WATER SUPPLY PROCEDURES MANUAL

MECHANICSVILLE VOLUNTEER FIRE DEPARTMENT

December 2003

FOREWORD

The content of this document is the result of the recommendations made by Charles H. Donaldson during his work as a consultant to the Mechanicsville Volunteer Fire Department. Donaldson submitted a survey report which contained extensive recommendations on the equipment and procedures to use to conduct water supply operations. Development of new procedures and techniques has proceeded over the years and incorporated in this manual as our water supply capabilities have increased. This latest update incorporated changes in procedures enabled by the addition of new apparatus and equipment and the retirement of older equipment.

Joseph R. Guyther, Jr.
November 2003

INTRODUCTION

The first due area of the Mechanicsville Volunteer Fire Department encompasses the Fifth and portions of the Fourth and Sixth election districts of St. Mary's County. The area can be characterized as rural/residential with clustered commercial areas distributed throughout the district. There are several municipal-type water systems serving specific commercial, institutional or residential areas. Adequate and reliable water supply static sources for fire fighting purposes also exist in most parts of the area. When sufficient apparatus and manpower respond quickly to the scene of a fire and the procedures outlined in this manual are utilized, the Mechanicsville Volunteer Fire Department is capable of mounting an effective fire attack.

Much of the area where significant development is occurring has central water with fire hydrants. All new commercial construction in non-hydrant areas must provide a National Fire Protection Standard 1142 compliant water supply on site. The remainder of the area will require tanker shuttle or relay pumping operations from remote sources. Some of the developing areas are on the waterfront that will allow drafting operations.

The transport of water at serious fires will almost always consist of one of three types of operations: hydrant operations, relay operations or tanker shuttle operations. In rare instances
the utilization of two of these techniques may be required in sequence or even simultaneously. Hydrant operations are usually only limited by the capacity of the hydrant and can easily exceed 1000 gpm. Relay operations generally supply from 750 gpm to 1000 gpm depending upon the length of the lay and the size of the hose used. An effective water shuttle operation can supply 500 gpm or more.

The availability of pumpers with 1250 or 1500 gpm pumps equipped with large diameter hose (LDH), along with readily available tankers with folding tanks, has given the department the capability to move major volumes of water. Utilization of this equipment provides the flexibility to transport water by hose lines or tank vehicles.

PURPOSE

The purpose of this document is to provide a description of the standard procedures and operations to be utilized by the Mechanicsville Volunteer Fire Department to train and to conduct large scale water supply operations. The document also contains organizational structures to maintain an effective water supply capability. Specific techniques related to optimizing water supply operations are contained in the appendices. The document provides the necessary information to enable the Mechanicsville Volunteer Fire Department to utilize its existing equipment to mount an effective water supply operation during major fires throughout its first due area.

The procedures portion in this manual deals primarily with water shuttle operations. Hydrant and relay operations are not covered in detail. Maryland Fire and Rescue Institute Pump Operator Training provides some instruction in these operations and every pump operator is required to take this training before becoming an assigned driver. The reader should keep in mind that although water shuttle operations are emphasized in this manual, hydrant operations or relay operations are the preferred methods of obtaining water for fire fighting where their use is feasible. Water shuttles over distances less than one half mile are probably not an efficient utilization of the pumpers, pumper-tankers and water supply units available in Southern Maryland. Their large diameter hose load and pump capacity can readily be put to better use in a relay operation. If a large scale water supply operation is called for and a relay using one to three relay pumpers (3000 feet or less from source to fire) is possible, that is the preferred alternative.

Chapter 1

STANDARD OPERATIONAL PROCEDURES

A. WATER SOURCE:

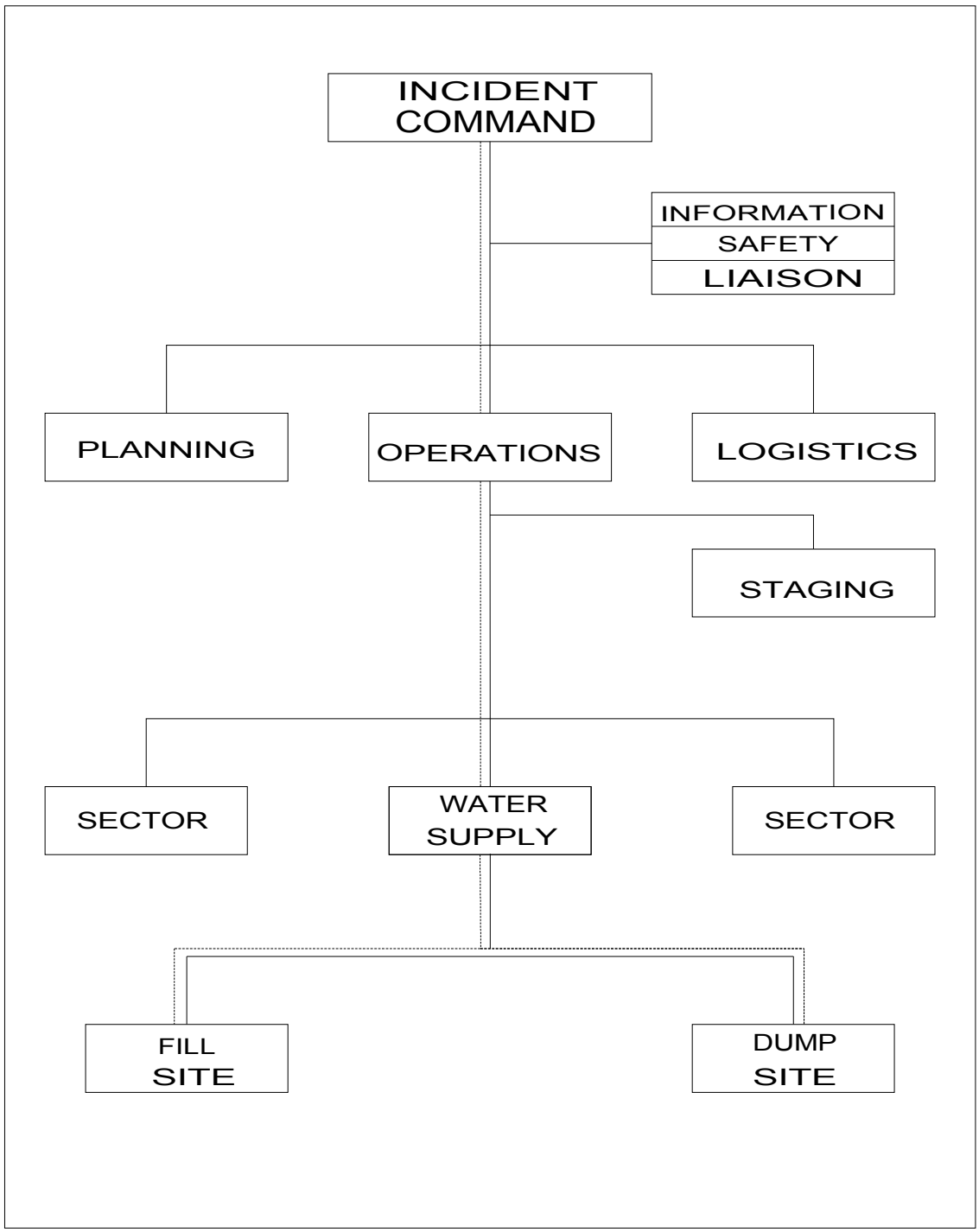
During water supply operations the nearest hydrant or designated standard water source listed in the FIRE DEPARTMENT WATER SUPPLY book will be utilized unless the incident commander designates an alternate source. Fire officers should be familiar with the locations of the source sites listed and their characteristics.

B. WATER SUPPLY COMMAND:

The officer riding in the right seat of the first tanker (Tanker 2, Engine 24 or Engine 224) shall automatically assume the duties of incident **Water Supply Officer** (WSO) until relieved of that assignment by a higher ranking officer or the incident commander. The water supply officer will normally be stationed at the dump site or the incident command post.

The use of the Incident Command System (ICS) dictates that the water supply officer will not take direct command of the fill site or dump site but will assign these as sector commands under his control and supervision. Figure 1 shows the water supply command structure when sufficient manpower is available to staff the required positions.

Normally the officer on Engine 21 will assume command of the fill site. The dump site command will usually fall under the command of the officer on the supply pumper at the scene.



Command Structure

Figure 1

C. Apparatus Assignments:

1. Engine 23:

a. Hydrant Areas – Engine 23 will lay from a hydrant to the fire scene utilizing the Humat valve.

b. Non-hydrant Areas – Anytime that Engine 23 leaves the public roadway a supply line will be laid. The Humat will be utilized as a siamese for the water shuttle apparatus.

2. Engine 24:

a. Hydrant Areas – Engine 24 will pump Engine 21's supply line by hooking up to the Humat valve. If not needed for the above, it will be utilized as directed by the incident commander.

b. Non-hydrant Areas – Engine 24 will initially supply Engine 23 by pumping the supply line through the Humat valve. Engine 24 or Tanker 2's crew will set up the folding tank or tanks. When empty, E-24 will proceed to the designated fill site. If the fire is minor in nature (single room and contents) and no folding tank operations are planned, Tanker 2 or Engine 24 may act as a nurse tanker.

c. Daytime Response – Engine 24 will assume Engine 23's assignment and Tanker 2 and the next due tanker will supply Engine 24.

3. Tanker 2:

a. Hydrant Areas – No assignment.

b. Non-hydrant Areas – Tanker 2 will initially hook up to the supply line Humat valve and pump its water to Engine 23. Crew will simultaneously set up this unit's folding tank if required. When empty, this unit will go to the designated fill site for refill.

c. Daytime Response – Tanker 2 will perform Engine 24's assignment.

4. Engine 21:

a. Hydrant Areas – In hydrant areas Engine 21 will take the nearest hydrant and pump Engine 23's Humat. If supply lines are not laid or a split lay is required, E-21 will lay the necessary lines to the nearest hydrant.

b. Non-hydrant Areas – Engine 21 will proceed to the

designated water supply site nearest the incident and set up at that location, unless directed otherwise by the Incident Commander. For designated Target Hazards, Engine 21 will respond to the preplanned fill site and set up as prescribed by the Water Supply Preplan.

5. Brush 2:

a. Hydrant Areas – No assignment.

b. Non-hydrant Areas – Brush 2 will set up fill site sector command at Engine 21's gated wye manifold to provide communications and coordination of tanker fill operations, lighting during night time operations and personnel shelter during inclement weather.

6. Next Available Engine:

a. When the folding tank has been set up, the next available engine will set up to draft from the folding tank using the low level strainer and dump site kit adapters as required. Since the **second** arriving engine will often be assigned as an attack unit in support of Engine 23, the folding tank draft assignment will usually be filled by the **third** arriving engine. E-21 and E-24 are not candidates for this assignment unless another unit has already taken their primary assignment.

b. Upon obtaining draft the crew will connect a supply line to the Humat and proceed to pump to Engine 23 through the Humat.

7. Next Arriving Tanker or Pumper-Tanker:

a. Operate same assignment as Tanker 2.

8. If Engine 21 Fails To Respond:

a. The next two available engines (if none are enroute an additional two engines will have to be called) are assigned as follows; one as a draft engine and the other as the fill site engine. The fill site engine will act in the place of the large gated manifold carried on Engine 23 in order to maintain the 1000 gpm fill rate objective with two fill lines deployed. It will pick up the draft engine's supply line and deploy two fill lines (3 inch or LDH).

9. Engine 224.

a. In Station 22's first due area, E-224 will always be the first unit out on structural fires.

b. Hydrant Areas – Engine 224 will lay from a hydrant to

the fire scene utilizing the Humat valve.

b. Non-hydrant Areas - Anytime that Engine 224 leaves the public roadway a supply line will be laid. The Humat will be utilized as a siamese for the water shuttle apparatus until the supply pumper is set up on the folding tank, the tank is filled and a supply line attached to the Humat is charged.

10. Engine 222

a. Hydrant Areas - Engine 222 will pump Engine 224's supply line by hooking up to the Humat valve. If not needed for the above, it will be utilized as directed by the incident commander.

b. Non-hydrant Areas - Engine 222 will attach a 4 inch LDH line to Engine 224's Humat valve and act as the supply pumper once the folding tank(s) are set up and filled.

11. Laying Directly to Draft:

a. When a hose line is to be laid directly to a draft site, tankers or pumper tankers will supply Engine 23 while the Engine 21 or other available engines complete the layout.

b. Empty pumper-tankers may be used to complete the layout if needed, and to pump in relay once draft is obtained.

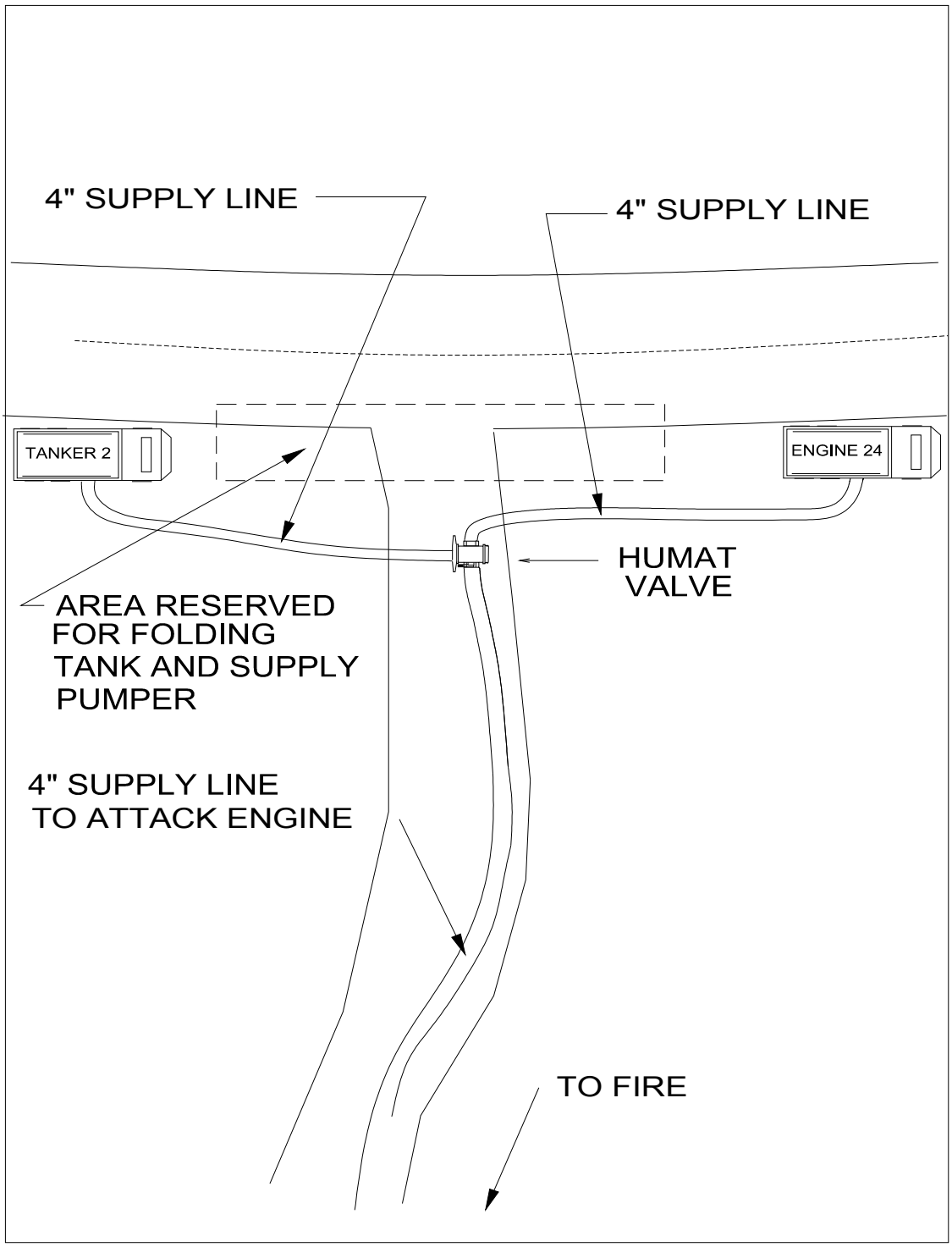
12. Water Supply 5: Water Supply 5 can perform any assignment given to any pumper in the above. These assignments include, set up a drafting operation from the portable tank, set up a primary or secondary fill site draft or lay a supply line to the nearest water site.

D. Initial Set Up (Non-hydrant Areas):

The proper initial set up of the water supply operation is essential for two reasons; (1) the water supply requirements are most critical during the first few minutes of the attack, and (2) it is difficult or impossible to build upon a poor set up. With the normal response of Engine 23, Tanker 2 and Engine 24, it is possible to provide a continuous flow of 500 gpm or more for up to 10 minutes. Engine 23 will drop the Humat and lay a supply line from the public highway. Engine 21 will respond to the nearest water source and set up a draft. Engine 24 and Tanker 2 will utilize the Humat valve as a clapper valve siamese to allow two feeder lines to supply the single 4 inch supply line to Engine 23. The advantage of using the clapper valve feature of the Humat is the ability to switch supply lines from one supply to another without shutting down, clamping or

removing the Humat feeder lines. This SOP allows use of both 2 1/2 inch couplings or 4 inch Stortz couplings to feed the Humat valve, thus maintaining compatibility with LDH and 3 inch supply line couplings. It leaves in place two feeder lines for pick up by incoming tankers until the dump tank with a supply pumper is ready to receive the first dump load and allows the transition to the supply pumper without interrupting the supply to Engine 23.

The supply line set up as shown in Figure 2 will provide an uninterrupted flow of water to Engine 23, minimize parking congestion, and leave space to set up the folding tank(s) and the supply pumper.



Initial Water Supply Operation

Figure 2

1. Tanker 2 or Engine 24:

a. Pull approximately 40 feet short or past the Humat valve drop site.

b. Supply the Humat intake by pulling the 4 inch preconnect and attaching it to the Humat or pull the 2 1/2 inch crosslay preconnect line and use the 2 1/2 inch X 4 inch Stortz adapter to attach to the 2 1/2 inch male to the Humat valve.

c. When the first arriving water supply unit is empty, the second unit picks up the supply by throttling up to pressure just as the first unit runs out of water. The pump should already be in gear at idle.

d. When empty, leave the 2 1/2 inch or the 4 inch feeder line connected to the Humat, disconnect the line at the apparatus, and respond to the assigned fill site.

e. Daytime Response – If Engine 24 is the attack pumper, Tanker 2 supplies Engine 24's Humat as above using the 4 inch. Once set up, rig a 3 or 4 inch supply line to the Humat for the next incoming tanker.

3. Next in Tanker(s):

a. Pick up the first available feeder line.

b. Charge the line as soon as the on scene supply tanker runs out of water.

c. Respond to the fill site when empty.

4. Next Available Engine:

a. Set up in the space between the feeder lines laid by Engine 24 and Tanker 2 as described above. The folding tank(s) from Engine 24 and/or Tanker 2 should be in position.

b. Pick up one of the 4 inch feeder lines to the Humat when ready to take over as supply pumper. If not an LDH engine use the 2 1/2 inch female to Stortz adaptor.

Chapter 2

WATER SHUTTLE OPERATIONS

The key to a water shuttle operation is **TO RIGOROUSLY MINIMIZE THE TIME THAT WATER SHUTTLE APPARATUS ARE IDLE.** A water shuttle operation is meant to move water. Water shuttle apparatus that are not moving are not contributing to the process.

The procedures contained in this chapter are directed toward maximizing the water flow by minimizing non-movement time of the water shuttle apparatus (e.g. hooking and unhooking, backing and turning). This task is accomplished by establishing a **dual** dumping and filling capability.

A. DRAFT OPERATIONS

The draft site operation will normally consist of Engine 21 laying from the designated manifold drop site to a nearby source of water and setting up a drafting operation to fill the water shuttle apparatus. In most cases the water source will be one of the preplanned supply points contained in the FIRE DEPARTMENT WATER SUPPLY book. This operation will require a driver and an assistant to lay out and set up. Figure 3 shows a typical set up for a draft site situation.

1. Draft Site Set Up:

The following procedure will be followed when the draft site is accessible to the water supply engine:

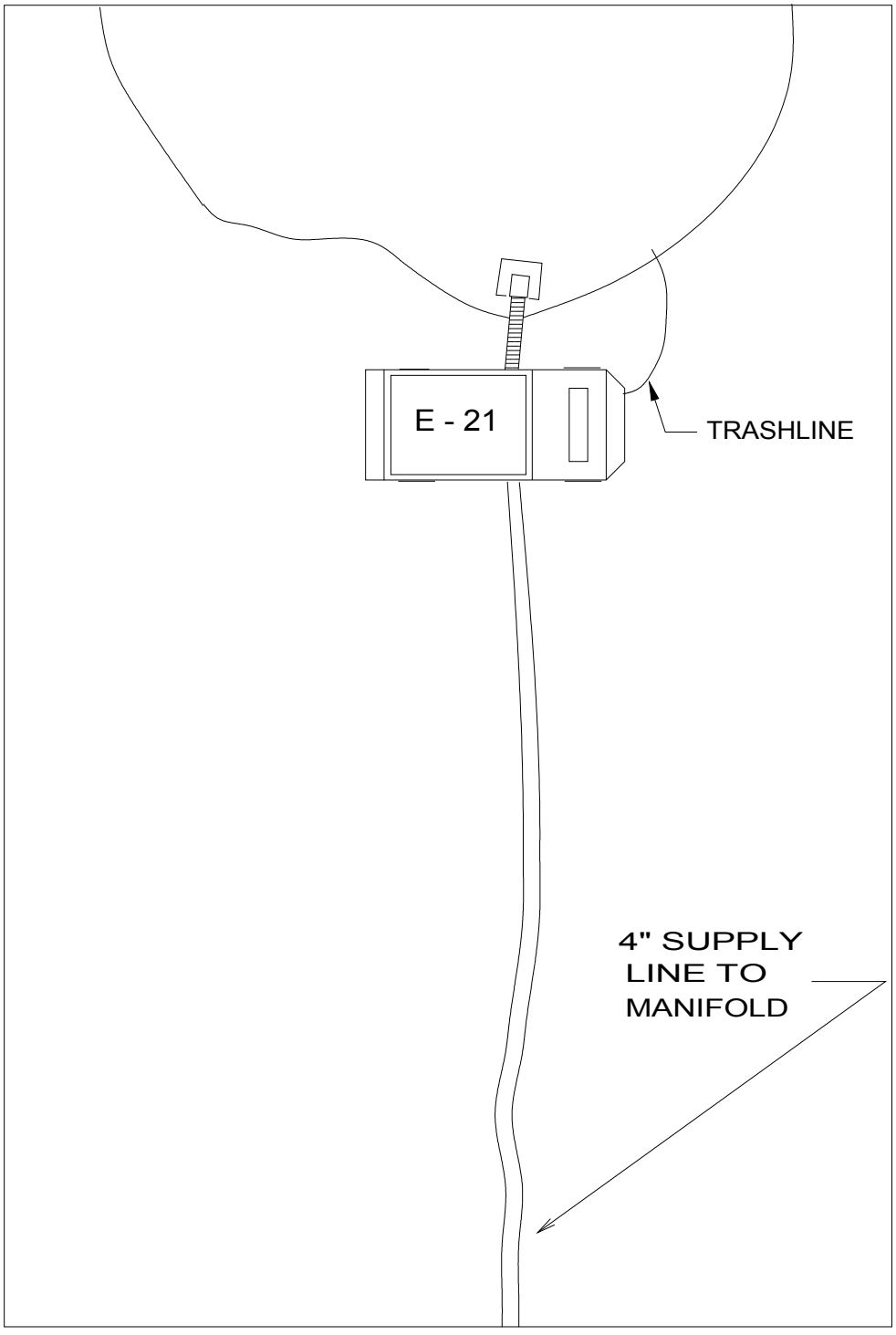
a. Identify closest draft site while enroute.

b. Stop at the designated fill site and drop the two lengths of 3 1/2 inch hose, the manifold and the fill site kit.

c. Layout 4 inch hose from the designated fill site to the water source.

d. Set up draft and charge the supply line. Pump the line at 150 psi **discharge** pressure.

e. Operate the trash line to maintain adequate pump cooling.



Fill Site Pumper at Draft

Figure 3

B. HYDRANT OPERATIONS

All hydrants have the capacity to fill tankers without the use of a pumper. However, using Engine 21, Water Supply 5 or any other available pumper will increase the fill rate, reduce hookup times and minimize tanker manuvering. Figure 4 shows a typical set up for this situation. The following procedure will be used when a hydrant is the water supply source.

1. Hydrant Site Set Up:

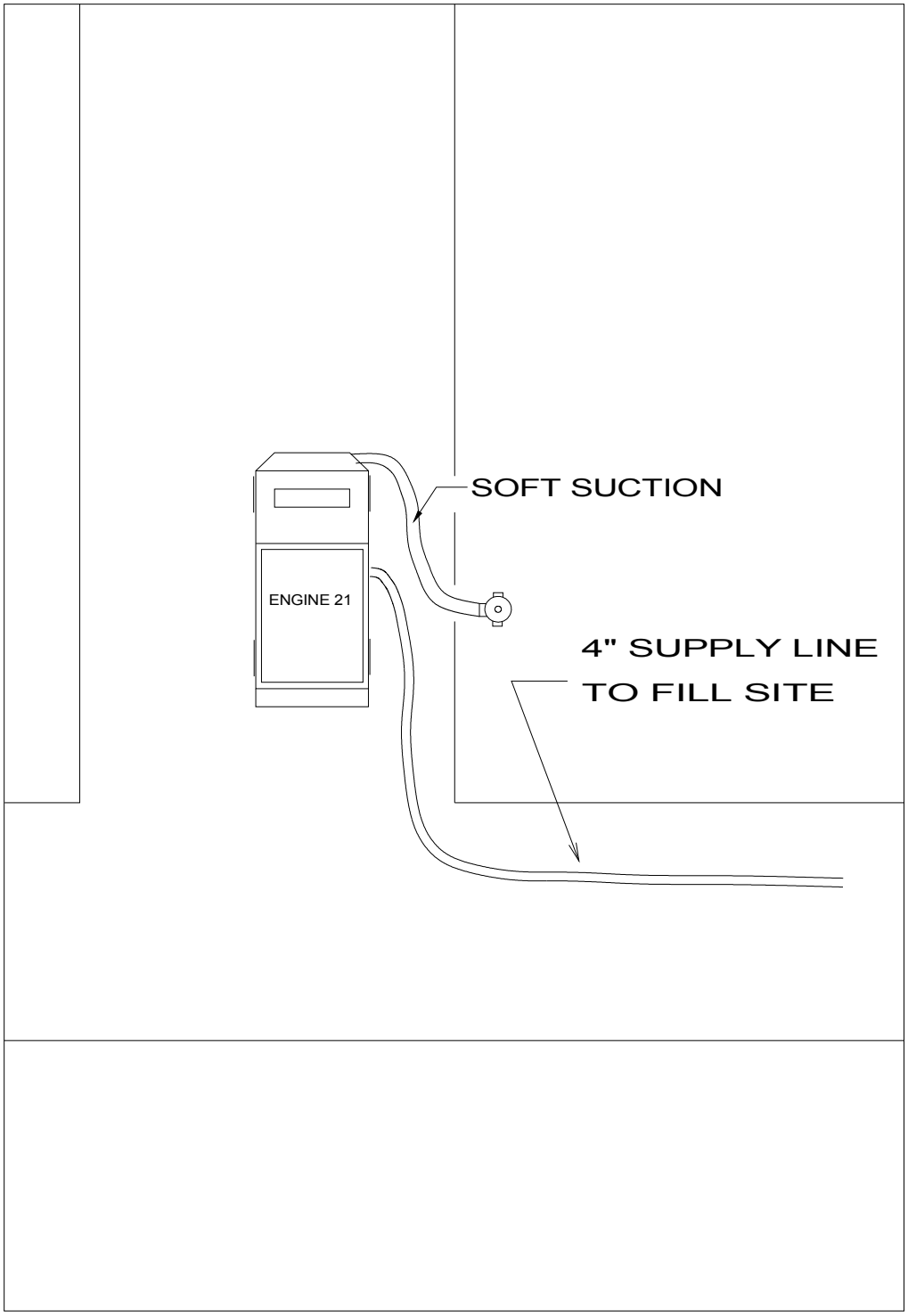
a. Select a fill site that will provide the incoming and departing water shuttle apparatus maximum maneuvering room. A circle or loop road arrangement is the most desirable.

b. Stop Engine 21 or Water Supply 5 at the designated fill site and drop the two lengths of 4 inch hose and the manifold.

c. Layout 4 or 5 inch LDH from the fill site to the chosen hydrant.

d. Connect to the large hydrant discharge using the soft suction (if close enough) or a section of 4" LDH.

e. Charge the supply line and pump at 150 psi **discharge** presure (as indicated on the discharge gage, not the master gage).



Fill Site Pumper on Hydrant
Figure 4

C. FILL SITE OPERATIONS

The key to a successful water shuttle fill site operation, whether using water from a draft or a hydrant, is to minimize hook up time, maximize the gpm fill rate, and minimize maneuvering time. This can be accomplished by using a dual fill line setup, filling the water shuttle apparatus **one** at a time, and selecting a fill site which permits a smooth "fill and go" traffic pattern with minimum apparatus backing or turning. Figure 5 shows a typical fill site set up. An officer and three fire fighters is the minimum crew required to efficiently handle a fill site operation. The following procedure will be used in fill site operations.

1. Fill Site Set Up:

a. Separate the two 4 inch fill lines dropped by Engine 21 as far as possible to minimize traffic interference between tankers.

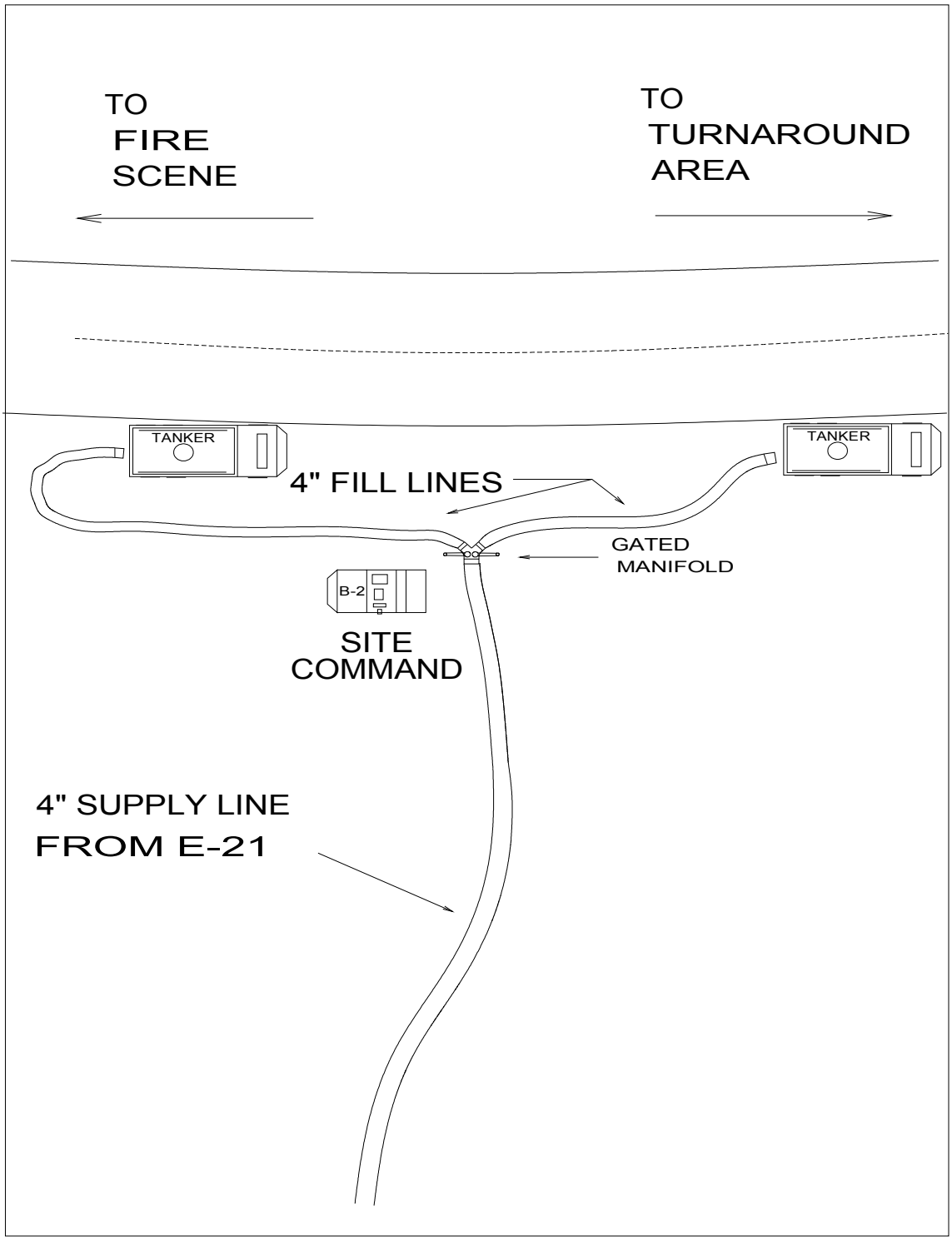
b. Man the two fill lines and the manifold with experienced personnel.

c. Fill **one** tanker at a time. Use the quick-connect Stortz couplings and the direct tank fill connection (required by NFPA 1901) whenever it is available. **CAUTION. Filling at a 1000 gpm rate creates the possibility of a severe water hammer if any valve is slammed shut.** Slowly close the manifold valve first to prevent trapping water in the fill line at high pressure. Drain 10 to 15 feet of the fill line after each fill operation to minimize weight and enhance fill hose maneuverability.

d. If Brush 2 is available, stage it in the vicinity of the manifold and utilize it as the fill site command post and to provide manifold lighting during night time operations.

e. Assign extra manpower as traffic directors at each fill line to direct incoming and departing tankers.

f. During nighttime operations, deploy the portable generator from Tanker 2 for fill site lighting.



Dump Site Initial Water Supply
Figure 5

D. DUMP SITE OPERATION

Like the fill site operation, dump site operation must be conducted to minimize dump time and maneuvering time. Dump time is minimized by having a minimum of **two** sides of the folding tank accessible for dumping. Figure 6 shows a typical dump site on a two lane road which provides two available sides for dumping.

A dump operation requires an officer, a minimum of one fire fighter to operate dump valves, and a pump operator for the supply pumper. Assign extra manpower as traffic directors to direct incoming and departing tankers. The sign of a well manned and well coordinated dump site operation is when the shuttle apparatus driver does not have time to leave the cab of his apparatus. The following procedure will be used to set up the dump site:

1. Dump Site Set Up:

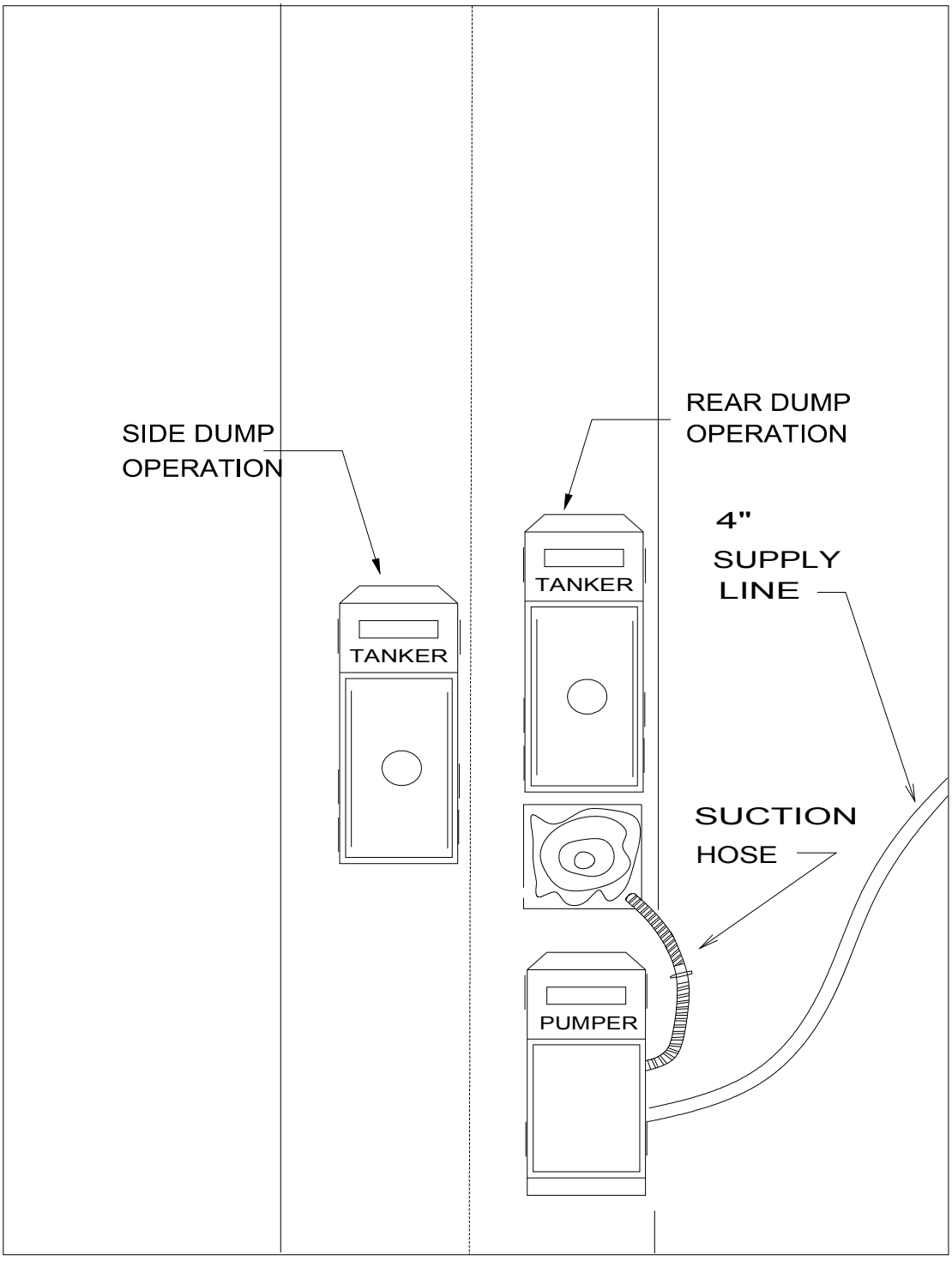
a. Deploy Tanker 2's, Engine 24's or Engine 224's folding tank, low level strainer and siphon and **two** sections of suction hose.

b. Select a dump site arrangement which permits **dual access** and expandability.

c. Position the first available pumper for folding tank drafting operations. Position the draft pumper with it's front bumper next to the folding tank. Use the front intake for drafting. If the pumper does not have a front intake use two sections of hard suction hose from the curb side suction tube to the dump tank. Maintaining two side access for dumping is essential to minimize maneuvering time. **Never block the roadway** by positioning the folding tank adjacent to the pumper's side suction intake.

d. Begin dumping and drafting operations. Attach the supply pumpers discharge line to the Humat valve when the tank has a sufficient water supply and the supply pumper has draft established from the folding tank.

e. As additional water shuttle apparatus arrive, position them to dump from the rear **or** the side utilizing both accessible sides of the folding tank at the same time. Position and set up the second tanker while the other is dumping or breaking down.



Dump Site with Supply Pumper
Figure 6

E. ADDITIONAL DUMP TANKS

A second folding tank and transfer siphon should **always** be added on major fires to increase the water supply storage capacity on the scene. This will minimize interruptions in the water supply during the inevitable lulls in shuttle apparatus availability. It will also provide additional tanker dump points. All of the necessary folding tanks, hose adapters, siphons, and accessories required for dual folding dump site operations are carried on Engine 24, Engine 224 and Tanker 2. Figure 7 shows a typical dual dump tank set up on a single lane highway. Use the following procedure when adding a second dump tank.

1. Second Dump Tank Set Up:

a. Add the second dump tank and rig the siphon as soon as possible as shown in Figure 7. Pump the 1 1/2 inch siphon transfer line at **150 psi.**

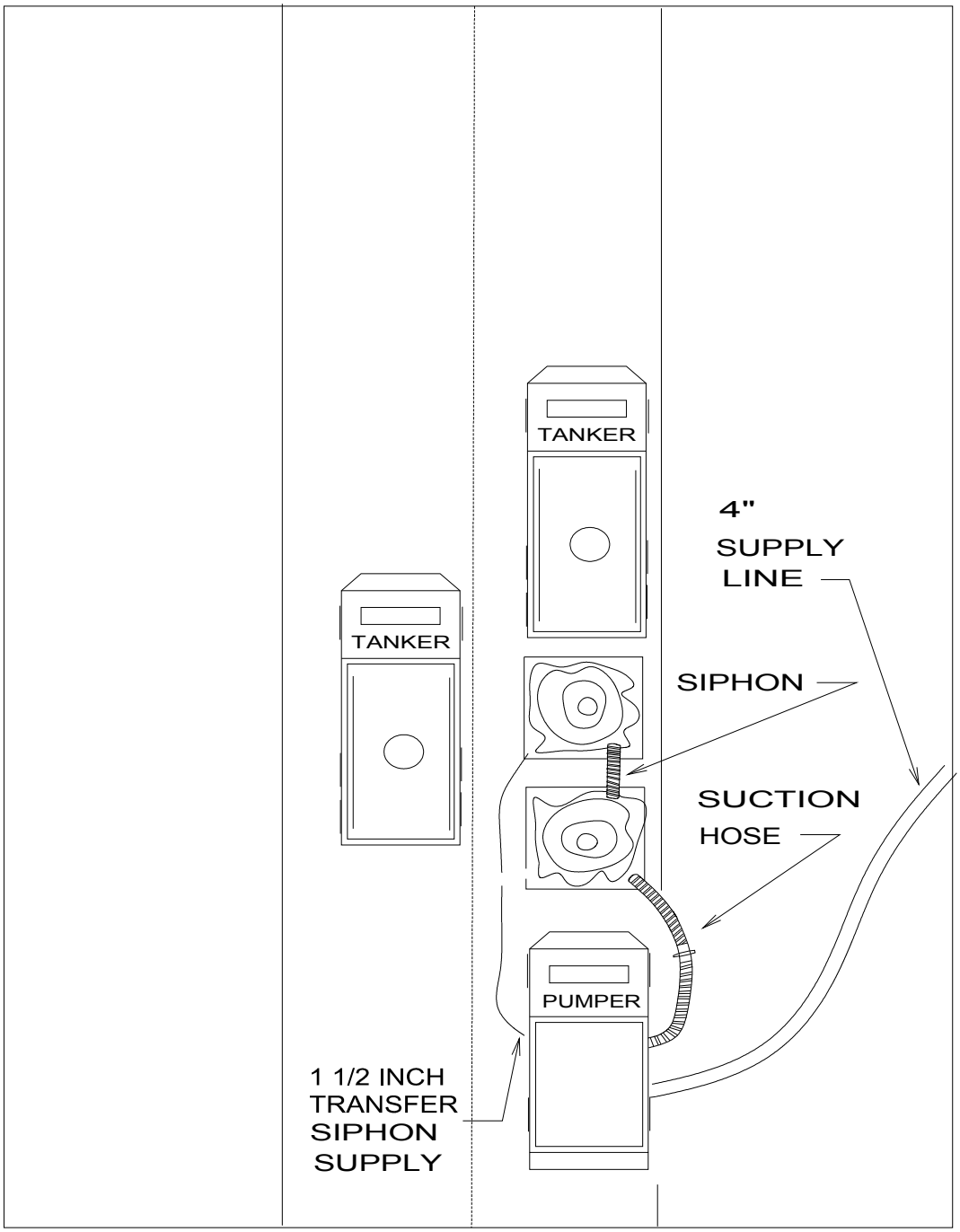
b. Dump from a single tanker at a time if the folding tank(s) are nearly full in order avoid having two half filled tankers idling at the dump site.

c. A second transfer siphon should be set up to allow transfers in the opposite direction as the first to provide maximum flexibility. Lay a 2 1/2 inch line from the supply pumper to a 2 1/2 inch X 2 - 1 1/2 inch leader line gated wye and connect the 1 1/2 inch siphon supply lines to this gated wye. Station a firefighter at the gated wye to control the tank transfer operation and tank levles. Have the supply pumper pump this 2 1/2 inch line at **150 psi.**

2. Pump off Site:

a. If tankers are waiting to dump after the second dump tank is set up, set up a pump off site positioned away from the dump site by using a section of 3 inch or LDH. Attach the pump off line to the gated intake on the suction fitting of the supply pumper. Opening the gate will not cause the supply pumper to lose prime when the 3 inch or LDH is charged. The water not pumped to the attack pumper will flow back into the folding tank. Once the pump off operation stops the supply pumper will automatically resume draft from the folding tank. This operation provides a secure means to hold the pump off line in place at high flow rates and avoids the hazard of a pump off line rising out of the folding tank and whipping around.

e. Add a Humat valve or a clapper siamese to expand the pump off site capability to two pieces of apparatus, one at a time without interruption.



Dual Tank Dump Site

Figure 7

E. RESOURCE ASSESSMENT

During any water supply operation the Water Supply Officer (WSO) should constantly evaluate the resources available and determine if they are sufficient to conduct and maintain the shuttle operation. The decision table below can be used to make this resource assessment. In using the table, the WSO must quickly assess whether the condition is temporary or an indication of a persistent problem. If the problem is persistent, actions must be taken to rectify the situation.

RESOURCE DECISION TABLE

OBSERVATION	RESOURCE SITUATION	ACTION
TANKERS WAITING AT DUMP SITE.	A. MORE STORAGE CAPACITY NEEDED. OR B. MORE DUMP ACCESS POINTS NEEDED. OR C. FIREGROUND FLOW RATE LESS THAN SHUTTLE CAPACITY.	ADD FOLDING TANKS. ADD FOLDING TANKS OR SET UP PUMP OFF OPERATION. ADVISE INCIDENT COMMANDER HE CAN INCREASE FIREGROUND FLOW RATE.
TANKERS WAITING AT FILL SITE.	NOT ENOUGH FILL POINTS.	SET UP AN ADDITIONAL FILL SITE OR ADD A SECOND FILL SITE PUMPER.
NO TANKERS WAITING AT DUMP SITE OR FILL SITE.	ADDITIONAL SHUTTLE TANKERS NEEDED.	CALL FOR ADDITIONAL TANKERS.

CHAPTER 3

ORGANIZATIONAL STRUCTURE

A. WATER SUPPLY OFFICER

The kinds of operations described in this document require full time water supply management to conduct continuous support and preplanning functions. Therefore, a STAFF POSITION of WATER SUPPLY OFFICER should be created. The person selected for this position should have Deputy Fire Chief rank to provide the authority necessary to carry out the responsibilities of the position.

1. Qualifications:

The Water Supply Officer should be a person who;

a. Has a good grasp of fire service hydraulics.

b. Preferably has prior line officer service as a Captain or above.

c. Has instructional ability and qualifications.

d. Is willing to give up personal contact fire fighting.

2. Duties:

a. Respond to serious working fires to advise the Incident Commander in reference to water supply matters and/or manage water supply operations.

b. Conduct training in water supply operations.

c. Make an annual inspection of designated static water sources to evaluate continued reliability and continued access.

d. Make updates, as required, of the Water Supply Book.

e. Evaluate new water sources and add useable sources to the Water Supply Preplan Book.

f. Establish and maintain a notice board in the fire station to keep personnel advised of hydrants out of service, back in service, new hydrants and new water sources.

g. Develop and/or modify and implement Water Supply SOPs with the approval of the Fire Chief.

h. Review all new water supply preplans to ensure their accuracy and adequacy.
i. Make an annual inspection of the Water Supply Books to insure that they are in good condition and up to date.

j. Conduct hydrant flow tests as necessary. Provide information of available fire flows to the Map Officer (committee) for entry onto the appropriate maps.

k. Act as liaison with the ISO during any grading inspections as they apply to water supply.

l. Develop the plan to reduce the Department's ISO rating. Coordinate and supervise the inter-company training required. Act as liaison with ISO through the County Commissioners for an ISO representative to witness the required demonstration.

m. To act as liaison person, along with the Fire Chief, to the St. Mary's County Fire Board representative with the Metropolitan Commission.

n. Recommend changes in apparatus or equipment as may be necessary to improve water supply operations.

o. Conduct, with the Chief Engineer, the annual service test of pumps and keep records of these in accordance with ISO requirements.

p. Act as Chairman of the water supply committee and assist the map book officer and the preplanning officer in their duties.

B. MAP BOOK OFFICER

The rapid growth of the community has created a very pressing need for accurate maps. The installation of fire hydrants makes it necessary to provide information to officers responding to fire incidents as to the location of hydrants. Hydrant locations in relation to the address of the reported incident are required so that decisions can be made as to laying out. Therefore, a STAFF POSITION of MAP BOOK OFFICER or line officer assigned these duties needs to be appointed to handle this task.

1. Qualifications:

The Map Book Officer should be a person who;

a. Has a basic knowledge of the roads and streets in the first due area.

b. Has rudimentary talent at sketching maps.

c. Has the ability or aptitude to work with computerized mapping systems.

2. Duties:

a. Develop or purchase maps of all hydrant areas showing:

(1) Location of address or business by name in relation to streets or roads.

(2) Location of address or business by name in relation to hydrants.

(3) Fire flow for the area shown.

b. Develop maps of all non-hydrant areas showing how the address numbers run.

c. Make necessary updates as areas are built up.

d. Develop map books to be placed in the station and on apparatus including Chief's vehicles.

e. Update map books as necessary.

f. Inspect map books no less than yearly to ensure that they are in good condition and that they are complete.

g. Act as a focal point person for membership to provide information on new developments which may require map book updates.

h. Act as Chairman of the map book committee and assist the Water Supply Officer in his duties.

C. PREPLANNING OFFICER

In any growing area there is a constant need for updating or generating prefire plans. This is caused by the construction of new structures, expansion of existing structures, or changes in occupancy. In addition, the construction or expansion of municipal water systems may require a reevaluation of existing preplans. The creation and maintenance of preplans requires a full time planning effort. Therefore a STAFF POSITION of PREPLANNING OFFICER or a line officer assigned to these duties should be appointed to handle these tasks.

1. Qualifications:

The Preplanning Officer should be a person who;

a. Has some training or experience in building construction and the effects of fire on building components.

b. Has some training or experience in conducting NFPA 1231 building surveys.

c. Has rudimentary talent at sketching building plans and site plans.

d. Has the ability and qualifications to organize and conduct company inspection visits and drills.

2. Duties

a. Conduct surveys of the target hazards in the first due area of the department for the purpose of gathering and storing information relevant to fire fighting and water supply operations.

b. To conduct NFPA 1142 surveys of all new target hazards and any target hazards which undergo significant changes that alter the required fire flow or minimum water supply required for fire fighting.

c. To develop a Water Supply Preplan for all new target hazards with the assistance and under the direction of the Water Supply Officer.

c. To conduct on-site company familiarization visits and in station drills to acquaint all members with the target hazard and the applicable water supply plan.

h. To act as Chairman of the preplanning committee and to assist the Water Supply Officer in his duties.

j. To assist the Water Supply Officer in his annual inspection of the Water Supply Preplan Books to ensure that all the books are up to date and incorporate any necessary revisions or additions.

Chapter 4

SPECIAL OPERATIONS

A. WEAK HYDRANT OPERATION

In some instances it may be necessary to utilize a hydrant which is incapable of supplying the 1000 gpm fill rate required for a water shuttle fill site operation. It is possible to fill water supply apparatus at the desired rate even if the hydrant is incapable of this rate by utilizing a folding tank as a storage reservoir as shown in Figure 8. The hydrant supplies its' maximum rate at all times and the water stored in the folding tank is used to meet the peak demand of 1000 gpm. Deliberately selecting a "weak" hydrant as a source in anticipation of utilizing this technique is discouraged. It should be used only when Engine 23 has committed to a hydrant that is subsequently found to be incapable of supplying the required 1000 gpm.

Although it is possible to supply the folding tank directly from the hydrant, the arrangement shown in Figure 8 provides the pump operator with the ability to control the entire operation from his pump panel, thus minimizing the workload and manpower required.

When the intake gate(s) controlling the water from the hydrant are opened during the shuttle apparatus filling operation, the pump will take water from the source at the highest **absolute** pressure. A collapsed or sputtering intake line is **not** a sign of pump impeller cavitation or an indication of drawing a vacuum on the hydrant. It is simply a sign that the pump has begun to draft from the folding tank and the collapsed or sputtering intake line can be ignored.

Keep in mind this operation requires a folding tank at the supply source. This folding tank may not be available at the initial set up but should be added as soon as possible.

The following procedure should be followed when utilizing a "weak" hydrant supply source:

a. Stop Engine 21 at the designated fill site and drop the two lengths of 4 inch fill hose, the adaptor bag, the manifold and the 4 inch supply line.

b. Layout from the fill site to the chosen hydrant.

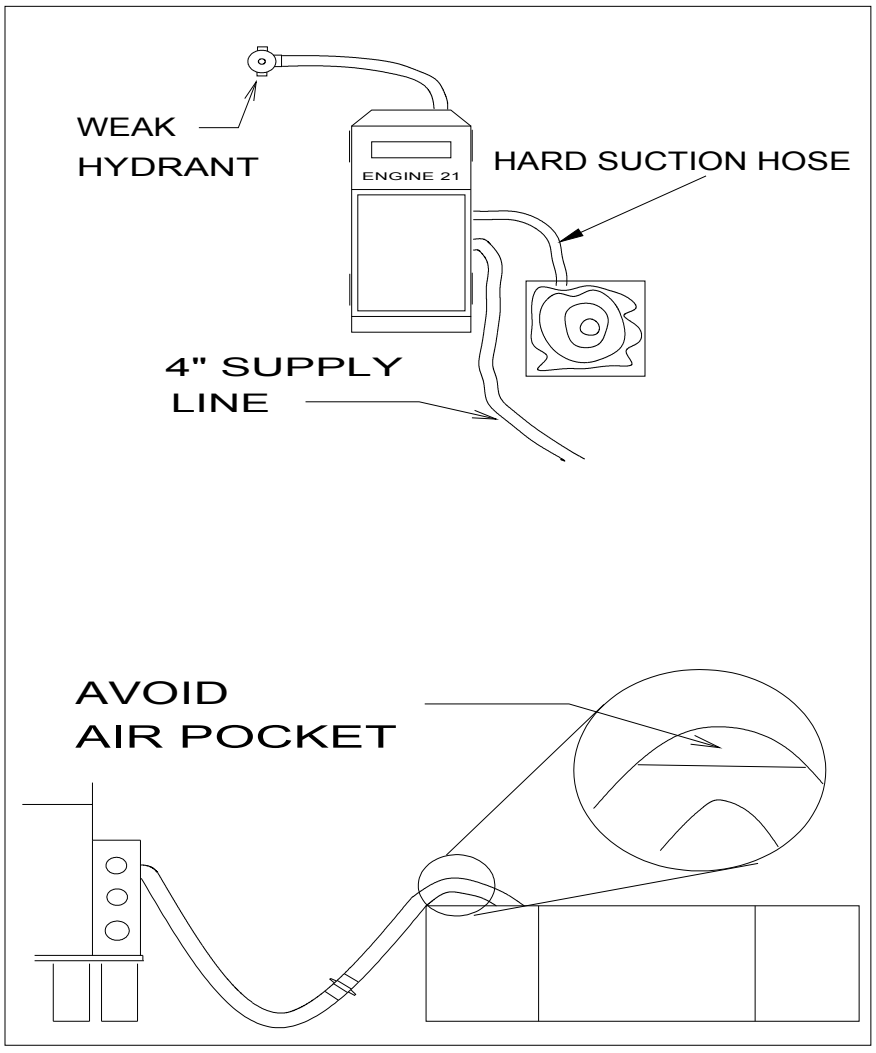
c. Connect (or reconnect if this operation was unanticipated) to the hydrant using the front intake preconnected soft suction or a 4 inch hose. The hydrant

line must be connected to a **gated intake** (such as the front suction) to avoid over filling the folding tank.

d. Deploy the folding tank. Use of the right side suction tube is preferred to minimize obstructions at the pump operator's position.

e. Fill the folding tank from the hydrant through the pump using the gated intake and the suction hose.

f. If the folding tank is emptied before the tanker is filled, stop the operation, send the shuttle apparatus to another source, or back to the dump site if it is nearly full, and refill tank.



Weak Hydrant Operation
Figure 8

B. **INACCESSIBLE WATER SOURCE:**

Occasionally the water source draft site may be inaccessible to Engine 21 (e.g. inclement weather, poor road conditions, excessive lift, etc.). In this case the floating pump will be used to draft and supply Engine 21. Engine 21 will then relay pump to the fill site. Figure 9 shows a typical set up for this situation. This operation can be accomplished by a driver and an assistant (four personnel total).

1. Inaccessible Source Set Up:

For an inaccessible source floating pumps will have to be used. The following procedure will be followed when the draft site is inaccessible to the water supply engine:

a. Identify the draft site while enroute.

b. Stop Engine 21 at the designated fill site and drop the two lengths of 4 inch hose and the manifold.

c. Layout 4 inch hose from the designated fill site to a point as close as possible to the water.

d. Remove the floating pump from Tanker 2 and position it at the water's edge.

e. Attach a 2 ½ or 3 inch hose line to the floating pump discharge.

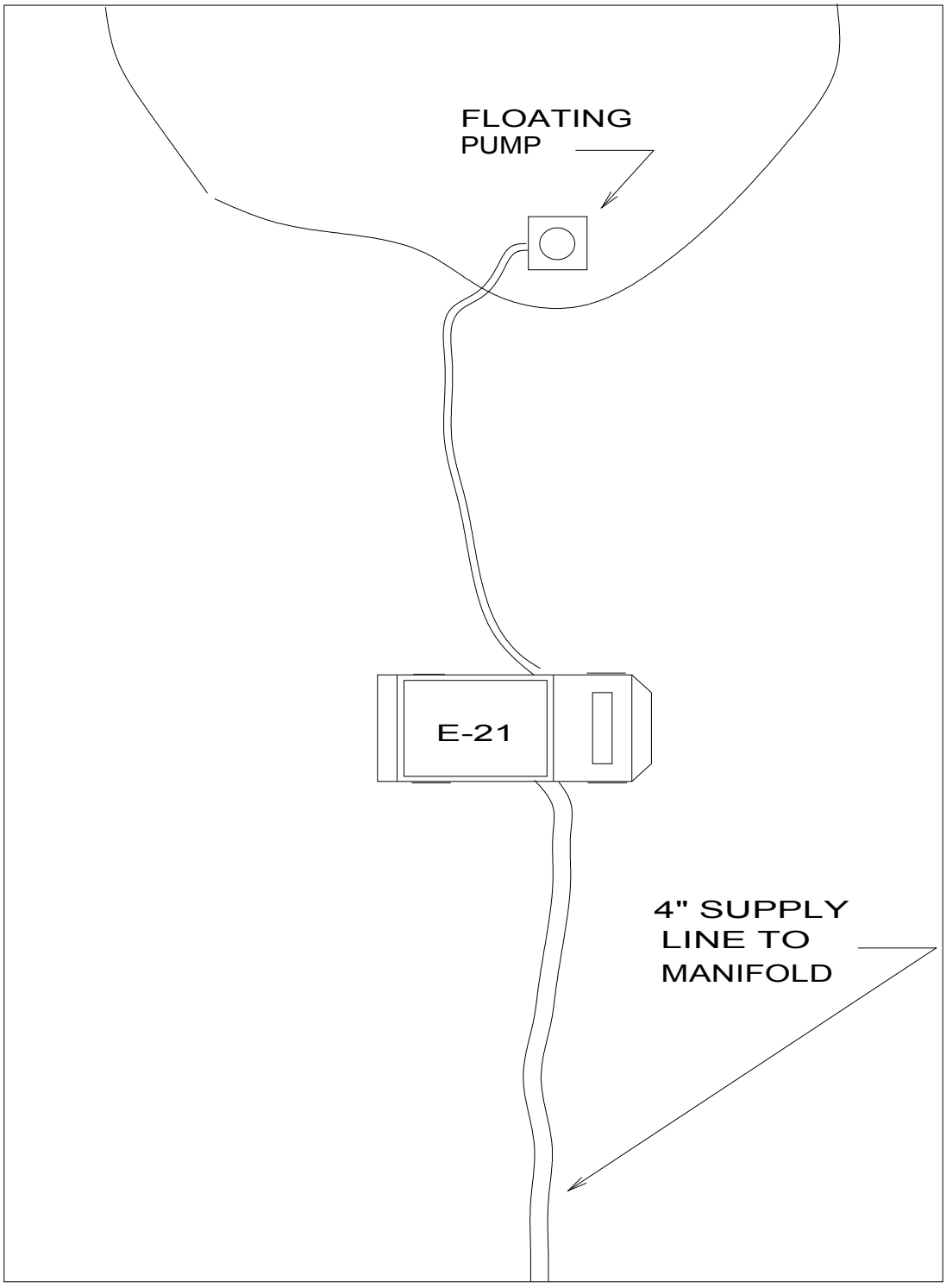
f. Complete the hose lay from the floating pump to Engine 21.

g. Attach the line to the gated intake on the pump panel. There should be enough slack hose left at the water's edge to deploy the pump.

h. Start the pump and place it in at least one foot of water.

i. Operate the trash line to maintain pump and engine cooling.

j. Deploy the weak hydrant set up described below with the floating pump acting as the weak hydrant or add a second floating pump.



Floating Pump Operation
Figure 9

C. FLOATING PUMP OPERATION

A combination of the two techniques described immediately above should be used when Engine 21 is being supplied by floating pump(s) and a fill rate of 1000 gpm is required. Essentially, we have an inaccessible site **and** a weak source (flow capacity less than 1000 gpm). Even though a single or even dual floating pumps are unable to provide a flow of 1000 gpm, they can support fill rates of 1000 gpm using the technique described below.

1. Floating Pump Set Up:

The following procedure should be followed when utilizing one or more floating pumps:

a. Set up Engine 21 as described in the above section on "Inaccessible Water Source".

b. Deploy the folding tank as described in the section on Weak Hydrant Operation. Use of the right side or front suction tube is preferred to minimize obstructions at the pump operator's position.

c. Fill the folding tank through the pump using the gated intakes and the suction hose.

d. If the folding tank is emptied before the tanker is filled, stop the operation, send the shuttle apparatus to another source, or back to the dump site if it is nearly full, and refill the folding tank.

APPENDIX A

DEFINITIONS

attack pumper: The pumper located at the fire building supplying the attack lines.

draft pumper: The pumper set up at the water source supplying water from a draft. When the water source for a tanker shuttle is a hydrant the draft pumper may be called the "water supply" pumper.

draft site: The site where an engine obtains water from a static source for filling tankers.

dump site: The location near the fire incident where water shuttle apparatus unload their water.

dump site kit: Accessories needed to effectively operate a dump site consisting of a low level or floating strainer for the supply pumper, one or two transfer siphons to maintain the proper water level in the primary tank, hard suction hose for use as a water transfer tubes and a 6" X 5" suction hose thread adaptor.

dump tank: The temporary water storage tank where tankers unload via a large outlet from their tank. See also folding tank.

fill site: The location where tankers are filled prior to returning to the fire scene.

folding tank: A portable water storage tank which collapses or folds for storage when empty.

hydrant operation: The movement of water from a hydrant near the fire incident via hose line.

large diameter hose (LDH): Supply hose of 4 inches diameter or greater.

manifold: A gated wye which allows branching the 4 inch supply line into two tanker fill lines.

pumper-tanker: A tanker which also complies with the NFPA 1901 Standard for a pumper.

relay operation: The movement of water via hose line from a remote source to the fire incident.

supply pumper: The pumper drafting from the folding tank or on a hydrant and supplying the attack pumper.

tanker: A water shuttle apparatus with a tank of at least 1000 gallons capacity which complies with the NFPA 1901 standard for a mobile water supply.

tanker operation: The use of tankers to supply water to the attack engine by direct connection of a hoseline to the attack engine's intake. Used where low or intermittent fire flows are acceptable.

water shuttle: The movement of water from a remote source to the fire incident via tanker.

water shuttle apparatus: The apparatus used for the actual movement of water in a water shuttle operation.

water supply: A water source for fire fighting purposes.

water supply officer: 1. The line officer in charge of the water supply operation during an incident. 2. The company officer responsible for the maintenance of the Department's water supply capability.

water supply site: 1. Alternative name for the draft site. 2. The site where an engine obtains water from a static source for filling tankers. It may be a hydrant, a cistern, stream, pond or other static source.

weak hydrant: A hydrant which can not supply 1000 gpm.

APPENDIX B

WATER SUPPLY OFFICER CHECKLIST

A. DUMP SITE

_____ Supply line being pumped.

_____ Folding tank(s) deployed.

_____ Supply pumper assigned.

_____ Supply pumper set up.

_____ Folding tank(s) accessible from at least two sides.

_____ Folding tank(s) clear of traffic.

_____ Dump site kit (low level strainer, siphon, extra hard sleeves) removed from E-24, E-224 or T-2.

_____ Sufficient manpower assigned (minimum of 3).

_____ Dump site sector commander assigned.

_____ Second folding tank deployed with transfer siphon.

_____ Sufficient resources available or in route.

B. FILL SITE

_____ Gated manifold deployed and supply line laid.

_____ Sufficient manpower assigned (minimum of 4).

_____ Brush 2 assigned fill site sector command.

_____ Shuttle tankers advised of fill site location.

_____ Secondary fill site identified.

C. DRAFT SITE

_____ Draft site designated.

_____ Engine 21 or assigned pumper(s) enroute.

_____ Engine 21 or draft site pumper set up.

_____ Floating pump(s) assigned as required.

APPENDIX C.

TANKERS NEEDED TO CONDUCT A WATER SHUTTLE OPERATION

REQUIRED FLOW	**ONE WAY** TRAVEL DISTANCE – 1 MI	**ONE WAY** TRAVEL DISTANCE – 2 MI	**ONE WAY** TRAVEL DISTANCE – 3 MI
1000 gpm	6	8	10
900 gpm	6	7	9
800 gpm	5	7	8
700 gpm	5	6	7
600 gpm	4	5	6
500 gpm	3	4	5
400 gpm	3	4	4
300 gpm	2	3	3
200 gpm	2	2	2
100 gpm	1	1	1

Assumed Values:

Tank Capacity 2000 gallons

Dump Preparation Time 1 minute
Dump Rate 1000 gpm (2 minutes)
Dump Breakdown Time 1/2 minute
Fill Preparation Time 1 minute
Fill Rate 1000 gpm (2 minutes)
Fill Breakdown Time 1/2 minute

Travel Time: 0.65 + 1.7 x Distance

Notes:
Travel Time is in minutes.
Distance is roundtrip travel in miles.
Number of tankers required is rounded **UP**.
Add 1 tanker for each four 1500 gallon tankers used.
Deduct 1 tanker for each two 3000 gallon tankers used.

A. USING THE CHART

The table provided above allows the water supply officer or incident commander to determine the number of tankers needed to provide the required fire flow for a target hazard. Use of this chart requires two pieces of information; the **required fire flow** for the building and the **distance to the water supply** point.

1. Procedure:

To determine the number of water shuttle apparatus required use the following procedure:

a. Determine the required fire flow from the target hazard preplan. If the structure on fire does not have a preplan estimate the required flow using the volume of the building times 10.

b. Estimate the distance to the fill site.

c. Locate the value closest to the required flow along the left side of the chart. If the exact value is not shown use the next highest value.

d. Locate the distance to the fill site along the top row of the chart. If the exact value is not shown, use the next highest value.

e. Sight across to determine the numbers of tankers needed.

The chart can also be used "backwards" to relate any of the three factors involved; required (or available) fire flow, distance to the water supply, or the number of tankers. Simply locate any two of the known factors and sight across (for fire flow) or up (for distance) for the value of the unknown third factor.

B. DISCUSSION

The basis for the chart contained in this Appendix is provided in "Rural Fire Fighting Operations", Book 2, Chapter 15 by Larry Davis. Multiplying the flow provided by a single tanker, as discussed below, provides the total number of tankers required.

Each water shuttle apparatus must complete a shuttle cycle which starts when the tanker is full at the incident and ends when the tanker is once again full at the incident dump site. The tanker delivery rate is the delivery rate in terms of gpm that the tanker can continuously deliver. The two key factors which affect the delivery rate are; the tank capacity in gallons, and the shuttle cycle time, or total elapsed time to complete one full cycle. This can be expressed by the formula:

TDR = TC divided by SCT

where: TDR = Tanker Delivery Rate
TC = Tank Capacity (gallons)
SCT = Shuttle Cycle Time (minutes)

If a 2,000 gallon tanker has a shuttle cycle time of 10 minutes, the tanker delivery rate is then 2,000 gallons/10 minutes, or 200 gpm. In other words, with only this one tanker shuttling water, a 200 gpm delivery rate could be maintained (This of course assumes that all additional cycles will be

completed in ten minutes or less).

If one expects to alter the delivery rate, then the factors that affect the delivery rate must be altered. Altering either tank capacity or cycle time will affect the delivery rate.

Increasing tank capacity in an existing tanker is not a practical alternative. Thus, if the delivery rate is to be increased, the only practical solution is to reduce the time required to complete the tanker shuttle cycle.

C. REDUCING TANKER SHUTTLE CYCLE TIME

To reduce tanker shuttle times, each activity included in the cycle time must be identified. Examining the complete shuttle operation reveals that a series of activities must be completed in sequence for the shuttle to be completed. The sequence of activities is:

- Prepare the tanker to dump.
- Dump the tanker.
- Break down the dumping set-up.
- Travel to the fill site.
- Prepare the tanker to fill.
- Fill the tanker.
- Break down the filling set-up.
- Travel to the dumping site.

These eight specific activities identify the critical path for any tanker shuttle cycle. An increase or decrease in the time required to complete any individual activity will increase or decrease cycle time, which will decrease or increase the delivery rate.

Since each of these activities requires some amount of time to complete, cycle time is actually dependent on eight separate and distinct time periods, each associated with a specific activity or series of tasks.

1. Dump Preparation Time:

This time segment begins as the forward motion of the tanker stops at the dumping site and ends when the first drop of water actually flows from the tank. This time segment includes the time required to perform any task which must be completed prior to dumping the tanker. Some examples are:

- waiting to dump
- backing the tanker up to a folding tank
- engaging pumps for jet-dump operations
- opening doors to make dump valves accessible
- placing dump extension tubes on dump valves

This activity and its resultant time segment are dependent on the arrangement of the equipment used, the number of available people and how well they can perform, and the procedures used.

2. Dump Time:

This time segment begins when the first drop of water actually flows from the tank, and ends when the water flow ceases. Ideally, this is when the tanker is empty, but this is not always the case, for two reasons. First, some tankers cannot completely dump all the water which they carry. In other cases, tanker dumping ceases before the tanker is completely empty because either the few remaining gallons or the reduced flow rate make it impractical for the tanker to sit idle any longer.

Dump time is totally dependent on the design and arrangement of the equipment used and the standard mode of operation (pump off or dump)in which the tanker is used. People or procedures have little bearing on dumping time and it can not be altered during the water shuttle operation.

3. Dump Breakdown Time:

Dump breakdown time begins when water flow from the tank is stopped, and ends when the wheels of the tanker begin to turn to leave the dump site. This includes the time required to perform any tasks which must be completed prior to the tanker's leaving the dump site, such as:

- disengaging the pump used for jet-dumping operations
- removing dump extension tubes
- closing access doors

Like dump preparation time, dump breakdown time is also dependent to some degree on equipment, people, and procedures.

4. Travel Time Empty:

This time segment begins when the wheels of the tanker first turn to leave the dumping site and ends when the tanker's wheels stop at the fill site where the tanker is to be filled.

This time segment is affected by a number of variables such as weather, the distance between the dumping site and the fill site, traffic, the condition of the roads and the topography of the area which are essentially beyond the control of the fire department.

The fire department does have control over some of the factors which affect this time segment. These are: the ability of drivers, the size and weight of the apparatus, the roadability of the apparatus, and so forth. The most important factor is that the driver take the time required to **safely** negotiate the route between the dumping site and the fill site. There is little that can be done during the actual course of the water shuttle operation to affect these, so all efforts made should be directed toward the safety of the operation.

5. Fill Preparation Time:

This time segment begins when the wheels of the tanker stop at at the fill site, and ends when the first drop of water enters the tank through the fill intake. It includes the time required to perform any task which must be completed to allow the tanker to be filled. Some examples are:

- waiting to fill
- manuvering to fill
- connecting tank fill lines
- charging hose lines to fill devices
- operating tank intake valves

This time segment is dependent on equipment, people, and procedures.

6. Fill Time:

Fill time begins when the first drop of water flows into the apparatus tank, and ends when the water flow stops. Fill time is dependent on the equipment, the fill arrangement used, the rate the water flows from the source and the procedures used.

7. Fill Breakdown Time:

Fill breakdown time begins when water flow into the tank stops and ends when the wheels of the tanker turn to leave the fill site. Fill breakdown time includes the time required to complete any task required to allow the tanker to leave the fill site including time for completing such things as:

- shutting down tank fill lines
- disconnecting tank fill lines

8. Travel Time:

The travel time full segment begins when the wheels of

the tanker first move at the fill site, and ends when the wheels stop at the tanker the dump site. It includes the turning and maneuvering time required to change the direction of travel back to the dump site. Travel time can be minimized by having the fill site located on a circular drive or loop road.

This time segment is dependent on the same basic factors which were identified under travel time empty. As such travel time full can be combined with the travel time empty to arrive at the total travel time. In the table, the calculation of travel time (the largest contributor to the water shuttle cycle time) is done according to the standard formula used by the Insurance Services Office.

D. ASSUMPTIONS

In the development of the table contained in this Appendix certain assumptions concerning capabilities and procedures were made. These assumptions are discussed below.

1. Assumptions for Calculations:

a. Tankers from St. Mary' County are generally 2000 gallons and tankers from Charles County are generally 1500 gallons. On any given incident an equal mix of tankers with these capacities can be anticipated. Also a 3000 gallon tanker combined with a 1500 gallon tanker is counted as two 2000 galon tankers.

b. All tankers can load and dump in compliance with the 1000 gpm rate required by Section 15-4.4 NFPA Standard 1901 for mobile water supply apparatus. The use of dump valves for unloading and the use of direct connect tank fills (required by NFPA 1901) for loading lends validity to this assumption.

c. A fill site operation which can supply 1000 gpm is assumed.

d. The availability of a second dump position at the folding tank is assumed. On narrow roads, side dumping may be required. NFPA 1901 requires water transfer capability to the left, right and rear of a water supply apparatus. The use of dump extension tubes (a section of hard suction hose), prepositioned at the dump site with the correct adapters, can fulfill this requirement.

e. The availability of a fill site with two fill lines is assumed.

E. WATER SHUTTLE TANKER EVALUATION

A water shuttle record sheet is included in Appendix D to assist in validating the numbers used in the table. This sheet can be used to determine the performance of a single tanker during an actual water shuttle operation. The results then can be used to project the results for multiple similar tankers over various distances.

APPENDIX D

WATER SHUTTLE RECORD SHEET

Date:_____ Location:

Unit #_____ Capacity:_____Travel Distance:

TIME RECORD OF OPERATION

EVENT	TRIP #1	TRIP #2	TRIP #3
Arrival at Dump Site			
Begin to Dump			
Tank Empty			
Leave Dump Site			
Arrival at Fill Site			
Begin Filling			
Tank Overflows			
Leave Fill Site			

CYCLE TIMES

	TRIP 1	TRIP #2	TRIP #3	Average
Dump Prep				
Dump Time				
Dump Breakdown				
Fill Prep				
Fill Time				
Fill Breakdown				
Cycle Total				

Average Cycle Time:_____
Number of Trips:___ Total Gallons:_____
Average GPM: _____Corrected to GPM per Mile: