CLASS	NUMBER OF VULNERABILITY RATINGS			
	Low	**Moderate**	**High**	**Total**
PWS-1:				
CLASS A	0	0	1	***1***
CLASS B				
With MCLs/MCLGs	1	0	0	***1***
Without MCLs/MCLGs	0	0	0	***0***
With & Without MCLs/MCLGs	0	1	0	***1***
CLASS C	0	0	0	***0***
TOTAL	***1***	***1***	***1***	***3***
PWS-2 (Unconfined Well):				
CLASS A	0	0	2	***2***
CLASS B				
With MCLs/MCLGs	3	0	0	***3***
Without MCLs/MCLGs	0	0	0	***0***
With & Without MCLs/MCLGs	0	2	0	***2***
CLASS C	0	0	0	***0***
TOTAL	***3***	***2***	***2***	***7***
PWS-2 (Confined Well):				
CLASS A	0	2	0	***2***
CLASS B				
With MCLs/MCLGs	0	1	0	***1***
Without MCLs/MCLGs	0	0	0	***0***
With & Without MCLs/MCLGs	1	0	0	***1***
CLASS C	0	0	0	***0***
TOTAL	***1***	***3***	***0***	***4***

Table F.9 Summary of Vulnerabilities by Contaminant Source Class

CONTAMINANT CATEGORY/ Source	**NUMBER OF VULNERABILITY RATINGS**			
	Low	**Moderate**	**High**	**TOTAL**
PWS-1:				
COMMERCIAL / INDUSTRIAL:				
Gas Station	0	0	1	***1***
Mining (Inactive Site)	1	0	0	***1***
RESIDENTIAL / MUNICIPAL				
Septic Systems	0	1	0	***1***
PWS-2 (Unconfined Well):				
COMMERCIAL / INDUSTRIAL:				
Gas Station	0	0	1	***1***
Mining (Inactive Site)	1	0	0	***1***
RESIDENTIAL / MUNICIPAL:				
Landfill	0	1	0	***1***
Septic Systems	0	1	0	***1***
Transportation Corridor	0	0	1	***1***
Wastewater Treatment Plant (PWS-1)	0	0	1	***1***
AGRICULTURAL / RURAL:				
Agricultural Crop Areas	1	0	0	***1***
PWS-2 (Confined Well):				
COMMERCIAL / INDUSTRIAL:				
Gas Station	0	1	0	***1***
Trucking Terminal	0	1	0	***1***
RESIDENTIAL / MUNICIPAL				
Landfill	1	0	0	***1***
Wastewater Treatment Plant (PWS-1)	0	1	0	***1***

It is the intent of the State to make the narrative reports a concise summary of the SWAP assessment process. Most of the focus of the report will be on summarizing the results of the susceptibility analysis. To that end, detailed discussions on how vulnerability ratings were derived for each PSOC will not be provided in the report, as this will only serve to overwhelm the reader with voluminous information. Depending on the size of the PWS, we would anticipate the text of the narrative reports to be approximately 10 to 20 pages long, excluding the table of contents, tables and figures.

The State is proposing the following report outline that should be considered when doing the narrative report for a public water system. A brief discussion is presented below on the ancillary information that might be considered and included in each section of the narrative reports.

EXECUTIVE SUMMARY (1 - 2 pages)

A concise summary on the results of the susceptibility analysis. The Executive Summary will be required for all PWSs, and will be posted on the SWAP web site in all cases. In the case of community water systems, the State will ensure that the summary is provided to the PWS for the purpose of including it in the Consumer Confidence Report (CCR) that each community water system is required to supply to its customers. In addition, the summary (and CCR) will contain information on how and where the public can obtain the complete assessment report. The PWS is free to utilize the summary in their CCR or provide a summary of their own that at least covers the information provided in the State's summary.

INTRODUCTION (2 - 3 pages)

Purpose of SWAP Assessment

A brief boiler plate discussion on why the SWAP assessment is being performed.

Components of SWAP Assessment

A brief boiler plate description of the four phases of the assessment process (i.e., public participation, delineation, contaminant inventory and susceptibility analysis) that would help to provide the framework for the discussion of the susceptibility analysis results.

SWAP ASSESSMENT RESULTS (8 - 16 pages)

SWAA(s) Delineation Results

Short, concise discussion (1 - 2 pages) on the methodology used to define the SWAA(s) for the PWS. In the case where a PWS might have multiple intakes/diversion structures (e.g., a transbasin water system) or multiple wells completed in multiple aquifers (such as PWS-2), discussion of the SWAA(s) should be tailored accordingly. A reference should be made to the accompanying figure(s) showing the resulting SWAA(s).

Contaminant Inventory Results

Short, concise discussion (2 - 4 pages) on the methodology employed to identify and locate PSOCs within the SWAA(s). The discussion should briefly describe the different categories of PSOCs (e.g., commercial / industrial, etc.) and classes of contaminants (i.e. Class A, B, or C) that were inventoried. The discussion should not get into a detailed description of the each individual PSOC and each individual contaminant that might have been inventoried, as there may be tens or hundreds of PSOCs in a given SWAA. A reference should be made to the accompanying figure(s) showing the resulting SWAA(s) and the PSOCs receiving HIGH and/or MODERATE vulnerability ratings.

Susceptibility Analysis Results

A concise discussion (6 - 10 pages) on the methodology, the factors impacting the analysis, and the outcome of the analysis. A brief introductory "boiler plate" discussion (1 page) should be presented on the eight step process that was used in the susceptibility analysis that establishes a framework for the public to understand the susceptibility analysis process.

Threat and Risk Factors Affecting Analysis

Brief discussion (2-3 pages) describing the threat factors (contaminant hazard and likelihood of release) and the risk factors (system integrity and setting sensitivity) that affect the vulnerability ratings and the methodology for assessing each factor. With respect to the threat factors, the discussion might focus on the relative types and numbers of contaminant hazards, and the degree to which the PSOCs are in compliance and/or protective/preventative measures and best management practices are or are not being utilized within the SWAA to reduce the likelihood of release. Likewise, with respect to the risk factors, the discussion might focus on briefly summarizing the structural integrity of the PWS intake(s), diversion structure(s), or well(s), as well as a concise discussion on the relative density of PSOCs within each sensitivity zone and/or the geologic or man-made factors that are affecting the analysis. Again, The discussion should not get into a detailed description of the threat and risk factors associated with each individual PSOC that might have been inventoried, as there may be tens or hundreds of PSOCs in a given SWAA.

Outcome of Susceptibility Analysis

Concise discussion (3-5 pages) on the results of the susceptibility analysis. Using the summary tables and maps, general statements should be made about the susceptibility of the water system to different classes of contaminants (i.e., Class A, B, and C) and to different categories of PSOCs (e.g. commercial, industrial, agricultural, etc.). The discussion might also provide general statements on PSOCs known to have released contaminants to surface or ground water. In the cases where historical sewer line discharges have been a problem within the SWAA and where non-point sources of contamination are suspected but not easily identifiable or attributable to a cause, the discussion should focus briefly on the relative susceptibility of the PWS to these sources. This way, the PWS and the public will be aware that these sources exist and that their water supply may be susceptible to these sources. With respect to these discussions, reference should be given to the accompanying summary tables and map(s) showing the distribution of PSOCs receiving a HIGH or MODERATE vulnerability rating.

Colorado Department
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