CITY OF GATLINBURG, TENNESSEE

INTEGRATED SOLID WASTE MANAGEMENT STUDY

FEBRUARY, 1993

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Introduction:

MTAS has been asked to do a review of the Gatlinburg sanitation division and its methods. Total review is necessitated because of the change to the composting of the entire waste stream at a central plant. In coordination with this disposal change, the City needs to make certain that the best methods are found for collection and transfer operations. **Collection is the primary thrust of this report.** However, in an integrated system, collection, transfer, and disposal all have to be considered together--none of it exists alone.

Gatlinburg has what is possibly, in MTAS observation and experience, the most difficult collection scenario of any city in Tennessee. This is due to traffic intensity during tourist season, predominance of restaurants with much food waste, cardboard containers, general tourist impact, steep mountain roads, bear visitation and distance to the disposal site. Add to this the need for public "cultural change" brought on by the Tennessee Solid Waste Management Act of 1991, the increasing expense of solid waste and the accelerating development, by manufacturers, of the means to do it differently--the time has arrived for a major re-thinking of the system.

EXECUTIVE SUMMARY

(A) **Install a transfer station in order to insure competency of the satellite truck operation and raise the effective work time of personnel and vehicles.**

(B) **Collect residential and some commercial with one man satellite trucks. The semi-automated cart system will be maintained as an option.**

(C) **Maintain the present commercial system but upgrade efficiency of operations.**

(D) **Change the yard waste system to knuckleboom collection and in-city grind and mulch and compost system.**

(E) **Handle bulky miscellaneous goods by use of a knuckleboom truck.**

(F) **Find the means of bear proofing with a prototype program and incrementally initiate into the system.**

(G) **Improve some of the safety procedures and personnel policies.**

The **most important recommendation is the concept of the transfer station.** If financially necessary, start by using the 29 cy truck as a transfer station, later moving to a fixed facility. The method of doing this explained later.

The **second most important recommendation is the conversion of residential to satellite truck collection.** This conversion might also include some commercial change over to carts if the cart system is adopted. The satellite idea will only work if a transfer station is available.

The **third most important idea is the steps taken to upgrade the efficiency of the commercial operation** including city ownership of the dumpsters, timely repair of the dumpsters, upsizing of all dumpsters to a uniform 4 cy size, hard standing the dumpster platforms, eliminating as many dumpsters as possible over to the satellite served cart system and bear proofing all commercial containers with locking devices, stiff lids or chains as necessary.

The **fourth most important idea is the pick-up of yard trim and bulky miscellany with use of the same knuckleboom vehicle. Shred and dispose of yard waste inside the City.**

We are not going to adjust the organization chart. Since the department operates on a very flexible basis with men and vehicles serving multiple purposes, we would urge that this policy be continued. **The sanitation manager needs maximum flexibility in assigning people and equipment.** As operations are revised, deal with each employee slot on a case-by-case basis. We are not going to use the word "elimination" here in relation to employee slots because conversion into a cleaner and better served City will absorb the manpower.

The City will need to gradually transition into whatever is to be done as a future system since so much investment is locked up in the present system. Some of the present system components that are suggested to be changed are: (1) Some of the City-owned side loading trucks to smaller one man vehicles as stated above; (2) Customer-owned side loading dumpsters to City owned dumpsters and uniform larger dumpsters; (3) Possibly the replacement of the wooden pens that are built around downtown street receptacles to igloo receptacles; (4) Multiplicity of constructed pen enclosures found by homes to uniform bear proof enclosures; (5) Multiple residential container types to a uniform size and type of can; and (6) The hand loaded bulk flat bed truck to a knuckleboom crane assisted pick-up. **These will all be discussed in various places in this report.**

It is further **recommended that one change at a time be done** to insure that all the problems are worked out and the system is fine tuned for the next change. If the Council desires, this process can still be quite short in time--possibly no more than two (2) years.

Base Data:

The purpose of a "base data" section is to list the arithmetic of the various parts of the system.

Gatlinburg has a permanent population of approximately 3,500. The tourist population raises the number to be served up to approximately 30,000 to 40,000 on any given day during the vacation months.

The waste stream reflects a vacation community. This consists of large quantities of cardboard (OCC--old corrugated cardboard) from supply boxes, food wastes and consumer throw-a-way materials. There is very little, if any, bulk industrial waste that was ever observed since the only industry is tourist oriented, service business and custom craft houses. The food waste, tourist impact and the political objective of a high level of downtown cleanliness makes the commercial sector pick-up a virtually non-stop operation.

The sanitation division carries 17 people on the payroll. The organization consists of the following: one sanitation manager and one assistant supervisor, six drivers, seven utility (loaders) workers and two sweeper operators--water truck drivers. The division will also carry three to four seasonal workers raising the total number of employees to 20 to 21.

All crews currently consist of two men per truck with the exception of the sweeping crew. Regardless of type of truck, three men are never on the same truck. The men and vehicles are assigned to crews as follows:

one sanitation manager
one assistant general supervisor
one sweeper operator (one sweeper vehicle--night crew)
one water truck operator (one water truck--night crew--works with the sweeper)
two flat bed truck crewmen (one flat bed vehicle--on-call bulk and miscellaneous service)
six side loader crewmen (three dumpster vehicles--daytime front street and commercial)
two side loader crewmen (one dumpster vehicle--night time front street and commercial)
four residential crewmen (two separate vehicles--two separate routes)
two to four extra temporary personnel for relief of absent parties and miscellaneous duties

Vehicle inventory is as follows:

one 15-cy hand loaded residential side loader (Scranton New Way)
one 18-cy hand loaded residential side loader (Pak-Mor)
four dumpster container side loaders as listed; 29 cy, 27 cy, 24 cy and a 23 cy--the 23 works at night. (Two of these are Truxmore and two are Pak-Mor)
one 14-cy "back-up" hand loaded side loader truck (Pak-Mor)

one regenerative air sweeper (Tymco)
one water truck
one flatbed--converted from a packer--handles on-call and miscellany

Total of 10 vehicles.

Proposed sanitation budget for this year (7/92-7/93) is $526,000.

There are approximately 1,765 collection points which are residents. Of the residents, 1,374 are picked up once per week (charged the fee) and 391 are picked up twice per week.

Four hundred and four residential customers are charged $3 per month for garbage service availability (drive-by) without getting any service. Once weekly service costs $6, and twice weekly costs $9. This billing is added to the water bill for collection purposes.

Commercial service is charged in a variety of ways.

Transfer Station:

There are six (6) recommendations:

1. **Build a two (2) ram transfer station.**
2. **Site at the present PW facility, if possible.**
3. **Do a temporary transfer concept, if necessary.**
4. **Have no city collection vehicles making compost plant trips.**
5. **Eliminate one commercial vehicle--through miles and man hours savings.**
6. **Do downtown collection with a satellite.**

We recommend a transfer station be built somewhere in town at a location convenient for all trucks to achieve rapid turn around and get back on route. It may be possible, and most desirable, to revise the present garage facility plan but not absolutely necessary if space is available elsewhere.

Residential Trucks: Average mileage for a round trip from the garage to the compost plant is around 30 miles. The time consumed is from 1 hour to 1.25 hours for each trip. Since the residential trucks go once per day, this is consuming between 15-16,000 miles per year on residential vehicles. Man hours on these trips consume between 1,050 and 1,300 man hours per year.

Commercial Trucks: The commercial operation varies but the four trucks make from four to seven trips a day. The annual excess mileage on the commercial trucks runs as high as 50-60,000 miles. This equates to more than half life on one vehicle. Man hours lost will run between 2,600 and 4,600 hours per year.

The time saved by a transfer station should eliminate at least one of the four commercial vehicles. The downtown street front loading should revert to a satellite one man operation. See notes under "residential operations" for a further explanation of the satellite concept.

There is a premise in all public works management that holds that **the primary means of reducing labor cost is to trim the non-effective man hours.** Non-effective time is further defined as all the time that people spend doing things that are not hands-on production work. Work may still be poor in efficiency but the poorest efficiency of all is time not spent on the collection route. After bringing effective time to about seven hours a day, the efficiency of method can then be upgraded. A transfer station is the one opportunity to bring effective time to the seven hour level.

There are **several ways to start a transfer operation** without building a transfer station. **None of these are recommended by MTAS** except as a way to get started on the concept. The preferred way is to build a fixed transfer station equipped as it should be from the first day of operation.

Temporary methods are as follows:

(1) The satellites and commercial service trucks can eject out their rear ends into the **loading bay of a huge rear end high compaction packer.** This packer can sit stationary and have the satellite come to it or it can travel to the satellite when called by radio.

(2) **A 75-cy, or larger, transfer trailer can be purchased equipped with an on-board compactor.** City trucks unload by means of a ramp into a gravity chute. This concept would require at least two trailers and one tractor.

(3) The **existing 29-cy container side loader that the City owns could also be used as a disposal haul truck accommodating all other trucks.** The loading scheme would be the overhead gravity chute idea as expressed in (2) above.

The MTAS recommendation is to build a fixed facility with two (2) high compaction ram compactors. Two rams would be better since one can have downtime while operations continue. There might also be a need for some specialized compacting of

select material. Mobile equipment should be bought to carry maximum allowable weight to the compost plant. To further relieve road time, the entire daily production could be hauled at night, if the arrangement can be made with Sevier Solid Waste.

The fixed facility should cost about $150,000 for the compacting rams, hoppers and control unit. The building without frills should cost around $150,000 for the pre-engineered structure and unloading slab. Site work would be in addition. If two trailers are purchased, each would cost about $55,000. The tractor would cost about $75,000. **Total cost for the transfer station with necessary rolling stock would start at approximately $435,000.** There would be some added cost as the site is shaped and some extras are added.

Residential Operations:

There are seven (7) recommendations:

1. **Review the ordinances in coordination with system change.**
2. **Create a means of enforcement--consider hiring a full-time Health Officer.**
3. **Go to satellite trucks, one man operated, and then mate to a transfer station.**
4. **Negotiate, on an individual basis, the customer purchase of carts for semi-automation.**
5. **Pay for carts with a monthly fee-amortization to be for a 10-year period.**
7. **Transition changes gradually.**

First, a general discussion to set the stage for recommendations.

The residential operations scenario consists of routes that run every week day. Both trucks involved are manned by two men. One truck is a 15-cy square body hand loaded side loader which runs the steeper areas, one truck is an 18-cy barrel body hand loaded side loader which runs the Glades and flatter areas. "Flatter" is a relative term as used here. The barrel body truck still gets into some steep areas. Both of these trucks do some light duty commercial stops.

The trucks are having to back up an excess number of driveways because there is no room at the top to turn around. The men are sometimes having to walk too far up driveways to collect. Some of these are so steep the truck can't negotiate the terrain. For the larger trucks in particular, this is placing too much stress on the transmission and braking system.

The residential routes are also characterized in too many places by an excessive amount of material laying on the ground, sometimes in the street due to bear raiding--but sometimes by home owner negligence. There has been seen no effective attempt by residential customers to protect against bears. The wooden pens, with or without gates, are too flimsy to stop the animals. The policy of the City has been to have the crew clean up this mess regardless of what caused it.

Garbage is put out in so many ways by residents as to cover the spectrum of how garbage may be placed for the men to collect. Location of this material is by the road, in garages, at the side of houses and wherever the homeowner decides to place it. Some of the more difficult stops for the men to handle consist of full can loads which have to be hoisted up out of wooden cages that have no gate. In light of the changes that will be done as a consequence of this study, **the City should review once again Title 8 of the City Code entitled "Health and Sanitation." After determining what the best mode of container, placement of same, degree of automation and bear-proofing, create a means of enforcement.**

This **means of enforcement may mean the hiring of a Health Officer**, reporting directly to the City Manager, who will be assigned all the duties of education and the one-on-one contact with offending citizens. This is more an education task than an enforcement problem. "Health Officer" doesn't quite describe the functions so consider other names.

Practically all residential routes are on slope conditions that are very severe compared to typical city street conditions. There are many dead ends. The trip to the compost plant through tourist traffic is taking too long. All of this **suggests that a lighter weight one-man operated satellite truck would be more appropriate--mated to a transfer station.**

The satellite trucks come in a variety of configurations and **usually cost in the range of $35,000 to $45,000 for the complete package.** This is half the cost of trucks that are currently being purchased. They should last longer on the slope conditions, use less fuel, serve the driveways better and, in general, be easier to operate in the mountainous terrain. The packing weights that these units achieve for a full payload range from 2,500 to 4,000 pounds (the newer "super" models will do 4,000 lbs.). The packing body is usually a 7-cy size. It was noted that the two-man crew operated 15-cy trucks that were only delivering about 7,000 lbs. to the landfill at the present time. There is one additional peripheral benefit. The small trucks save the lightly paved roads.

The satellite vehicles can be purchased with an easy add-on capability for the semi-automated system. The lifters are powered by truck hydraulics and attached to the lip of the loading door. **The lifter adaption will cost around $3,000 per vehicle.** The lifters can also be added later, but this is not as desirable as having the original equipment.

There are approximately 2,200 stops made a week in the residential areas with several hundred drive-bys. This number is enhanced somewhat by some commercial pick-up points. A one-man truck, with step-in cab, should be able to do 300-350 stops a day. This makes the satellite idea a very feasible idea.

In order to insure that residential is not done more than once a week, **the City ought to consider adapting the residential trucks to accommodate, on a negotiated basis with each home owner, the semi-automated carts up to 90 gallons each in capacity.** These can be up to 120 gallons but 90 gallon cans are normally used. Normally, on a daily route,

the semi-automated system will not improve the rate of productivity over the can or plastic bag "jerk and throw" conventional method of loading. These carts are brought in to solve some other problems. The gaining of capacity for once per week collection is the prime consideration although aesthetics of the container, back injuries, dog-proofing and odor containment are all relevant. These carts may not eliminate the bear problem.

The carts will cost about $70-$80 each purchased in quantity. The **financing of the carts should be paid back by the customer with a small monthly add-on** to the bill. This can be spread over several years since carts like these are usually warranted and amortized over about 10 years. The prices on conventional 90 gallon roll-out carts are presently in a slump. Price ranges down to $55 per can are possible at the present time.

The Bear Problem (Residential):

The Gatlinburg City Commissioners wish to have the bear problem addressed as a priority! The means discussed below will deal with this problem. One or more employees need to be reassigned to the task of experimenting with various options until a satisfactory solution has been found that balances bear damage against cost. This prototype experimentation is a must! If small scale research isn't done, the risk is run of sinking money into a City-wide program that proves to be a failure.

There are four (4) recommendations:

1. **Do nothing if the cost is too high.**
2. **Buy heavy duty semi-automated carts.**
3. **Build can enclosure cages out of expanded metal and angle iron.**
4. **Build a heavier enclosure cage out of strap iron or angle iron.**

By using scrap metal along with some purchased shelf stock pieces of material, this construction of containers could be done for an estimated figure of $2,000. This figure assumes some failed effort and loss of material but not continued failure. Some drafting work needs to be done to get this shop effort started in an effective way.

(1) One of the policies that could be adopted by the City is to cease all bear trashing clean up by the City employees. Telling the public to solve its own bear problem is assumed to be politically unacceptable. The only way to deal with bears is to recognize their strength and then buy or build something beyond their ability to destroy.

(2) The semi-automated cart systems that are on the market now are usually made of 0.125" thickness material. These can be made twice as thick by certain manufacturers willing to do so. They can also be equipped with a "positive locking wind latch" which is allegedly hard

to unlock. These latches can be placed on the lid in tandem rather than just one per cart. The City has been advised by separate letter about one vendor that will sell these. I suggest that the City buy at least two of these reinforced carts with tandem wind latches, place them in selected locations frequented by bears such as the Greenbrier restaurant, bait them with honey, etc., and try to get some bear activity to see if the bears can tear off the lid. A material thickness of 0.25" may suffice to be rip proof but this is unproven. These reinforced carts will probably cost around $75 each (90 gallon) if they are eventually purchased in quantity to serve all the residential area. Some of the light duty commercial customers can also be served by these carts.

Collection service on these type carts would be done by satellite trucks that would be equipped with the semi-automated flipper to spare the loader from back injury. (The subject of small satellite trucks will be covered in another section of the report.) This choice, if taken, would require curb side service. It would also be the most economical solution to bears in the residential areas.

(3) The residential units can also be bear-proofed by use of a cage similar to the one found in the parking lot at GSMNP Sugarlands headquarters. This is a cage built with bottom and sides built out of expanded metal grating. The top is a plate metal sheet of 0.125" or 0.1875" thickness. The latching mechanism may need some improvement in design. The corners and other turns are light angle. The expanded metal is touch welded to it. These corners could possibly be improved with a double angle (inside and outside) construction encompassing the expanded metal in a "clamping" idea. Self-tapping sheet metal screws should be driven through in numerous places to bind everything together. If cage units must be constructed, this particular kind would be the most economical. They could be built by unskilled labor in the City shop with management by one good supervisor. These cages could be carried to and from the field and placed with a small bumper crane added onto a light truck.

(4) These bear-proof cages could also be built by bolting together strap iron. In this scheme, the strap iron would take the place of expanded metal. To make very certain of exceeding the animal's capability, the strap iron could be replaced with light angle iron in the size range 1" to 1.25" wide on each leg with a thickness of 0.1875" to 0.25". This thickness can be increased depending on the strength of the bear. This design approach is the "fail-safe" method since construction can be stiffened until the strength of the cage can be increased to match the

animal. Channel iron can also be used but this seems to be excessively strong. These cages can be constructed en masse in the shop just as those described in (3) above. Use table mounted drills to drill holes that have been laid out in the shop with a jig or template and bolt (or finish with self-tapping screws) using production techniques. Avoid all welding in this construction and do everything with bolts or screws since it is faster and more reliable. The units can then be spray painted, several at a time. Once a good design has been tested, they should be constructed with a labor cost not exceeding one to two person hours per unit. The door, constructed of the same light angle, can be a slide up like a window or a fold up or down (preferably down) like a cellar door. The hinge, based on the principle of a round rod inside a pipe, may require some welding to attach to the rest of the frame.

The more difficult problem associated with all these scenarios is the latching mechanism on the lid or gate. The bear proofing may be easy to solve here, but the people proofing (the tendency not to secure the latch after using) may require some intense thought. Any kind of device attached well enough to endure brute strength and that requires a thumb will defeat the animals. It may be impossible to "fail safe" the latch from human forgetfulness. However, it may not be terribly important since the bears can be counted on to refresh everybody's memory.

If it is important to be able to handle the process all the way through by manpower only, the six panels of the cage could be assembled on site.

These cages may have to be chained off to the nearest tree, to an iron eye-bar pin set in concrete or to a duck bill anchor similar to that used to hold guy wires on utility poles. The cages could also be bolted to a concrete pad built just large enough to sit the cage. All of this may seem extraneous for stopping an animal but the possibility of the container being trashed and thrown into the street repeatedly has to be considered. A fast way of anchoring must be encompassed in this plan in order to have a complete "system". An example would be to have duck bill anchors jack hammered into place on a production basis.

These cages might be constructed in a variety of sizes to accommodate various containers including the semi-automated carts (if necessary). The concept would be the same, just change the size of the panels. It should be reiterated that bears can be defeated. It is a matter of how sturdy does the cage have to be.

Financing of the bear cages is something that should be done with an add-on to the monthly bill for those people that choose to participate. Participation in the program could be made voluntary in the beginning. The practical effect of this would be to direct the animals to the non-participants who would then be motivated to join the program.

Since anything of sturdy construction should last a long time, the monthly charge required of each participant to get full cost return should be very little. A 10-year amortization would be reasonable. It would be a good idea to have the City continue to own the cage/cart so that control is maintained over the repair/replacement. The cost would be dropped even further as the units are paid off. It is observed that in Gatlinburg, as is typical of all cities, that too many individual owners of garbage containers just aren't responsive to the need to make repairs of any kind.

Most likely, it will eventually require mandatory participation to discourage bears from coming into the area. However, the voluntary program, once it reaches a given percentage of residents, will achieve a "critical mass" of participation such that the public will support a conversion to a mandatory program.

Commercial Operations:

There are 11 recommendations:

1. **Maintain the dumpster side loader system but upgrade.**
2. **Tighten control over number and type of commercial containers--to improve efficiency.**
3. **Change front street collection to semi-automated carts or to igloos.**
4. **Eliminate all dumpsters under 4 cy in size.**
5. **Revert some commercial points to satellite service.**
6. **Eliminate the metal cans and wooden pens on the front streets (see item #3).**
7. **Place authority for dumpster repair decisions exclusively in the Sanitation Manager--delegated to route crewmen.**
8. **Revert ownership of all dumpsters to the City--owner payback with a monthly service charge.**
9. **Require a hard stand under dumpsters.**
10. **Revert and modify as many dumpsters as possible to cardboard storage.**
11. **Use one compactor ram in the proposed transfer station for recyclable loading, if needed.**

After careful consideration of all the choices, it is decided that the **side loading dumpsters are still the best concept for heavy commercial service** in the downtown area or in service to apartment complexes of some size. This is a system that normally would not be recommended anywhere but there doesn't seem to be any other choice in Gatlinburg because of all the narrow spaces that have to be negotiated by the trucks.

The commercial area is receiving an extraordinary amount of service. This has been the political intent in the past and no doubt will continue to be so. The intent was to insure that sanitation collection was kept at a high level downtown because of the tourist

environment. The natural consequence of this constant service level will be the quite unequal amount of material that is in the dumpsters at any given time. Cans and dumpsters range from full to empty, and many stops produce almost nothing. The amount is unpredictable. The only comment that will be made here is that the **City needs tighter control over the number and size of containers that service a business** in order to bring as much efficiency as possible to a chaotic situation. See the discussion threaded throughout this report.

The front street or street pick-up as it is called is done three to four times in a 24-hour period. Containment on the street is by small metal cans that are set inside a small wooden surround. It is observed that this is hard on the backs of men doing the collection and is considered an unsafe practice. The **street pick-up lends itself ideally to the use of a satellite operation equipped as a semi-automated system--or the use of the "igloo" system.** Either of these concepts would be a partial antidote to the traffic conditions. Since more than one cart or igloo can be placed at any one location, the number of route runs per 24 hours can be trimmed. The igloo system is serviced by a bumper truck crane or knuckleboom crane.

Igloos are containers of various sizes that are loaded through the top or through a mailbox side. They are equipped with a hook in the top to accommodate a crane. They can be emptied by release of a trap door in the bottom, or they can be set on the truck and replaced with an empty igloo. The driver has to step down from the truck only to attach the hook.

The satellite, by using the semi-automated concept, can **also be used in the commercial sector at selected lower volume locations.** This would be done in order to eliminate some of the side loader dumpster pick-ups. Eight to nine of the 90-gallon carts could be purchased for the cost of one $490 dumpster. The carts are usually loaded more efficiently by the customer.

In order to go to a cart or igloo system on the front street, **eliminate the wooden pens and metal cans on the front streets.** Since carts and igloos can both be purchased in green or brown (or other) colors, there seems to be no need for wood around it. These can also be customized with logos. They are at least as aesthetic as the present system. The top lids of both can be purchased with a hole to take most sidewalk waste which is small in size. If a merchant insists on using this can, the lid can be lifted. With this system, **the route would need to be run only twice in 24 hours** rather than three times. The first run time can shift to early afternoon and the second would be after midnight. Any busy location can have more containers placed there so that the route will only require twice daily servicing.

Under these changes, demand on the large dumpster loaders would be lowered. Some of the commercial points become satellite serviced, front street demand is lowered to twice daily service, the haul distance is eliminated and some of the cardboard is picked up by Sevier Solid Waste from modified 4-cy dumpsters. The number of **vehicles working downtime during the day should be reduced to one dumpster loader, preferably a large**

one for maximum load, and one satellite truck (carts) or one flatbed (igloos). It is understood that the dumpster loaders have had to travel to the landfill two to three times during the summer. The worst case scenario that could happen would be the need for an additional satellite truck but not another dumpster loader.

This scenario is not taking into account the possible long runs that the department may have to make inside the GSMNP, to Pittman Center or other out of town points.

One of the additional benefits under this change scenario is the **elimination of all dumpsters less than 4 cy in size.** The intent of the City was to eliminate these as they were worn beyond repair. With the cart or igloo systems, these smaller dumpsters can be done away with immediately.

Since business houses now own the dumpsters, it is a cumbersome procedure to get defective dumpsters picked up and repaired. These are currently being sold to owners for the net cost to the City of $490. The City policy needs to be changed so that the **sanitation department (usually the driver) can make the summary decision to have the container picked up** and brought in for clean up, repair of the iron, repainting as necessary, replacement of casters and bear modifications as needed. The caster problem is quite crucial in the difficulty of loading these type of containers. In order to insure clean, well-maintained containers, the City should simply take over ownership of the containers and accept the cost of doing so from the public funds if it is necessary to make it politically acceptable. The present system of business owned dumpsters doesn't work anywhere and it is not working in Gatlinburg. In spite of the regulations proposed dated 1/1/85, paragraph 1.3, that stipulates how dumpsters are being maintained, it is not being done. **Private ownership does not work!**

The cost of **City ownership and maintenance of dumpsters containers can be defrayed with a modest monthly surcharge on the garbage bill. If the City maintains, the containers will last for an indefinite life.** All parts can be sandblasted and brought back to new condition. Even if the bottom rots out, it can be replaced by welding in new sheet steel. The long-range cost to business houses will actually be less since containers can be retrieved from the field in a timely fashion. The **repurchase cost to buy back from the owners can be negotiated starting from current new price with deductions for each defect according to a scale geared to the cost of returning to new condition.**

These containers are extremely difficult to wrestle around on loose aggregate or muddy ground. The **City should adopt a policy requiring a hard stand under these dumpsters.** This would include an apron out in front so that casters stay on hard surface all the way over to the reasonable location of the parked truck. Most are well situated in this respect anyway so the addition of the apron will make loading much easier. This is another item important enough for the City to do if necessary in order to not provoke the anger of business owners with still another cost charge.

Since OCC (cardboard) is the volume robber in dumpsters, the volume should shrink considerably with the elimination of the cardboard from regular garbage pick-up. This is mentioned in contemplation of the SSW plan to pick up OCC. Even more commercial outlets can then revert to the cart system thereby insuring that the downtown can be serviced with fewer vehicles, as has already been discussed in prior sections of this report. Note that the proposal to reduce truck miles in the downtown area stands upon numerous improvements in the system. All of these are mentioned somewhere in this report but not together.

Whichever agency, SSW or the City, does the cardboard collection, the City employees would still do the dumpster modification (angle frame front slot) to accommodate business needs. The purpose of the slotted front, with the top locked off, is to force business house employees to flatten all cardboard so that they load into the container. It works wonders in prolonging storage life on the dumpster. Typically, if a business house has two containers, one would now receive cardboard and the other would then be adequate for mixed garbage. Or, under another scenario, one dumpster would remain and revert to cardboard storage, and the other dumpster would be replaced by a cart (for mixed garbage) to be serviced by a satellite.

If there are two compactor rams with trailer space, then one transfer trailer space can be used for a recyclable such as cardboard. Full payloads of OCC can be delivered to the SSW facility for which the **City should receive some compensation.**

The Bear Problem (Commercial):

There are three (3) recommendations;

1. **Do the GSMNP Chimneys picnic area model dumpsters at selected locations.**
2. **Replace all plastic lids with reinforced steel tops.**
3. **Snap lock the lids for easy employee unlatching.**

The dumpsters located in the Chimneys picnic area of GSMNP which are serviced by the City have had the plastic lid replaced by a lid of sheet plate steel at least 0.125 inches thick. This lid stays down at all times except when the dumpster is lifted into the truck for unloading. This lid assembly can be locked off in the closed position. On top of this lid are two postal box type insert openings for public use. These openings are sufficient for general picnic type trash but insufficient for the typical motel or retail store. The GSMNP method is not recommended for widespread dumpster modification in the City because of the expense involved. These **dumpsters are recommended for certain specific locations of high bear activity--such as the ski mountain area.**

There is another way of modifying the existing dumpsters. The lids on these dumpsters are typically plastic. **Change the lid to metal.** Make the metal at least 0.125 inches thick. Weld cross bracing on the underside in several places as "stiffeners" for the top. It has to be strong enough to serve as a bear trampoline. Use chained snap locks to hold the lid in place. A swinging bar locking device is also available on the market. Side doors on the dumpsters, if any exist, will have to be locked in closed position during the night.

Both of the methods (1) and (2) can be done by City employees. Method (2) is more economical and faster to do in the shop but it is impossible to estimate cost until a prototype is done. This is a job that can be done, one at a time, as bear damage is reported at a specific location.

White Goods, Bulk and Miscellaneous Over-sized:

There are five (5) recommendations:

1. **Purchase a knuckleboom truck.**
2. **There are three knuckleboom systems options--select the one of choice.**
3. **Continue the present on-call route development.**
4. **Use one ram and one trailer in the transfer station on bulky collection days.**
5. **Seek to have recyclers take the old appliances and autos.**

Those items that are too large for regular pick-up are currently being picked up on an on-call route basis by two men equipped with a flat bed stake body truck. This truck was a packer truck that had the packer drum removed and a new body placed on the chassis. The department has had as many as 75 calls per month during heavy spring garage clean out by residents but calls average less than that. There were, for example, 45 calls through August 27, 1992, which is normally a slow month. The men are hand loading this material.

We recommend that a long bodied knuckleboom type truck be purchased to replace the aforementioned operation. Price on this type vehicle could range between $35,000 and $45,000 depending upon several equipment modifications. One of the existing packers or existing stake body trucks could be modified to have the knuckleboom added. This type of collection could be done simultaneously with the brush collection as will be described in the next section. The knuckleboom truck should have the same two employees assigned, one to drive the truck, switching to operate the boom, and one on the ground.

Three options on the knuckleboom concept will be discussed. The City of Collegedale had a knuckleboom modified by the vendor so that it loads a 20-cy towed, open top trailer (sometimes referred to as "swacars"--a manufacturer's name). The concept was developed to serve a small town. The boom loads the trailer with brush but can also pick up

all the bulky household items and swing around to load the truck with these items. Since the boom cannot be made to swing 360 degrees--it actually swings about 210+ degrees, the operation can serve only the right hand side of the street.

Frankly, the tow problem and turn around problem on hills, plus so many dead end drives makes this concept, on first consideration, a dubious idea for Gatlinburg. This one time pass-by total service route idea was at least good enough to mention. It might be worth a trip to Collegedale to see this operation.

The second option, in using a knuckleboom truck, is to have the body of the truck serve as the container platform for everything. Do not tow a trailer. Brush would be picked up in a separate and different trip from white goods, bulk and miscellaneous over sized waste. This cuts the loading capacity but the truck will negotiate difficult terrain much better.

The third option, in using the knuckleboom idea, is to buy a truck without a bed, and have it serve strictly as a tow vehicle. The 20-cy trailers (swacars) could be served by still another tow vehicle which would be a "shuttle" truck, but this doesn't seem necessary for Gatlinburg. The redeeming feature of this system is the continuous service on route. This could easily translate into seven effective hours each day on route for the operation of the knuckleboom. This system would require three employees although there are known cases where only two employees do the job, one on the knuckleboom and one driving the shuttle truck. The City would be much more responsive in serving requests since all the work would be done in fewer crew hours for any given week. This concept has some of the same problems that have already been mentioned for towed trailers.

Continue to use the current scheduling method of call requests that gradually become a route as enough of these requests are recorded. The route can be laid out in a continuous line based on the phone calls that would have to be received in the department. In order to give a high level of service, the simple expedient of a code-a-phone would be a good idea.

Since this material is to be landfilled and not run through the composting drums, a separate trailer can be loaded at the transfer station on bulk pick-up days. This would be delivered directly to the landfill. Gatlinburg should seriously search for some vendor that will pick up and recondition old appliances or prepare them for recycling as original base materials. These would include scrap metal dealers and appliance recyclers.

Yard Waste:

There are seven (7) recommendations:

1. **Do not change the current regular route collection of bagged leaves.**
2. **Do special bagged leaf runs, if necessary.**

3. **Collect limbs and brush with a knuckleboom loader.**
4. **Place all waste in the sanitation department.**
5. **Tow the SSW tub grinder to Gatlinburg for periodic brush chipping.**
6. **Refuse to carry brush to the SSW site.**
7. **Give free chips or mulch to residents.**

For homeowners who wish to **send out leaves, these are currently bagged** and placed with other garbage. **No change is recommended** since this system can't be improved and everything is going to be composted anyway. If volume becomes too much on a regular route, have the driver leave the bagged leaves. The two men that do bulk pick-up could then run the route and load the bagged leaves into the flat bed or a dump truck. This operation could also be done by any other crew assigned to a special leaf run. This bagged pickup system is adopted by many cities as the most economical system regardless of the terrain or other considerations.

Tree limbs and brush are now being picked up by two men in the street department, loaded by hand into a dump truck, and hauled to any location that will accept. This is another service done on an on-call route basis. There were about 200 calls in the heaviest month of April, 1992, centered around the "sparkle days" campaign. This hand loading is inefficient. The dump truck bed is too small. Assuming a resort town could never stand for the noise of a chipper on route, the only other logical system is to **use the knuckleboom** as has already been described in the previous section.

Since certain allegedly "quiet" chippers are now being manufactured, on-route chipping may not have such a noise problem. However, the cities that have tried both methods, route chipping and knuckleboom loading, have found knuckleboom collection to be less costly. But be dubious about this statement. Every city is a custom analysis. What works for most may not apply in Gatlinburg because of the random use of the service, the hills and dead ends.

The **brush collection should be placed in the sanitation department. Get the street department completely out of anything related to solid waste.** This reorganization could allow both brush and bulky material to be picked up at the same time thereby saving considerable route mileage as well as the time of two employees. **Street employees ought to be working in the street. Sanitation employees should be taking care of all waste regardless of the nature of same.** This organization just plain makes for more efficient coordination by the City Manager and more certain accountability by departments.

Since Sevier Solid Waste has purchased a portable 10 foot diameter Olathe tub grinder, there is no reason why this can't be brought to Gatlinburg on a periodic basis to reduce brush and wood by grinding or double grinding to get course or fine mulch. The City should **absolutely refuse to haul brush to the composting facility** for chipping and

shredding. This will negate all the savings in brush handling that have been discussed. It is a thoroughly bad idea. The tub grinder can quite easily be pulled. SSW doesn't have to get involved. The City employees can do it all.

The brush can be chipped up at the transfer station site and placed in piles for use around the city. If use around the City does not consume the chips or mulch, then ram into the transfer trailer with everything else.

This next subject isn't necessarily a part of collection but will be mentioned to show how these systems work together. "The whole becomes greater than the sum of the parts--if the parts are worked together to achieve the greatest end result."

If a knuckleboom unit is purchased, it makes an ideal platform for tree limbing. Use a hand carried hydraulic power pack that has its own engine to power a variety of small forestry tools such as a pruner, circle saw and chain saw. These can be purchased with long extenders for reaching up into trees. Power companies use these extensively. Although strictly speaking, this kind of work belongs in the street department, the bigger garbage trucks are the best "reality check" on vegetation that might be encroaching into or over streets. It would be more economical for the city to have the brush collectors do this while on route, hauling off as they cut.

Safety--Discipline--Miscellany:

There are eight (8) recommendations:

1. **As trucks are purchased, change color to a safe lime green, use city logo.**
2. **Install economy model flashing arrows on trucks.**
3. **Install back up horns on all vehicles, especially the one-man operations.**
4. **Commence to install air conditioning in vehicles--for increased productivity.**
5. **Have drivers shape their own routes--once total work load is set by the Manager.**
6. **Keep updated route maps in the various managers' offices.**
7. **In contemplation of system changes, do site specific study to reduce costs.**
8. **Put a stop to abuse of the system by front street store owners.**

This would be incomplete without some discussion of safety of men and the public. It was noted that the trucks are a dark green color. Although it is not a forest service truck, it looks like one. There is no particular reason why a tourist person would see this as a truck that stops in the street. If green is desired, a fire truck lime green with a city logo on the packer body would be a more safe color.

It was also noted that the vehicles have minimal flashing lights which make them somewhat dangerous, in particular, on mountain curves since they can't be seen. There is a three-foot wide flashing arrow, priced at $235, which several cities have bought. These can be conspicuously seen for hundreds of yards. These arrow boards could be placed on the front or rear of garbage trucks, as appropriate.

There needs to be a back-up horn on all vehicles. This becomes especially important as one-man operations are commenced. Any vehicle bought in the future ought to have air conditioning. The return is easily gotten in increased production by the men.

Routing wasn't studied because there is little that an outside agency can do to improve routing. Generally, the driver of a vehicle, left to his own choice will establish a most efficient route. This is premised on the basis of an assigned number of points to serve--there is no hint here that the drivers can schedule their route out of existence. We recommend that routing be done this way in the future. Once changes have been made, the driver ought to work out the routing and bring in a marked up map for review by the Sanitation Manager. This map should be placed in all the places where officials, such as the City Manager, need to know.

This has been touched on previously but will be restated. The system has grown up without volume controls. There has also been obvious poor enforcement of ordinance controls. There is, for instance, an estimated 500 dumpsters out there. This is far too many inasmuch as there are as many as five to seven in one location. There is no way that a business house could be putting out that much garbage for daily collection. They couldn't afford to buy that much material to be thrown away.

This proliferation of dumpsters represents a problem that needs to be solved by a variety of methods. These will include: (a) having some dumpsters with a locked down top and front end cardboard slot to take flattened cardboard, (b) the small dumpsters should be replaced with 4-cy containers or 90-gallon carts and (c) the front street metal cans need to be replaced with much larger carts or igloos.

Even with Gatlinburg's high level of service, any business house that needs more than one collection every day is doing something wrong--or the City is doing something wrong. Any residence that needs collection more than once per week is also having some of the same problems. **All of this is restated to encourage the City to place some limits! And then help the customer meet them.** None of this means that the service level is any less. It means--Pay some attention to garbage!

The storekeepers that front on the front streets are getting a lot of free garbage pick-up and overloading the small containers out front. Sometimes cardboard boxes are stacked alongside, effectively ruining the image that the City wants with their wooden surrounds. This should be stopped in two ways. Replace those metal cans with carts (or igloos) with insert holes in the top for bottles, cans, small sacks and the kind of stuff tourists throw away.

The mail box flap is also obviously a part of the solution. The store keeper can carry his material to a dumpster and pay the fee for having it serviced. If the storekeeper is a low volume user of service, he can have one or more 90-gallon carts to store his garbage. The carts are also more sanitary than the metal cans with the detachable lids.

This may be too candid. Besides being a poor system, collection on the front streets is not doing what was intended for the Gatlinburg image!

The essence of what systems analysis is about is the best possible combination of manpower, method, machinery, material and money so that all parts of the whole are mated in the best possible combination. Every site has to be rethought so that a large truck with two men aren't servicing a collection point that doesn't really need service at the time. The City Council and City Manager need to send a strong message that every collection point needs to conform to new legislative mandates, whatever they are. The men on the **sanitation crews need to be repeatedly indoctrinated in a policy of not casually living with a non-conforming situation.** These are to be brought back to management until the problem is corrected--we are speaking of a somewhat relentless attitude about shaping up the system.

Public Relations:

Public relations is the most sensitive, yet most important of all subjects. Extensive contact with the public through personal contact and news media information is highly recommended through this time of transition. Personal contact, repeated personal contact, with the errant party is the best method of finally getting every collection point to function inside a plan. The public is accustoming to dealing with waste with an "out of sight--out of mind" mentality. There is usually very little deliberate attempt to violate the mandates. This personal contact cannot be emphasized too much. It is the key to successful change once adequate news media notice has been given.

Other cities, when initiating major change in the system, did a house to house contact for conversation and hand out of material. One section of town after another was indoctrinated until all were in the new system. This was one of the most effective means to get change. Printed door hangers are another good method of advising about change. It is also effective to inform when the loader finds something wrong at curbside. Chattanooga uses bright reflective stickers to stick onto the container with the errant item marked. Not only does the owner see the message when driving in, the rest of the neighborhood also sees it.

The tourists have not been convinced that bears are a problem, or can be made into a problem by "habituation." Street information signs relating to bears are noticeably missing on city streets. A simple "Do Not Feed The Bears" would be good as a constant reminder about garbage. Wall signs in all places of public use would also be a constant reminder.

These are economical methods for the City to use.

Gatlinburg has been enjoyable. The Gatlinburg integrated solid waste management system could be a municipal model for Tennessee and a resort city model for the rest of the U.S.A.

Financial analysis has to be done on each part of the system as it is initiated--much of it has to do with vehicle cost reduction. The dollar figures presented in the narrative are estimates to give some idea of the feasibility of each major section of the study.

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