Vehicle Recovery Operations

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1. WORK DESCRIPTION

1.1 Due to the wet and muddy conditions that are common at many Mosaic facilities, it is often necessary to recover vehicles that have become stuck in mud or immobile for other reasons.

2. VEHICLE RECOVERY RISKS

2.1 There are a wide range of vehicles that can become stuck. Combine this variation with the various types of equipment used for recovery, and it makes recovery operations inconsistent and risky.

2.2 Risks associated with recovery, if the recovery equipment and procedures are inadequate, include:

a. Recovery equipment can fail if it not attached properly, or if its capacity is not adequate for the recovery being attempted. When rigging fails, it can be extremely hazardous to anyone in the vicinity.
b. Vehicle damage can occur if recovery ropes or recovery tow lines are not attached to the correct anchor points.
c. The recovery vehicle can become damaged, get stuck, or even roll over if the job is not planned well or is not executed correctly.
d. If recovery is near a body of water or on a slope, the recovery vehicle or the vehicle being recovered could roll down the slope or enter the water. These type of recovery operations are high risk and need to be planned thoroughly.

3. VEHICLE RECOVERY CONTROLS & REMINDERS:

3.1 During the rainy season, vehicle recovery frequency and risks can increase due to the wet conditions.

3.2 Recovery operations require:

3.2.1 The use of a checklist (See Appendix E) during low-risk recovery operations.

3.2.2 A pre-job or field level hazard assessment (PJRA or FLHA) for high-risk recovery operations.

3.2.3 Approval of supervisor/manager before initiating a recovery.

3.3 Only ropes, winch lines or tow lines meant for recovery and approved shall be used. (cables/slings, etc. meant for lifting are not acceptable)

3.4 Only attach recovery equipment to approved towing (anchor) points on vehicles.

3.5 Inspect all recovery equipment prior to recovery; look for:

3.5.1 External wear - caused by dragging over rough surfaces.

3.5.2 Local abrasion - look for signs of substantial local abrasion caused by movement over sharp edges while ropes or straps are under tension.

3.5.3 Cuts and abrasions.

3.5.4 Sunlight degradation - never leave equipment exposed to sunlight for long periods of time.

3.5.5 Label damage. The label should always be legible

3.5.6 Damage to the recovery rope loops (eyelets).

3.6 Recovery Equipment (clevises/shackles and pulling strap or ropes) shall be sized appropriately and selected based on the following:

3.6.1 The weight of the vehicle being recovered.

3.6.2 The material and depth the equipment is stuck in.

3.6.3 The orientation and position of the vehicle being recovered.

3.6.4 The pulling capacity of the mobile equipment being used for the recovery.

3.7 If there is any uncertainty around the capacity or suitability of the recovery equipment available, do not attempt vehicle recovery. Consult a qualified engineer or qualified vehicle recovery contractor before proceeding.

3.8 All ground personnel shall be cleared from the immediate area and remain out of the line of fire until pulling is stopped or recovery is complete.

4. TYPES OF VEHICLE RECOVERY

4.1 Vehicle recovery is pulling or pushing a vehicle or mobile equipment out of the mud or ditch with another vehicle or mobile equipment (i.e. pickup truck is stuck in the mud and loader pulls it out using a recovery strap).

4.2 **Self-recovery**. (Powered winch recovery). Starts at the location where the equipment becomes disabled. The operator/crew uses the available recovery items such as a winch to perform self-recovery. Reference section 10.3 Winch Safety for details on winch hazards and effective controls for this type of recovery.

4.3 **Vehicle-Assisted recovery**. Involves the assistance from a second, like or heavier class vehicle. The principle is to use another piece of equipment of the same weight class or heavier to extract or tow the mired equipment by using a tow line or kinetic rope.

4.4 **Dedicated-recovery**. Dedicated recovery vehicles (3rd party vehicle recovery services) are used when self or like vehicle recovery is not possible because of the severity of the situation, safety considerations, or the inability to use like-vehicle assets.

4.5 **Low-Risk Vehicle Recovery** is when a disabled vehicle is in horizontal position with all four wheels on the ground. Prior to completing this type of recovery, the employees shall:

4.5.1 Complete a Low-Risk Recovery Checklist.

4.5.2 Have a supervisor/manager review and approve the recovery plan (in person or via phone).

4.6 **High-Risk Vehicle Recovery** is any situation not meeting the low-risk definition above. Prior to completing this type of recovery, the employee shall:

4.6.1 Notify his/her supervisor prior to initiating vehicle recovery.

4.6.2 Conduct an on-location discussion with supervision to determine recovery method(s) and decide if a third-party vehicle recovery service is required.

4.6.3 Complete a PJRA/FLHA.

4.6.4 Have his/her supervisor review and approve the PJRA/FLHA (on-location)

4.7 When a Low-Risk Vehicle Recovery becomes High-Risk:

4.7.1 Stop the job.

4.7.2 Notify supervisor and follow additional steps in Section 4.6 above.

Note: Workers should complete/update a PJRA/FLHA whenever work changes, hazards are not identified, controls are not sufficient or implemented.

Note: When using a winch during a vehicle recovery operation always reference Section 10.3 Winch Safety.

5. Vehicle Recovery Kits

5.1 The following tables list the recovery equipment that will be provided:

Recovery Kit for light duty vehicles such as 1500/2500/3500s	**52,300 lbs. capacity**
Recovery Rope - Bubba Kinetic Rope 1-1/4" diam. x 30' long. 52,300 lbs. MBS	
Synthetic Shackle - Synthetic – 7/16" diam. with a 6" width bow. 52,300 lbs. MBS	
Recovery dampener - Warn (brand)	
Hitch receiver mount – Overland aluminum compatible with soft shackles and 2" – class IV hitch	
Gloves	

Recovery Kit for full size dump trucks	**74,000 lbs. capacity**
Recovery Rope - Bubba Kinetic Rope 1-1/2" diam. x 30' long. 74,000 lbs. MBS	
Synthetic Shackle - Synthetic – 5/8" diam. with a 11" width bow. 76,400 lbs. MBS	
Recovery dampener - Warn (brand)	
Anchor points – OEM or equivalent rated recovery point - hook or eyelet (bolted or welded)	
Gloves	

Recovery Kit for Heavy Duty equipment	**131,500 lbs. capacity**
Recovery Rope - Bubba Tow Line - 1-1/2 inch diameter 30 ft long rated for 221,000 lb.	
Synthetic Shackle - Synthetic – 3/4" diam. with a 11" width bow. 250,000 lbs. MBS	
Recovery dampener - Warn (brand)	
Anchor points – OEM or equivalent rated recovery point - hook or eyelet (bolted or welded)	
Gloves	

Recovery Kit for Heavy Duty equipment	**147,000 lbs. capacity**
Recovery Rope - Bubba Tow Line Rope 1-1/8" diam. x 30' long. 147,000 lbs. MBS	
Synthetic Shackle - Synthetic – 5/8" diam. with a 11" width bow. 125,000 lbs. MBS	

Recovery dampener	- Warn (brand)
Anchor points – OEM or equivalent rated recovery point - hook or eyelet (bolted or welded)	
Gloves	

Note: With site approval a 3" wide by 20-foot long Bubba Rope® Black Ops Strap with a 23,5000 lb. breaking strength can be use in place of Bubba Rope listed for light-duty vehicles.

5.2 All recovery gear (the entire kit) shall be turned in after a one-time use for the purpose to undergo an inspection by a third party. Specific details of the turn in process will be determined and communicated at each site.

Note: We will treat the recovery kits just like fire extinguishers – turn in for replacement after one use.

6. RECOVERY POINTS / ANCHOR POINTS

6.1 Recovery points are towing hooks or towing eyes that are mounted (bolted or welded) to the vehicle frame (chassis).

6.2 Having good quality rated recovery gear is of little use if not properly and safely attached to the vehicle.

Warning: Never use a tow ball as recovery point on a vehicle. A tow ball is not designed to handle the extreme loads that can be generated in a vehicle recovery situation. If it fails, it can become a projectile.

Warning: Avoid using connection points that are non-metal, weak metal, that move, or are designed for a tow truck or transport use (shipping points). Eyelets on vehicle's undercarriage can be confused for recovery points. They are fitted to secure a vehicle when it is in transit and, like tow balls they can become a projectile if they fail.

6.3 Front recovery points

6.3.1 Vehicles (light, medium and heavy-duty trucks) may be equipped with rated recovery points from the factory. Rated front recovery points (anchors) shall be affixed (bolted or welded) to the vehicles or to the bucket for a front-end loader for example.

Figure 1 – Recovery Connection Points		
Pick-up truck front close anchor frame mounted	Front loader bucket clevis mount	Front loader bucket hooks

6.4 Rear recovery points

6.4.1 Vehicles equipped with a standard 2-in hitch receiver opening have several rated recovery options.

6.4.2 If present, remove the trailer ball mount and replace it with a specially designed hitch receiver mount designed to accept a rated shackle.

⚠ **Warning:** Do not remove the towing hitch and slip in the end of the recovery rope into the receiver. The recovery rope could rub on the sharp edge of the hitch receiver and get damaged, or the hitch pin could bend, making it difficult to remove it.

Figure 2 – Rear anchor points – Light duty vehicle with a hitch and soft or hard clevis. Hard clevis usage must be approved by Supervisor

Figure 3 – Rear anchor points – Heavy duty vehicle		
Float Truck Rear Anchor Hook	Rear Anchor with Pin	Shackle/Clevis Mount – Welded

7. RECOVERY ROPES and TOW LINES

7.1 Kinetic Ropes

Figure 4 – Kinetic Ropes		
Bubba Rope 1-1/4" x 30' Capacity: **52,300 lbs**.	Bubba Rope 1-1/2" x 30' Capacity**: 74,000 lbs.**	Bubba Rope – 2" x 30' Capacity: **131,500 lbs.**

7.1.1 All Light duty vehicles and golf carts should be pulled with a 1-1/4" diameter recovery rope. A Bubba Rope 1-1/4-inch diameter by 30-foot-long with a 52,300 lbs. breaking strength

7.1.2 Heavy-duty vehicles such as Float Trucks/ Boom Trucks will be equipped with a Bubba Rope.

7.1.3 The 1-1/2-inch-wide by 30-foot long kinetic rope is strong enough to pull a full-size dump truck out of the muck. Rated for 74,000 lb. breaking strength and suitable for Float Trucks, Boom Trucks.

7.1.4 The 2-inch-wide by 30-foot-long kinetic rope is ideal for safely recovering heavy-duty vehicles such as tractors, semis and dump trucks from sticky situations. Rated for 131,500 lbs. breaking strength and suitable for Cranes.

7.1.5 Kinetic ropes are best suited for vehicle recovery where both units involved have somewhat similar weight. A rope that is too thick or oversized for the recovery operation at hand will not stretch and will act more like a static component.

⚠️ **Warning:** Make sure the components are in good condition and strong enough for the recovery. A kinetic rope can stretch like a spring and if a component (shackle or anchor point) fails the rope can fly back towards itself.

7.1.6 When making rope connections to the vehicles' anchors, ensure they are frame mounted and sturdy. Protect the rope loop-ends from sharp edges.

7.2 Tow Ropes

7.2.1 The 1- 1/8 inch by 30-foot long **Bubba Rope Mega Tow Line** is rated for 147,000 lb. of breaking strength. Made of material called PLASMA® or high-modulus polyethylene (HMPE) that will not stretch, preventing recoil.

7.2.2 Bubba Ropes shall not be used for any suspended load rigging.

Figure 5 – Mega Tow line

7.3 **Recovery rope selection based on vehicle weight**. Bubba Ropes have no official Work Load Limit (WLL) information on the tag. The manufacturer recommends multiplying the weight of the stuck vehicle by a Safety Factor of 3.5 or 4 times and then selecting the rope that has a breaking strength that is equal to or higher than that number.

For example: If a Ford 450 SD Medium Duty Truck with 16,000 lbs. Gross Vehicle Weight (GVW) needs recovered, the rope rated for 56,000 lbs. or more should be selected.

Note: Working Load Limit (WLL) should always be greater than the GVWR for the bogged vehicle.

8. SHACKLES

8.1 Synthetic rope shackles (soft shackles) are preferred for vehicle recovery operations. Hard shackles (metal shackles) are a last resort and its usage must be approved by a supervisor.

8.2 Soft Shackles

8.2.1 Soft shackles are made of the same type material used for a winch line. These shackles are lightweight, very strong and flexible. These shackles are available at different capacities/ratings from 52,300 to 125,000 pounds rated breaking strength. Select one that has a similar capacity to the rope or strap you plan to use.

8.2.2 A shackle chafe guard is recommended when using a soft shackle to protect it from cuts and abrasion. The guards are made of nylon. Use them as a pair, protecting both sides of the shackle or a single contact point.

8.2.3 Table 1 list the soft shackles available and matching recovery rope capacities.

Table 1 – Soft shackles

Soft Shackle	Shackle Rope Diameter	Shackle Rated Break Strength (lb.)	Bow Diam.(in.)	Recommended Rope	Rope rated break strength (lb.)
Mega Gator-Jaw PRO	5/8	125,000	11	Mega Tow Line – 1-1/8 diam.	147,000
Mega Gator-Jaw PRO	5/8	125,000	11	Extreme Bubba, Tan eye loops. 2-in diam.	131,500
Mega Gator-Jaw	5/8	76,400	11	Jumbo Bubba - Green eye loops. 1-1/2 in diam.	74,000
Gator Jaw PRO	7/16	52,300	6	Big Bubba – Orange eye loops. 1 1/4 in diam.	52,300

Figure 6 - Soft Shackle and chafe guard

8.2.4 How to use

Figure 7 – How to use soft shackle

8.2.5 Soft Shackle Care and Maintenance

The Shackle can be washed with water and air dried. While Gator-Jaw fibers are stronger than steel, they are susceptible to wear and cutting. Always inspect the shackle before use for excess wear, cutting, or worn and frayed areas.

⚠ **Warning**: Do not exceed shackle breaking strength. If unsure if use is within capacity, DO NOT USE IT!

Keep away from hot exhaust and corrosive materials

Do not use if the shackle is cut, frayed, burned, melted or unbraided. It is not intended for highway use, prolonged towing, nor intended for lifting purposes.

8.3 Hard Shackles

8.3.1 When using hard shackles for vehicle recovery, Mosaic requires anchor style shackles with screw pin. These shackles may also be called Bow style shackles.

8.4 Shackle Identification and Marking

8.4.1 Shackles approved for vehicle recovery must have markings by the manufacturer to show:

- Manufacturer's name of trademark
- Size (Diameter of body)
- Rated Load / Capacity (Work Load Limit)

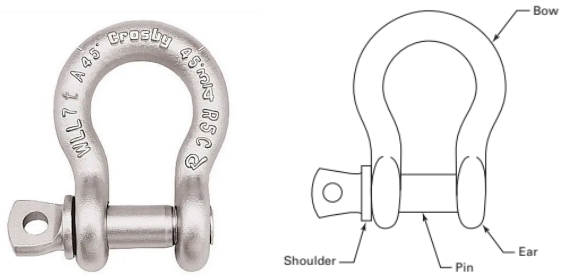
Note: Shackles must meet Mosaic's standard of domestic manufacture. Foreign manufactured shackles are prohibited.

8.4.2 Always use markings on the shackle body to identify the work load limit.

Table 2 – Hard shackles			
Shackle Size	Working Load Limit (WLL)	Safety Factor	Breaking Strength (lbs.)
5/8 inch	3.25 Tons / 6,500 pounds	6:1	39,000
3/4 inch	4.75 Tons / 9.500 pounds	6:1	57,000
7/8 inch	6.5 Tons / 13,000 pounds	6:1	78,000

8.4.3 Always ensure that the shackle selected meets or exceeds the working load limit for the task at hand and is comparable to the WLL or breaking strength for other recovery components to be used.

Figure 8 – Hard Shackle markings



8.4.4 The shackle pin may also may have some markings to identify the name of the manufacturer and material grade or load rating.

Figure 9- Shackle Pin Markings

8.4.5 Shackles must be removed from service if damage is visible after an inspection. Shackles shall only be returned to service when approved by a Qualified Person.

- Missing or illegible manufacturer's name and rate/load identification

- Load bearing components are bent, twisted, distorted, stretched, elongated, cracked or broken.
- Indications of damage
- Excessive thread damage
- Excessive pitting or corrosion
- Excessive nicks or gouges
- Incomplete pin engagement (Body spread, pin not fully seated)
- Makeshift or substandard pins not supplied by original manufacturer

Figure 10 - Hard shackle

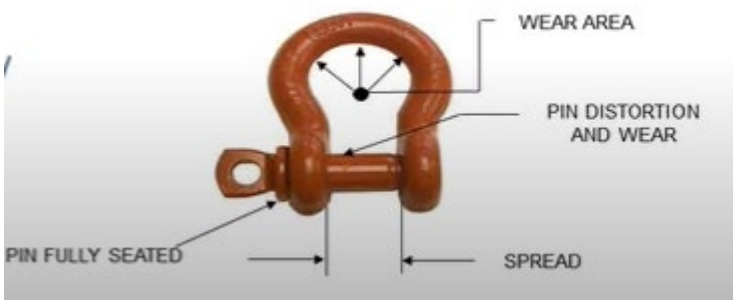


Figure 11 - Hard Shackle defects

9. RECOVERY DAMPENER

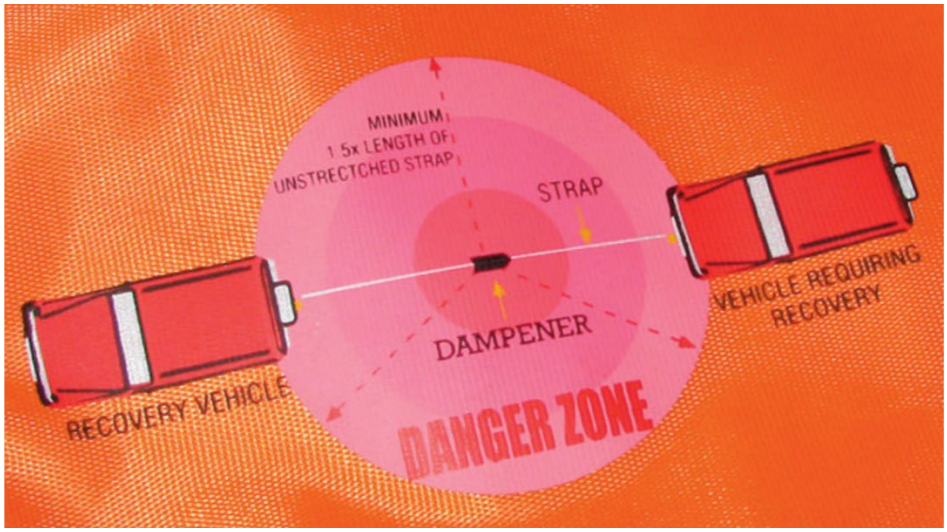
9.1 Recovery dampeners are used to mitigate the risk of flying projectiles that could cause harm to those involved with recovery efforts or nearby individuals. A recovery dampener can contain some of the recoil from a broken recovery rope or winch line if they should fail during a recovery operation.

9.2 Dampeners are typically made from heavy duty vinyl. Dampeners, due to their heavy weight design, can be used as is or additional weight can be added by filling inside pockets with extra weight. Dampeners are designed with a rubber coated center section prevents sliding down the towline, and a reflective strip provides increased visibility.

⚠ **Warning:** When using a dampener, precautions should be taken to keep observers at a safe distance. A dampener will not absorb all the recoil.

9.3 When using one dampener, place it on the winch line, recovery rope, midway between the winch and the anchor point. Do this before the cable or rope is put under tension. Do not approach or move it once tension is applied. If necessary to move or remove the dampener, slack the tension on the rope first. When using a dampener over a winch line do not allow it to get pulled into the fairlead.

Figure 12 – Recovery danger zone. 1-1/2 to 2 times the length of the rope.

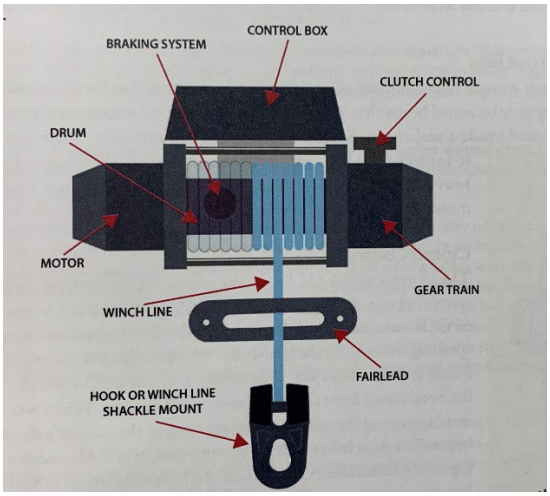


Note: People outside the vehicles involved in the recovery must remain outside this illustrated danger zone during the recovery.

10. WINCH

10.1 The standard winch is a Warn VR EVO 12-S (Winch-103225) with a Max Line Pull of 12,000 lbs.
Remote Type: 2 in 1 plug in remote with wireless capability.
Line material: Synthetic Rope; Diameter 3/8 inch; Length 90 ft.
Fairlead type: Hawse; Warn removable abrasion sleeve, part 100330.

Figure 23 – Typical electric winch.



10.1.1 **Winch Controller -** a low-voltage, wired control module that plugs into the winch control box. This allows the person to stand a safe distance from the winch when controlling the direction of the winch motor, drum and line – winch in or winch out. Some vehicles are equipped with a wireless remote control.

10.1.2 **Control Box** - contains all the electronics of a winch, plus the winch controller outlet.

10.1.3 **Clutch Control -** lever on the winch itself or a button on a wireless winch remote which normally has two settings: FREESPOOL and ENGAGED.

10.1.4 **Motor –** powered by the battery, this device provides power to the gear mechanism, which in turn rotates the winch drum and winds the winch line in or out.

10.1.5 **Gear Train** - transfers motor power to the drum.

10.1.6 **Drum -** sometimes called the winch spool, this is a hardened, hollow metal cylinder, around which the winch line is wrapped.

10.1.7 **Fairlead** - this device guides the line onto the winch drum and minimizes winch line wear. Fairleads are typically two types – roller and hawse. Fairleads with metal rollers are used with steel cable winch lines and Hawse fairleads are smooth, machined aluminum with no rollers.

10.1.8 **Winch Line Thimble** - grooved metal eyelet, around which the cable or synthetic rope is wrapped and fastened back onto itself. Metal thimbles protect the line from getting crushed or overstressed.

10.1.9 **Winch Hook or Winch Line Shackle Mount** - allows connection to winch line to recovery equipment. All new winches come with stock winching hooks mounted on a thimble.

10.1.10 **Hook Safety strap** - strap that allows individuals to keep fingers away from the fairlead while the winch line is being spooled in. When a winch line is attached to a hook at the end of the line, it should have a safety strap.

10.2 **Winch Line – Steel Cable or Synthetic Rope.**

Synthetic rope winch lines are preferred for vehicle recovery operations. Steel cable lines on winches are being replaced as vehicles come into the shop for service.

10.2.1 Synthetic rope winch line is safer than steel cable especially under extreme load when the potential for breakage exists.

10.2.2 Synthetic rope is lighter in weight and weighs about one-seventh the amount of steel cable.

10.2.3 Rope is stronger than cable. Based on diameter for diameter basis, synthetic rope winch line is over 30 percent stronger than quality steel cable.

10.2.4 Rope is less prone to retirement due to damage. Once a steel cable kinks, its breaking load strength is seriously compromised requiring it to be removed from service. Synthetic rope doesn't kink and has no bending "memory".

10.2.5 Cable is harder to spool back on a winch drum in the field. It is more prone to create disorganized winch line layers (called "Bird's nests') on the cable drum.

10.2.6 Synthetic rope is easier to abrade, cut or melt. In most winching situations, steel cable is less prone to damage than rope when sliding it over rough surfaces.

10.3 **Winch Safety**

Hazard Recognition

10.3.1 Pinch Point / crushing – entanglement in the moving parts of the winch (parts examples – pulleys, gears, calendar rolls, hooks, clamps).

10.3.2 Stored energy - the winch cable can break and backlash. While snapping back, the individual steel cable strands will also quickly "unwind". Synthetic rope winch line also has some stretch under high resistance load and can result in recoil causing it to snap backwards.

Hazard identification

10.3.3 Pre-inspection is required and will help ensure good functional working order prior to use.

Apply Effective Controls

10.3.4 Follow ALL manufacturer's instructions.

10.3.5 All rotating/moving parts shall be guarded.

10.3.6 The cable shall not be slid through a person's hands, even when wearing gloves. Over time, steel ropes can have broken wires protruding from them.

10.3.7 While paying out cable, utilize a WARN Hook Strap or other device without a handhold to prevent direct contact with the hook if backlash occurs.

10.3.8 Know the winch's weight capacity. Ensuring a winch suitable for the job will minimize the potential risk.

10.3.9 Estimate the total resistance and consider grade and slope, weight of the vehicle, and type of surface/terrain and include a reasonable factor of safety.

10.3.10 Do not overload / shock load the winch to avoid damaging the brake.

10.3.11 Ensure drum clutch is disengaged when pulling rope out to allow it to "free spool"

10.3.12 Keep the rope fed through the fairlead as straight as possible. This will help keep the rope from becoming damaged from kinks and bunching up.

10.3.13 Before tightening and during winch use, keep everyone clear of the vehicle, equipment, and rope. Designate a spotter to observe any issues that may arise and to alert personnel.

⚠ **Warning**: Every winching situation has the potential for personal injury. To minimize that risk, it is important to familiarize yourself with the operation of your winch before using it and be constantly safety oriented.

10.4 Field method of determining resistance.

10.4.1 Rarely it is necessary to arrive at a precise weight in recovery operations. A close estimate will generally suffice. It is also difficult to use a mathematical formula to determine the resistance of a vehicle in mud. A practical estimate made by the Army Manual on Vehicle Recovery Operations is as follows:

10.4.2 When a vehicle becomes bogged to the extent that it can no longer propel itself, the resistance to overcome is at least equal to the weight of the vehicle.

10.4.3 Vehicle weight can be used as an estimate until the mud comes up to the top of the wheels. If the vehicle is mired to the fenders, the weight of the vehicle should be multiplied by two to estimate resistance. If the vehicle is mired to the cab, the weight should be multiplied by three.

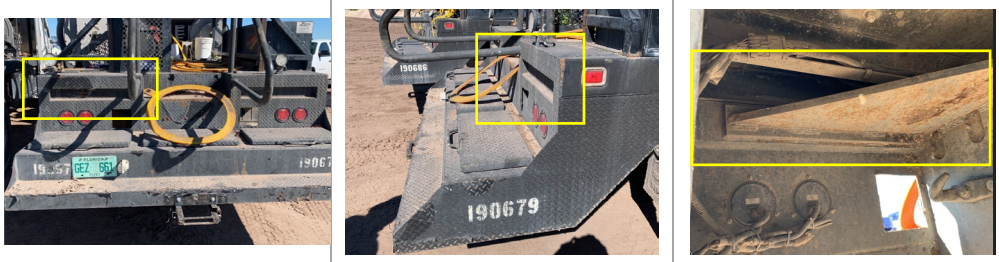
10.4.4 During the planning of the recovery, a Mosaic representative should be able to determine if recovery equipment capacity (winch or rope) is appropriately sized for the vehicle being recovered.

11. Vehicle recovery without using ropes – push method

11.1 The push method is used during a Low Risk Vehicle Recovery scenario, where a recovery vehicle can approach the disabled vehicle, thus requiring no need to erect rigging.

11.2 At mine sites, float trucks are outfitted with a custom reinforced rear bumper push box. These boxes that can be used to push a bogged truck forward using a front-end loader equipped with forks.

Fig 14 – Float truck bumper push box



12. TRAINING

12.1 The following table outlines the training required for this procedure

Audience	Training Elements / Topics	Frequency	Method
Fleet vehicle user Supervisors	Vehicle recovery general knowledge Vehicle-assisted recovery operations Self-recovery - winch	New hire Every 3 years refresher	CBT
Equipment Operator	Vehicle recovery general knowledge Vehicle-assisted recovery operations Self-recovery - winch	Every 3 years refresher	CBT

13. DEFINITIONS

13.1 **Breaking Strength** - Breaking Strength sometimes also known as Rated Capacity refers to the labeling of some recovery equipment. It is defined as the point at which the recovery equipment will fail. Typically stated in pounds, breaking strength for a recovery rope is determined through destructive testing under ideal controlled conditions when the product is new. Some ropes list Minimum Breaking Strength (MTS), while others use Average Tensile Strength (always higher than MTS). MTS is the best measure of rope strength and is the strength at which the weakest test sample broke.

13.2 **Safety Factor or Design Factor -** the ratio of the breaking strength to the work load limit. Some brands of shackles have a safety factor of 6 to 1 while some ropes have a ratio of 3:1. Safety Factors are not regulated and can range all over the place.

13.3 Work Load Limit (WWL) - WLL is a calculated number derived by applying a Safety Factor. The WLL for a rope is the MTS divided by a Safety Factor (SF). The point of the Safety Factor is to help prevent a user from overloading the rope or shackle past its breaking point.

14. REVISION LOG

Rev. No.	Rev. Date	Revised By	Reason for Revision
0	09/01/2021	PMO	Initial release
1	2/15/2024	PMO	Recovery equipment
2	5/15/2024	PMO	Equipment turn-in