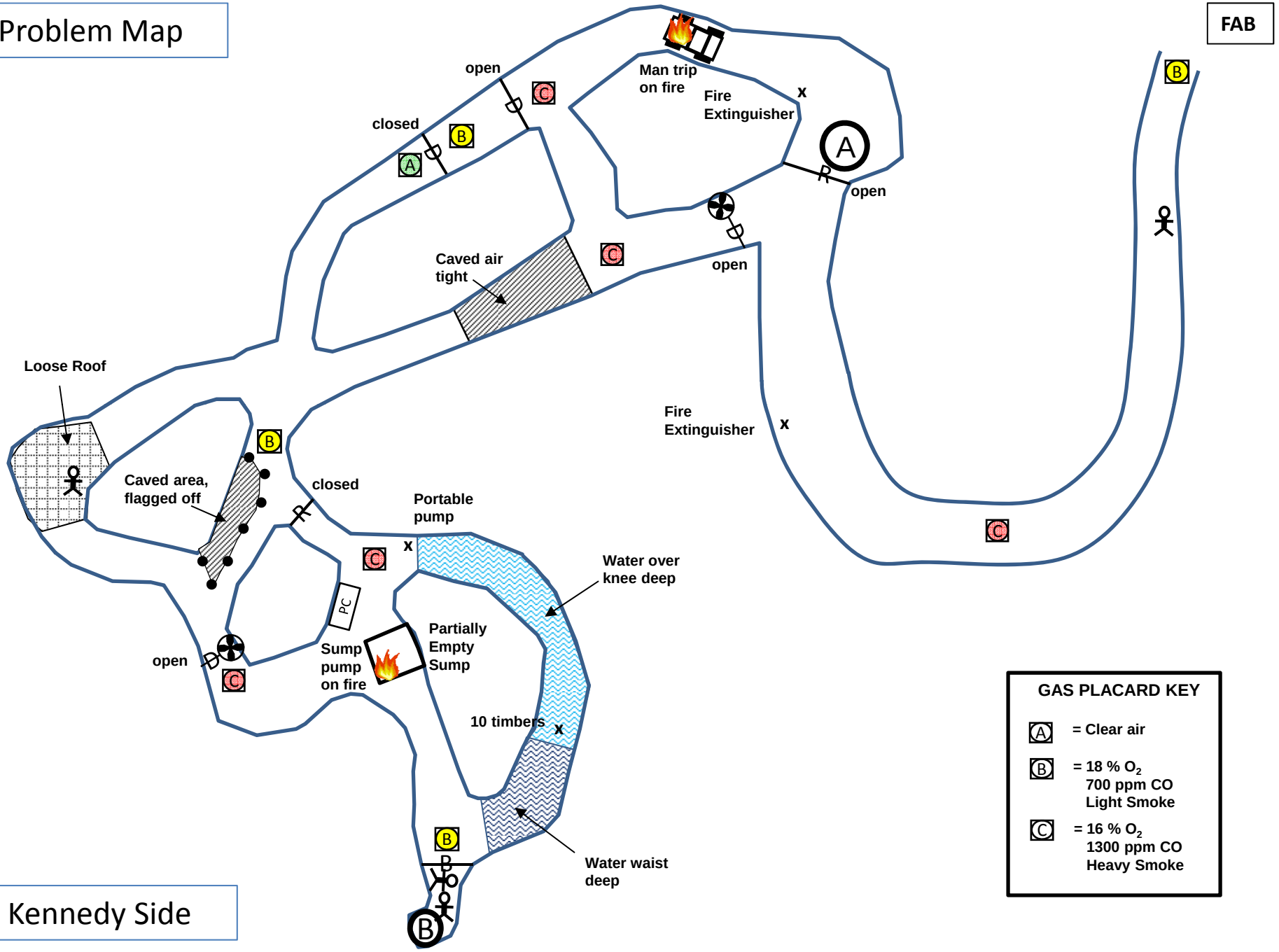
Problem Map

FAB

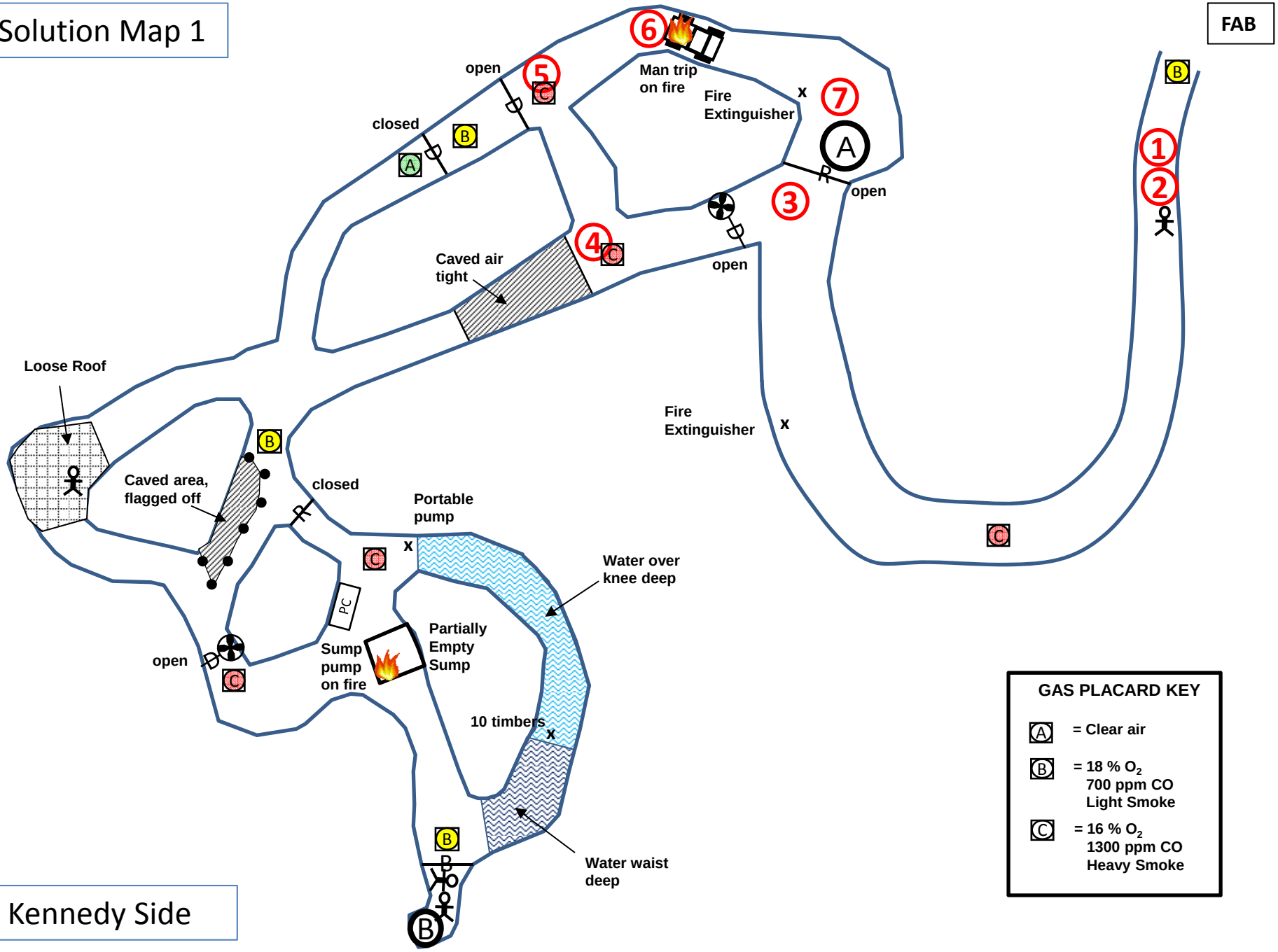


GAS PLACARD KEY

- A = Clear air
- B = 18 % O_2
  700 ppm CO
  Light Smoke
- C = 16 % O_2
  1300 ppm CO
  Heavy Smoke

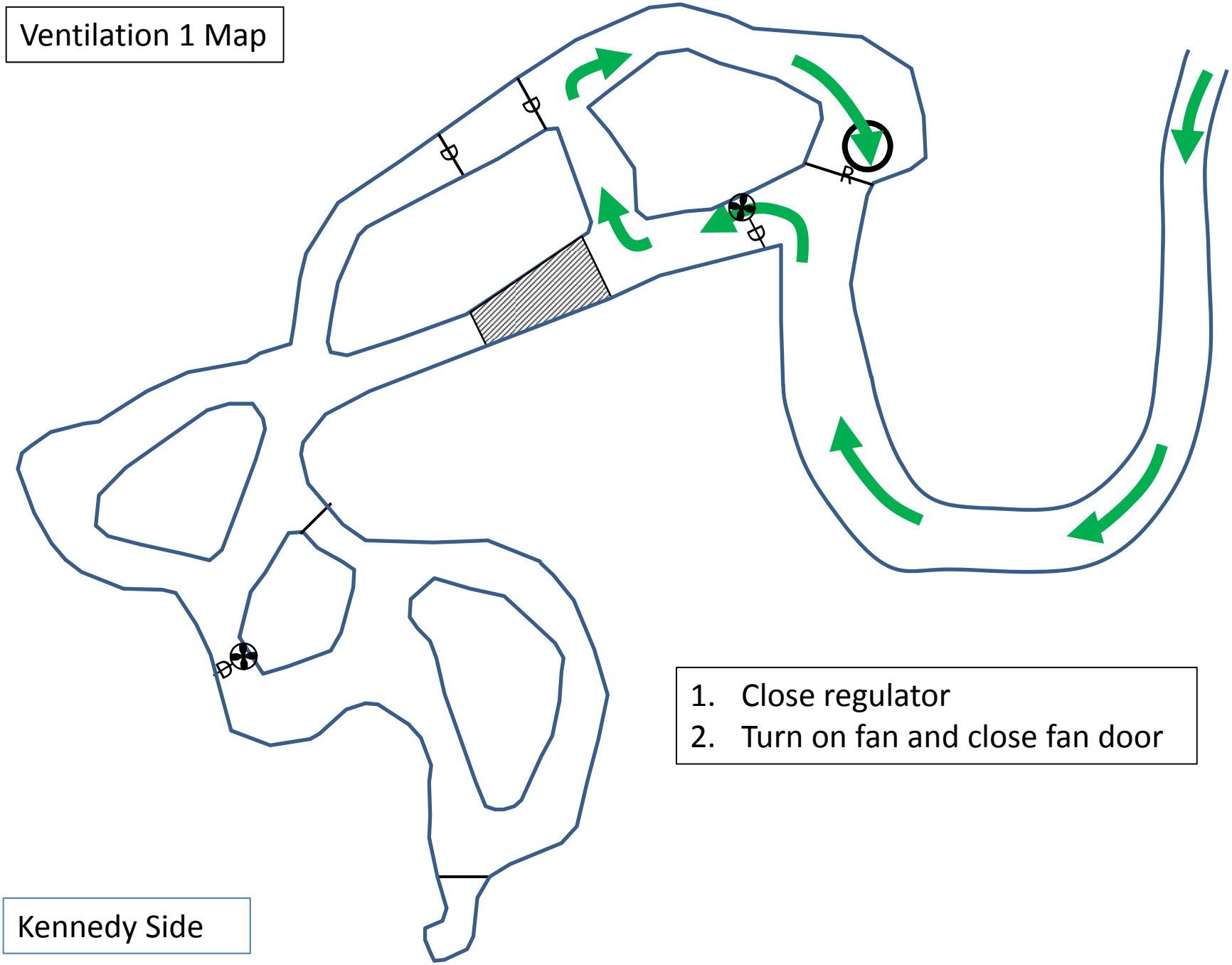
Kennedy Side

Solution Map 1



Kennedy Side

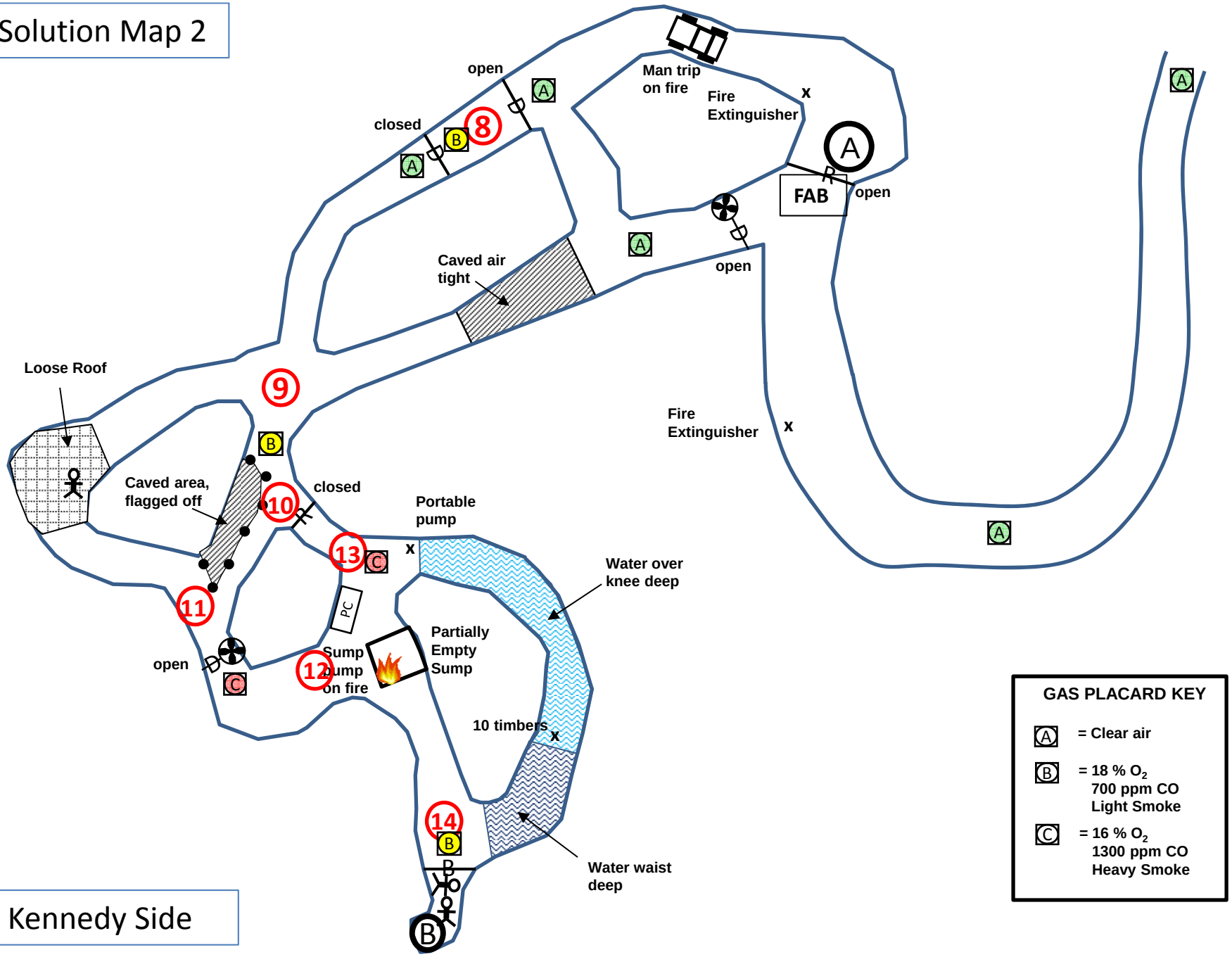
Ventilation 1 Map



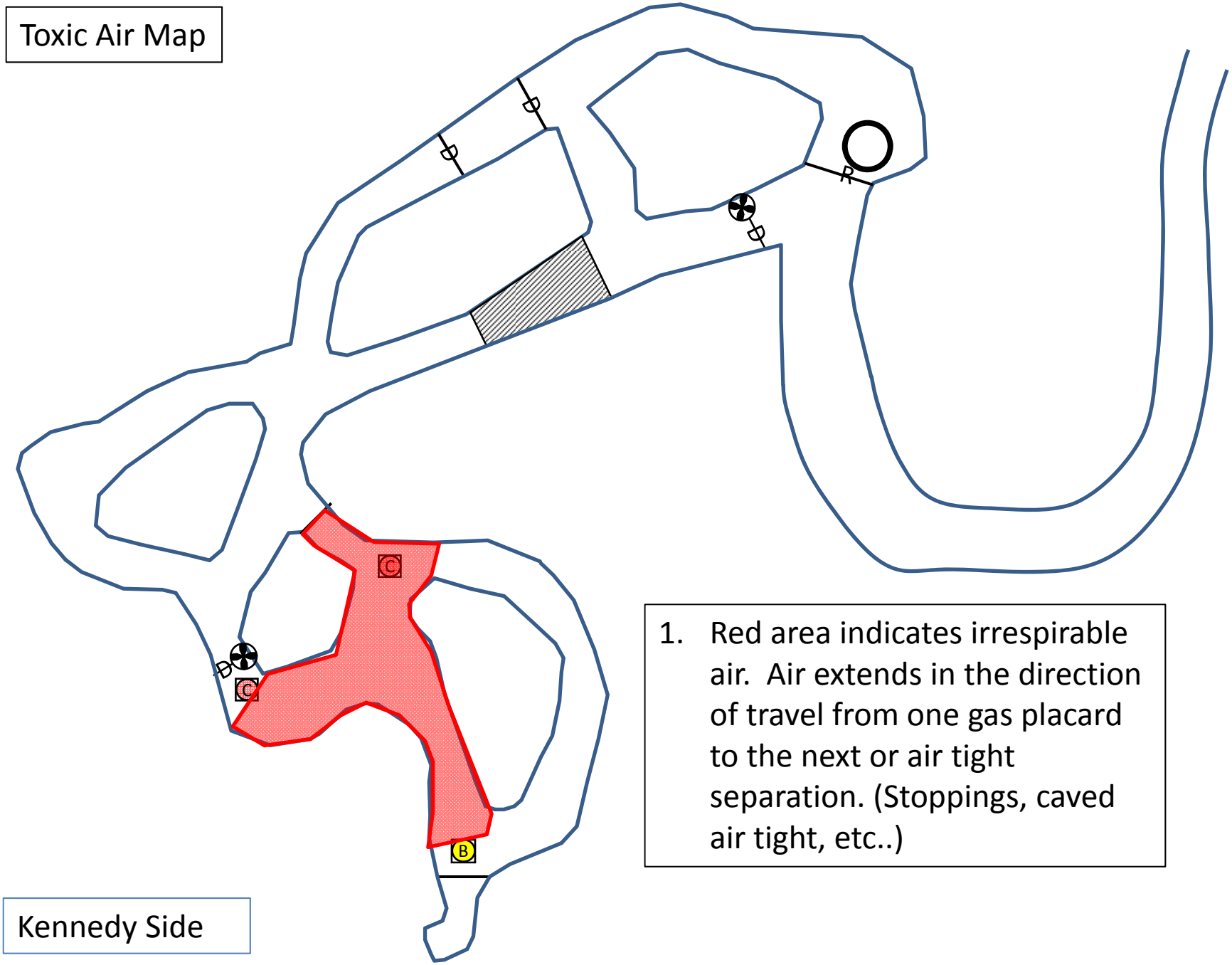
1. Close regulator
2. Turn on fan and close fan door

Kennedy Side

Solution Map 2



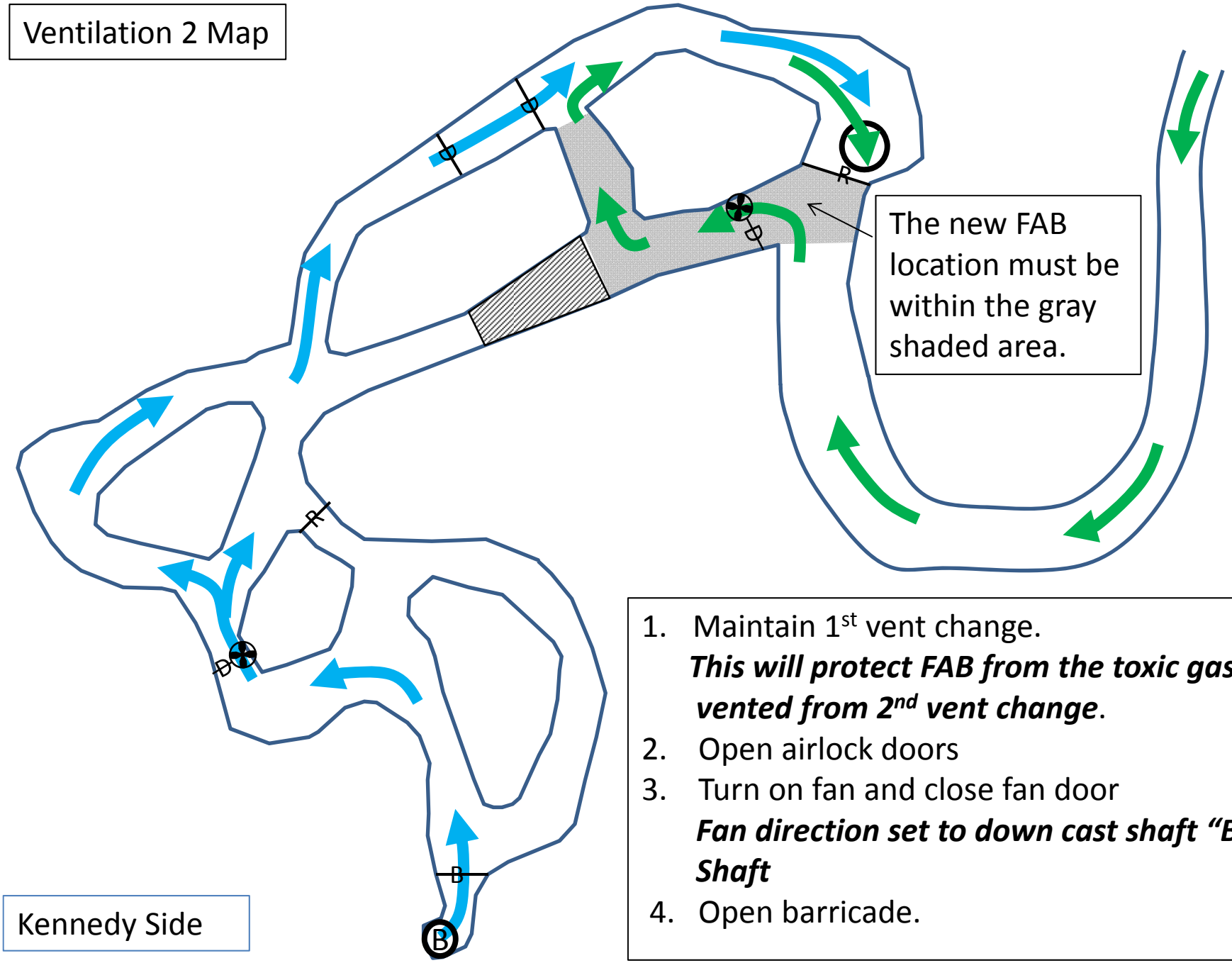
Toxic Air Map



1. Red area indicates irrespirable air. Air extends in the direction of travel from one gas placard to the next or air tight separation. (Stoppings, caved air tight, etc..)

Kennedy Side

Ventilation 2 Map

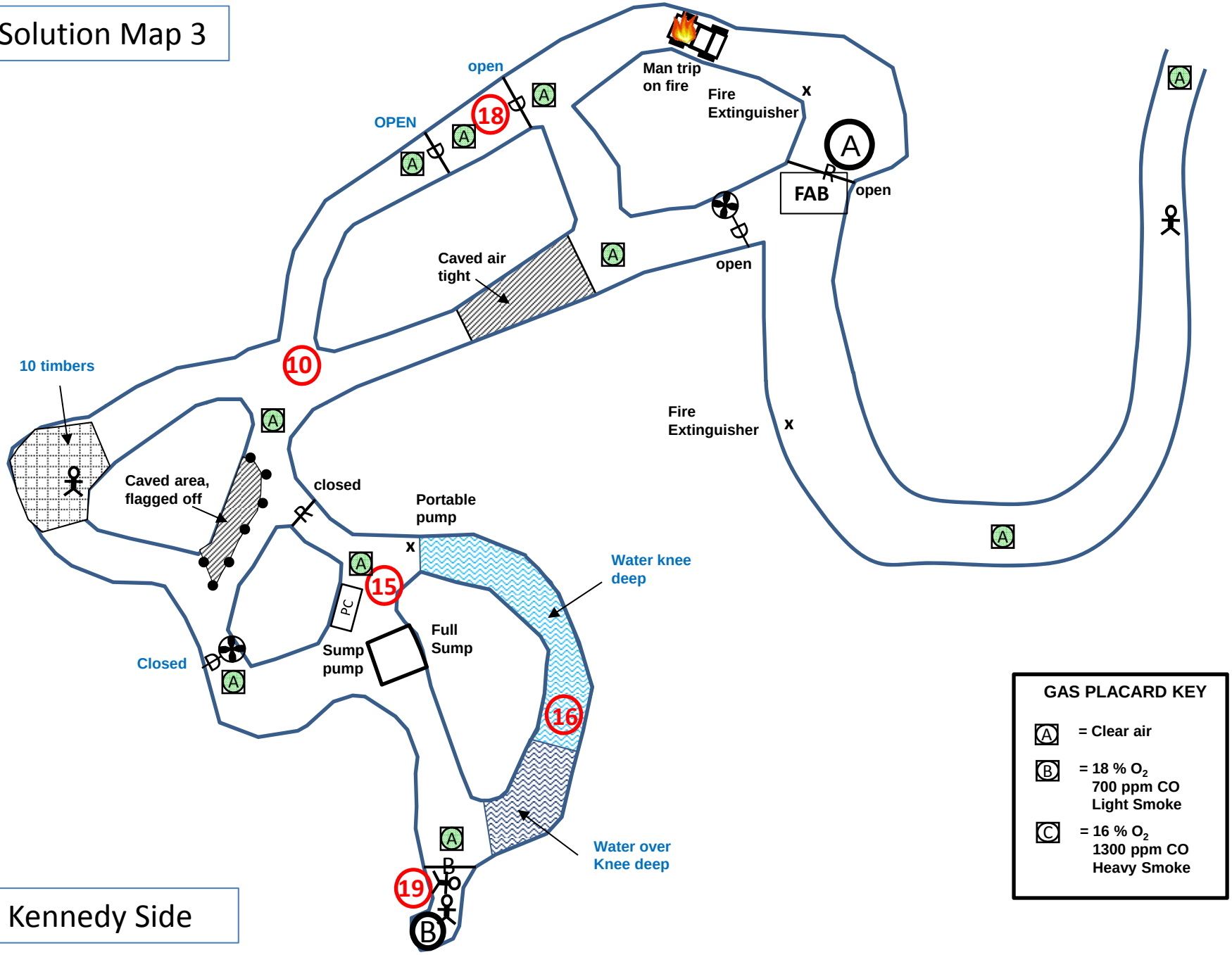


The new FAB location must be within the gray shaded area.

1. Maintain 1st vent change.
   This will protect FAB from the toxic gases vented from 2nd vent change.
2. Open airlock doors
3. Turn on fan and close fan door
   Fan direction set to down cast shaft "B" Shaft
4. Open barricade.

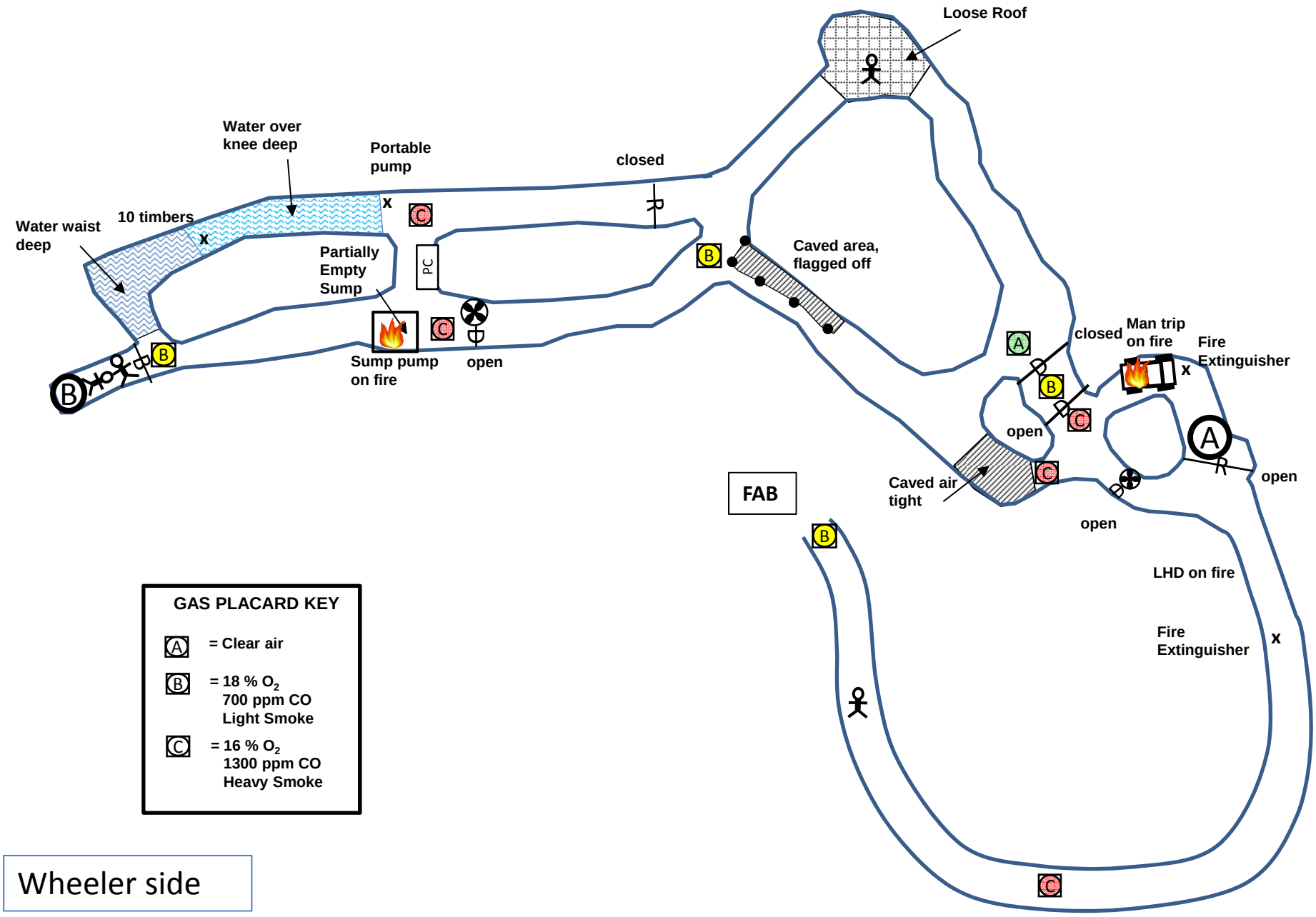
Kennedy Side

Solution Map 3



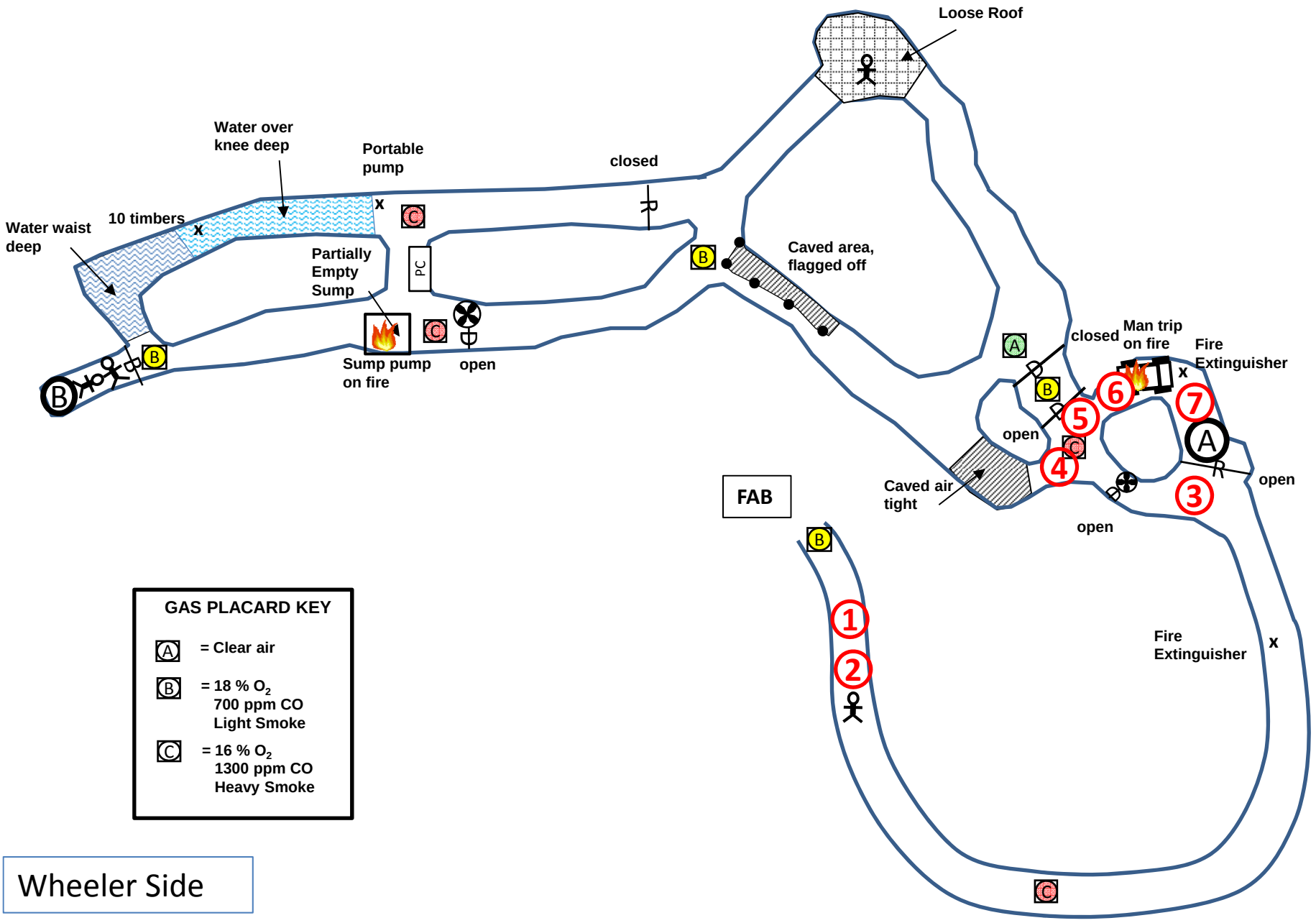
Kennedy Side

Problem Map



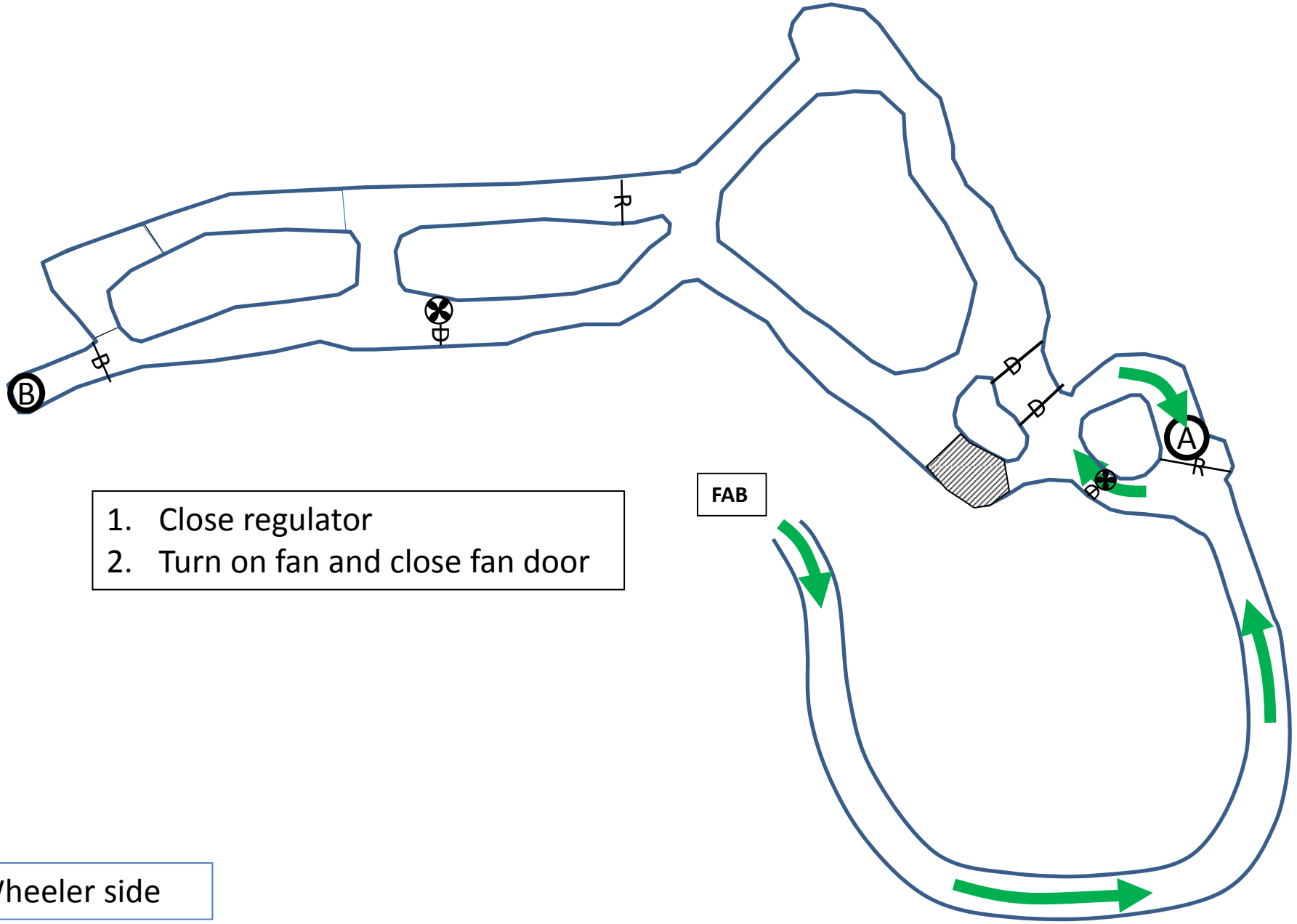
Wheeler side

Solution Map 1



Wheeler Side

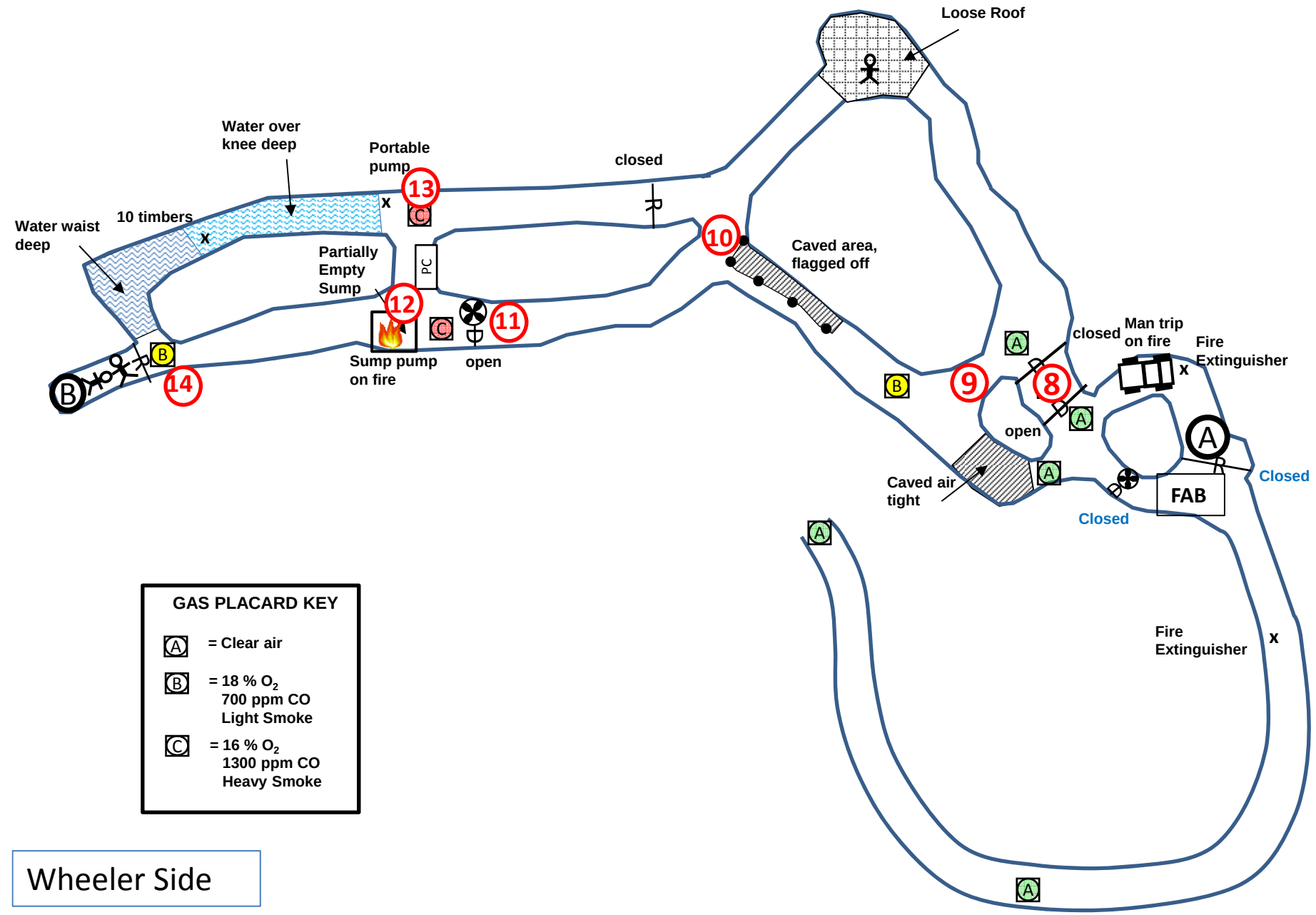
Ventilation Map 1



1. Close regulator
2. Turn on fan and close fan door

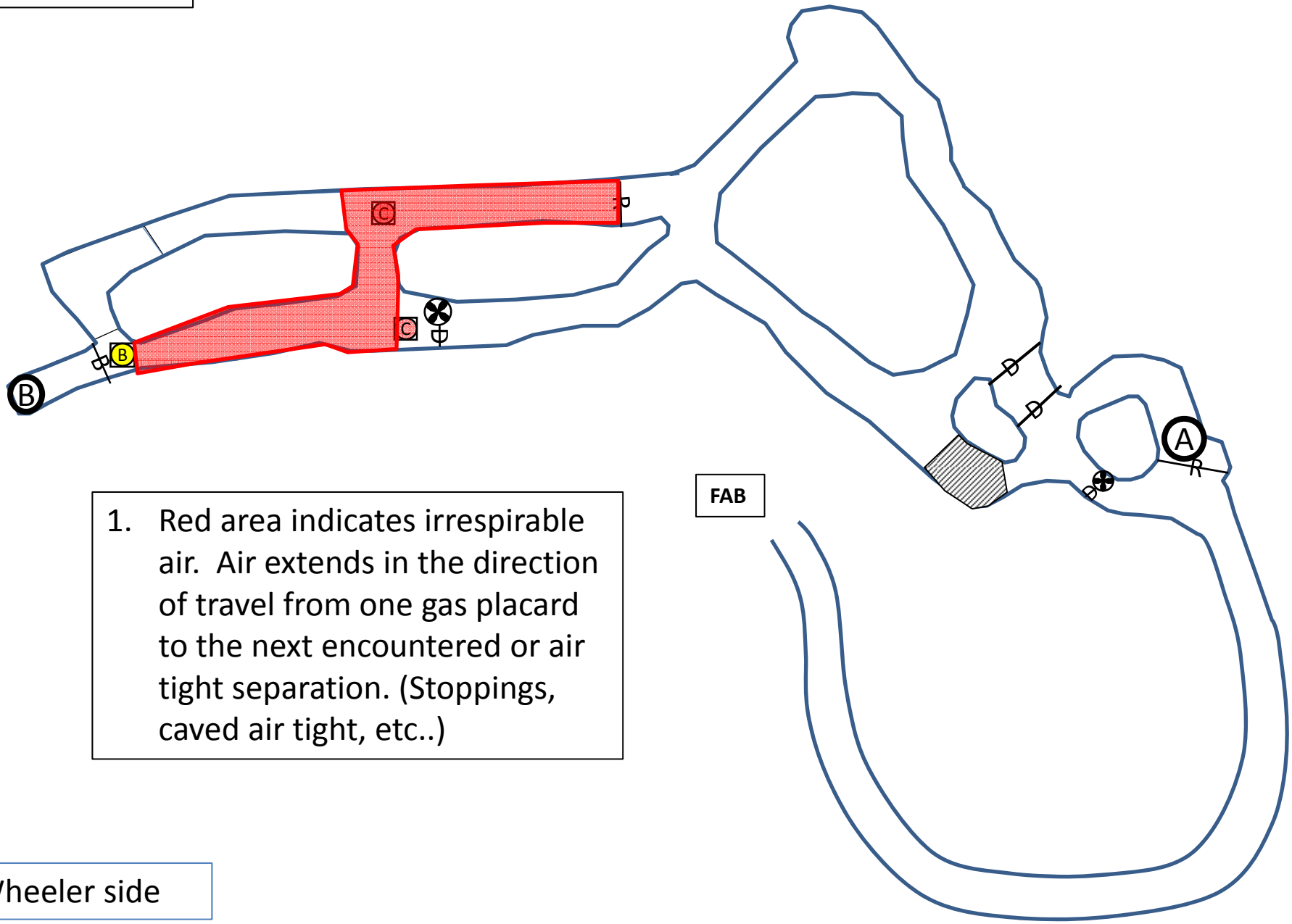
Wheeler side

Solution Map 2



Wheeler Side

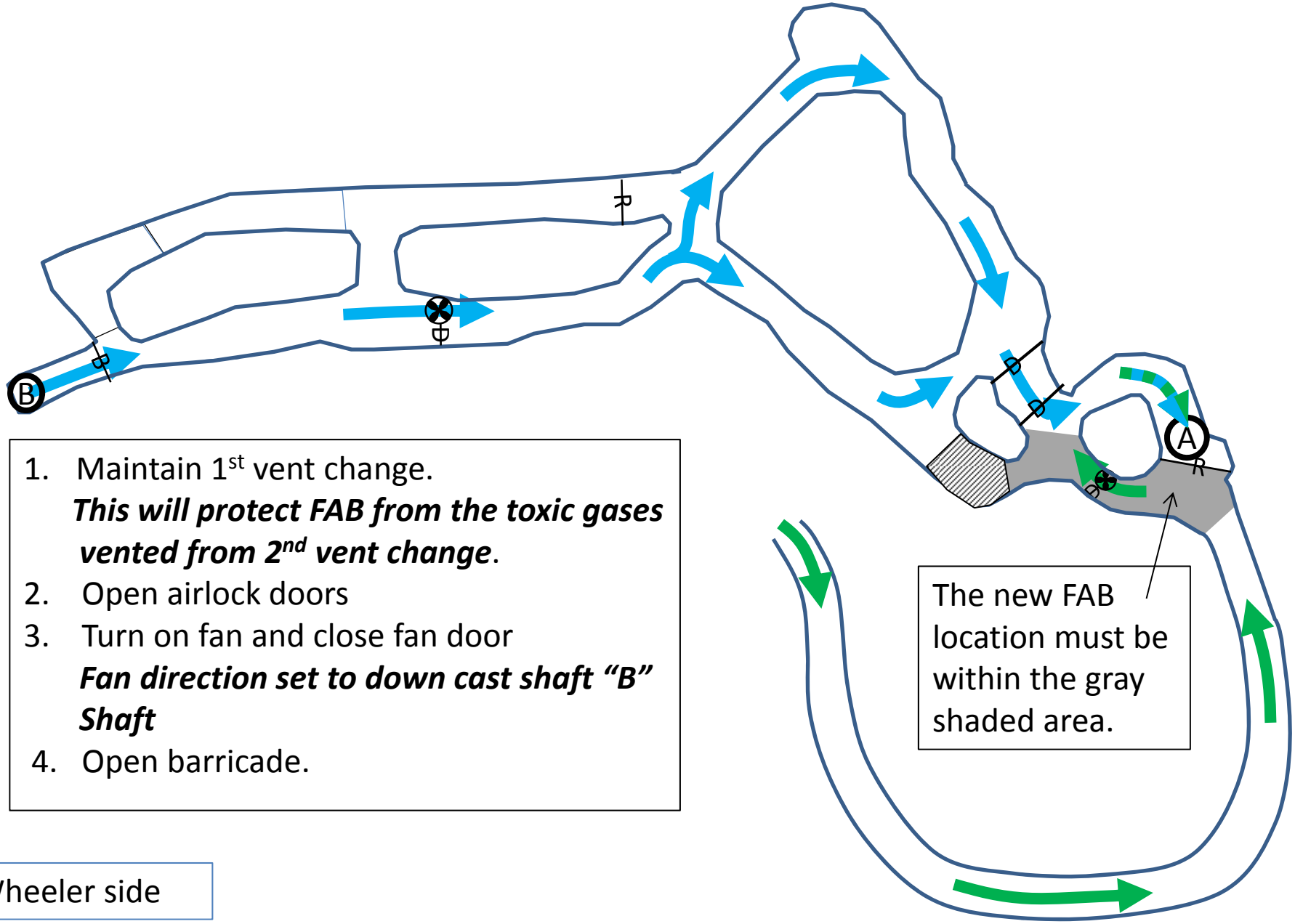
Toxic Air Map



1. Red area indicates irrespirable air. Air extends in the direction of travel from one gas placard to the next encountered or air tight separation. (Stoppings, caved air tight, etc..)

Wheeler side

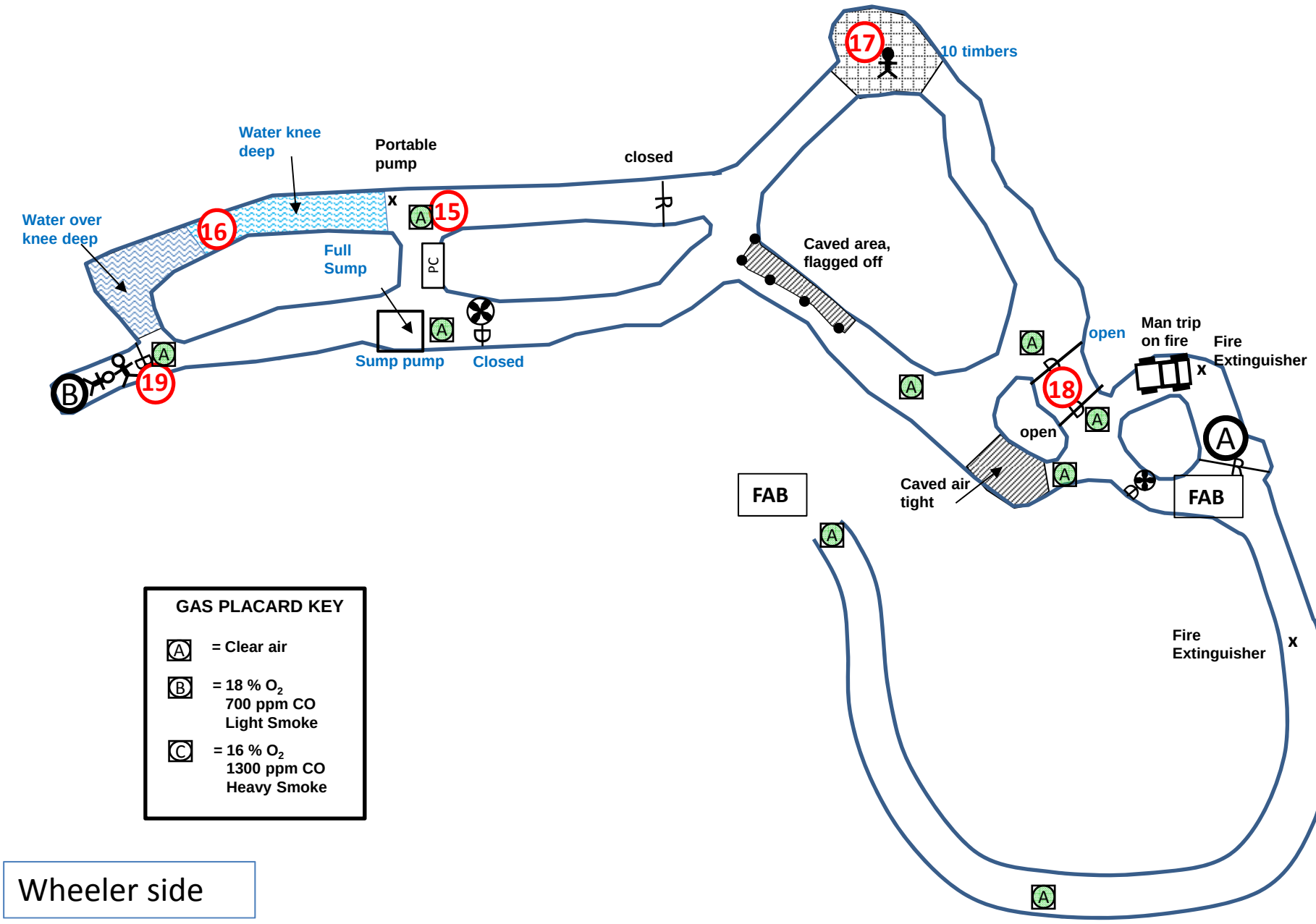
Ventilation Map 2



1. Maintain 1st vent change.
   This will protect FAB from the toxic gases vented from 2nd vent change.
2. Open airlock doors
3. Turn on fan and close fan door
   Fan direction set to down cast shaft "B" Shaft
4. Open barricade.

Wheeler side

Solution Map 3



Wheeler side

Missouri Mine Rescue Contest
Rolla, MO
September 26, 2013

MINE INFORMATION

BACKUP TEAM(S)	Two backup teams are on-site at this time.
EXPLOSIVES	Explosives are available and stored on the surface.
ELECTRICITY	A 4160 Volt power line enters the mine by way of a lined borehole. The line feeds a non-permissible power center and supplies power to the main fan in the mine.
GAS	The mine has a non-gassy mine classification (Category VI). Occasionally, traces of methane are found.
GUARDS	Guards have been placed at each mine shaft and are monitoring the air quality at both locations.
GEOLOGY	The mine is located in Southeast Missouri. The carbonate-hosted lead-zinc ore deposit is classified as the Mississippi Valley Type (MVT). The ore deposit is important and a highly valuable concentration of lead and zinc sulfide ore hosted within carbonate (limestone, marl, dolomite) formations and which share a common genetic origin. This ore body ranges up to 0.5 million tons of contained ore and has a grade of between 4% combined lead and zinc to over 14% combined lead and zinc. The ore body has approximately 125' of overburden and undulates from 5' to 8' in depth. Only a small portion (Approximately 1000' long) of the ore body has been developed.
MATERIALS	All materials to work the problem are located underground or on the surface at the fresh air base and are identified by placards.
MINE MAPS	The mine map was last updated on September 12, 2013.
MINING METHOD	The mine was developed with the standard room and pillar method. Conventional drilling and blasting methods will be used when production begins.
MINING EQUIPMENT	Only small LHDs and jackleg drills are used to assist in the rehabilitation of this mine.

NOTIFICATION	All federal, state, and local officials have been notified.
OPENINGS	The mine has 3 openings: • A 700' long slope acts as the main entrance to the mine for men and materials. The slope was developed on a 17% grade with an average width of 10 feet and height varying for 7 to 10 feet. • Shaft "A" is a 10' diameter shaft acting as the main return airway for the mine. The shaft also incorporates a portable hoist with 2 man bullet for the mines secondary escape way. Currently the hoist is down for repairs but will be available in the next few weeks. • Shaft "B" is the newest mine opening, developed last month. The 4' diameter shaft was developed to assist in ventilation and can be utilized as an up cast or downcast airway.
PHONES	There are no phones in the mine. Communication is conducted by use of radios.
ROOF SUPPORT	Point-anchor resin bolts are used in varying lengths for primary roof support. Wooden posts are used for secondary support.
VENTILATION	Two 48-inch diameter Joy axi-vane fans are used to ventilate the mine. • One fan is located near the bottom of the slope and is operated in the blowing mode. This fan acts as the main fan induces approximately 20,000 CFM into the mine from the slope and is returned out the "A" shaft. This fan is NOT reversible. The fan controls are located underground near the fan. • The second fan is located farther in the mine. This fan is also capable of ventilating approximately 20,000 CFM of air into the mine. This fan is reversible and portable. The fan can easily be moved and set up within a few hours.
WATER	The mine pumps approximately 500 gallons of water daily. There is a main sump with a high pressure water pump (100 GPH) operating at the sump. Smaller portable pumps are used throughout the mine as water is pumped to the main sump and then out of the mine.

Missouri Mine Rescue Contest
Rolla, MO
9/26/2013

TEAM BRIEFING

You have arrived at the Easy LZ Mine, an underground Lead-Zinc mine that is owned and operated by the Acme Mining Company. The mine was developed in the late 1950's and is currently being rehabilitated for future mining.

The mine is a single level operation which has 3 openings. The slope is the main entrance to the mine for men and materials. There are 2 shafts developed for ventilation. Shaft "A" is also used as a secondary escapeway but currently the portable hoist is inoperable.

The mine currently operates two 8-hour shifts, which run from 6:00 a.m. to 2:00 p.m. and 3:00 p.m. to 11:00 p.m., five days per week. The rehabilitation work is performed by a small 4 man crew on each shift. Work entails construction, roof support and pumping water. The mine anticipates beginning production within a few weeks.

At 6:00 a.m. today, the regular 4 man crew and Supervisor Joe Black began work at the Easy LZ Mine. Black conducted an on shift inspection of the mine and then went to the surface office to fill out the examination books and to order supplies for the week. At approximately 8:00 a.m., Black received a broken message on the radio from one of the underground miners about a fire. He looked out the window and noticed smoke coming from the "A" shaft. Black attempted to make contact with the miners below but no one acknowledged his call. Black ran down the slope but quickly retreated when smoke became too thick to see. A call was made to MSHA and the State Mines and Minerals office. They have arrived and have set up a command center. We also have EMT and ambulance service available if needed.

Currently there are guards protecting and monitoring the mine openings. The entrance to the slope has light smoke. The "A" shaft has light smoke as well coming out. The "B" shaft is clear air. Gas readings are being taken but we do not have the results as of yet. The fans are OFF at this time. Power underground is ON.

There are 2 back up teams available but one team's apparatus have not arrived yet. We are asking rescue teams to only take one spare apparatus into the mine to explore and leave any additional ones you may have to help equip the 2nd spare team. If a situation arises that would require you to have additional breathing units the command center will make the determination to either supply you with the units or change your team out with a backup team. Also if you have any brattice material (curtain, pogo sticks, and frames) available, the command center is asking that you leave that behind as well. The mine is very low on building supplies so a rationing of brattice material will be necessary.

If you are ready and willing, the services of your mine rescue team are needed. Your team will be the first to enter the mine. We want you to map all accessible areas of the mine, account for the four missing miners, and bring any survivors to the fresh air base. The mine manager will be in charge. He will stay at the fresh air base and report your progress to the command center.
GOOD LUCK!

TEAM INSTRUCTIONS

1. Extinguish or seal any fires
2. Account for the four (4) missing miners
3. Bring any live miners to the FAB
4. Explore and map all accessible areas of the mine

FRESH AIR BASE INSTRUCTIONS

- Only one attendant or alternate will be allowed to assist at the fresh air base. This person can assist the team and answer any questions the team may ask. However, this person cannot physically assist the team beyond the fresh air base.
- The fresh air base attendant and mine rescue team alternate are not allowed to speak to anyone during the working of the problem except their team members and the mine manager.
- The fresh air base attendant will maintain voice communications with the team utilizing a portable, hard wire system. The assistant may listen in with a separate headset. The assistant will be able to interact with the team only when they are at the fresh air base.
- After the team has completed their 50 foot check, the teams will not be allowed to physically compare the team map with the fresh air base map. When teams are at the FAB, the map man and FAB attendant will not make changes (edits) to their maps. **DO NOT HAVE WRITING INSTRUMENTS IN YOUR HANDS AT FAB.**

Missouri Mine Rescue Contest
Rolla, MO
9/26/2013

PROBLEM SOLUTION

Solution Map 1 (Team Stops 1-7)

FAB
Teams will want to examine the shaft opening but will not be allowed to. Only the slope opening is available to the teams.

Team Stop 1
Teams will advance into the mine. Members will count off going into the mine and smoke. Teams will make their first team check within 50' of the slope opening with all members underground.

Team Stop 2
Teams will see and hear injured miner #1 at approximately 60' from the mine opening. Teams must complete their first team check prior to reaching the victim or be discounted for the infraction. The victim is suffering from smoke inhalation. The victim will be able to walk out. Teams will need to conduct a first and secondary assessment on the victim using BSI. (Change BSI before touching other victims)

Team Stop 3
Teams will examine and take gas readings at entry 1 and at regulator (open). Although the regulator is open, "A" shaft is very close to the opening of the regulator. Any attempt to go through the regulator will result in team endangerment to members getting under the shaft opening. Teams will see the fan and fan controls in entry 1. The door is open and the controls are in the off position. Teams will have passed a fire extinguisher. They can pick it up and use it as needed.

Team Stop 4
Teams will advance through the fan door to the next intersection. They will find caved impassable in entry 1 with the cross-cut right open. Gas tests and will be made at the caved air tight and open x-cut.

Team Stop 5
Teams will advance to entry 2 where they will find an airlock door open and inby door closed. Inside the airlock the will find air is at a respirable level. Gas tests and D&I will be conducted at required areas.

Team Stop 6
Teams will come to a burning mantrip. It will take 1 fire extinguisher to extinguish the fire.

Teams Stop 7
Teams will advance to "A" shaft. They will find another fire extinguisher (they can pick it up). At this point the mine manager will inform the team that their communication cable has reached its limit. Teams may advance through the airlock doors to the next intersection but will not be able to travel any further.

At this time teams will have to advance the FAB in order to continue exploring the mine. Before the FAB is advanced, the toxic gases outby the caved airtight and airlock will need to be ventilated. ***See Vent Map 1.***

Teams will first get permission from the command center to change ventilation in the mine. Teams will:

- close the regulator door
- close the fan door
- Turn on the fan. *Teams will be required to have UG power turned on at surface for fan power.*

This will clear all the irrespirable outby the caved air tight and airlock.
Note*: the "B" gas placard does not clear in between the airlock doors*.

Teams will be required to advance the FAB to approximately the first intersection (bottom of the slope) to allow enough communication cable to complete the problem.

Teams must upon re-entering areas cleared of gases make gas checks at all required locations: openings, dead ends, etc.

Solution Map 2 (Team Stops 8-14)

Team Stop 8
Teams will stop in the airlock, close the outby door and open the inby door maintaining air separation. They will take gas checks and note the clear air placard.

Team Stop 9
Teams will advance to the next intersection. Teams will find light smoke with CO and lower O2 levels. They will examine the loose roof in entry 2 and tie back the caved airtight in entry 1. Gas tests, D&Is and roof checks should be conducted accordingly.

Team Stop 10
Teams will advance to the next intersection where they will find a regulator with the door closed. They will also encounter a caved area timbered off. The area is wide enough to pass through (3') but teams must be careful in passing. Stepping into the timbered off area will result in team endangerment. Teams will tie in the back side of the loose roof on this stop *(on Wheeler side*).

Team Stop 11
Teams will advance to the fan with door open. Through the door, teams will find an irrespirable air placard. Teams will tie in the back side of the loose roof on this stop *(on Kennedy Side).*

Team Stop 12
Teams will encounter a pump on fire at the mine sump. It will take 1 fire extinguisher to extinguish the fire. Teams will examine the power center. The power center is off, breakers to the sump pump; portable pump and fan are all open (off).

Team Stop 13
Teams will advance to the adjacent intersection to find water over knee deep and a portable pump located at the edge of the water. They will also find the back side of the regulator closed.

Team Stop 14

Teams will advance towards “B” shaft where they will find a stopping with regulator closed acting as a barricade. When they knock on the regulator miners #2 and #3 will answer. Victim statement: ***“We are doing well and have no injuries. We have an air shaft back here and it is supplying us with fresh air”.*** Teams will also see the water waist deep adjacent to the barricade. The air in front of the barricaded regulator is respirable. Teams may open the regulator door to get to the victims and examine the barricaded area. *(Known conditions behind barricade, no change in ventilation if door opened)*. Teams only have one apparatus and can only take out one victim at this time. If teams request an additional apparatus, they will be told it will take 1 hour to make one available *(too long of time)*. Teams should recognize that they will have to ventilate the irrespirable air before both victims are rescued. The victim(s) should be left in the barricaded area with the door closed while teams explore in areas that are irrespirable while setting up a ventilation change.

Solution Map 2 (Team Stops 15-19)

Team Stop 15

Teams will advance back to the portable pump. Teams will need to turn on the power center and close the portable pump breaker. After the pump has been on for 15 seconds the water over knee deep placard will be flipped to water knee deep.

Team Stop 16

Teams will advance into the water knee deep and find 10 timbers. The area marked water waist deep will be changed to water over knee deep and will not be examined.

Team Stop 17

Teams will **retrea**t back to the loose roof. The 10 timbers will be enough support the area and reach miner #4. The miner was alive but will be dead when teams reach this victim. At this time all miners are accounted for the second ventilation.

Team Stop 18

Open airlock doors. If the outby fan was turned off, teams should call out to the FAB to reestablish the first ventilation change.

Team Stop 19

As teams advance to the barricade teams should turn on the 2nd fan (blowing toward “A” shaft) and close the fan door. When the barricade is opened the travelway out of the mine will be vented free of toxic gases allowing for an open face retreat. As the team retreats, gas tests will need to be conducted at openings where ventilation has been cleared upon re-entering the areas.

There are 2 important elements to consider when ventilating the barricade.

- *Protecting the FAB*
  The FAB must be placed outby the toxic air flow from the second ventilation change. The FAB must be in the gray shaded area (**see Vent Map 2**). Also the first ventilation change must be maintained. The pressure from the 1st fan will act as a barrier and ensure the toxic gases ventilated from the 2nd ventilation change do not exhaust out the slope direction over the FAB.
- *Protecting the miners behind the barricade*.
  "B" shaft must down cast. It is imperative that the timing of the second ventilation steps do not allow the air to initially up cast. An up cast will occur if the barricade is opened with the 1st ventilation maintained, the airlock doors open and the second fan not blowing air toward shaft "A". Also if the air lock doors are open and the inby or second fan is blowing air toward shaft "B" when the barricade is opened will result in an initial up cast in "B" shaft. Air initially up casting in "B" shaft moves the toxic gases outby the barricade over the victims behind the barricade, endangering them.

Teams will first get permission from the command center to change ventilation in the mine. Teams will:

- Maintain the 1st ventilation change.
- Open the airlock doors
- Set the second fan to pull air from "B" shaft (downcast).
- Turn on the fan and close the door at the fan
- Open the barricade.

The toxic air in front of the barricade will be ventilated by air down casting "B" shaft through the 2nd fan and out "A" Shaft".