PURPOSE
To provide guidelines for determining water supply needs and selecting the most effective hose line size or sizes based upon initial and ongoing size-up and fire ground factors.

OVERVIEW
Adequate water supply during fire attack operations has a critical impact on fire control outcomes. A good water supply and adequate GPM flows from attack lines result in favorable outcomes. Delayed or limited water supply and inadequate GPM flows leads to delayed fire control, increased risk to fire fighters and victims, and greater fire loss. The use of excessive amounts of water, leaking couplings or nozzles may increase property loss inside the structure, and hinder fire investigations.

HYDRANT WATER SUPPLY
First due companies approaching the scene with any evidence of a working fire in a structure should lay their own supply line. Exceptions to this guideline may include:

- Obvious critical rescue requiring a full crew
- Unsure of actual fire location in multi-unit building complex
- Hydrant within fifty feet of the fire

Hillside or remote custom homes, junkyards, re-cycle or mulch facilities, high fire-load occupancies, and limited hydrants require pre-planning for unique hose-lays, drafting from canals, or extremely long supply lines.

A second supply line should be considered on any working incident. Considerations include alternate side of the fire, commercial buildings, large volume of fire, etc. Lines must be laid with consideration for the access problems they create. Always lay the line along the side of the roadway that the hydrant is on and cross over at the fire if necessary. Slow down when laying lines, faster speeds result in excess hose on the roadway. Slower speeds also provide several advantages:

- Reduces the risk of striking pedestrians or vehicles or firefighters
- Provides time for the Company Officer to size-up and evaluate critical fire ground factors.
- Provides time for the Engineer to appropriately spot the apparatus.

PUMPED WATER
After initial arriving companies have established an adequate water supply, newly arriving companies should stage on those hydrants providing the ability to pump the hydrant. Staging key pumpers on hydrants enhances fire ground safety in several ways:

- Ensures an uninterrupted water supply
- Provides volume when needed (extremely long supply lines i.e.: Apartments re-cycle facilities, junk yards or limited water mains & hydrants).
- Ability to pump water through the forward pumper in the event of mechanical failure

Pumped water supply (Humat Valve Operation) is necessary when large volumes of water are required on the fire ground. This normally occurs later in the attack operation when Engine Mounted Master Streams, ladder pipes, or multiple high GPM attack lines are in operation.

Generally, first alarm companies should lay their own supply lines to cover all critical tactical positions before pumped water is considered. A non-pumped 500 foot 4” supply line can flow 800 GPM. Most initial attack operations, including Engine Mounted Master Streams operations can be adequately supplied without pumped water.
In most cases, the need for pumped water occurs late in the first alarm assignment, or as the second alarm companies arrive. Command should address the need for pumped water as ladder pipes or multiple Engine Mounted Master Streams are ordered into operation.

When pumped water is initiated, Command should maintain control of key hydrants and order pumped water on a priority basis. Contact with the Water Department to provide total master stream gpm requirements should always be considered.

**MASTER STREAM SUPPLY LINES**

When establishing supply lines for master stream operations the diameter and length of the line as well as the anticipated volume of water for the fire must all be taken into account.

Most ladders in the metropolitan area are platforms and have two guns with the ability to flow 2000 GPM when provided an adequate water supply. 4 inch hose is limited to about 800 GPM at 500 feet in length before it must be pumped by another engine at the hydrant. Whenever a water supply is established to operate a ladder pipe two supply lines MUST be laid between the key pump at the hydrant and the forward pump at the ladder. Failure to provide two lines will limit the ladder to about 1200 GPM depending upon the length of the single line. Command must assign the key pumper to lay a reverse back to the hydrant and have them pump two lines to the forward pump.

5 inch hose has 1/3 of the friction loss of 4 inch hose and will therefore provide a greater volume of water to the forward position. 5 inch hose can typically supply 1000 GPM 1000 feet away without being pumped. Most departments that use 5 inch hose don’t use Humat valves and make no provisions to pump the supply line other than shutting down the hydrant and hooking directly to a discharge. There are times however that 5 inch hose must be pumped. Long lays with 5 inch hose need to be pumped in order to supply the necessary volume to ladder pipes with 2000 GPM capacities. A single 5 inch hose can deliver 1800 – 1900 GPM when pumped by a key pumper making it unnecessary to lay two 5 inch supply lines.

**ATTACK HOSE LINE CHOICE**
The objective of the attack hose line choice is to provide enough GPM flow to overcome the volume of fire being produced, or an adequate flow to effectively cool and protect exposures.

**BASIC ATTACK HOSE LINE PLACEMENT**

When operating in the offensive attack mode, attack hose lines of adequate volume should be advanced inside the fire building (never more than 150 feet) to put water on the fire and to control access to halls, stairways, or other vertical and horizontal channels through which people and fire may travel.

- The first stream should be placed between the fire and persons endangered by it.
- When no life is endangered, the first stream should be placed between the fire and the most severe exposure or unburned areas.
- A second hose line should be deployed to protect a secondary means of egress (always bear in mind the presence of Fire personnel operating in opposing positions).
- Additional hose lines should cover other critical areas or when covered, back up in place hose lines.
- Whenever possible, crews should position hose lines in a manner and direction that supports rescue activities, begins confinement, protects exposures, and controls loss.
When a change from offensive to defensive operation occurs, crews should pull hand lines out of the fire building only if safe to do so. Do not delay exiting the building for the sake of salvaging a few feet of hose and a nozzle if conditions are deteriorating rapidly, unless the line is needed for crew protection during egress operations.

FIRE STREAM CHARACTERISTICS AND CONSIDERATIONS
Fire control forces must consider the characteristics of fire streams and choose the most effective nozzle and stream for the task:

- **Solid Stream:** Greater penetration, reach and striking power. Less steam conversion.
- **Peripheral:** Increased heat absorption/expansion. Shorter reach. Most effective in confined spaces and protecting exposures.

Choose the proper sized attack line:

- **1-3/4” Lines:** Fast, mobile, greater volume, 175 GPM
- **2” Lines:** Reasonable speed, mobility and variable volume Depending on pump pressure and nozzle, up to 350 GPM.
- **2-1/2” Lines:** Slow, difficult to move, volume at 250 GPM
- **Elevated Master Stream:** Mostly stationary, slow to set up – maximum water, 500 to 1,000 GPM
- **Engine Mounted Master Streams:** Fast, large volume, great reach and penetration, 500 to 1,000 GPM

Offensive attack activities must be highly mobile—as mobility is slowed, attack activities begin to become more defensive in nature and effect. Many times effective offensive operations are often referred to as “aggressive”.

FIRE STREAM CONSIDERATIONS – OFFENSIVE STRATEGY
An offensive attack mode should achieve an effect on the fire quickly—consequently, backup plans should be developed quickly. If you apply water to an offensive attack position and the fire does not go out - React! Back it up or re-deploy to a more effective position. Think ahead! Predict where the fire is going to go and put crews in positions ahead of the fire. This is especially true when fighting fires in compartmentalized structures such as strip malls, apartments or any structure with a common attic.

Beware of hose lines that have been operated in the same place for long periods. Fire conditions change during the course of fire operations (most things will only burn for a limited time) and the effect of hose line operations must be continually evaluated. If the operation of such lines becomes ineffective, move, adjust, or redeploy them.

Beware of the limitations of operating nozzles through holes. The mobility of such streams is necessarily limited and it is generally difficult to evaluate their effectiveness. Sometimes you must breach walls, floors, etc. to operate—realize the limitations of such situations.

When utilizing crews with hand lines to enter basement fires, crews should not open nozzles until they can see and/or are near the fire—crews should not use fog streams when operating in basement fires. Steam production will be extensive, straight streams should be used.
Have attack lines ready during forcible entry operations. Attack crews should be fully protected and supervised before forcible entry is initiated.

Company Officers and Sector Officers must assume responsibility for the effectiveness of their fire streams. These officers must maintain an awareness of where fire streams are going, their effectiveness and then report the general operational characteristics back to the Sector Officer or Command. Company Officers must be aware that nozzle diameter adjustment or nozzle tip reduction may be necessary in order to produce an effective stream.

**FIRE STREAM CONSIDERATIONS – DEFENSIVE STRATEGY**

Exterior master streams should not be used with interior operations in the same structure. The exception to this would be a defensive strategy while protecting exposures from interior positions. Command must closely coordinate any exterior streams, particularly ladder pipes and engine mounted master streams. Extreme caution should be taken with interior and exterior attacks in the same building.

Master streams may be useful in knocking down a large body of fire in a segment of a structure where the intent is to operate in offensive positions after significant knockdown is achieved. Command and the Sector Officers must evaluate the structure’s stability in these situations. This evaluation should occur after the master streams are shut down and **BEFORE** committing crews to interior positions. When there is any question as to the stability of the structure crews should not be deployed to interior positions.

When there is a change in strategy from Offensive to Defensive, Command must prioritize hand line operations. Large volume hand lines such as 2 ½ inch and 2 inch lines may be used to protect exposures from defensive positions outside of the collapse zone. Smaller (1 ¾”) hand lines should be shut down after changing to a defensive operation. Pump operators should close the discharges to these lines to prevent well-meaning firefighters from trying to use hand lines where they are ineffective and place the firefighters inside the collapse zone. Command and sector officers must maintain all members in positions outside the collapse zone and prevent firefighters from moving into positions that are unsafe.

**ENGINE MOUNTED MASTER STREAMS**

Engine Mounted Master Streams offer very large GPM flows (500 to 1,000 GPM), quick operation, reach and penetration. A solid bore tip offers greater reach, penetration, with a more intact stream than a peripheral nozzle that is set on straight stream.

Engine Mounted Master Streams should be considered for structures that are well involved, beyond reach of attack lines, for exposure protection, and situations that pose an unusual safety risk to firefighters.

Engine Mounted Master Streams should never be operated on a structure where firefighters are operating interior.