



Public Works Department – *Standard Operating Procedure*

NUMBER: 26.0

TITLE: Snow Management and Ice Control Plan

DIVISION RESPONSIBLE FOR UPDATES: Street Operations

26.1 Snow and Ice Control Plan

This snow and ice control plan is meant to supplement the official Town Council approved snow and ice control policy. Information in this plan is geared toward providing information and guidance to Town employees that have snow and ice removal responsibilities on public Town roadways.

The primary objectives of the program are:

1. Provide snow and ice control services to facilitate emergency service access to stakeholders, and
2. Minimize duration of impact to the community's normal vehicle operations.

The following are the service levels established to meet the above objectives:

- Plow snow from streets during storm events so that at least one lane is passable in each direction, 95% of the time. Plows are not deployed to secondary streets for every storm. This goal applies to secondary streets when plows are deployed to these streets.
- Plow snow from primary streets (Priorities 1 & 2) so that all lanes are opened for travel on all primary roads with Priority one roadways plowed from curb to curb within ten (10) hours after snowfall ceases, 95% of the time.
- Plow snow from secondary streets (Priorities 3 & 4) so that at least two lanes are passable within 10 (10) hours after snowfall ceases, 95% of the time, for storm events between November 15 and March 15
- Remove snow plowed to the center of streets in the downtown area within 72 hours after snow fall ceases, 100% of the time

26.2 Storm Warning Notification

The Streets Operations Manager and the Division Superintendent monitor weather reports from national and local forecasters to determine the necessary personnel and equipment per event. After thorough evaluation of emailed and televised forecast the mobilization order is then given to respective Snow Managers.

The Public Works Street Operations Division utilizes the National Weather Service, the Town's Police Department and the Douglas County Sheriff's Department to help determine when snow and ice control operations should begin. After normal working hours, this will typically be done by the use of Town officers in the field contacting the Dispatch area and advising them of potentially adverse road conditions.

The Department's Street Operations Manager will decide when to begin snow or ice control operations. The criteria for that decision include:

- Established snow accumulation thresholds within the Town Council approved snow policy;
- Drifting of snow that causes problems for travel;
- Icy conditions which seriously affect travel;
- Time of year and predicted weather forecast; and
- Time of snowfall in relationship to heavy use of streets

Snow and ice control operations are expensive and involve the use of limited personnel and equipment. Consequently snowplowing operations will not generally be conducted for snowfall of less than two (2) inches. The official Snow & Ice Policy document approved by Town Council establishes threshold depths. This document is located at:

J:\Programs\Accreditation - Department Policies & Procedures\26.0 Snow Management & Ice Control

When snowplowing and/or ice control operations are initiated, all primary streets (Priorities 1 and 2) will be plowed. Secondary streets (Priorities 3 and 4) may or may not be plowed when snow and ice control operations are initiated for primary streets. The criteria to initiate snowplowing on secondary streets involve a determination of whether the streets will be passable for vehicles based on the predicted storm event. Temperatures and time of year will also be considered. No more snow will be plowed than is necessary to maintain two-way traffic.

Generally, secondary streets will be plowed when the accumulation of snow or ice is predicted to be more than four (4) inches on the roadway:

- Between November 15 and March 15, or
- Is predicted to deposit snow greater than 8 inches in depth on the roadway prior to November 15 or after March 15

The Snow and Ice Control Policy is the official document for current thresholds.

26.3 Personnel Scheduling

A complement of equipment and personnel will be deployed to plow snow for every storm event in accordance with the requirements found in the current Snow and Ice Control Policy. This can vary between 6 and 50 personnel, as well as between 6 and 26 pieces of equipment.

The following are the minimum staffing numbers that are necessary to fulfill 24-hour operations throughout the full duration of a storm, utilizing two 12-hour shifts.

Primary Streets (Priorities #1 and #2): 26
Secondary Street (Priorities #3 and #4): 20

In order to provide for full manning, the following number of employees from the departments listed will be maintained:

Public Works:	Number of CDL staff: 16	Non-CDL staff: 12*
Water:	Number of CDL staff: 16	Non-CDL staff: 12
Parks & Rec:	Number of CDL staff: 6	Non-CDL staff: 7
Total Pool:	CDL staff: 38	Non-CDL staff: 31

**Includes department employees funded by Development Services Enterprise Fund*

Start times will vary depending on the event.

Public Works will monitor all forecasts and develop the manning needs for each storm event. Available staff from Public Works will be utilized first. All remaining needs will be drawn from the remaining pool. The Public Works Snow Manager will provide each department's Snow Coordinator with the number of staffing needed for each shift identified. The Snow Operations Shift Manager will make adjustments as necessary to deal with changing, or forecasted changing conditions.

The full "pool" of staff from each department will be trained so that the individual Department Snow Coordinators can determine individually how they wish to supply the number of staff requested for each shift of each snow event..

Snowplow operators will be expected to work up to twelve-hour shifts. Because of safety concerns, no operator shall work more than a twelve-hour shift in any twenty-four hour period. Operators will take a fifteen-minute break every two hours with a half-hour meal break after four or six hours depending on circumstances and operational need. After a twelve-hour shift, the operators will be replaced if additional qualified personnel are available. This is in line with Town personnel guidelines which require a minimum of 8-hours rest in any 24-hour period.

26.4 Mobilization

When a snow deployment is activated, Department Snow Coordinators will be notified by the Street Operations Manager or the Streets Division Supervisor as soon as possible. The Snowplow Managers will then be responsible for contacting their respective staff to notify them of the reporting time. As much notice will be given as possible. However, personnel will be expected to respond within one (1) hour of being notified.

The Snow Operations Shift Manager will update information as soon as it's available; include future predictions, expected shift start times with date and current time. When the timing of a storm and prediction is large enough to activate the residential plowing operations it will be determined by the Snow Operations Shift Manager if personnel need to be sent home to prepare for the snow event. When this happens all Department Snow Coordinators will receive an e-mail along with a phone call to make sure all employees that are affected are sent home to get the proper rest required. The Snow Operations Shift Manager will communicate available accommodations as determined by storm intensity and duration.

Personnel are expected to be available anytime that snowfall is predicted. Therefore, their mobile cellular phones should be charged and "on" in order to be contacted for duty. The Snow Coordinators are responsible for:

1. Assigning personnel to snowplowing duties and shift
2. Notifying personnel when a plowing shift is activated
3. Managing requests for time off & sick leave
4. Arranging for the delivery of snowplowing equipment to the Public Works Service Center for each storm event

It is up to the Department Snow Coordinators to allow for transition time between regular work duties and snow plowing duties so that proper rest periods will occur prior to the initial shift and after the final shift.

26.5 Snow and Ice Control Materials

The following materials are purchased prior to the Snow and Ice season when prices are lowest for shipment. The Granular materials are stockpiled and stored in a covered facility located at 675 Justice Way. The liquid materials are stored in double wall self-contained spill proof containers at the same location.

The following materials are available for use on Town streets:

Ice Slicer (anti-icing material):	3,500 Tons
Liquid De-Icier (Magnesium Chloride)	12,000 Gallons

The material to be placed on a designated route is determined by the route priority.

Primary Streets

- The primary streets are divided into seven (13) areas for snow & ice control efforts.
- Up to 26 Town personnel will be used to clear these routes
- These are the heavy-duty, big plows & heavy equipment and will focus on clearing the Town's arterials and collectors (Priorities 1 and 2 streets)
- Priorities 1 and 2 streets make up close to 65% of all lane-miles in the Town
- Personnel assigned to these duties need a Commercial Driver's License (CDL)

- After the event, crews will clean up intersections and finish widening the routes.

Secondary Streets

- The secondary streets are divided into five (10) areas for snow clearing efforts; Deicers will be placed only in limited areas.
- 10 Town personnel will be used to clear these routes; 1 person for each route.
- These are the light-duty plows and will focus on clearing the Town's residential streets. (Priority 3 and 4)
- Priority 3 and 4 streets make up close to 35% of all lane-miles in the Town.
- Personnel assigned to these duties do not need a Commercial Driver's License (CDL)

In response to the potential of heavy snow accumulating on very cold roadway surfaces and forming hard pack ice/snow on the roadway. Two business days ahead of the forecasted snow event, The Streets Division Manager will consult with the Public Works Director to recommend to the Town Manager that Enhanced Plowing Operations be initiated below the standard threshold set forth in policy. The decision will be made after determining that conditions may exist that would cause snow fall in residential roadways to persist for an extended period of time as snowpack/ice. The following criteria will be used to determine if this recommendation should be made.

- An extended period (5 or more days) of very cold temperatures (20 degrees or lower daytime temps) precedes a snow storm that lowers the consistent surface pavement temperature below 32 degrees.
- An extended period (5 or more days) of very cold temperatures (20 degrees or lower daytime temps) following a snow storm that would prevent melt and inhibit road recovery.
- The moisture content ratio of the forecasted storm (if data is available) is lower than 10:1 (Meaning 10 inches of snow equals 1 inch of precipitation)
- Several, closely spaced, smaller storms that would not require an enhanced plow response on their own would collectively result in snow accumulation on roadways of several (4 or more) inches. The intent is to maintain snow accumulations on the roadway below the threshold amount. An example: A 2" storm on Monday, another on Wednesday, and another on Friday, the total would be 6" (assuming a 4" threshold). Enhanced operations would be deployed for the Wednesday and Friday storms.

ROADWAY PRETREATMENT – Determination & Protocols

There are some circumstances where the application of material to pre-treat the roadways will enhance roadway conditions and augment snow and ice mitigation efforts.

For these situations the following material is available for use on Town streets:

Liquid De-Icier (Magnesium Chloride) 12,000 Gallons

The overall objective of pretreatment is to proactively prevent or mitigate the buildup of ice and snowpack on priority roadways to facilitate the passage of emergency services and other vehicular traffic throughout the community.

The Streets Operations and Maintenance Division Manager, Street Operations Superintendent, or designee will monitor numerous weather services to determine whether or not there is a need for proactive application of deicing material. It must also be noted that granular deicers will not be considered for pretreatment of roadways due to air quality concerns.

The basic criteria for consideration for pretreatment of road surfaces will be as follows:

- Generally between November 15th and March 15th
- Dry conditions are expected to precede the event.
- Priority 1 pretreatment route – ambient temp is forecasted to drop below 32 degrees for 4 to 6 hours or more.
- Priority 2 pretreatment route – ambient temperature is forecasted to drop below 20 degrees for 6 or more hours.

The 2019/20 Pretreatment Priority 1 and 2 map is located at: J:\Divisions\Streets\1 SNOW & ICE CONTROL\Snow Route Maps\2018-2019 Maps IcePretreatment_Overall.pdf

Further considerations for pretreatment must be taken into account even if the above criteria are met. Pretreatment will not be conducted when the following conditions are expected:

- Rain is forecasted prior to event.
- Drizzle is forecasted prior to the event.
- Asphalt temperatures are expected to remain relatively high (over 32 degrees) for the first four hours of the event.

Studies have shown that pretreatment efforts can be effective up to 7 days in advance of a snow event provided that conditions remain dry before the event. Generally the decision to apply pretreatment will occur no greater than five days prior to an event due to the extremely variable nature of weather patterns in the Colorado Front Range.

In most circumstances the pretreatment operation will occur during normal business hours. In the event of an extended weekend or holiday period, a crew consisting of on call personnel will be called upon to carry out the operations.

The Division Manager or Superintendent will monitor the forecast for the weekend event and establish a plan of operations which may include pretreatment prior to the event. The on call Supervisor will continue to monitor conditions during the weekend to be able to appropriately adjust operations and or pretreatment needs during the weekend.

TRAINING

All staff assigned to plowing duty will be trained annually so that in the event of a very large event where multiple shifts are needed, adequate trained personnel are available to respond. Training is managed by the Street Operations Manager. This will also allow for redundancy and backups in the case of vacation, alternate schedules, etc.

26.6 Equipment Inspection

Annual inspections are performed by the Fleet Division to inspect the vehicles for DOT operational approval. During the month of September the Streets Division gears up the removal equipment with the appropriate sanders and plows per designated vehicle. The crew examines the vehicles and their attachments to see if any repairs are needed. If repairs are needed the crew addresses them on a case by case basis to get them into service. The equipment is test driven to make sure that everything is functional to include testing of the AVL system.

In preparation for a predicted event crew members are then assigned to prep the equipment to include pre-trip inspections, fueling and fluid checks are completed along with any repairs prior to the event.

26.7 Equipment Calibration

The Street Operations Manager or Division Supervisor will coordinate equipment calibration annually. Liquid applicators and granular applicators are calibrated with the vehicles' output controls. This is to ensure that material is not wasted and used efficiently as possible. The liquid deicing truck control box is put into calibration mode and is run thru a test sequence and the material is caught in five gallon pails. The material is then measured to make sure the output is the same as the control panel is indicating. The system is set up to have a range of output from 20 gallons to 100 gallons per lane mile. The operator is trained to average 70 gallons per lane mile but has the ability to increase amount depending on road conditions.

The dump trucks out fitted with V-box spreaders are calibrated by the Force America Representative. The application rate is set at 100 to 1000 pounds per lane mile. The

operators are trained annually to apply an average of 140 pounds per lane mile and have the ability to raise the amount depending on road conditions. The max pounds per lane mile are used to unload the trucks.

The dump trucks out fitted with tailgate spreaders are calibrated by the Force America Representative. The application rate is set at 100 to 500 pounds per lane mile. The operators are trained annually to apply an average of 140 pounds per lane mile and have the ability to raise the amount depending on road conditions. The max pounds per lane mile are used to unload the trucks.

26.8 Snow Route Assignments

Snow and ice control efforts are a basic responsibility of the Town to provide for travel and emergency service access. Snow storm events cannot be predicted and are often of varying lengths and intensity requiring different levels of resources.

The Public Works Department is the primary Town department responsible for snow and ice control operations. They are assisted primarily by the Utilities Department as well as the Parks & Recreation Department with personnel resources depending on the time of year and intensity of the storm event.

Primary Streets

- The primary streets are divided into thirteen (13) areas for snow & ice control efforts
- 13 Town personnel will be used to clear these routes and each truck is equipped with a map book of all areas of town. Each employee is assigned an area before each event with a designated route by the Snow Operations Manager
- These are the heavy-duty, big plows & heavy equipment and will focus on clearing the Town's arterials and collectors (Priorities 1 and 2 streets)
- Personnel assigned to these duties need a Commercial Driver's License (CDL)

Secondary Streets

- The secondary streets are divided into ten (10) areas for snow clearing efforts;
- 10 Town personnel will be used to clear these routes; Each truck will be equipped with a map book of all areas of town. Each employee will be assigned with a designated route at the beginning of their shift by the Snow Operations Manager.
- These are the light-duty plows and will focus on creating a passable lane in each direction on the Town's residential streets. (Priorities 3 and 4 streets)

Personnel assigned to these duties do not need a Commercial Driver's License (CDL)

Emergency Situations

All requests for emergency assistance from the following agencies will be responded to immediately:

- Town of Castle Rock Police Department
- Town of Castle Rock Fire Department

- Douglas County Sheriff's Office
- Colorado Department of Transportation
- Colorado Highway Patrol or
- Other emergency service agency

Calls for emergency assistance from the public will be transferred to Police Dispatch or requested to call 911.

Emergency Declaration and Emergency Operations Center (EOC)

In the event of a snow emergency, the Town Manager or his designee will make a Declaration of Snow Storm Conditions in accordance with Municipal Code 10.10.030. Following this declaration, traffic control and law enforcement will assume actions under Municipal Codes 10.10.040 and 10.10.050. These actions will commence until the Town Manager or his designee terminates the Snow Storm Condition, as outlined in Municipal Code 10.10.060.

The Town Manager may also activate an emergency operations center to centralize response activities and coordinate communications with the public.

26.9 Loading Procedures

Annually, during pre-season preparedness the lead team members of the Streets Division train and teach operators the safe techniques of properly loading equipment with the desired amounts of materials. This includes liquid and granular filling operations, such as utilizing the wheel loaders to load out granular material and the proper use of the storage tanks to deliver liquid materials to the application equipment.

- The first operator to the storage facility operates the wheel loader for the granular vehicles, loading out all the trucks.
- All liquids are loaded on the equipment prior to the forecasted event.
- Once the equipment is loaded the operators adjust tailgate spreaders according to the desired output for the severity of the event.
- Liquid applicators and granular applicators are calibrated during the pre-season preparations.

26.10 Spreading and Plowing Procedures

Each year snow removal operators are required to attend the annual snow and ice control training that is facilitated by the Streets Division. This training discloses all the aspects of plowing and proper placement of the de-icing materials that are to be used.

- Pre-trip inspections

- Safe operations (speed limitations, braking techniques, seat belts, amount of snow a vehicle can safely remove while maintaining control of the vehicle)
- Self-preparedness (well rested, food, and a possible change of clothes)
- Knowing the routes before the snow covers the area
- Snow Storage
- Granular placement techniques
- Liquid placement techniques
- Snow route priorities see section 26.8
- Levels of Service see section 26.8
- Checking communication before heading out to assigned route (radios, and cell phones)

26.11 Snow Storage

Snow will be plowed in a manner so as to minimize traffic obstructions. The center of the roadway will be plowed first. The snow shall then be pushed from left to right on two-way streets. On one-way streets or where there is a center boulevard, snow may be pushed in either direction. The discharge shall go onto the area behind the curb for primary streets and into the parking area on secondary streets. Snow in cul-de-sacs will normally be plowed to the center in an attempt to provide the largest turning radius possible for emergency vehicle ingress and egress. When a plow goes on a bridge, the driver shall slow down so snow does not go over the bridge, if possible.

Streets and parking stalls in the downtown area will be plowed to create a windrow of snow in the center of the street. Removal of the snow in these windrows will be completed when all other roadways are passable. This special service improves overall driving conditions and allows for public parking where pedestrian and vehicle traffic volumes are the highest.

The Town's Street Operations Manager will determine if and when snow will be removed from an area by truck. Such snow removal will occur in areas where there is no room on the street or in vegetated areas behind the curb for snow storage and in areas where accumulated piles of snow create a hazardous condition. Snow removal operations will not commence until other snowplowing operations have been completed. Snow removal operations may also be delayed depending on weather conditions, personnel and budget availability. The snow will be removed and hauled to a snow storage area.

When snow is removed from the streets trucks will be loaded with a snow blower or front end loader and the snow will be hauled to the snow storage area located on the west side of the downtown area. All operators will visit this area prior to winter months to establish snow storage location and procedures.

26.12 Snow Operation Damages

If a driver witnesses an accident, notify police dispatch on the following;

- Location – address and cross street, if possible
- Indicate whether anyone was injured
- Request police or fire personnel if needed

If involved in an accident;

- Contact your supervisor and police dispatch
- Stay with vehicle and wait for assistance
- Place warning markers as needed
- Do not discuss accident with others involved

Do not use your vehicle to pull out motorists who are stuck or jump start another vehicle. If you witness a vehicle that is obstructing traffic or causing an unsafe condition, call police dispatch and advise them of the location and description of the vehicle.

Should the plow strike an object (manhole, water valve, curb or any object in the road right of way), check the plow for possible damage. If plow needs new blades, bolts or curb shoes, contact supervisor immediately and document damage to all infrastructure so necessary repairs are made promptly. Complete a post-trip DVIR (DRIVER'S VEHICLE INSPECTION REPORT)

Damage claims associated with private property are handled through the Town's Legal Department in the same manner as all private property damage claims associated with any Town activity.

26.13 Parking Limitations

On-street parking limitations may be enforced during snow emergencies. In the event of a snow emergency, the Town Manager or his designee will make a Declaration of Snow Storm Conditions in accordance with Municipal Code 10.10.030. Following this declaration, traffic control and law enforcement will assume actions under Municipal Codes 10.10.040 and 10.10.050. These actions will commence until the Town Manager or his designee terminates the Snow Storm Condition, as outlined in Municipal Code 10.10.060.

26.14 Performance Measures

The following table identifies the key performance measures that the Division utilizes in order to assess levels of service from year to year.	Goal
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Performance Measure	
Percentage of storm events where primary streets are plowed so that so that at least one lane is passable in each direction during the storm.	95%
Percentage of storm events where primary streets are plowed to open all lanes of traffic within 10 hours after snowfall ceases.	95%
Percentage of storm events where secondary streets are plowed so that 2 lanes are passable within 10 hours after snowfall ceases.	95%
Percentage of storm events where snow is removed from the downtown area within 72 hours after snowfall ceases	100%

26.15 Summary Highlights

AVERAGE DAILY PRODUCTION: Complete plowing 10 hours after it stops snowing

RECOMMENDED CREW SIZE: 6 - 50 personnel

GENERAL PROCEDURE:

- Pre wet bridges and trouble spots
- Deploy dump trucks when it's starting to get slick
- Deploy pickups when snow depth on the roadway is predicted to be 4 inches or more between November 15th and March 15th.
- Haul snow from downtown within 72 hours after snowfall ceases
- On-Call Mechanic on duty
- Communications with all Snow Managers

EQUIPMENT:

- 13 dump trucks equipped with plows and sanders
- 10 pickups equipped with plows
- 3 loaders
- Motor grader
- V-plows
- Snow blower
- Communication devices
- Hardware and software with AVL

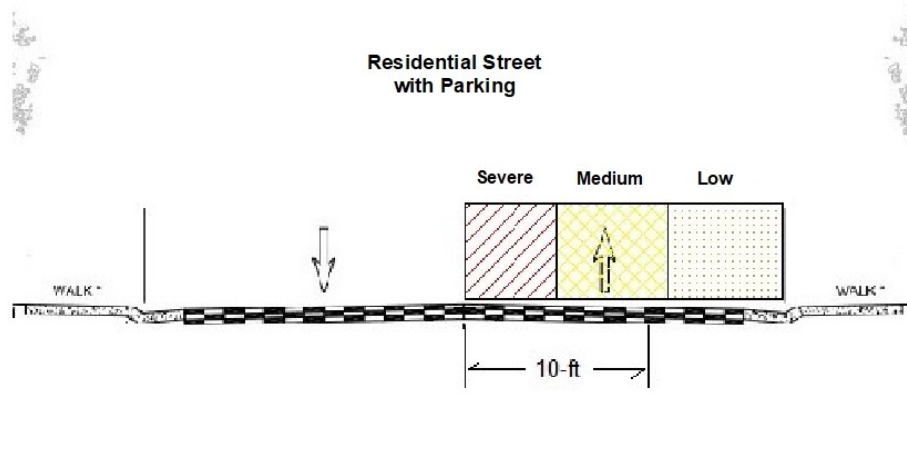
- Personnel Protective Equipment (Refer to CIRSA PPE Manual for required safety gear located on the (J: Drive, Safety, PPE Manual), or the Street Division Operations room.

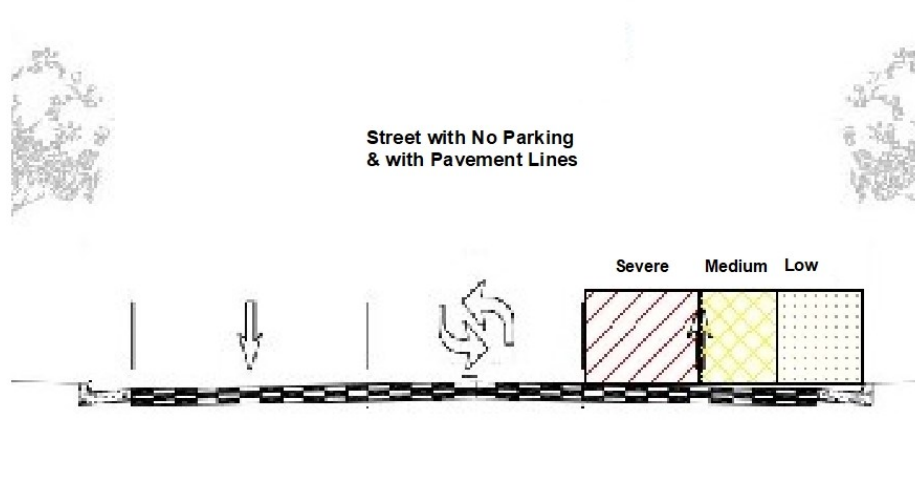
26.16 Post Storm Ice-Breaking

Ice-breaking operations begin after snow management operations have ceased after a snow storm. If another snow storm occurs prior to all ice-breaking operations being completed, ice-breaking operations will cease, and snow management operations will commence.

Problem Definition: Icing on travel lanes of roadway.

- Severe – Ice covers more than 50% of a single travel lane.
- Medium – Ice covers up to 50% of a single travel lane.
- Low – Ice does not affect the wheel paths of a single travel lane.





Prioritization: Ice-breaking resources will be dispatched to locations based on a priority system using the problem definitions listed in the previous section to determine order of operation, with the goal of maximizing traction for vehicles:

Priority #1: Primary streets identified on snow management maps

- High volume intersections first
- High volume segments next

Priority #2: Secondary streets identified on snow management maps

- Higher volume intersections first
- Higher volume segments second
- Gang mailbox locations third

Residential Routes #3: Tertiary and quaternary streets on snow management maps

- Higher volume intersections first
- Higher volume segments second
- Gang mailbox locations third

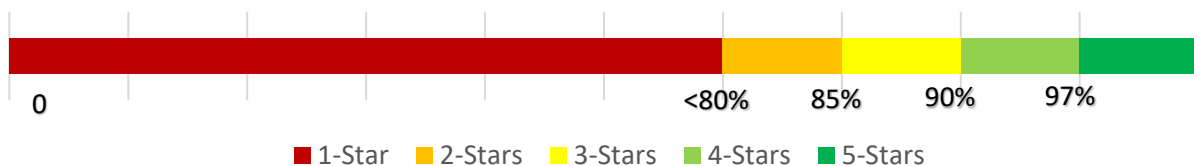
Location Identification: Once snow management operations have been completed. Streets personnel will begin assessing ice-breaking locations and prioritizing responses per the previous sections.

- Streets staff will be divided into areas to complete a full assessment of these areas and list all locations requiring ice-breaking. Areas will be identified by approximate length of each of the three problem definitions.
- All locations will be mapped and prioritized.
- Resources will be dispatched to priority locations based on judgement of the Division Manager and/or Field Supervisors

- Calls from the public identifying locations will be added to the priority listing as they are received.
- Streets personnel will assess all called in locations and adjust priority based on this assessment.
- The Division Manager and/or Field Supervisors will use judgement when determining whether it's more productive to hit various priorities in the same area.

Service Level:

- % of Severe locations addressed within three business days after snow stops.



This LOS will be assessed one time after each storm. The average for all storms for the year will be completed at the end of each year.

Operational Procedures:

Triage – Prioritizing Work

- After Ice-breaking crews are deployed, Field Supervisors will continue to assess known areas and ice complaints in order of receipt, to prioritize the work areas.
- Crews will move into high priority areas based on the prioritized work list and guidance from Supervisors.

Ice Breaking Operation

- Crews, when possible, will be equipped with a motor grader, front-end loader, icebreaker attachment, one plow dump truck.
- When icebreaking crews are deployed, they will first address the ice build-up in the travel lane of the roadway and continue to clear the ice into the flow line of the gutter. The ice may be placed back into the snow storage area subsequent to being initially removed as described below.

Ice Disposal:

The disposal of the ice will depend on a number of circumstances but the general options are:

- Windrow – Break the ice and windrow along the sunny side of the roadway in the snow storage area or if possible, the side of the roadway where no structures are present, taking care to avoid piling material in front of driveways, crosswalks, gang mailboxes, and ensuring the flow line of the gutter is clear for drainage.
- Haul – In the event there is no sufficient storage area or there is too much ice then crews may use a number of dump trucks to haul off the ice to an approved dumping location. (Time and labor intensive)
- Slushing – Mix the ice with salt and move the mixture back and forth across the roadway until melted. (This method is only recommended for high ambient temperatures are present. Also time and labor intensive)

Reviewed and Updated: October 2020

Approved: _____
Assistant Public Works Director