APPENDIX D: Analysis of Open Face

Analysis of Open Face

Newby Island Landfill

Blue Ridge Service

October 30, 2009

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October 30, 2009

Rick King, General Manager
Newby Islande Landfill

RE: ANALYSIS OF ACTIVE FACE DIMENSIONS – DRAFT REPORT

Dear Mr. King,

I am pleased to present you with this draft report describing our findings in regard to the Active Face Dimensions for the Newby Island Landfill.

Through our evaluation we determined that the active face is properly-managed and as small as it can be without sacrificing safety or creating significant loss in efficiency. In fact, in our experience, it is considerably smaller than most other landfills of similar size (i.e., 2,000-3,000 tons/day).

Your effort to maintain a small working face is obvious and we commend your staff for the excellent job they're doing. However, we recommend you do not reduce the face size any further, as doing so may be detrimental to operational efficiency and could create an increased safety hazard due to crowding.

Thank you for trusting us with this important task. Please contact me if you have additional questions.

Respectfully,

Neal Bolton, P.E.

Engineer's Certification

The following report contains calculations, analyses and opinions regarding the operation of the Newby Island Landfill. I hereby certify that the following report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of California.

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STANDARD OF CARE

Services performed for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time constraints. This is my professional responsibility. No other warranty is made either expressed or implied.

INTRODUCTION

The Newby Island Landfill herein referred to as NILF, is located near the southern tip of the San Francisco Bay.

Based on the information provided to us, the landfill receives approximately 2,700 tons of waste per weekday – and significantly less on Saturday.

Blue Ridge Services (BRS) was hired to evaluate the size of the landfill's open face and determine if it is appropriate.

The term "Open Face" refers to the portion of the landfill where trash is actively being spread and compacted. The food scraps in the exposed waste attract gulls and other nuisance species. In an effort to minimize any local environmental impacts, the landfill has established numerous operational procedures. One of those is: Operating the landfill with the smallest practical active face.

BRS principal, Neal Bolton, conducted an on-site review of the landfill on October 19, 2009. At that time he met with landfill staff and examined the operation of the active face, taking measurements and photographs. He also requested – and later received – a variety of data in regard to inbound waste tonnage, equipment utilization and standard operating procedures.

Overview of Cell Construction

Commercial and self-haul vehicles bring waste into the landfill where it is dumped at the landfill's tipping area (a.k.a., *tipping pad* or *unloading area*). Waste is then pushed to the active face (a.k.a., *open face*) where it is spread and compacted into a "Cell." The term "cell" refers to the basic (daily) building block of the landfill.

As each day's cell is created, the landfill staff must safely and efficiently manage the inbound flow of waste – as it varies widely throughout the day – carefully balancing many important factors. Those factors include:

- *Inbound Waste Tonnage*
- *Inbound Vehicles per Hour*
- *Location & Size of Commercial Tipping Area*
- *Location & Size of Self-Haul Tipping Area*
- *Type of Vehicle(s)*
- *Type of Waste*
- *Typical size of load (average tons/load)*
- *Weather Conditions (e.g., wind, rain, etc.)*
- *Size / Number of Bulldozers*
- *Production Rate of Bulldozer(s)*
- *Size / Number of Compactors*
- *Production Rate of Compactor(s)*
- *Size/number of dozers pushing from the tipping area*
- *Minimizing wait time for trucks*

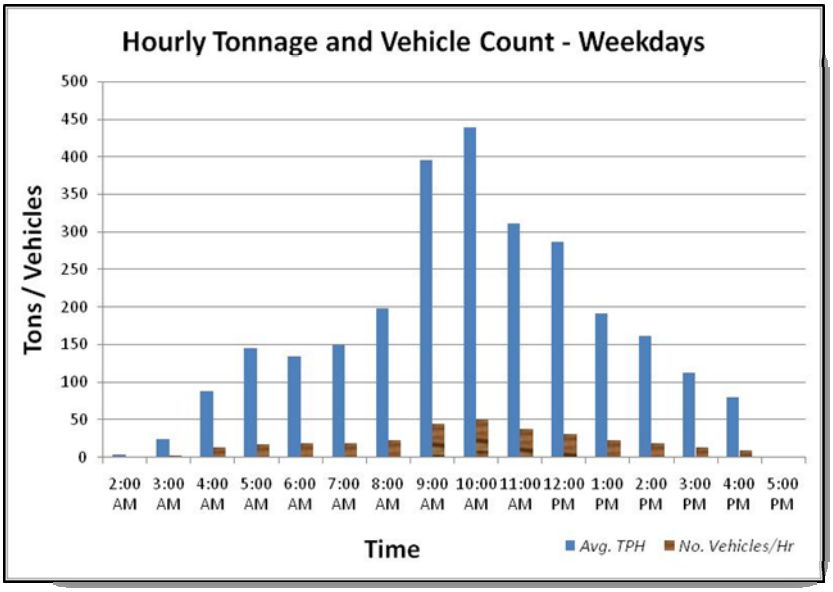
The manner in which the landfill crew addresses these factors has an obvious short-term impact on daily operation, but the greatest impact is long-term. Those ultimate, long-term goals include:

- *Achieving optimum waste density*
- *Reducing the receipt of non-waste materials (i.e., soil, recyclables, etc.);*
- *Maximizing the life of the landfill;*
- *Minimizing environmental impacts and;*
- *Maintaining a safe workplace*

Clearly, the process of cell construction is complex. With all of this in mind, we present the following analysis of cell construction – more specifically, an evaluation of the *active face* at the Newby Island Landfill (NILF). Our analysis begins with Inbound Tonnage.

INBOUND WASTE TONNAGE

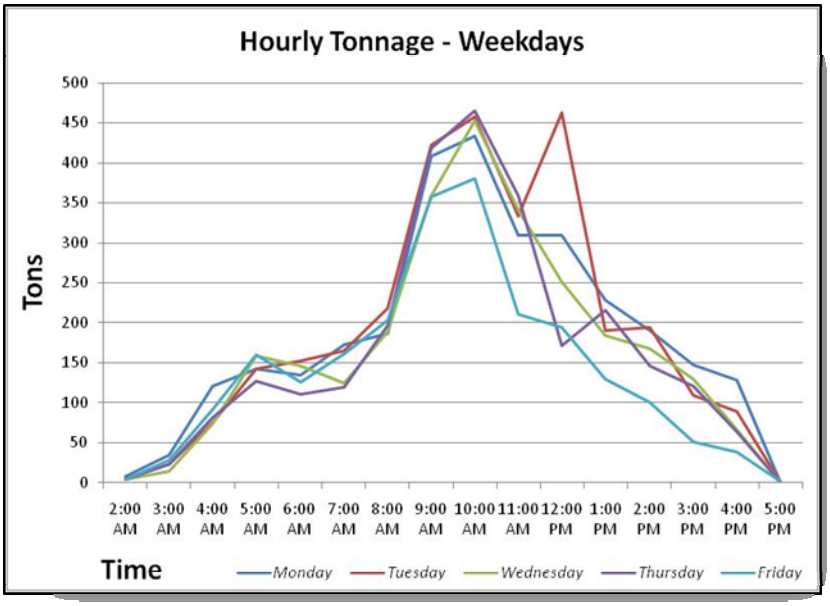
When it comes to operating a landfill efficiently and economically, most activities are related to inbound waste tonnage. Accordingly, we based much of our analysis on the *"open face"* on the foundational parameter of inbound waste tonnage.



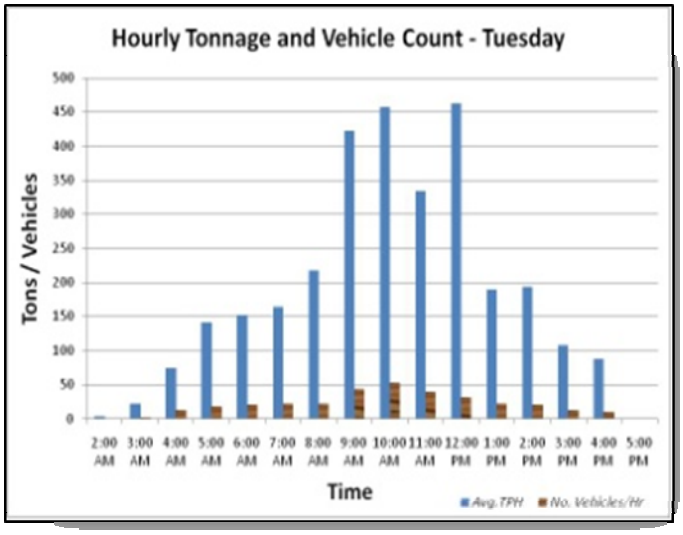
Because inbound waste is processed in small increments – essentially one load at a time, the most useful tonnage information is: tons per hour. These two charts show hourly tonnage.

The first shows average weekday tons per hour, along with the average number of commercial vehicles per hour.

The second shows tons per hour for individual weekdays.



Based on the information provided to us, it appears that daily (weekday) tonnage, while averaging approximately 2,700 tons per day, varies widely throughout the week.



Friday was lowest at just over 2,200 tons per day, and Tuesday was highest at over 3,000 tons per day.

Of the predictable waste stream patterns, one of the most noteworthy is the late-morning tonnage peak.

Similarly, the number of vehicles also peaks at this time.

EVALUATION OF OPEN FACE

In order to provide an objective analysis of the landfill's open face, we evaluated it from several different perspectives. These include:

COMMERCIAL VEHICLES PER HOUR

The landfill must provide adequate space for waste vehicles to safely unload without creating (unsafe) crowding or excessive wait times. Many of the vehicles are equipped with dump bodies and thus require an extra margin of safety when unloading.

AREA REQUIRED TO SPREAD & COMPACT INBOUND WASTE

The area required for processing waste is based primarily on the rate (tons per hour) of the inbound material, its loose density and the capabilities of the landfill compactor(s).

MINIMUM AREA REQUIRED FOR MACHINE SAFETY

A certain number of machines is required to safely and efficiently handle the incoming waste, and these machines require a minimum area in order to work safely.

OPTIMUM CELL GEOMETRY (TO MINIMIZE SOIL USE)

Landfills strive to reduce the volume of material (i.e., soil) used to cover the trash, in order to minimize airspace consumption. To accomplish that, every effort is

made to maintain the smallest possible (safe) working face while still meeting other important criteria.

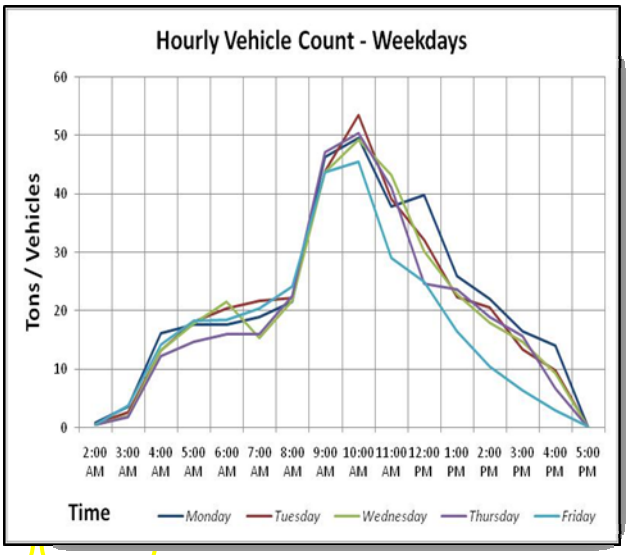
Commercial Vehicles per Hour

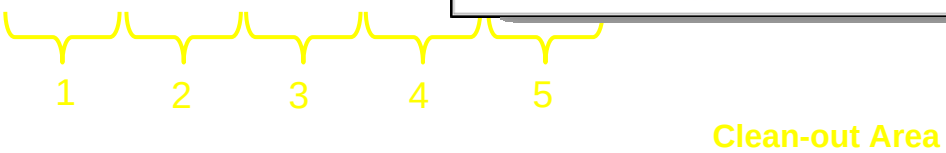
Commercial waste vehicles follow a certain procedure at the tipping area, including:

1. *Pull up to the tipping pad and make eye contact with the spotter;*
2. *Receive direction from the spotter;*
3. *Back into position at the edge of the tipping pad,*
4. *Set the truck's parking brake*
5. *Unlatch the rear of the truck (tarped loads have been un-tarped prior to entering the tipping area).*

6. *Operate the controls to unload the truck*
7. *Walk to the rear of the truck to affirm the load has discharged*
8. *Return to the cab, release the parking brake and pull to the clean-out area.*

On average, this process takes approximately 6 minutes. At that rate, each unloading slot could accommodate a maximum of 10 vehicles per hour. Thus, during the peak periods (*i.e., 50 vehicles per hour*), the tipping area must provide a minimum of 5 unloading slots.





This is of course based on an ideal work flow, where all vehicles dump quickly, no trucks break down and there are no other unforeseen delays.

Additionally, when a load is dumped, a bulldozer must move into that truck's slot and push the load to the active face. While the load is being removed, that slot – and perhaps adjacent slots – is not available for the next truck.

At the time of my site visit there were 5 unloading slots. And because my visit (11:00 a.m.) coincided with the peak traffic flow, there was in fact, a truck waiting in line to enter the unloading area. Minimizing truck wait time is important from the standpoint of both customer service and environmental protection. The California Air Resource Board (CARB) has established a maximum idle time of 5 minutes for commercial trucks (over 10,000 GVW) with diesel engines. Clearly, the landfill must provide enough unloading slots to keep waste vehicles moving quickly and avoid excessive waiting.

Finally, in order to provide a safe dumping area, it is best to maintain 10-15' clearance between vehicles. This works out to a minimum tipping width of between 90' and 110'. At the time of my site visit, I measured the width at 100'.

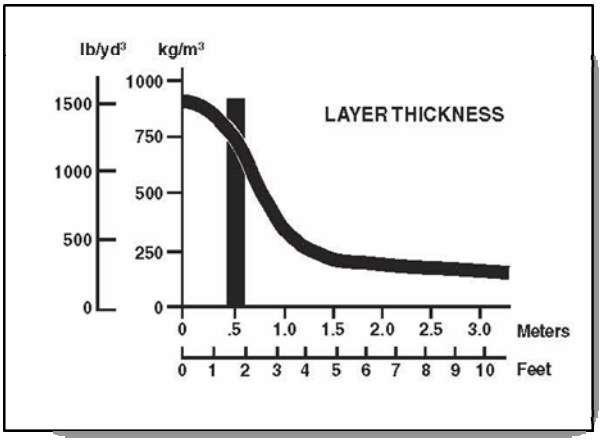
In my opinion the landfill is operating with the narrowest possible tipping area necessary to maintain a safe and efficient operation. And, such a narrow width is only possible because the landfill operator is:

1. *Directing self-haul vehicles and other "slow-unloaders" to dump along an adjacent side of the active face*
2. *Requiring commercial vehicles to remove their tarps prior to entering the unloading area*
3. *Providing a separate clean-out area where commercial drivers can clean the truck hopper after they've dumped their load.*
4. *Providing a well-trained spotter who can efficiently direct vehicles at the unloading area*

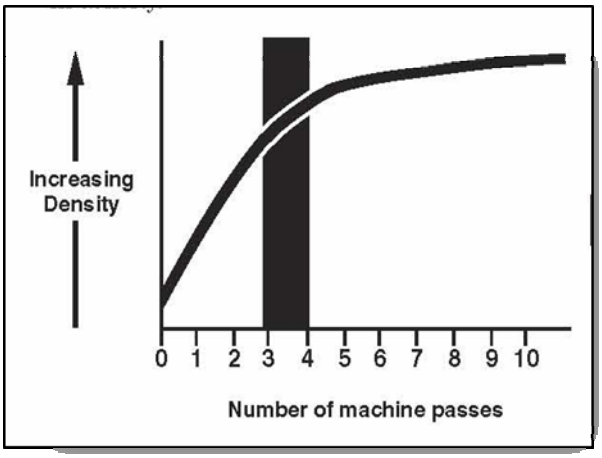
5. *Utilizing an adequate number of dozers and compactors to quickly push, spread and compact waste as it is unloaded*

AREA REQUIRED TO SPREAD & COMPACT INBOUND WASTE

As waste is dumped, pushed and spread across the active face, it "fluff's up," resulting in a (loose) density of approximately 350 pounds per cubic yard (pcy). In order for the landfill compactor to re-compact the waste to its highest practical density, it must be spread in thin layers. According to the Caterpillar Performance Handbook, the most effective compaction occurs when waste is spread to a thickness of 1 ½ feet.

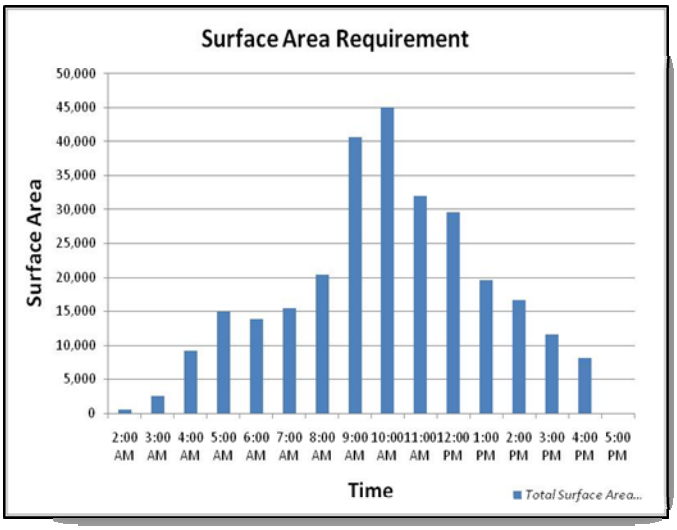


The compactor(s) then make multiple passes over the waste until it reaches the optimum density. According the Caterpillar Performance Handbook, the highest reasonable density occurs after 4 machine passes.



In order for the landfill compactor to achieve top performance, the active face must be large enough to accommodate the inbound (loose) waste.

Based on meeting these two criteria, we evaluated the inbound waste stream in regard to the amount of surface area required. Based on our analysis, if one compactor was utilized, the peak waste flow would require approximately 1 acre of open face (45,000 sf). However, because two compactors are typically used, the open face dimensions can be cut in half, to approximately 22,500 square feet. At the time of my site visit, the open face was approximately 18,000 square feet (100' x 180'). From this



standpoint, the NILF is operating with an open face that is approximately 20% smaller than expected.

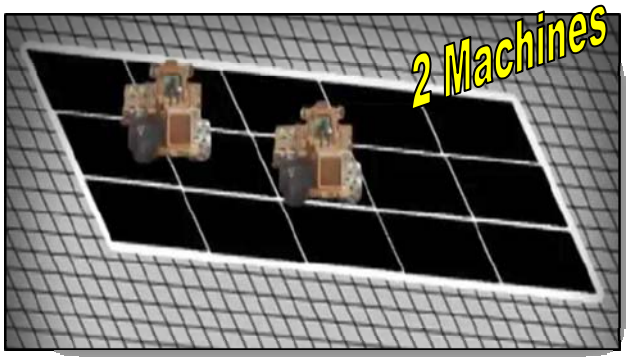
MINIMUM AREA REQUIRED FOR MACHINE SAFETY

A certain number of machines are required to safely and efficiently handle the incoming waste, and these machines require a minimum area in order to work safely. Based on our site visit and subsequent review of NILF equipment

records, it appears that the normal operation includes 2 bulldozers and 2 landfill compactors.

When multiple machines are working together in close proximity, the accident potential increases. And the level of risk is inversely related to the size of the work area – increased congestion means increased risk.

As a general rule of thumb, a landfill's active face must be at least 3 compactor-lengths in width and length in order to provide a safe and adequate work area. Additionally, another 2 machine-lengths should be added *(to the face length or width)* for every additional machine.



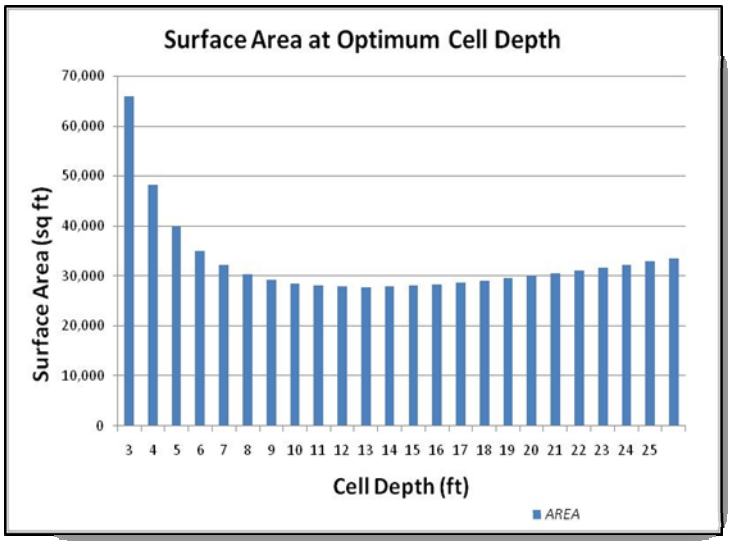
A Caterpillar 836 Landfill Compactor is 33.4' long. Thus, with two machines, the face is expected to be 16,733 square feet. At the time of my site visit, the face was approximately 18,000 square feet. From this standpoint, the NILF is operating with an open face that is approximately 8% larger than expected. It should be noted that while the bulldozers are typically included in this rule of thumb, some additional area for them to safely work is reasonable.

OPTIMUM CELL GEOMETRY (TO MINIMIZE SOIL USE)

Landfills strive to reduce the volume of material (i.e., soil) used to cover the trash, in order to minimize airspace consumption. Often, in the process of minimizing soil use, considerable effort is directed toward maintaining the smallest possible (safe) working face.

This is typically coordinated with other important aspects of the operation, including:

- Providing enough working area to achieve good waste compaction;
- Reducing the distance (and associated cost) of pushing waste from where it is dumped to the active face;
- Avoiding uphill pushing to provide maximum dozer productivity at minimum cost;
- Establishing adequate unloading space for both commercial and self-haul vehicles and;
- Providing safe, easy vehicle access during all weather conditions



In the process of optimizing cell geometry, these criteria are carefully evaluated. We have developed an Excel®-based computer model for calculating the optimum cell geometry.

For this project, we conducted a cursory analysis using the information provided to us.

The results of our analysis, as shown in this chart, identify the optimum surface area to be approximately 27,000 square feet with a cell depth *(measured vertically)* of 12 feet.

At the time of our site visit, the NILF was operating with an open face of approximately 18,000 square feet, 33% smaller than our estimated optimum size. It is possible that a more detailed assessment may yield a smaller optimum open

face …or perhaps the NILF is sacrificing something (e.g., lower density or increased machine cost) in order to maintain a smaller than optimum open face.

SUMMARY

Through our evaluation of the Newby Island Landfill, we have determined that the size of the open face should be maintained at not more than 27,000 square feet. The fact that the face is currently less than 20,000 square feet is not problematic, but offers clear indication of the landfill staff's effort to minimize potential impact(s) created by exposed trash.

However, in the interest of achieving a high level of waste compaction and providing a safe work environment, we strongly recommend there be no further reduction in size.