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Division of Solid & Hazardous Waste
Utah Department of Environmental Quality

DAGGETT COUNTY LANDFILL

STATE PERMIT APPLICATION TO OPERATE A CLASS II LANDFILL

Application produced by Town of Manila
with contributions from Daggett County, Forest Service
and various Utah State Agencies
January, 1998

UTAH DEPART OF ENVIRONMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE
Application for a Permit to operate a Class II Landfill

PART I GENERAL DATA

1. Name of Facility	Daggett County Landfill
2. Site Location	3 miles South of Town of Manila
3. Facility Owner	Town of Manila and Daggett County
4. Facility Operator	Town of Manila
5. Contact Person	Mayor Chuck Dickison Town of Manila Office Manila Utah, 84046 435-784-3143
6. Type of Application	(x) Initial application
7. Property Ownership	(x) Joint Ownership with Daggett County

Proof Of Ownership

Copies of United States Forest Service Permit for 5 acre expansion and Quit-Claim Deed showing joint County/Town ownership accompany this application.

Plan of Operation

Construction Schedule

Improvements include a future storage/attendant shed, refurbished fencing around landfill, enhanced security gate, and improved access roads. These improvements will be in place by end of 1998.

On-Site Solid Waste handling Procedures

Incoming loads will be evaluated by the on-site attendant on days of operation and documented using included "Landfill Log." An example of this log is included with this application. Waste depositors will be then directed to the appropriate area for dumping. As needed, the waste will be spread and compacted in the cell. A contracted Caterpillar will be utilized for this purpose and to additionally cover the spread, compacted, waste with the prescribed inches of suitable covering material. Final coverage of the filled cells will be accomplished with the prescribed inches of suitable covering material.

Acceptable Types of Wastes

The following types of waste will be accepted at the Daggett County Landfill.

household Wastes: Vegetable wastes, trash, discarded animals, and household waste generated from single, multiple residences, hotel, motels, campgrounds, and day use recreation areas.

Commercial Wastes: All types of wastes generated by stores, offices, restaurants, storage facilities, and other non-manufacturing activities.

Waste Tires: Tires will be separated as accepted and placed into a segregated area. When significant volume exists, efforts will be made to dispose of the tires with a commercial outlet.

Common household Hazardous Wastes: Acceptance of this type of wastes will be minimized at the Daggett County Landfill.

Appliances: Appliances will be separated from the landfill cells, properly stored, and disposed of with a commercial outlet in the business to accept such appliances.

Procedures for the Exclusion of Unacceptable Types of Wastes.

All incoming landfill users will be asked to identify the types of wastes included in their load and to specify waste, to their knowledge, may require special handling. In addition, inspections of incoming loads of waste will be made at time of unloading. The purpose of this inspection will be to determine the presence of hazardous types of waste or suspicious containers. Identification of potentially hazardous materials could initiate the immediate closure of the landfill and notification of proper officials.

Monitoring and Self Inspection

No ground water monitoring facility is proposed at this landfill site due to low potential for ground water contamination.

Routine inspections will be made by Town of Manila personnel on-site for such things as litter control, unauthorized burning, and improper waste disposal. Assessments will be made periodically for cover material integrity, erosion impact, and determination of other adverse conditions. These inspections will be documented on the form labeled "Landfill Inspection Form". The results of this inspection will be submitted yearly to the Utah Solid and Hazardous Waste department.

Contingency Plans

The following actions will be taken in case of ground water contamination, fire, explosion, or presence of hazardous materials.

Ground Water Contamination

No ground water monitoring facility will be present at the landfill due to low potential for water contamination. However, if significant levels of ground water contamination are detected in down gradient locations and the problem can be directly linked to landfill operations, corrective action as deemed necessary to correct the problem will be taken.

Fire Control

Due to the method of landfill operation and site land composition, fire hazard does not pose a significant threat. On-site landfill attendants will be on hand to discourage waste and debris fires started on purpose or accidently. Proper officials will be notified in the event of a landfill fire and the fires will be extinguished. If necessary, landfill operations will be altered to allow for the proper handling of the fire. On-site posting will prohibit fires.

Explosion

An explosion at the landfill will cause the site to be secured and proper officials to be notified. Landfill operations will discontinue until safe to do so.

Alternative Waste Handling Procedures

In the event it should become necessary to discontinue using an open cell, another will be readied to accept waste and to act as a backup cell. Necessary use discontinuance of the landfill would require temporary negotiation with a landfill operator close enough and able to handle Daggett County Waste.

Maintenance of Installed Equipment

Required maintenance at the landfill would be limited to site machinery.

Disease Vector Control

The remoteness of the landfill should not contribute to problems with disease vectors. However, if problems were to arise, remedial action would be taken in the form of rodent trapping or other measures of extermination. Covering of waste and dead animals should inhibit problems with scavenging vermin.

Recycling Program

Daggett County Landfill management intends to accept, separate, and dispense to a commercial outlet, all waste tires brought to the landfill. Only an amount deemed to be reasonable will be stored prior to release to the outlet. Appliances, automobiles, and other metals brought to the landfill will be released to an appropriate commercial business. No other recycling programs are currently proposed at the Daggett County Landfill.

Training

Landfill attendants and operators will be required to review the contents of this operation plan. Additional training will be required with emphasis on hazardous waste identification and appropriate handling. Appendix attachments include materials for the identification of hazardous wastes. Landfill attendants and operators will be required to be familiar with identification of hazardous wastes. Appropriate out of agency training will be obtained.

Landfill Access Control

Daggett County Landfill staff will be present during times when the landfill is open for acceptance of public waste. Town of Manila, Daggett County, and the United States Forest Service collection vehicles will be allowed access to the landfill for waste deposit purposes during non-public access hours.
The purposed times the landfill is open to the public are Mondays, 0900-1200, and the first Saturday of each month, 0900-1200 during the winter months. Summer hours begin May 1st and end the last day of October. These hours include landfill opening each Saturday, 0900-1200 hours. Hours of operation for public waste deposits are posted within the county.

Methods of Access Control

When not open to the public, the landfill will be secured behind fencing and a locked gate at the access road. The position of locked gates preventing access will enhance discouragement of illegal dumping due to potential detection by passing motorists.

Closure Plan

Ongoing Activities

The Daggett County Landfill closure plan is intended to provide the ability to minimize need for extensive maintenance and the threat to human health and the environment.
Landfilling operations on the jointly owned 20 acre site have consisted of developing open cells, filling with waste, and properly covering. Efforts have been made to ensure that closure covering does not provide for excessive mounding not consistent with natural terrain.
Future closure efforts will include proper closure of each cell upon reaching waste capacity. A new cell will be opened at this time for continued landfill operation. Closure activities will include:

1) As each cell has reached waste capacity, landfill operators will grade excess cover material to form an earthen mound over the cell. The graded mound should provide for effective surface drainage to prevent water infiltration.

2) Cover material derived from cell excavation will be used to cover the expended cell at a cover material depth of 18 inches or more.

After each phase of cell completion, review for proper closure will be made by the landfill operator.

PART II GENERAL REPORT

GENERAL BACKGROUND

Daggett County's landfill is an existing landfill seeking a permit to continue operation with appropriate expansion. The landfill has been receiving waste since 1974. The landfill area of operation is currently a small parcel of land covering 20 acres jointly owned by Daggett County and the Town of Manila. An additional 5 acres is available for landfill expansion under special permit from the United States Forest Service.

Location

The Daggett County Landfill is located approximately 3 miles South of the Town of Manila with access from Utah State Highway 44. Public access is restricted to days of operation by a locked gate. Lands surrounding the landfill are currently owned privately and by BLM. The general location is described in Special Use Permit from the Forest Service dated 4/13/82, and Quit-Claim Deed demonstrating joint Town/County ownership.

Current Status

Presently, the landfill activities are confined to developed cells within the fenced 20 acre site jointly owned by the County and Town. Disposal is regulated to specific areas of the cells in order to provide the ability to close the cell in stages with appropriate cover. Landfill waste will be covered daily by tarps and permanent coverage will be done in phases. Final cover will consist of dirt in depths of 18 inches.

Landfill Service Area

Daggett County landfill serves all of Daggett County. Town solid waste is collected by the Town of Manila weekly and deposited in the landfill. Waste generated by county residents and the county is deposited into the landfill by individual users. The United States Forest Service is the largest by volume user of the landfill with waste generated from users of the Flaming Gorge National Recreation Area.

Legal Description

The following identifies the limits of ownership and landfilling operations for the Daggett County Landfill:

Land under joint County/Town ownership
NE 1/4 NE 1/4 NW 1/4, N 1/2 SE 1/4 NE 1/4 NW 1/4, E 1/2 SW 1/4 NE 1/4 NW 1/4, Section 5, Township 2 North, Range 20 East, Salt Lake Meridian.

Permit Land for Future Expansion
NW 1/4 NW 1/4 of Lot 2, Sec 5, T2N, R20E, SLM

Name and address of facility
Calendar year covered by the report
Results of monitoring processes

FINANCIAL ASSURANCE PLAN

The Daggett County Landfill, in accordance with Financial Assurance provisions as outlined in R315-309-2, establishes the following estimated costs for closure and post-closure activities. The guide for the preparation cost estimates for closure and post-closure care at landfills was followed in this process. This guide is found in Appendix G of Utah Solid Waste Permitting and Management Rules. Cost estimates are based upon currently experienced landfill costs utilizing resources available in Daggett County. Third party costs might differ in the closure and post-closure process depending upon resources used.

PART III - TECHNICAL INFORMATION

GEOHYDROLOGICAL ASSESSMENT

General Description

The landfill site is located between the north flank of the Uinta Mountains of Utah and on the south margin of the Green River basin of Wyoming. This area's subregion is the Uinta Mountains Section (McNab and Avers 1994). The geomorphology of this section is characterized by the anticlinal uplifting of the Uinta Mountains with an east-west orientation. Periglacial and glacial processes have shaped higher elevation landforms with freezing and thawing activitity as a crucial role. In the lower elevations, alluvial and colluvial activity is the dominant landforming processes.

Geologic Assessment

The following geological summary was taken from two sources: 1) Geology of the Flaming Gorge Area Utah-Colorado-Wyoming, Geolgoical Survey Professional Paper 490 (Hansen 1965) and 2) Geology of the Manila Quadrangle Utah-Wyomying (Hansen and Bonilla 1952).

Regional Geology

The landfill is located is in the Uinta Mountain section within the Southern Rocky Mountain physiographic province. The surrounding Phil Pico Highlands subsection (Nelson, 1994) is a series of hogback ridges along the north flank of the Uinta Anticline. The Curtis, Entrada and Carmel formations from the Jurassic form the hogbacks that contain and surround the landfill site.

Local Geology

The site is located in a small enclosed basin of alluvium near the top of a hogback in the Entrada formation. To the southeast is a scarp slope composed of the Carmel Formation and to the northwest is the broad dipslope of the Curtis formation. There are alluvially blanketed strike valleys on either side of the hogback.

The Entrada is a crossbedded, finegrained, well-cemented sandstone. This formation is very thick, with depths up to 325 feet, forming cliffs, hogbacks and strike ridges. The drainage is fair to good with high slope stability.

The Carmel, is very similar to the Entrada. It is more blocky with thin bedded oolitic and coquinal limestone interbedded in lower parts with gray to greenish-gray shale and gypsum with some red beds locally evident. The drainage is poor due in areas with undisturbed limestone and moderate where the limestone is fractured. Slope stability is high.

The surficial geology of the landfill is mapped as Quaternary older alluvium, between the Jurassic formations of Entrada and Carmel sandstones. The greater part of the alluvium is fine grain material,

containing loose silt and silty sands, and also includes stringers and lenses of dirty subangular gravel. The thickness of the alluvium ranges between five to thirty feet deep forming a flat valley bottom. Alluvial drainage characteristics include rapid surface runoff with low permeability. Slope stability is low, which is subject to slumping along steep slopes and forming gullies along floodplains and benches.

The subsurface geology, mainly underneath the Quaternary older alluvium, probably contains the Entrada, Carmel and possibly the Navajo sandstone formations. The Navajo is a very light gray to cream color sandstone that is very homogeneous. It consists almost entirely of fine to medium grained sandstone composed of subangular to rounded frosted quartz grains. It is the deepest of the three sandstones, with depths reaching 800 feet. The drainage and permeability is very good and slope stability is excellent.

The landfill site is about 1500 feet northeast from the South Valley Fault. This fault trends about North 70° West from a junction with the Uinta fault, five miles into South Valley where it eventually dies out. The fault is downthrown on the southwest and dips steeply southwest. Its stratigraphic throw probably does not greatly exceed 300 feet and by its apparent horizontal displacement, it is classified as a dip slip fault.

Hydrologic Assessment

Surface Water

Regionally, the landfill is located within the Upper Green/Flaming Gorge subbasin. This subbasin captures all surface runoff that drains into the Flaming Gorge Reservoir and the Green River. The landfill is also located within the Sheep Creek Watershed. This watershed drains the North, Middle and South Forks of Sheep Creek, Lodgepole Creek, Hope Creek, Death Valley, Birch Spring Draw, and the area around South Valley. The South Valley subwatershed is where the landfill is located. This subwatershed is approxiamtely 16.0 square miles in area. It primarily includes all intermittant, empherial and perennial streams that drain into Flaming Gorge around the Lucerne and South Valley.

Within a mile radius of the Manila City landfill, surface water is present in a number of unnamed intermittent streams, with none of them flowing through or around the landfill. Plus, there are no perennial streams within the one mile radius. Sheep Creek, a 4th order stream channel is the nearest perennial stream, which is about 2.5 miles to the southwest. The closest surface water feature is an intermittent stream approxiamtely 300 feet to the southeast that flows through an alluvial valley. The intermittent stream is more defined as a small gully that probably only runs during the snowmelt season and during high intensity, long duration rainfall periods.

The landfill is located within a depressional swale. This swale concentrates snowmelt and probably rainfall within and around the landfill. During the site visit, frozen water was apparent throughout the landfill. The road leading into the site was also concentrating water into the landfill. Given the physiographic characteristics of the landfill, snowmelt is the only source of water into the site. Also, the swale does not allow runoff or overland flow to leave the landfill into another drainage. Everything is captured as subsurface flow.

Subsurface Water

No test boring or core drilling was conducted onsite at the landfill. However, near the gate leading into the landfill, a private well was drilled in 1976 for stockwatering purposes. This site is approximately 500 feet southwest of the landfill. The well log was used to interprete the depth of groundwater and the geologic stratigraphy below the landfill.

Groundwater was not encountered until about 700 feet below the surface. The test boring stratigraphy showed homogenous material of sandstone with red soft sandstone with white hardstreaks to 660 feet. This would be interpreted as Entrada sandstone, underlined by the Carmel, then probably the Navaho. A small layer of blue-greyish shale was encountered next then finally water at 700 feet. The well log did not go into any great detail on depths of different formations and characteristics.

Groundwater monitoring that includes the flow direction and rate is unknown at this well. I would speculate that flow direction would parallel the direction of the bedding planes, therefore draining towards the Northwest, into South Valley.

Water Quality

To my knowledge, there has been no surface or subsurface water quality monitoring completed at the landfill facilities. Therefore, the impacts upon the ground water and surface water from leachate discharges is unknown. Given the physical, geologic and climatic characteristics of the landfill, the potential for ground water contaminations from landfill leachate discharge is probably minimal and does not justify the need for ground water monitoring. With the combination of the soil and geologic formations underlining the landfill and with the water table about 700 feet, makes the migration of contaminates to the water very unlikely.

Water Rights

Table 3.1 displays all the tabulated water rights and wells, located within a 2000 foot radius of the landfill. There are three water rights within the 2000 foot radius and no filed water rights on-site at the landfill. The one well, is located at 1000 South, 1200 East from the Northwest corner of Section 5, Township 2 North, Range 20 East, with the Salt Lake base meridian.

Water Right Number	*Ownership Name*	*Water Use*	*Source*
41 2519	United States Forest Service	Stockwatering	Cottonwood Wash
41 3246	State of Ut. School & Inst. Trust	Stockwatering	Well
41 2619	Broadbent. D. Clay	Stockwatering	Cottonwood Wash

Water Balance

From precipitation data gathered in Manila, average annual precipitation is 9.68 inches (Ashcroft et al 1992). Unfortunately, there is no evaporation data at this site, so to equate the loss due to evaporation, data will be used from evaporation pan data near Flaming Gorge Reservoir. Annual evaporation loss is calculated to be 43.33 inches per year with a average annual precipitation of 12.50 inches (Ashcroft et al

1992). By equating the Manila data with the Flaming Gorge data, evaporation is calculated at 33.56 inches.

Since evaporation is higher than precipitaion, this equates to a negative water balance, which is typical for desert, arid environments. Water is also lost through infiltration but the majority is through evaporation and there is no surplus of water.

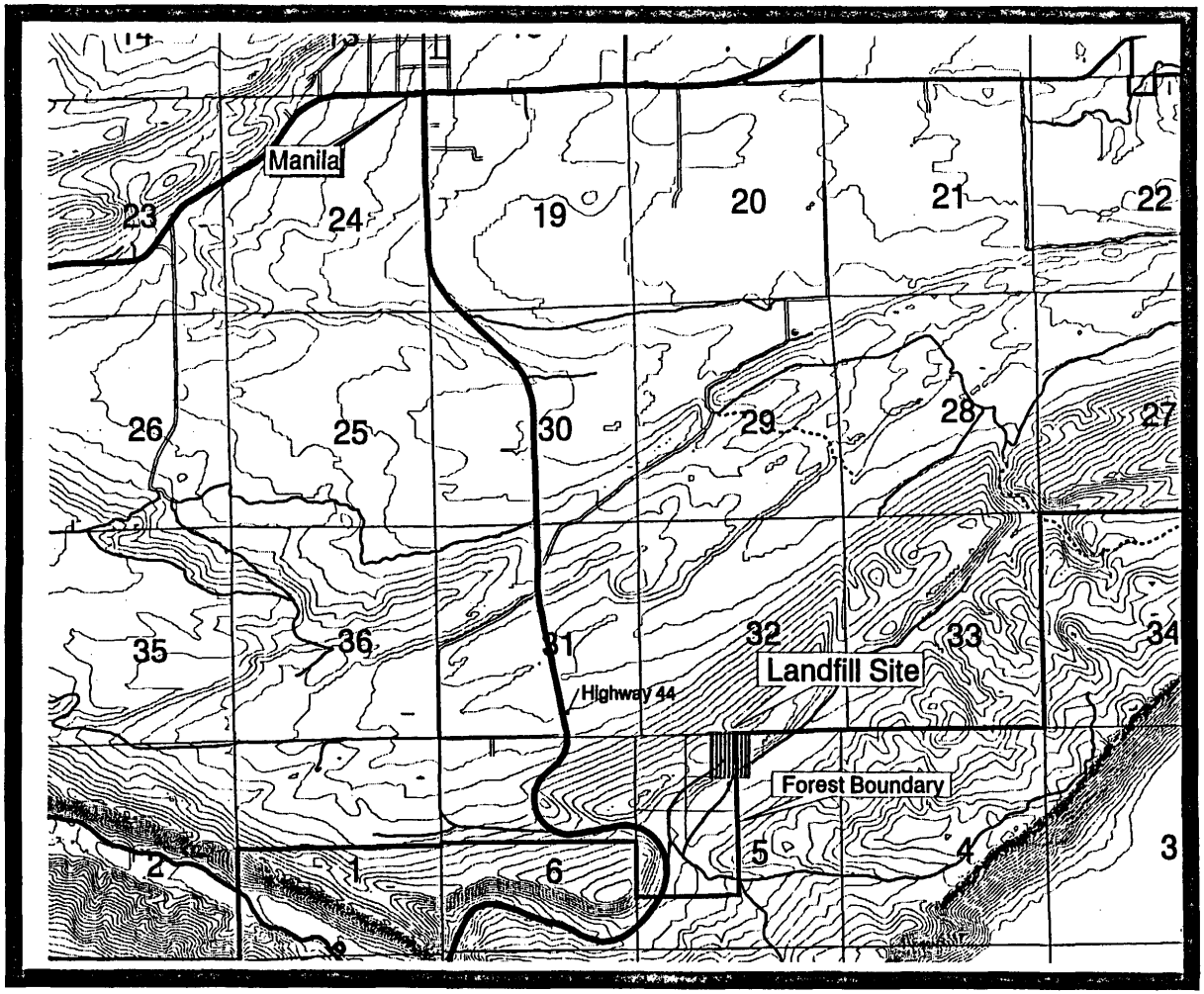
Soil types and Properties

Soil Description

The landfill area was frozen during the time of the soil and water field investigations. Only one soil description was done at the latest landfill trench which showed approximately 50 inches of profile. The top 4 inches was too disturbed to describe.

The profile shows a silt loam, very deep, moderately well drained soil that formed predominantly from colluvium from sandstone and shales. The subsurface is very pale brown silt loam about 40 inches thick. The underlying material is a reddish brown gravelly loam with an abrupt broken boundary is about 3 inches (at sampling site). The underlying horizon was light yellowish brown silt loam 4 inches to the top of the fill. The pH was around 8.0 for all but the reddish brown gravelly loam which was neutral. Permeability is moderately rapid. Slope is 5 to 10 percent

Manila Landfill Location Map



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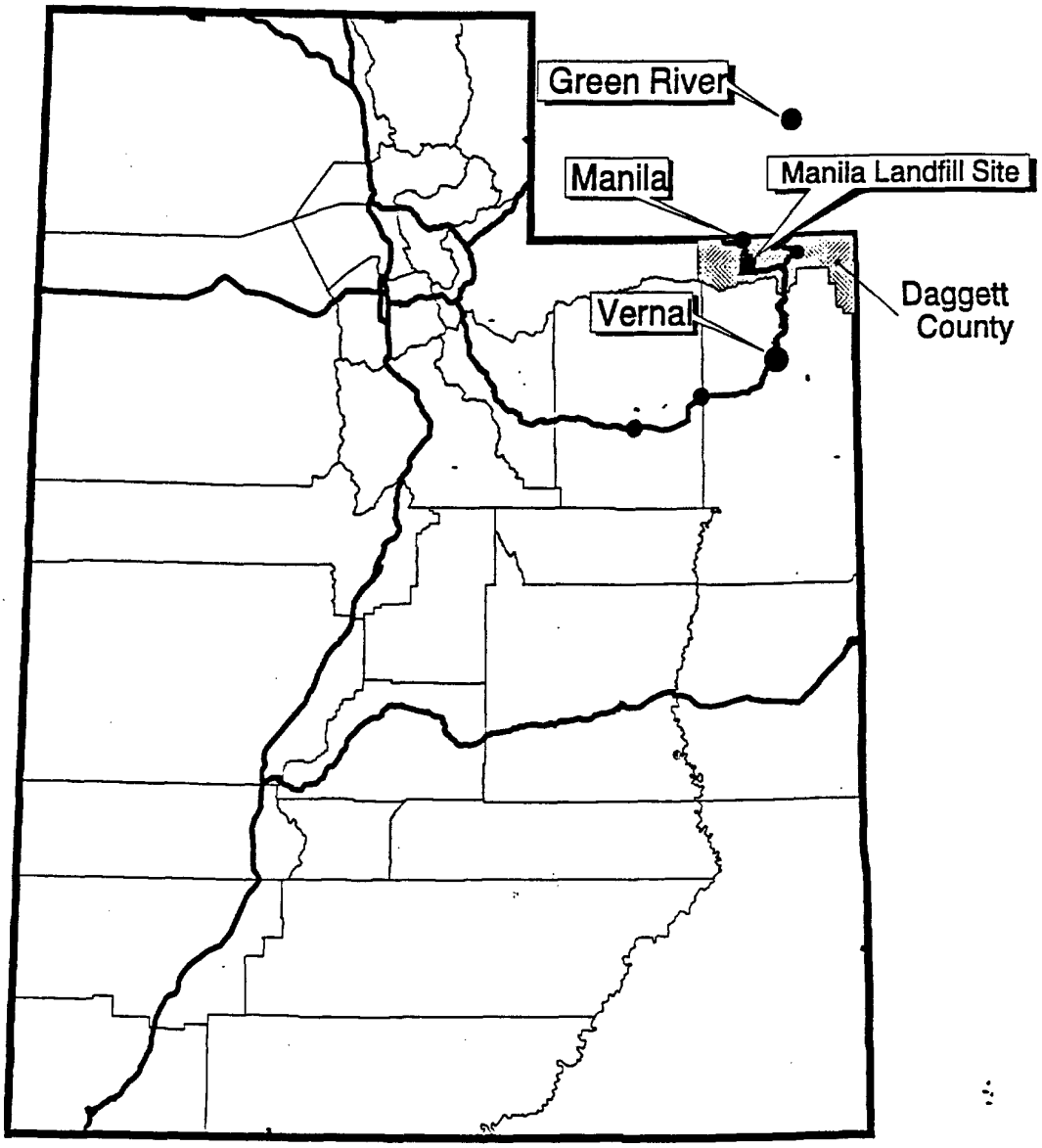
Manila Landfill Vicinity Map



Appendix A

Recorded at Request of

at M. Fee Paid $ Recorded March 15, 1974

by Gene Briggs Dep. Book 74 Page 313 Ref. Entry # 8633

Mail tax notice to Address

QUIT-CLAIM DEED

[CORPORATE FORM]

DAGGETT COUNTY, a corporation organized and existing under the laws of the State of Utah, with its principal office at Manila, of County of Daggett, State of Utah, grantor, hereby QUIT CLAIMS to Daggett County and the Town of Manila, as tenants in common

grantee

of Manila, Daggett County, State of Utah for the sum of Ten dollars and other good and valuable consideration DOLLARS,

the following described tract of land in Daggett County, State of Utah:

NE 1/4 NE 1/4 NW 1/4, N1/2 SE 1/4 NE 1/4 NW 1/4, E 1/2 SW 1/4 NE 1/4 NW 1/4, Section 5, Township 2 North, Range 20 East, Salt Lake Meridian. Subject to all existing rights of record.

The officers who sign this deed hereby certify that this deed and the transfer represented thereby was duly authorized under a resolution duly adopted by the board of ~~directors~~ commissioners of the grantor at a lawful meeting duly held and attended by a quorum.

In witness whereof, the grantor has caused its corporate name and seal to be hereunto affixed by its duly authorized officers this day of , A. D. 19

Attest:

Secretary.

[CORPORATE SEAL]

DAGGETT COUNTY ~~Company~~

By

Albert Neff, Chairman

Gene Briggs, Recorder

STATE OF UTAH,

County of Daggett } ss.

On the 11th day of March, A. D. 1974 personally appeared before me Albert Neff and Gene Briggs who being by me duly sworn did say, each for himself, that he, the said Albert Neff is the ~~president~~ Chairman and he, the said Gene Briggs is the ~~secretary~~ Recorder of Daggett County Company, and that the within and foregoing instrument was signed in behalf of said corporation by authority of a resolution of its board of directors and said Albert Neff and Gene Briggs each duly acknowledged to me that said corporation executed the same and that the seal affixed is the seal of said corporation.

Notary Public.

My commission expires 5/21/75 My residence is Manila Utah

FORM NO. 103C— © LAW PUB. CO. — 3218 SO. 300 W. EAST — SALT LAKE CITY

United States Department of Agriculture Forest Service	a. Record no. (1-2)	b. Region (3-4)	c. Forest (5-6)
SPECIAL USE PERMIT P.L. 94-579 Act of ~~xxxxxxxx~~ Oct. 21, 1976 This permit is revocable and nontransferable (Ref. FSM 2710) 36 CFR 251.50, et seq.	70	04	Ashley 01
	d. District (7-8)	e. User number (9-12)	f. Kind of use (13-15)
	Flaming Gorge 01	1033	Disposal Area 313
	g. State (16-17)	h. County (18-20)	k. Card no. (21)
	Utah 49	Daggett 009	1

Permission is hereby granted to Daggett County % Carl Collett, Chairman

of Manila, Utah 84046,

hereinafter called the permittee, to use subject to the conditions set out below, the following described lands or improvements: A small parcel of land located in the

NW¼ NW¼ of lot 2, Sec. 5, T2N, R20E, SLM

This permit covers 5 acres ~~and xxxxxxxxxxxxxxxxxxxx miles~~ and is issued for the purpose of:

Operating and maintaining a sanitary landfill for Daggett County

1. Construction or occupancy and use under this permit shall begin within N/A months, and construction, if any, shall be completed within N/A months, from the date of the permit. This use shall be actually exercised at least N/A days each year, unless otherwise authorized in writing.

2. In consideration for this use, the permittee shall pay to the Forest Service, U.S. Department of Agriculture, the sum of N/A Dollars ($) for the period from 19, to , 19, and thereafter annually on Free Use (36 CFR 251.2 a & b), Dollars ($):

Provided, however, Charges for this use may be made or readjusted whenever necessary to place the charges on a basis commensurate with the value of use authorized by this permit.

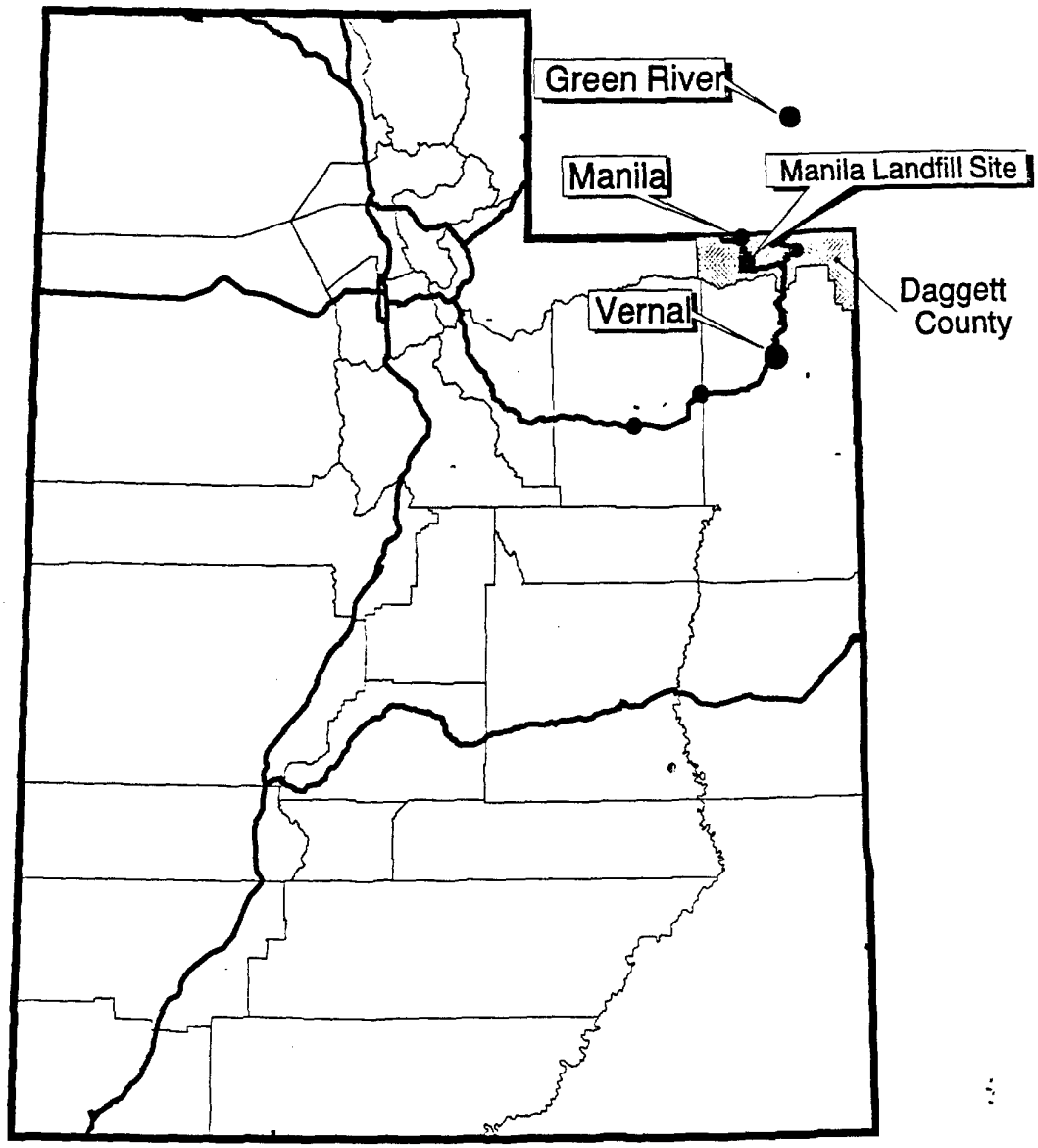
3. This permit is accepted subject to the conditions set forth herein, and to conditions 18 to 32 attached hereto and made a part of this permit.

	NAME OF PERMITTEE	SIGNATURE OF AUTHORIZED OFFICER	DATE
PERMITTEE	DAGGETT COUNTY	Carl S. Collett TITLE CHAIRMAN	4-13-82
ISSUING OFFICER	NAME AND SIGNATURE JAMES N. CRAIG	TITLE FOREST SUPERVISOR	DATE 4/13/82

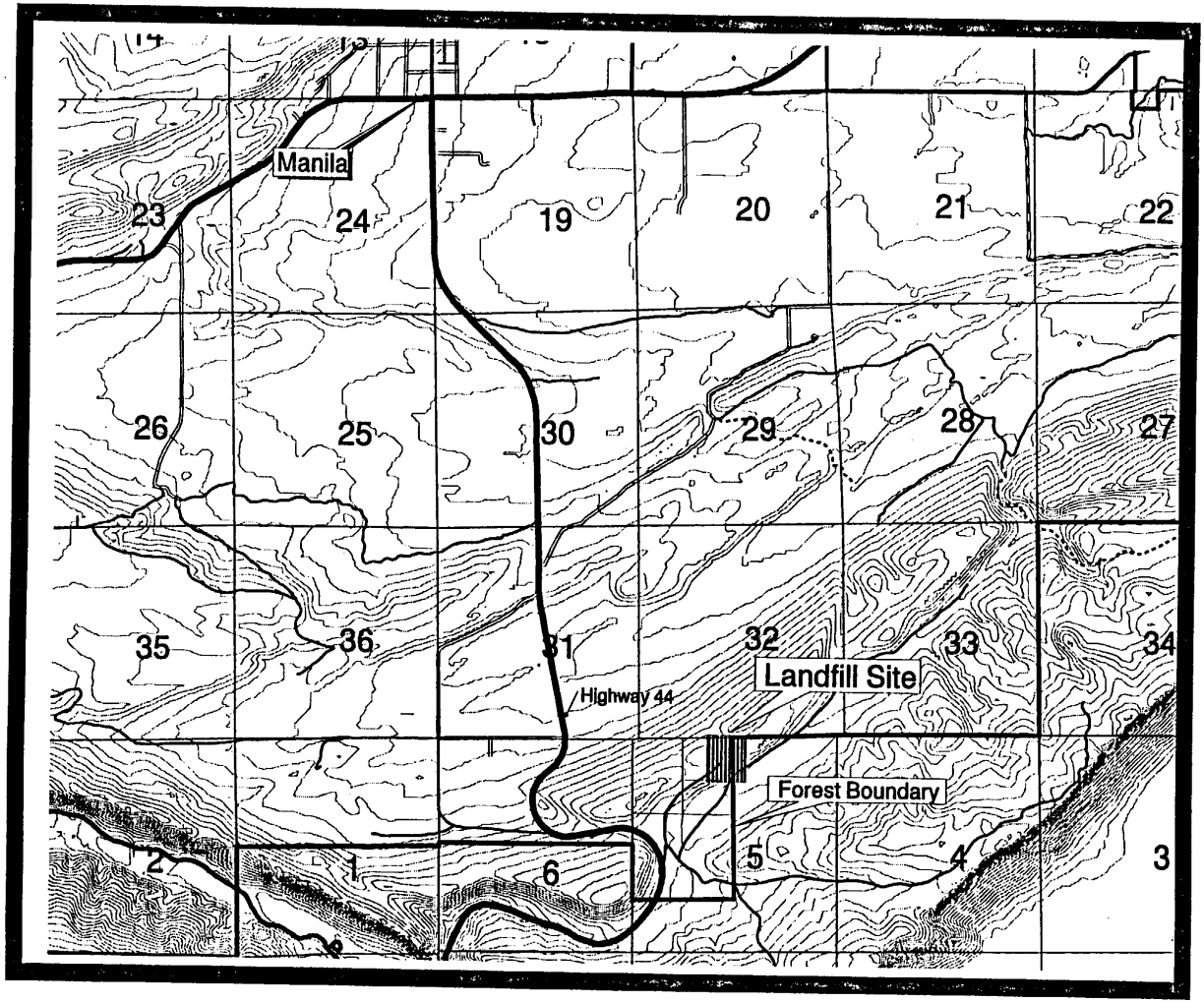
(CONTINUED ON REVERSE)

2700-4 (7-71)

Manila Landfill Vicinity Map



Manila Landfill Location Map



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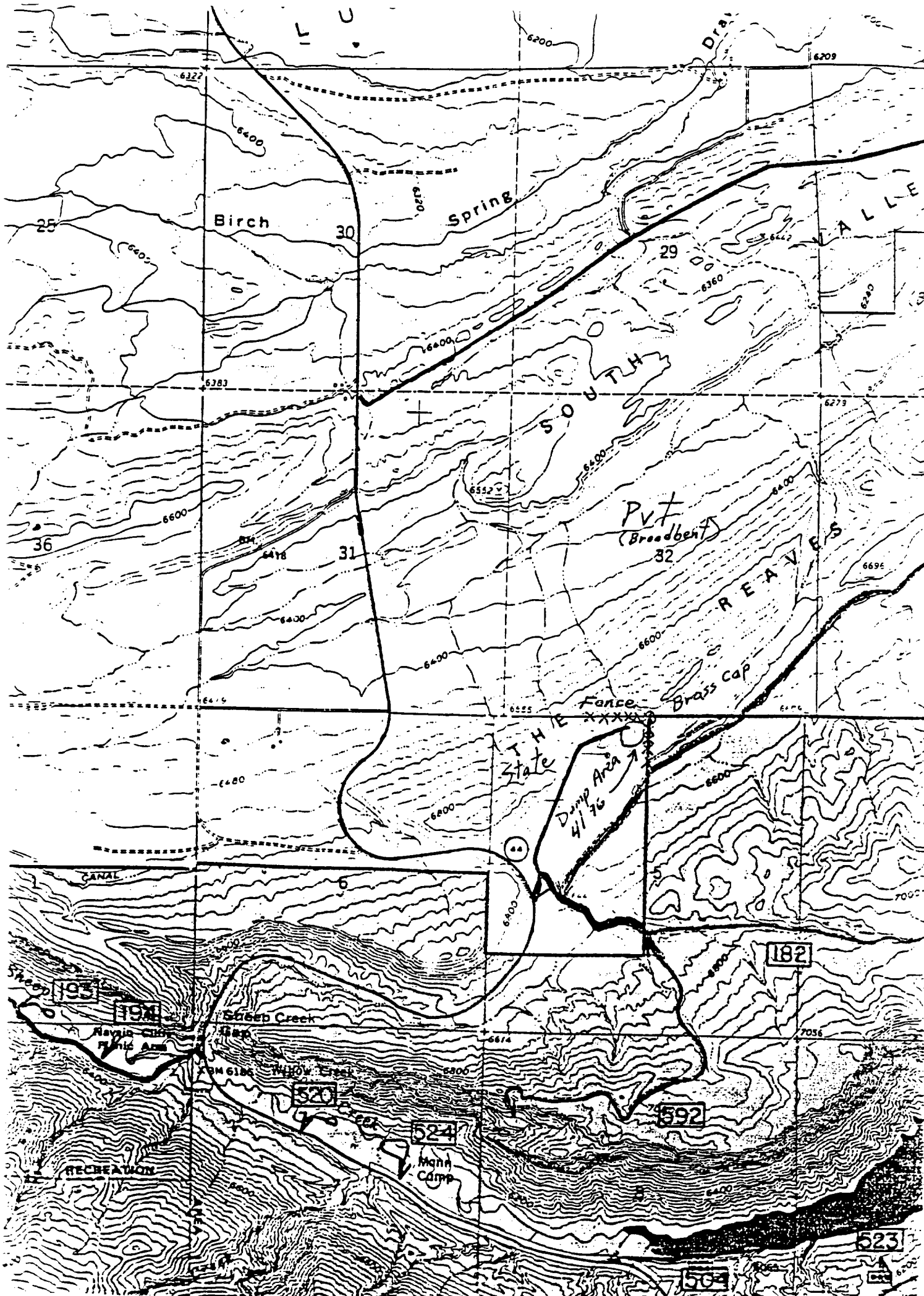
Birch
Spring
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Pvt
(Broadbent)
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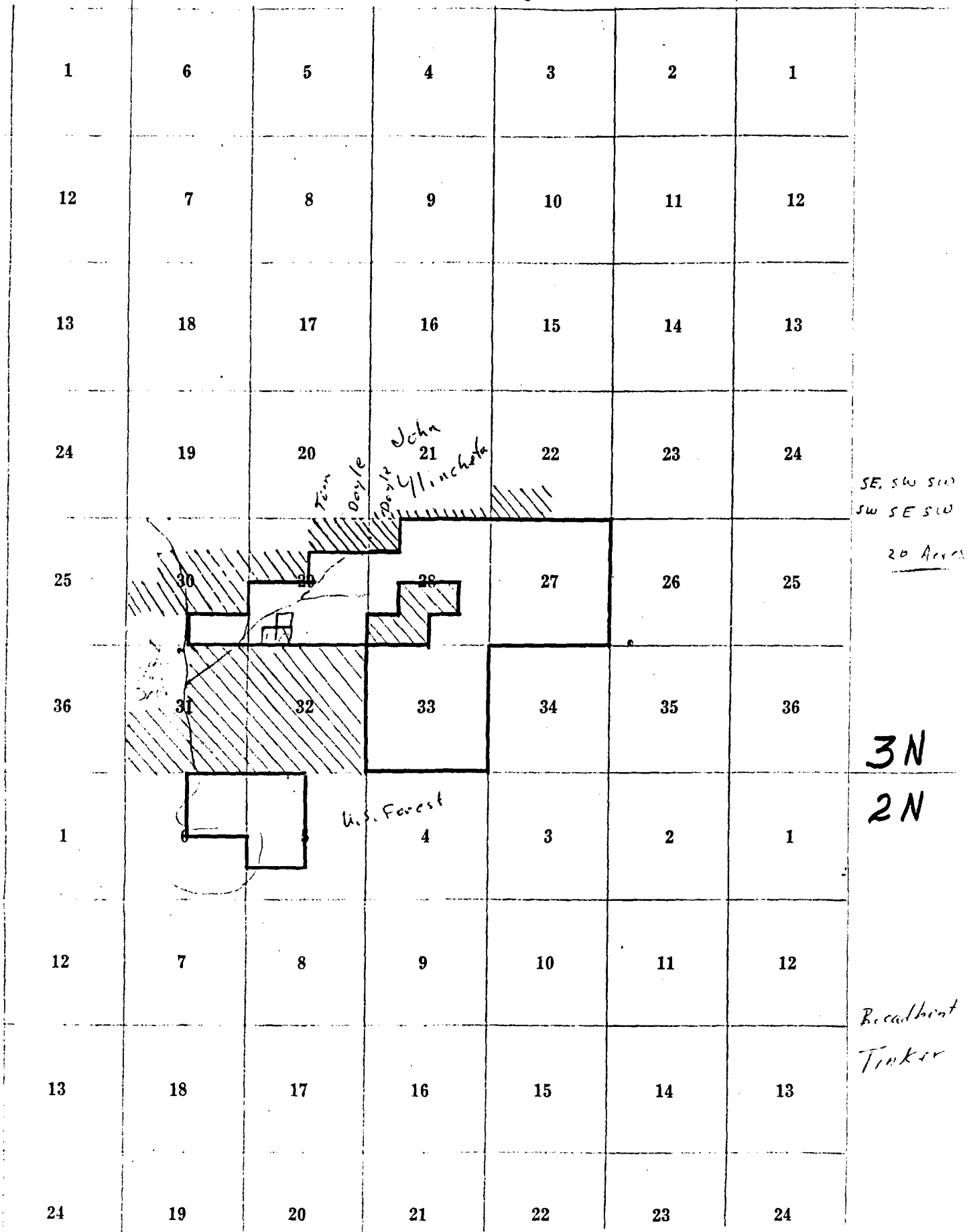
THE
Fence
Brass cap
State
Dump Area
41 76
CANAL
Sheep Creek
Gap
Navajo Cliff
Picnic Area
Willow Creek
Mann
Camp
RECREATION
193
194
520
524
182
592
523
504

County, Daggett County Landfill

P. M. Township Range 20E P. M.



Appendix B

COUNTY LANDFILL LOG

DATE	VEHICLE LICENSE NO.	ESTIMATE VOLUME (In Cubic Yards)	WASTE SOURCE	DRIVERS & SELF-INSPECTED DESCRIPTION OF THE TYPES OF WASTE	INSP Y/N

FORM INSTRUCTIONS: (All incoming loads must be recorded)

- Estimated Volume--should be estimated as accurately as possible and should state if the load is compacted or not.
- Waste Source--how the waste was generated (e.g. commercial, campground, residential, agricultural etc.)
- Driver & Self-Inspected Description of Waste-- record a general statement as to the types of waste in the load both from your own observations and the drivers description.
- Insp.--specif[illegible]th an "X" in this column if the load was flagged for a more intensive inspe[illegible] (to be recorded on "Waste Inspection Form").

LANDFILL INSPECTION FORM

On-site landfill inspections must be completed on a quarterly basis. Inspectors should consider each of the factors listed and record the findings in narrative on this form. As well, the location of any problem areas should be marked on a landfill site map and referred to in the narrative.

Inspector's Name _____ Title _____

Inspection Date _____ Inspection Time _____

Inspection Categories

Conformity with Landfill Design Scheme & Methods: Make note of any variation from design guidelines or landfilling methods.

Integrity of Run-on Control Berms and Ditches: Note any undo erosion or failures of current systems and specify any needed expansion or upgrades.

Evaluate the Adequacy of Daily Cover for Active Cells: Inspect to insure daily cover conforms to operating plan.

Inspect the Integrity of Cells that have Already Received Final Cover: Note the status of vegetative cover that has established, any erosional impacts, and any evidence of subsidence.

Inspect for Litter, Disease Vectors, Evidence of Burning, and also the adequacy of the access gate, fencing and signage.

Update with a describe of any remedial action taken to rectify or repair any problems encountered in the inspection and indicate the date the corrective action was taken.

Inspector's Signature: _____

WASTE INSPECTION FORM

To be completed on a random basis (about every 20th load) or when a suspicious load is encountered.

Inspected by _____ Date_____

Vehicle License Number _____ Drivers Name _____

Drivers Address:

_____ _____ _____ _____
Street City State Zip

Drivers Description of the Types of Waste Contained in the Load

Source of the waste (according to driver) _____

_____

Types of waste (according to driver) _____

_____

Inspectors Analysis of Waste Material
Segregate and break-down the load in the presence of the landfill user and indicate existence and relative volume of the following types of waste contained in the load:

Infectious Waste	_____	Asbestos	_____	Liquids	_____
Radio Active	_____	Animals	_____	Furniture	_____
Automobiles	_____	Ag. waste	_____	Sludge	_____
Ash	_____	Tires	_____		

Other Types of Hazardous Wastes (describe) _____

_____

Action Taken _____

Appendix C

Chapter 2

BACKGROUND FOR DEFINING HAZARDOUS WASTES

There are two major methodologies presently in use to identify wastes as hazardous–a list approach and a criteria approach. Both approaches are difficult to implement. The criteria approach addresses the problem more directly. It identifies those properties of waste that cause hazardous effects to the environment and then recommends methods and procedures to measure these properties (or effects). The list approach, on the other hand, is more indirect. The waste is analyzed for certain prescribed species, and depending upon the presence of these species (and possibly their concentration), a hazard judgement is made. The following discussion will address methods presently available to implement a criteria approach.

Since some aspects of the safe management of hazardous waste are identical to safe management of other regulated substances, some of the methods mentioned herein are those recommended by other agencies for the testing of these other regulated substances. Waste materials, however, do possess certain peculiarities of form and function for which existing criteria may not be adequate or appropriate to characterize a waste's hazardousness. In these cases, the differences are mentioned and the problems addressed. The criteria that will be discussed are: flammability, corrosiveness, and reactivity. These criteria can be viewed as properties of the waste as disposed and can be measured by directly testing the waste.

There are other criteria, such as waste toxicity, etiologic activity, genetic activity, and tendency to bioconcentrate, which must be considered in the context of their routes of exposure. A waste containing a contaminant conforming to these criteria can only be a hazard if there exists a vector (exposure route) by which this contaminant can be made available to the environment under disposal conditions. In order to measure these criteria in a meaningful way, the measurement must be done on the exposure vector, be it eluent from the waste, vapor due to waste evaporation and sublimation, or air float particles from waste particulates. For example, a waste may contain a toxic constituent, but if this toxicant is bound up in the waste matrix in such a way that it cannot leach (elute), vaporize, air-float particulate, or sublimate under disposal conditions, the waste does not present a toxicity hazard. Therefore, any testing done to identify wastes that would conform to the above criteria should ideally be done on these vectors. Testing of this sort is complex and still under development in both the public and private sectors. This chapter will not deal with these criteria further.

FLAMMABILITY

Flammability is one criterion for defining a waste as hazardous. Flammable wastes may cause damage directly, from heat and smoke production, or indirectly, either by providing a vector by which other hazardous wastes could be dispersed (such as convection currents carrying toxic particulates or dust), or could cause otherwise benign wastes to become hazardous (such as plastics which, when ignited, undergo condensation reactions or depolymerize to emit toxic fumes). For these reasons, it is desirable to identify wastes that are flammable, so they can receive proper handling.

One method by which the degree of flammability

TAKEN FROM: "STATE DECISION-MAKER'S GUIDE FOR HAZARDOUS WASTE MANAGEMENT" U.S. E.P.A. 1979 #10320

of a material can be defined is by the flashpoint (FP) of the substance. This is the lowest temperature at which evaporation produces sufficient vapor to form an ignitable mixture with the air, near the surface of the liquid, or within the vessel used. (By "ignitable mixture" is meant a mixture that, when ignited, is capable of the initiation and propagation of flame away from the source of ignition. By "propagation of flame" is meant the spread of flame from layer to layer independently of the source of ignition.)

The initiation of flame is always the result of the progressive auto-acceleration of reaction, which becomes possible only under definite thermal conditions brought about by an external source (for example, spark discharge, hot walls of a vessel, etc.) Most combustion reactions are exothermic (heat producing), and as they proceed they raise the temperature of the surroundings. Since reaction rate is a function of temperature (a measure of available energy), these reactions accelerate themselves by the thermal energy they release in reaction. (The reaction here is oxidation, that is, the exhaustive combination of the vapors with the elemental oxygen in the atmosphere.)

In defining flammability, only the flash point need be considered since direct vigorous oxidation of a substance not in the gaseous state is very rare at normal temperatures. While all agencies and organizations that define flammability use flash points as their limiting criteria there is no consensus as to what that limit should be (for example, Department of Transportation F.P. $< 100°F$, California F.P. $< 80°F$). In landfill situations, there are many available external sources of energy which could provide the impetus for combustion–electrical energy resulting from sparks generated by bulldozers, thermal energy resulting from the heat of neutralization when wastes of differ-pH's are mixed, biologically initiated thermal energy from the decomposition of organic wastes, etc. These sources could raise the temperature at the landfill surface above the ambient temperature. Data should be gathered on the temperature and energy sources at landfills to help address the question of what flashpoint limit should be chosen to avoid conflagrations due to these external sources.

Another source of concern is the fact that disposal sites often contain wastes that are not hazardous by themselves, but when burned become hazardous (for example, certain plastics give off noxious fumes when burning, beryllium dust may leave the site by a vector supplied by the fire, etc.) For this reason, it may be desirable not only to require that flammable wastes be placed in a hazardous waste facility, but also combustible wastes. Combustible wastes can be managed in a safe manner at these facilities by being segregated from those wastes which become hazardous upon burning.

The established tests for flammability take the physical state of the substance into consideration, since the state will affect the vapor pressure and consequently change the flash point. Therefore, flammability will be examined for the four following physical states of wastes: (1) pure liquid; (2) solution; (3) sludge; (4) solid. The testing modifications that must be made for each state, and a short discussion of each state follow:

I. Pure Liquids

The vapor, as measured by the vapor pressure, produced by a pure substance is directly proportional to the ambient temperature. (The reference is primarily to liquids, although there are certain solids, e.g., camphor, that sublime, that is, change from a solid to a vapor, at ordinary temperatures, and that have a meaningful vapor pressure.) The "ideal vapor pressure" of a substance is defined as the sum of the vapor pressure of each constituent multiplied by its mole fraction. Temperature is a manifestation of molecular motion, which in turn is a physical consequence of the kinetic energy of the molecules themselves. At any given temperature, the molecules in a sample will have a "spread" of kinetic energies that can be statistically described as a Boltzman distribution.

A molecule must possess a certain minimum threshold energy in order to overcome the attractive forces of its neighboring molecules in the close-packed liquid state. As the temperature is raised, the entire curve shifts toward higher kinetic energy and more molecules now possess the prerequisite energy to escape into the gaseous state.

It has been suggested that flash points be standardized to a particular atmospheric pressure, since barometric pressure does vary with different locations, and with time at the same location. The reason for

this suggestion is as follows: Atmospheric pressure is the measure of the amount of air available at any given point. Thus, as the atmospheric pressure drops, less vapor (that is, lower vapor pressure) is necessary to attain that concentration which defines an ignitable mixture, and the temperature which produces this lower vapor pressure (that is, the flash point) is also lower. One might assume then that if the barometer drops appreciably after a flash-point determination is made, what was tested as a nonflammable substance at the higher reading may be flammable at the new pressure. However, this seems to be an unrealistic concern since according to the National Oceanic and Atmospheric Administration (NOAA), the largest barometric deviation in a single day (excluding hurricanes and tornadoes) *is less than 20 mm Hg,* and this would change a flash point of 80°C by less than 3°C.

There are several common methods of determining the flash point of a liquid. The methods vary only slightly with the apparatus used, and these apparatus are of two types—open cup testers and closed cup testers. The method is basically as follows: the sample is placed in the sample cup and heated at a slow but constant rate. A small test flame is passed across the cup at regular, specified intervals. The flash point is taken as the lowest temperature at which application of the test flame causes the vapor at the surface of the liquid to flash.

The apparatus on the market differ in four ways: (1) sample cup type; (2) cup insulation type; (3) heating mechanisms; (4) agitation.

The most important of these is the type of sample cup. Open cup testers as a class give higher flash points than closed cup testers, and are normally used for determinations on liquids with relatively high flash points. These higher determinations result from the fact that the design of the top of the sample cup in an open cup tester allows the sample to be in greater contact with the atmosphere, preventing any quantitative buildup of vapors over the liquid as it is heated. Closed cup testers have smaller openings above the sample cup; this keeps the vapor from quickly dissipating and results in a mixture richer in vapor. Thus, closed cup testers would be representative of the worst, or most dangerous situation.

There are two types of cup insulators (temperature baths): liquid bath and air bath. Since the purpose of these temperature baths is to ensure a uniform temperature around the entire sample, a liquid bath is superior to an air bath, due to the better thermal transport properties of liquids as compared to air.

As far as temperature control mechanisms are concerned, it makes no difference whether the apparatus has a gas or electric burner. Both are equally accurate at the low temperature of concern, and the choice becomes one of convenience (electric) versus economy (gas).

The final choice that must be made is whether or not to include a method of sample agitation in the apparatus. If the sample to be tested is very viscous, tends to skin over, or contains suspended solids, a stirrer should be incorporated into the apparatus to agitate the sample and prevent local temperature variations. Since a pure nonviscous liquid can also be run on such an apparatus without a stirrer, it is recommended that a stirrer be incorporated into the apparatus.

There are a number of different flash-point testers offered by the vendors, Fischer and Sargent to name two, with various combinations of the above features (Table 1).

The following is a short discussion on three types of physical state deviations from a pure liquid and and how they should be handled.

II. Solution

A solution is the least complex deviation from a pure liquid, and the procedures for ascertaining flash points of solutions have also been developed. The vapor pressure of solutions will vary either positively or negatively from the ideal vapor pressure (where the "ideal vapor pressure" is defined as the sum of the vapor pressure of each constituent multiplied by its mole fraction). Solutions can be tested in the same manner as pure liquids with the following procedural change. If the flash point is determined to be 6.6°C (20°F) or higher, a sample of the liquid evaporated to 90 percent of its original volume should be tested. The lower value of the two tests can then be used as the flash point of the material. The purpose of this procedure is as follows: Since the different components in the mixture have different volatilites,

Table 1. Commonly Encountered Hazardous Materials and Products Found in Small Batches of Waste

TYPICAL WASTE SOURCES	HAZARDOUS MATERIALS
1. ACIDS	
Pickling Liquor Battery Acid Acidic Chemical Cleaners Spent Acid Plating Operations Laboratory Glassware Acid Baths Glass Etching Solutions	Chromic-sulfuric acid mixture, hydrobromic acid, hydrochloric acid, hydrofluoric acid, nitric acid, perchloric acid, sulfuric acid
2. ALKALIES	
Miscellaneous Caustic Products Alkaline Battery Fluid Caustic Wastewater Cleaning Solutions Lye	Ammonia, lime (calcium oxide), potassium hydroxide, sodium hydroxide, sodium silicate
3. ORGANICS *(Mainly Non-Halogenated)*	
Capacitor Fluids Chemical Cleaners and Solvents Chemical Toilet Wastes Electrical Transformer Fluids Furniture and Wood Polishes Laboratory Chemicals Paint Removers Silver Cleaning Agents Shoe Polish	Aromatic compounds, organic amides, organic mercaptans, organonitriles, nitrobenzene, phosgene, thioureas
4. HALOGENATED ORGANICS	
Cleaning Solvents Laboratory Chemicals Paint and Varnish Removers Dry Cleaning Solutions Capacitors and Transformers Containing PCB	Carbon tetrachloride, chloroform, methylene chloride, polychlorinated biphenyls (PCB)
5. INORGANICS	
Catalysts Chemical Toilet Wastes Laboratory Chemical Wastes Paint Sludge Plating Solutions Fluorescent Lamps Germicidal and "Disinfectant" Solutions Paints Fluxes Aluminum Cleaning Agents	Ammonium fluoride, ammonium silicofluoride, antimony salts, arsenic salts, asbestos products and fibers, beryllium compounds, barium salts, borane compounds, cadmium salts, chromium salts, cyanide compounds, inorganic halides (potassium bromide, sodium iodide), lead compounds, mercury salts, selenium salts, sodium silicofluoride, vanadium compounds, zinc chloride

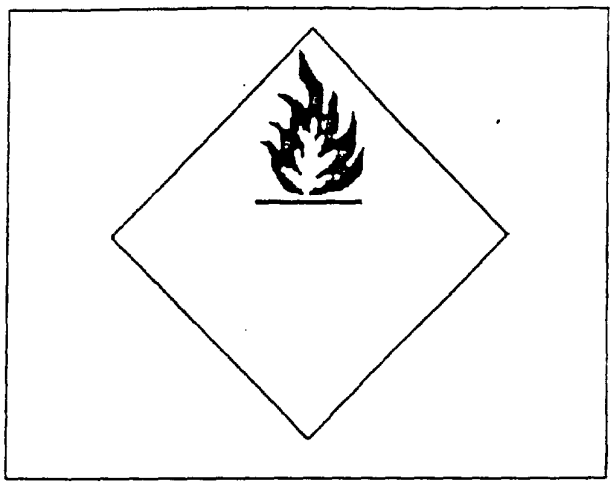
Table 1. Commonly Encountered Hazardous Materials and Products Found in Small Batches of Waste (Continued)

TYPICAL WASTE SOURCES	HAZARDOUS MATERIALS
6. EXPLOSIVES Illegal Explosive "Firecrackers" Laboratory Wastes Obsolete Explosives Track Torpedoes Blasting Caps Detonators Commercial Pyrotechnics for Private Use	Ammonium nitrate, ammonium nitrate-fuel oil mixtures (ANFO), dynamite, mercury fulminate, nitroglycerin, 2,4,6-trinitrotoluene (TNT), water-gel explosives
7. PESTICIDES Waste Pesticides House and Garden Discarded Pesticide Cans Waste Water from Cleaning of Pesticide Containers Containers and Pesticide Application Equipment	Chlorinated hydrocarbon pesticides, organophosphate pesticides, phosphorothioate pesticides, organic carbamates, organic thiocarbamates
8. GASES Welding Gases Laboratory Gas Cylinders Local Anesthetic "Aerosol" Cans Medical Oxygen Cylinders	Acetylene, ammonia, carbon monoxide, chlorine, ethyl chloride, hydrogen, hydrogen sulfide, methyl chloride, nitrogen dioxide, oxygen, other gases under high pressure
9. BANNED PRODUCTS Banned Pesticides Banned Hair Sprays Banned Aerosol Bathroom Cleaners Waste Lead-Base Paints	Aerosol products containing vinyl chloride as propellant, aldrin products, lead-based paints containing 0.5 percent lead or greater

Table 2. Reference Manuals on Hazardous Properties of Laboratory Chemicals and Commercial/Industrial Products

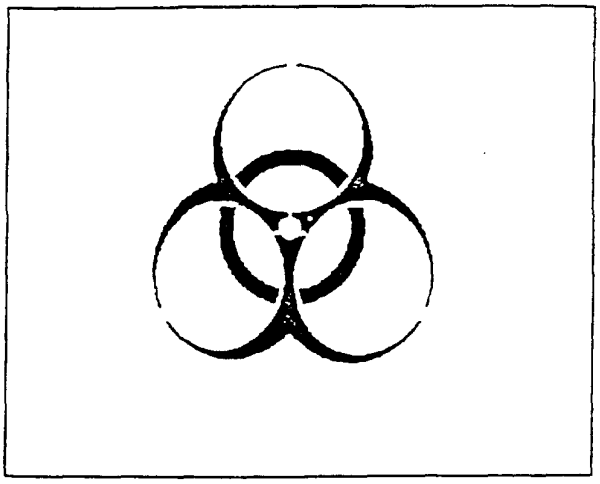
REFERENCE	CONTENTS
Gleason, Marion N., et al. *Clinical toxicology of commercial products; acute poisoning.* 3d ed. Baltimore, The Williams & Wilkins Co., 1969. various pagings.	Contains alphabetical compilation of 3,000 major chemical substances (ingredients) found in widely used commercial products, and gives toxicity information and a toxicity rating for each ingredient. In addition, the manual contains a trade name index for 17,000 products, identifies the manufacturers and lists the ingredients for each product and identifies the toxic components.
Stecher, P.G., et al. *The Merck index; an encyclopedia of chemicals and drugs.* 8th ed. Rahway, N.J., Merck & Co., Inc., 1968. 1713 p.	Describes 10,000 individual substances, provides data on their toxic effects on humans and test animals, and lists common uses for selected entries. In addition, the index lists poison control centers and first aid procedures. A cross-index of chemical names and formulas is also given.
Sax, N.I., et al. *Dangerous properties of industrial materials.* New York, Reinhold Publishing Corporation, 1957. 1467 p.	Lists 9,000 general chemicals and products; gives descriptions of physical properties and toxicity, explosion, fire, and radiation hazard ratings. For each chemical, pertinent data are provided on personal hygiene, ventilation, disaster control, shipping regulations, and storage/handling procedures.
Weast, R.C. *Handbook of chemistry and physics.* 56th ed. Cleveland, CRC Press, 1975-1976. various pagings.	Identifies physical and chemical properties of most organic and inorganic chemicals. The handbook gives toxicity of select chemicals, and general information on chemical hazards, fire precautions and first aid.
Christensen, H.E., Luginbyhl, T.T., and B.S. Carroll. *Registry of toxic effects of chemical substances; 1975 edition.* Washington, U.S. Government Printing Office, June 1975. 1296 p.	Identifies toxicity (to man, animals, and aquatic life) of most known organic and inorganic chemicals and identifies carcinogenic, teratogenic, and mutagenic nature, if any.

FLAMMABLE SYMBOL



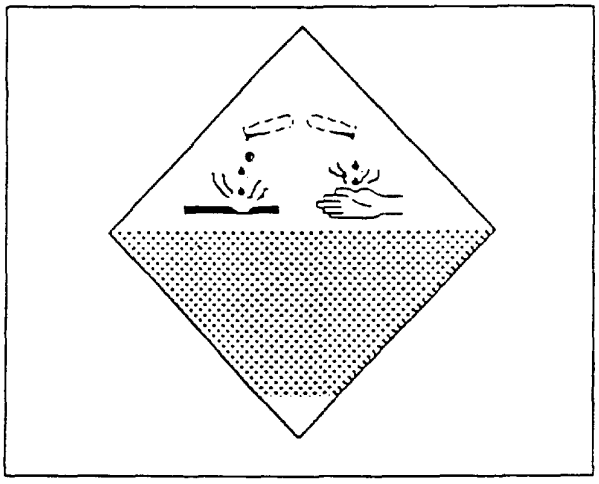
Category	Message	Symbol	Background (shape/color)
Flammable Liquid	Flammable Liquid (black/white	Flame (black/white)	(diamond) (red)
Flammable Solid	Flammable Solid (black)	Flame (black)	(diamond) (red/white strip)
Spontaneously Combustible	Spontaneously Combustible (black)	Flame (black)	(diamond) (white top) (red bottom)
Dangerous When Wet	Dangerous When Wet (black/white)	Flame (black/white)	(diamond) (blue)

BIOMEDICAL SYMBOL



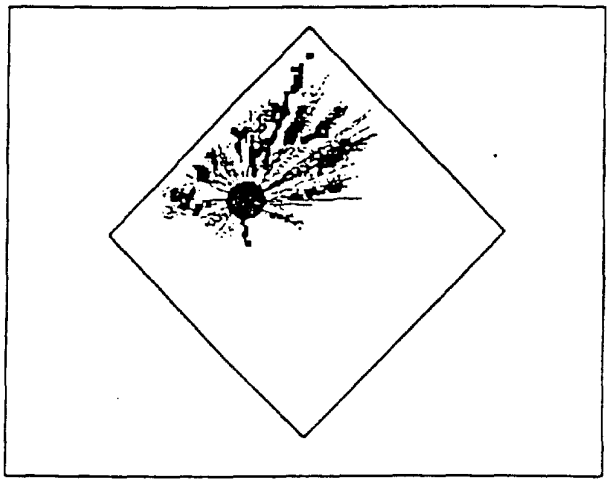
Category	Message	Symbol	Background (shape/color)
Biomedical	Biomedical Material Etiologic Agents (black/white)	(special symbol) (black)	(rectangle) (black/white)

CORROSIVE SYMBOL



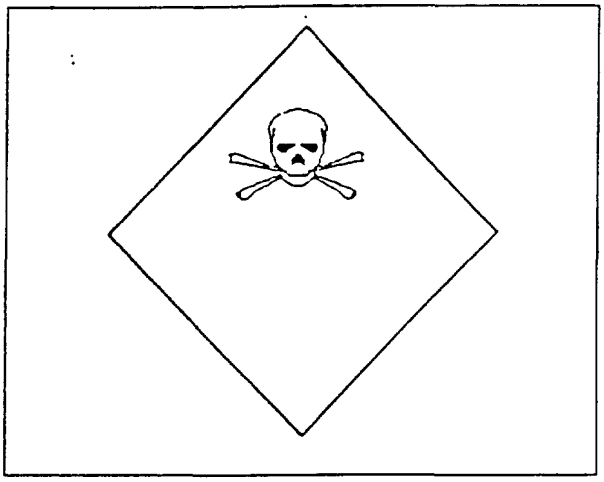
Category	Message	Symbol	Background (shape/color)
Corrosive	Corrosive (black/white)	(special symbol) (black/white)	(diamond) (white top) (black bottom)

EXPLOSIVE SYMBOL



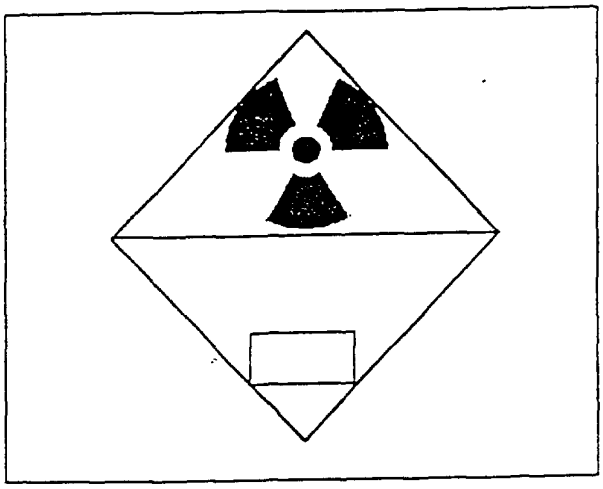
Category	Message	Symbol	Background (shape/color)
Explosives	Explosive A (black)	Exploding Ball (black)	(diamond) (orange)
	Explosive B (black)	Exploding Ball (black)	(diamond) (orange)
	Explosive C (black)	Exploding Ball (black)	(diamond) (orange)
	Blasting Agent (black)	(none) (black)	(diamond) (orange)

POISON AND IRRITANT SYMBOL



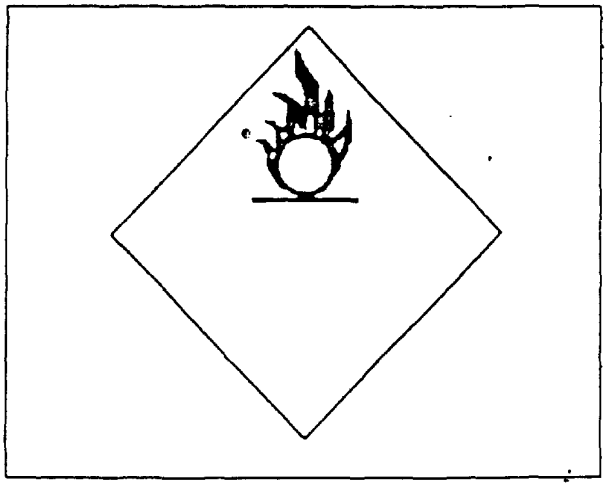
Category	Message	Symbol	Background (shape/color)
Poison	Poison (black)	Skull/X Bones (black)	(diamond) (white)
Poison Gas	Poison Gas (black)	Skull/X Bones (black)	(diamond) (white)
Irritant	Irritant (red)	(none) (none)	(diamond) (white)
	Irritant (black)	Skull/X Bones (black)	(diamond) (white)

RADIOACTIVE SYMBOL



Category	Message	Symbol	Background (shape/color)
Radioactive	Radioactive (black/red)	(special symbol) (black)	(diamond) (white or yellow or yellow/white)

OXIDIZER SYMBOL



Category	Message	Symbol	Background (shape/color)
Oxidizer	Oxidizer (black)	Flaming Circle (black)	(diamond) (yellow)
Organic Peroxide	Organic Peroxide (black)	Flaming Circle (black)	(diamond) (yellow)

Appendix D

DUCHESNE, UINTAH & DAGGETT SOIL CONSERVATION DISTRICTS

AS OF MAY 1997

Snowpacks across the Uintah Basin and North Slope areas are much above average. The North Slope areas are much above average. The North Slope is at 166% and the Uintah Basin is near 146% of average Snowpacks in these areas had only 43% of normal snowmelt last month.

Precipitation during April was above average at 120%, bringing the seasonal accumulation (Oct-Apr) to 130% of average.

Reservoir storage is at 77% of capacity.

Water supply conditions are excellent and much above average streamflow expected, high peak flows and a high potential for agricultural inundation.

RESERVOIR STORAGE

(Measured in 1,000s of Acre Feet)

RESERVOIR	USABLE CAPACITY (total water that can be drained)	USABLE STORAGE 1996	1997	AVERAGE
FLAMING GORGE	3749.0	3107.3	3087.0	-*-
MOON LAKE	35.7	29.1	26.2	19.9
RED FLEET	25.7	22.1	17.9	-*-
STEINAKER	33.4	30.9	25.6	23.0
STARVATION	165.3	144.8	129.3	113.5
STRAWBERRY-ENLARGED	1105.9	719.1	880.3	-*-

-*- NOT ENOUGH YEARS OF DATA TO ESTABLISH AN AVERAGE

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utdmp.ut.nrcs.usda.gov or www.wcc.nrcs.usda.gov

** FORECAST ** WATER SUPPLY FOR THE UINTAH BASIN ** FORECAST **

NATURAL RESOURCES CONSERVATION SERVICE (formerly SCS)

Further information contact USDA-NRCS Paul Percival or Brent Draper 722-4621or 789-2100

AS OF FEBRUARY 1998

FORECAST POINT *on the river system*	STREAMFLOW FORECASTS* APRIL through JULY			30 YEAR AVERAGE	PERCENT OF AVERAGE
	1996	1997	1998		
WEST FORK DUCHESNE RIVER *near Hanna*	30	45	20	26	77
DUCHESNE RIVER *near Tabiona*	120	155	89	105	85
STILLWATER RESERVOIR *inflow*	90	125	75	81	93
ROCK CREEK *near Mountain Home*	100	140	85	94	90
DUCHESNE RIVER *above Knight Diversion*	210	290	165	189	87
STARVATION RESERVOIR *inflow Strawberry River*	150	260	95	117	81
CURRANT CREEK RESERVOIR *inflow*	27	45	16	21	76
MOON LAKE *inflow*	75	100	65	69	94
YELLOWSTONE RIVER *near Altonah*	70	100	58	65	89
DUCHESNE RIVER *at Myton*	325	550	210	263	80
UINTA RIVER *near Neola*	56	135	76	85	89
WHITEROCKS RIVER *near Whiterocks*	37	95	52	58	90
DUCHESNE RIVER *near Randlett*	350	700	260	328	79
ASHLEY CREEK *near Vernal*	35	80	43	51	84
BIG BRUSH CREEK *above Red Fleet Res.*	13	27	18	20	88
HENRY'S FORK *near Manila*	45	70	33	42	79
FLAMING GORGE RESERVOIR *inflow*	1550	1800	950	1197	79
YAMPA *near Maybell*	1300	1500	835	947	88

* FORECAST VALUES ARE FOR THE NATURAL FLOW (actual flow may be affected by upstream water management)
Measured in 1,000s of Acre Feet

Station - MANILA Month - FEBRUARY, 1998

Day of Month	Day of Year	Total Sol Rad lyø	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew Point Deg Fahrenheit	Soil 20 in Deg Fahrenheit	Total Precip inch	Penman Evap inch
1	32	202	1.3	49	14.3	27	39	18				70	91	42	18	32	0.00	0.04
2	33	154	1.9	118	10.7	31	45	22				74	88	44	23	32	0.00	0.05
3	34	78	1.8	44	17.9	33	42	25				79	89	59	27	32	0.00	0.04
4	35	177	1.6	128	10.7	37	47	27				74	89	56	29	32	0.00	0.04
5	36	204	5.8	230	39.4	39	52	30				71	89	49	30	32	0.00	0.08
6	37	199	1.0	67	6.9	33	44	22				73	87	53	25	32	0.00	0.04
7	38	145	1.1	25	10.7	37	44	32				81	91	61	32	32	0.00	0.03
8	39	121	3.4	244	25.0	42	58	29				82	95	60	37	32	0.00	0.08
9	40	226	7.8	249	32.2	30	36	24				55	66	49	17	32	0.00	0.06
10	41	262	4.0	222	19.7	27	36	19				54	79	42	13	32	0.00	0.06
11	42	112	3.4	244	32.2	25	33	17				76	88	53	19	32	0.00	0.04
12	43	231	3.5	117	30.4	27	36	16				57	80	42	15	32	0.00	0.06
13	44	119	1.1	98	7.2	31	42	22				80	88	64	26	32	0.00	0.04
14	45	208	6.4	333	32.2	36	42	21				64	89	37	24	32	0.00	0.07
15	46	132	3.6	157	17.9	37	51	28				71	89	37	29	32	0.00	0.07
16	47	147	3.0	160	16.1	38	54	29				66	89	77	34	32	0.11	0.07
17	48	184	1.0	58	8.9	31	36	25				81	90	67	26	32	0.00	0.03
18	49	204	3.9	91	26.8	30	37	25				74	90	52	23	32	0.00	0.05
19	50	300	1.8	71	16.1	26	38	15				53	72	30	12	32	0.00	0.06
20	51	271	1.6	61	10.7	22	32	13				78	87	69	17	32	0.00	0.04
21	52	263	1.9	87	16.1	30	46	16				69	89	40	20	32	0.00	0.06
22	53	92	2.4	88	19.7	36	51	26				82	90	66	31	32	0.01	0.06
23	54	157	0.5	59	12.5	28	35	18				84	90	71	24	32	0.13	0.03
24	55	220	13.4	317	57.3	38	44	29				66	89	52	28	32	0.00	0.07
25	56	310	19.6	260	50.1	26	31	19				51	71	38	12	32	0.00	0.07
26	57	176	10.3	255	35.8	22	27	16				53	66	46	9	32	0.00	0.05
27	58	299	13.6	255	32.2	21	26	17				48	55	40	6	32	0.00	0.06
28	59	336	7.7	256	26.8	21	28	13				38	49	27	1	32	0.00	0.07

MONTHLY STATISTICS

	Total# Sol Rad lyø	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew* Point Deg Fahrenheit	Soil 20 in Deg Fahrenheit	Total Precip inch	Penman Evap inch
TOTAL	2764															0.25	1.51
AVE	197	4.6	102	22.8	30.6	40.5	21.9				69	83	51	22	32		0.05
MAX	330	19.6		57.3	42	58	32				86	95	77	37	32	0.13	0.08
MIN	78	0.5		7.2	21	26	13				38	49	27	1	32		0.03

NOTE: Monthly averages might vary slightly from the average of the daily values printed due to rounding of the daily values.

* Maximum and minimum values of the dew point and wet bulb temperatures are hourly rather than daily values. Daily maximums and minimums can be obtained by scanning the values printed in the corresponding column.

\# Total solar radiation and total Penman Evapotranspiration are corrected for missing daily values by substituting an average (of days with day) value for each missing value before the total is obtained.

ø 1 ly = 1 cal/cm² = 4.1855 J/cm² = 3.6855 BTU/ft² = .01163 KW/m²

Station - MANILA Month - JANUARY, 1998

Day of Month	Day of Year	Total Sol Rad lye	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew Point Deg Fahrenheit	Soil 20 in Deg Fahrenheit	Total Precip inch	Penman Evap inch
1	1	170	1.2	239	16.1	34	50	21				58	75	33	20	32	0.00	0.04
2	2	117	3.9	169	23.3	41	52	33				50	71	30	23	32	0.00	0.07
3	3	166	2.0	176	17.9	35	46	25				67	91	33	25	32	0.00	0.04
4	4	155	3.6	24	26.8	29	38	18				75	91	46	21	32	0.00	0.04
5	5	85	9.0	248	41.2	26	34	19				62	89	39	16	32	0.00	0.04
6	6	179	2.3	154	28.6	21	33	10				49	83	24	5	32	0.00	0.03
7	7	128	1.0	102	8.9	20	32	12				65	84	44	11	32	0.00	0.02
8	8	182	2.2	1	14.3	26	38	18				60	85	44	15	32	0.00	0.03
9	9	182	1.2	209	8.9	28	40	14				56	86	21	11	32	0.00	0.03
10	10	133	1.2	275	8.9	29	43	20				54	74	37	15	32	0.00	0.04
11	11	174	6.1	327	46.3	35	47	24				55	83	30	20	32	0.00	0.06
12	12	177	4.9	254	59.0	33	61	20				49	90	23	15	32	0.00	0.11
13	13	104	6.7	257	46.5	32	56	25				61	89	49	21	32	0.02	0.09
14	14	194	2.9	231	33.4	27	38	16				51	66	41	12	32	0.00	0.05
15	15	111	3.3	35	34.0	31	48	18				72	89	53	23	32	0.00	0.06
16	16	109	3.4	209	28.6	28	44	14				70	89	51	20	32	0.09	0.06
17	17	120	7.0	231	62.6	41	65	31				75	92	47	33	32	0.18	0.11
18	18	169	5.2	138	44.7	36	48	27				47	70	28	18	32	0.00	0.07
19	19	144	9.0	300	44.7	34	44	25				56	81	43	21	32	0.00	0.06
20	20	188	10.6	259	46.5	27	33	18				47	62	38	11	32	0.00	0.05
21	21	197	4.2	252	26.8	22	30	16				49	70	32	7	32	0.00	0.04
22	22	138	2.4	11	35.6	22	35	10				62	86	47	12	32	0.00	0.04
23	23	182	2.6	135	28.6	31	41	24				65	90	47	22	32	0.00	0.04
24	24	180	4.3	199	44.7	34	45	27				65	89	36	23	32	0.00	0.06
25	25	180	8.8	242	37.6	33	40	26				51	80	32	17	32	0.00	0.05
26	26	216	1.1	138	10.7	32	48	22				61	88	30	19	32	0.00	0.04
27	27	155	1.1	299	7.2	29	44	20				68	89	38	20	32	0.00	0.04
28	28	213	1.3	150	12.5	32	49	22				61	80	32	20	32	0.00	0.05
29	29	155	1.0	113	6.5	26	31	18				83	91	74	22	32	0.00	0.02
30	30	115	2.8	73	19.7	34	40	29				82	91	65	29	32	0.00	0.03
31	31	202	3.5	331	23.3	30	38	21				70	89	52	22	32	0.00	0.05

MONTHLY STATISTICS

	Total* Sol Rad lye⊗	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew* Point Deg Fahrenheit	Soil 20 in Deg Fahrenheit	Total Precip inch	Penman Evap# inch
TOTAL	2461															0.29	1.38
AVE	159	3.9	224	28.9	30.2	43.0	22.6				61	83	40	18	32		0.05
MAX	216	10.6		62.6	41	65	33				83	92	74	33	32	0.18	0.11
MIN	85	1.0		7.2	20	30	10				47	62	21	5	32		0.02

NOTE: Monthly averages might vary slightly from the average of the daily values printed due to rounding of the daily values.

* Maximum and minimum values of the dew point and wet bulb temperatures are hourly rather than daily values. Daily maximums and minimums can be obtained by scanning the values printed in the corresponding column.

\# Total solar radiation and total Penman Evapotranspiration are corrected for missing daily values by substituting an average (of days with day) value for each missing value before the total is obtained.

⊗ 1 ly = 1 cal/cm² = 4.1855 J/cm² = 3.6855 BTU/ft² = .01163 KW/m²

Station - MANILA Month - DECEMBER, 1997

Day of Month	Day of Year	Total Sol Rad lye	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg	Air Temp Max Fahrenheit	Air Temp Min	Soil Temp Mean Deg	Soil Temp Max Fahrenheit	Soil Temp Min	Rel Humidity Mean Percent	Rel Humidity Max	Rel Humidity Min	Dew Point Deg	Soil 20 in Fahrenheit	Total Precip inch	Penman Evap inch
1	335	61	1.7	189	10.7	40	59	27				87	90	84	37	32	0.00	0.05
2	336	90	3.6	198	14.3	31	38	22				88	90	84	28	32	0.03	0.04
3	337	177	1.0	317	8.9	22	35	13				81	91	54	16	32	0.02	0.02
4	338	114	0.5	254	5.4	23	34	11				73	92	45	15	32	0.00	0.02
5	339	133	0.4	320	5.4	20	31	10				64	87	46	10	32	0.00	0.02
6	340	113	0.5	330	7.2	22	32	16				80	88	59	17	32	0.00	0.02
7	341	127	0.7	336	7.2	29	41	20				74	88	43	22	32	0.00	0.03
8	342	61	5.9	281	44.7	32	44	26				78	91	56	26	32	0.00	0.05
9	343	80	16.0	264	51.9	25	29	21				62	68	57	15	32	0.00	0.04
10	344	102	12.6	247	48.3	20	24	15				53	84	37	7	32	0.00	0.04
11	345	178	2.0	298	19.7	15	27	4				63	84	38	6	32	0.00	0.03
12	346	162	1.1	312	7.2	19	35	8				68	90	31	10	32	0.00	0.03
13	347	168	0.7	112	5.4	22	37	12				77	90	47	16	32	0.00	0.02
14	348	89	0.5	97	8.9	16	26	9				88	90	83	14	32	0.00	0.02
15	349	82	2.2	331	17.9	23	35	12				78	85	61	18	32	0.00	0.03
16	350	164	0.8	14	5.4	25	38	13				68	89	46	16	32	0.00	0.02
17	351	138	0.6	323	5.4	29	43	20				62	74	43	18	32	0.00	0.03
18	352	91	1.8	313	19.7	29	37	22				67	80	46	20	32	0.00	0.03
19	353	169	4.4	273	26.8	23	31	11				65	87	51	14	32	0.00	0.04
20	354	153	1.0	51	8.9	16	25	5				83	90	62	12	32	0.00	0.02
21	355	58	0.9	76	8.9	15	23	7				88	90	87	13	32	0.00	0.01
22	356	126	1.2	242	10.7	19	28	9				85	90	68	15	32	0.00	0.02
23	357	145	1.6	153	25.0	16	30	-1				73	90	34	9	32	0.00	0.03
24	358	84	5.0	204	19.7	19	28	11				80	90	55	14	32	0.00	0.03
25	359	145	2.8	260	14.3	15	28	0				84	91	70	11	32	0.00	0.03
26	360	143	0.5	222	5.4	8	20	-4				87	90	84	5	32	0.00	0.01
27	361	92	11.1	238	60.9	18	36	4				65	90	29	9	32	0.00	0.06
28	362	76	10.1	243	46.5	29	40	19				41	50	24	9	32	0.00	0.07
29	363	100	9.2	246	37.6	40	46	33				49	58	43	22	32	0.00	0.07
30	364	170	4.0	224	32.2	37	46	26				53	71	36	21	32	0.00	0.06
31	365	156	0.8	163	7.2	32	48	19				64	86	35	20	32	0.00	0.03

MONTHLY STATISTICS

	Total@ Sol Rad lye	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg	Air Temp Max Fahrenheit	Air Temp Min	Soil Temp Mean Deg	Soil Temp Max Fahrenheit	Soil Temp Min	Rel Humidity Mean Percent	Rel Humidity Max	Rel Humidity Min	Dew* Point Deg	Soil 20 in Fahrenheit	Total Precip inch	Penman Evap# inch
TOTAL	1873															0.05	1.00
AVE	121	3.4	267	19.3	23.5	34.7	13.6				72	84	53	16	32		0.03
MAX	178	16.0		60.6	40	59	33				88	92	87	37	32	0.03	0.07
MIN	58	0.4		5.4	8	20	-4				41	50	24	5	32		0.01

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\# Total solar radiation and total Penman Evapotranspiration are corrected for missing daily values by substituting an average (of days with day) value for each missing value before the total is obtained.

@ 1 ly = 1 cal/cm² = 4.1855 J/cm² = 3.6855 BTU/ft² = .01163 KW/m²

Station - MANILA Month - NOVEMBER, 1997

Day of Month	Day of Year	Total Sol Rad lyø	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew Point Deg Fahrenheit	Soil 20 in Deg Fahrenheit	Total Precip inch	Penman Evap inch
1	305	256	13.5	263	42.9	39	47	34				34	43	24	13	32	0.00	0.10
2	306	252	5.0	228	23.3	39	51	28				29	46	19	9	32	0.00	0.10
3	307	192	1.3	155	8.9	40	56	27				45	64	23	20	32	0.00	0.06
4	308	246	9.2	242	51.9	50	60	33				26	65	17	14	32	0.00	0.11
5	309	244	1.3	185	8.9	44	63	29				28	47	15	11	32	0.00	0.07
6	310	240	1.0	129	7.2	44	64	30				32	46	19	15	32	0.00	0.07
7	311	213	3.4	236	25.0	45	64	30				35	55	18	17	32	0.00	0.11
8	312	141	3.3	161	25.0	40	54	29				62	86	38	27	32	0.16	0.07
9	313	97	0.9	141	14.3	35	61	19				84	90	75	31	32	0.01	0.06
10	314	168	0.2	4	7.2	22	30	10				84	90	73	18	32	0.01	0.02
11	315	59	2.8	190	12.5	30	37	25				87	90	83	27	32	0.00	0.03
12	316	157	1.0	279	8.9	29	38	24				82	89	69	25	32	0.16	0.03
13	317	194	2.0	265	23.3	32	39	25				71	90	48	23	32	0.00	0.04
14	318	219	4.1	99	23.3	18	34	1				65	90	35	6	32	0.00	0.05
15	319	223	0.6	323	5.4	11	26	-1				65	82	42	2	32	0.01	0.02
16	320	223	0.6	278	5.4	22	39	5				62	83	30	10	32	0.00	0.03
17	321	148	1.5	222	19.7	29	42	17				71	85	43	21	32	0.00	0.04
18	322	193	3.7	297	26.8	32	42	22				48	63	33	15	32	0.00	0.08
19	323	134	1.9	297	35.8	34	53	21				65	89	38	23	32	0.00	0.05
20	324	142	7.6	253	32.2	36	59	27				67	88	51	26	32	0.05	0.11
21	325	108	6.2	264	41.2	32	39	28				57	68	47	19	32	0.00	0.05
22	326	205	1.6	289	12.5	25	40	14				56	74	29	12	32	0.00	0.04
23	327	164	0.9	90	7.2	29	44	16				65	81	47	20	32	0.00	0.03
24	328	196	1.5	152	10.7	35	51	23				61	85	26	23	32	0.01	0.04
25	329	169	4.9	268	41.2	36	50	27				47	71	18	16	32	0.00	0.09
26	330	117	9.7	6	42.9	40	51	24				50	69	39	23	32	0.00	0.18
27	331	64	4.0	75	55.5	45	59	30				77	90	31	37	32	0.14	0.08
28	332	70	0.6	86	8.9	51	73	29				85	89	81	46	32	0.20	0.26
29	333	95	0.1	81	7.2	43	64	31				87	89	82	39	32	0.00	0.04
30	334	70	1.3	126	8.9	38	50	29				87	90	85	34	32	0.00	0.04

MONTHLY STATISTICS

	Total# Sol Rad lyø	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew* Point Deg Fahrenheit	Soil 20 in Deg Fahrenheit	Total Precip inch	Penman Evap* inch
TOTAL	2490															0.63	1.76
AVE	166	3.2	225	21.5	34.8	49.3	22.8				61	76	42	21	32		0.06
MAX	256	13.5		55.5	51	73	34				87	90	85	46	32	0.20	0.11
MIN	59	0.1		5.4	11	26	-1				26	43	15	2	32		0.02

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Total solar radiation and total Penman Evapotranspiration are corrected for missing daily values by substituting an average (of days with day) value for each missing value before the total is obtained.

ø 1 ly = 1 cal/cm² = 4.1855 J/cm² = 3.6855 BTU/ft² = .01163 kW/m²

Station - MANILA Month - JUNE, 1997

Day of Month	Day of Year	Total Sol Rad Ly/d	Wind Ave V mph	Wind Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew Point Deg Fahrenheit	Soil 2f in Deg Fahrenheit	Total Precip inch	Penman Evap inch
1	152	429	4.7	73	35.9	64	73	51				48	69	34	40	32	0.00	0.21
2	153	284	3.3	88	25.1	60	74	53				72	89	48	51	32	1.41	0.14
3	154	577	6.6	82	25.9	69	96	54				56	92	14	49	32	0.00	0.23
4	155	421	3.8	214	26.8	67	82	53				31	59	11	31	32	0.00	0.23
5	156	597	5.5	318	28.6	66	80	50				24	56	12	26	32	0.00	0.28
6	157	571	3.7	135	26.8	60	63	51				42	93	11	37	32	0.00	0.26
7	158	512	3.9	98	29.3	65	80	50				39	81	16	38	32	0.05	0.24
8	159	196	2.1	81	26.8	62	70	57				79	93	52	56	32	1.42	0.19
9	160	401	2.4	103	25.0	62	72	56				69	85	42	51	32	0.00	0.16
10	161	323	3.1	125	37.6	64	81	52				75	88	42	55	32	0.12	0.17
11	162	460	2.2	117	10.7	63	74	52				59	89	27	46	32	0.00	0.17
12	163	371	5.1	263	37.6	58	71	51				58	88	19	42	32	0.00	0.17
13	164	286	5.8	67	28.6	59	68	51				35	89	25	43	32	0.02	0.14
14	165	342	5.4	248	44.7	56	68	47				60	88	16	41	32	0.00	0.16
15	166	554	4.4	320	28.9	59	72	45				55	89	21	40	32	0.00	0.22
16	167	489	8.0	158	34.1	64	74	53				43	69	24	41	32	0.00	0.22
17	168	588	6.1	244	23.3	69	81	57				32	55	16	36	32	0.00	0.26
18	169	215	3.4	192	37.6	67	87	52				71	87	43	57	32	0.57	0.22
19	170	552	3.9	229	26.8	82	119	62				53	89	11	59	32	0.00	0.41
20	171	520	5.6	230	35.8	69	80	57				40	74	15	40	32	0.00	0.22
21	172	561	2.9	39	17.9	70	88	56				47	89	14	45	32	0.02	0.24
22	173	613	6.3	293	34.1	72	85	55				21	44	11	27	32	0.00	0.31
23	174	542	5.0	197	32.2	66	81	51				29	54	12	31	32	0.00	0.27
24	175	599	5.2	223	28.8	61	74	48				22	44	13	20	32	0.00	0.27
25	176	612	3.1	119	17.9	61	80	41				24	46	12	22	32	0.00	0.26
26	177	449	3.1	271	23.3	68	87	49				21	40	13	24	32	0.07	0.25
27	178	558	5.6	258	32.2	72	89	58				17	34	11	23	32	0.00	0.29
28	179	561	5.2	290	31.2	68	81	51				16	29	11	19	32	0.00	0.29
29	180	614	6.0	328	28.9	67	81	49				17	37	11	20	32	0.00	0.30
30	181	621	9.1	330	44.7	69	81	51				14	21	11	19	32	0.00	0.31

MONTHLY STATISTICS

	Total# Sol Rad Ly/d	Wind Ave V mph	Wind Dir Deg	Wind Max mph	Air Temp Mean Deg Fahrenheit	Air Temp Max Deg Fahrenheit	Air Temp Min Deg Fahrenheit	Soil Temp Mean Deg Fahrenheit	Soil Temp Max Deg Fahrenheit	Soil Temp Min Deg Fahrenheit	Rel Humidity Mean Percent	Rel Humidity Max Percent	Rel Humidity Min Percent	Dew* Point Deg Fahrenheit	Soil 2f in Deg Fahrenheit	Total Precip inch	Penman Evap inch
TOTAL	7221															1.61	7.16
AVE	481	4.7	219	29.2	63.9	80.5	51.5				43	69	21	38	32		0.24
MAX	621	9.1		44.7	82	119	62				79	93	52	59	32	0.57	0.41
MIN	196	2.1		10.7	59	68	41				14	21	10	18	32		0.09

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Total solar radiation and total Penman Evapotranspiration are corrected for missing daily values by substituting an average (of days with data) value for each missing value before the total is obtained.

@ 1 ly = 1 cal/cm² = 4.1868 J/cm² = 3.6863 BTU/ft² = .01163 KW/m²

Station - MANILA Month - MAY, 1997

Day of Month	Day of Year	Total Sol Rad Ly	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg	Air Temp Max Fahrenheit	Air Temp Min	Soil Temp Mean Deg	Soil Temp Max Fahrenheit	Soil Temp Min	Rel Humidity Mean Percent	Rel Humidity Max	Rel Humidity Min	Dew Point Deg	Soil 20 cm Fahrenheit	Total Precip inch	Penman Evap inch
1	121	548	15.4	269	48.3	35	65	32				61	88	27	21	32	0.07	0.01
2	122	447	9.9	238	31.1	42	51	31				32	47	24	13	31	0.00	0.18
3	123	504	2.9	197	19.7	47	64	29				36	71	15	18	32	0.00	0.17
4	124	517	8.6	248	48.3	57	73	37				24	48	13	17	32	0.00	0.24
5	125	507	4.0	47	19.7	56	72	36				29	41	19	17	32	0.00	0.23
6	126	463	5.9	177	42.9	56	74	41				24	45	14	20	32	0.00	0.24
7	127	367	7.0	235	37.6	56	67	44				24	48	14	17	32	0.00	0.24
8	128	566	4.2	121	19.7	51	66	35				24	39	15	14	31	0.00	0.23
9	129	537	2.4	106	19.7	54	73	36				27	50	19	15	32	0.00	0.22
10	130	547	4.1	119	19.7	59	74	40				21	39	12	17	31	0.00	0.25
11	131	464	4.5	194	46.3	57	72	41				26	40	15	21	32	0.00	0.24
12	132	562	5.2	184	37.6	56	73	37				35	71	15	24	31	0.00	0.24
13	133	491	5.7	229	42.9	64	74	48				19	55	13	19	32	0.00	0.20
14	134	429	6.5	229	42.2	63	76	48				23	48	13	22	32	0.00	0.23
15	135	446	5.2	203	33.8	64	77	46				27	52	13	26	32	0.02	0.24
16	136	369	3.9	261	31.4	62	77	48				31	45	14	23	32	0.00	0.22
17	137	438	6.9	234	5.9	60	78	47				35	55	13	31	32	0.13	0.24
18	138	537	7.5	236	37.6	61	72	45				29	46	14	28	32	0.00	0.25
19	139	576	3.2	127	18.1	55	72	36				39	77	14	26	32	0.00	0.22
20	140	264	4.4	355	34.0	55	71	41				36	74	19	23	32	0.00	0.17
21	141	330	3.9	170	30.4	57	72	50				65	89	29	44	32	0.02	0.16
22	142	423	2.8	206	28.8	64	81	51				53	91	18	42	32	0.00	0.19
23	143	303	4.3	189	42.2	58	79	44				48	79	18	34	32	0.00	0.19
24	144	244	6.4	25	42.9	54	66	45				72	90	46	45	32	0.14	0.13
25	145	236	3.7	289	28.8	47	57	40				90	91	47	40	32	0.10	0.10
26	146	355	7.4	248	35.4	47	59	38				44	64	28	25	32	0.00	0.18
27	147	428	4.6	196	32.2	52	63	35				40	69	19	29	32	0.00	0.19
28	148	333	3.7	106	26.8	56	68	42				46	73	31	33	32	0.00	0.18
29	149	252	3.9	227	30.4	67	116	39				70	90	47	57	32	0.17	0.35
30	150	471	3.1	115	17.9	61	74	51				57	86	30	45	32	0.00	0.19
31	151	492	4.8	111	25.0	67	82	51				46	80	19	44	32	0.00	0.28

MONTHLY STATISTICS

	Totals Sol Rad Ly	Wind Ave mph	Wind V Dir Deg	Wind Max mph	Air Temp Mean Deg	Air Temp Max Fahrenheit	Air Temp Min	Soil Temp Mean Deg	Soil Temp Max Fahrenheit	Soil Temp Min	Rel Humidity Mean Percent	Rel Humidity Max	Rel Humidity Min	Dew Point Deg	Soil 20 cm Fahrenheit	Total Precip inch	Penman Evap# inch
TOTAL	6944															0.85	6.54
AVE	441	5.5	196	31.4	56.1	71.9	41.6				33	64	21	26	31		0.21
MAX	576	15.4		51.9	67	116	53				90	91	48	57	32	0.17	0.35
MIN	236	2.4		16.1	38	51	28				16	36	13	12	31		0.17

NOTE: Monthly averages might vary slightly from the average of the daily values printed due to rounding of the daily values.

* Maximum and minimum values of the dew point and wet bulb temperatures are hourly rather than daily values. Daily maximums and minimums can be obtained by scanning the values printed in the corresponding column.

Total solar radiation and total Penman Evapotranspiration are corrected for missing daily values by substituting an average (of days with day value for each missing value before the total is obtained.

@ 1 ly = 1 cal cmy = 4.1855 J cmy = 3.6855 BTU fty = .01163 Wh cmy

Appendix E

Appendix F

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt
Governor
Dianne R. Nielson, Ph.D.
Executive Director
Dennis R. Downs
Director

288 North 1460 West
P.O. Box 144880
Salt Lake City, Utah 84114-4880
(801) 538-6170
(801) 538-6715 Fax
(801) 536-4414 T.D.D.
www.deq.state.ut.us Web

May 1, 1998

Mayor Chuck Dickison
1st East Hwy 43
P.O. Box 189
Manila, Utah 84046

Re: Daggett County Landfill permit review

Dear Mayor Dickison:

Enclosed is the review of the permit application you submitted to the State of Utah for the construction and operation of a Class II solid waste landfill. Please review the enclosed *Request for Additional Information #1 (RAI #1)*. The *State Permit Application to Operate a Class II Landfill* submitted by the Town of Manila will require additional information to be complete. This additional information is noted in the grayed paragraphs with a vertical bar on the left margin. Please also review Sections R315-303 and R315-315 of the *Utah Solid and Hazardous Waste Permitting and Management Rules* for general operation of the landfill. Included in these sections of the *Rules* are the guidelines for developing **Plan of Operation** and **Inspection Schedule**.

Also enclosed is the form called the **Solid Waste Annual Report**. This form is required for all existing landfills to be submitted annually. A review of our records indicated that no Annual Report was submitted for this facility this year. Please complete this form and return to our office at the address noted on the form.

If you have any questions to any comments made in the enclosed *RAI #1* or the Annual Report, please call Roy Van Os at (801) 538-6879.

Sincerely,

Rusty Lundberg

for Dennis R. Downs, Executive Secretary
Utah Solid and Hazardous Waste Control Board

DRD/RVO/sm

enclosures

c: Joseph B. Shaffer, M.A., M.B.A., E.H.S., Director of Health, Tri Counties Health Dept.
Ted Allen, DEQ District Engineer
Chad Reed, Commissioner, Daggett County

F:\SHW\SPB\RVANOS\WP\Daggett County RAI #1a.wpd
Daggett Co/Class II LF

Town of Manila

PO Box 189
Manila, UT 84046

PHONE: (435) 784-3143
FAX: (435) 784-3356

MAYOR
Chuck Dickison

TOWN CLERK
Judy Archibald

COUNCIL MEMBERS
Ida Marie Twitchell
Nita Steinaker
Gretchen Northcott
Connie Reed

12/24/98

Dear Roy Van Os,

First let me express my thanks for the help and guidance you have given in the application process. It was an interesting experience and a challenge.

It took longer than anticipated, but enclosed is the additional information necessary to complete the application. I followed the guideline your office provided to compile the necessary information. Additionally, I have provided maps with the engineers seal.

Please advise me if there is more information needed. Again, thank you for your help and patience.

Sincerely,

Chuck Dickison

Chuck Dickison, Mayor

DAGGETT COUNTY LANDFILL
CLASS II PERMIT APPLICATION
PERMIT #98?
ADDITIONAL PERMIT INFORMATION

Additional information per sections:

Subsection R315-302-2(2) Plan of Operation

(f) Landfill gas monitoring will be performed by the district engineer. In the event the landfill can not be used, a contingency plan for alternative use will be in place until this landfill be suitable for continued use. An agreement is in the process of renewal with the Greenriver Wyoming landfill to accept Daggett County landfill waste.

(g) The road into the Daggett County Landfill is regularly maintained by the Daggett County Special Road District. The emphasis is on keeping the road in good condition to provide public access and dust minimization. The road and grounds within the landfill area are maintained by the Town of Manila, landfill operator.

(l) **Closure and Post-Closure care cost estimate**

Each open trench at the Daggett County Landfill tends to represent a 3-4 month operation depending upon time of year. Each trench is closed, graded and contoured upon cease of operations within that trench. Summer use can be heavy due to the tourist traffic in the National Recreation Area. Winter use is a product of full time residences which are minimal. Based upon these factors and considering costs of rental equipment and contract labor, a current practice, the following is the estimate for closure of the landfill with an open trench. The cost for closure and post-closure care can easily be a budget allocation for the Town of Manila and Co-owner, Daggett County.

Final Closure Costs:	Fifteen hours equipment and labor	$750.00
	Ten hours labor for area preparation	150.00
	Total	$900.00
Post-closure care and inspection:	Two hours monthly	$30.00

Subsection R315-302-3 General Closure and Post Closure Requirements.

(2) **Closure Performance Standard.**

(a) Closed cell grading to prevent water ponding and covering with 18 inches of native soil will minimize need for further maintenance at the Daggett County Landfill.

(b) No liners are required for this landfill. Ground water depth is anticipated at 660 feet or more. Gases from this landfill are not anticipated. Subsequently, threat to human health and the environment are not anticipated. Closure will not result in post-closure escape of products posing threats.

(c) Preparation for the post-closure period will include incremental closure of each cell upon discontinued use.

(3) **Closure Plan and Amendment**

(a) Closure will include grading and contouring of the landfill at time of closure.

(c) Incremental closure is not applicable at the Daggett County Landfill since each trench represents 3-4 month operations and each trench will be graded and contoured upon cease of operations within that particular trench.

(5) The Post-Closure plan shall provide activities for continued facility maintenance and monitoring for as long as the Executive Secretary determines necessary for facility stabilization and protection of human health and environment.

The financial responsibility for the closure and post-closure activities can be met by the respective budgets of the Town of Manila and co-owner Daggett County. Specific anticipated costs are as follows:

Final Closure last open trench: Fifteen hours equipment and labor	$750.00
Final area preparation: Ten hours labor	150.00
Closure Total	$900.00

Post-Closure Monthly cost of Facility care and Inspection: $ 30.00

(6) Post-Closure Plan and Amendment.

(a) Post-Closure care at the Daggett County Landfill may include but is not limited to the following:

(1) Maintenance of the closed landfill area as needed
(2) Inspection of surface water
(3) Any other activities required by Executive Secretary

(b) As required by Subsection R315-302-2(1), the Town of Manila will keep this Post-Closure Plan on file and abide by its provisions. The Post-Closure plan will include monthly inspections of the closed facility with purpose of monitoring the progress of site stabilization, potential for gas production, and general facility inspection for conditions considered adverse. This maintenance activity shall continue until they may be safely stopped.

(c) The Post-Closure Plan shall provide for monthly time intervals for the inspection and monitoring of the closed Daggett Landfill at its current location. The cost estimate, anticipated as a budget item, is estimated at $30.00 monthly. These costs reflect anticipated labor costs for the monthly inspections by Town or contract employee.

*page 15 amendments.

(iv) Identification of closure costs including cost calculations and the funding mechanism.

(1) Closure cost estimates are based on experienced cost to close an open waste trench at time of use completion. These cost include labor and the equipment necessary to incremently cover the waste in the trench and the final cover consisting of 18 inches of native soil. Additionally included in the closure costs are fifteen hours of labor or area final preparation.

Closure cost as anticipated by experienced costs: $900.00

(2) Post-Closure costs for the thirty year period are based upon the anticipated costs of two hours labor each month for site inspection.

Post-Closure cost as anticipated yearly: $360.00

(e) Post-Closure plan issues:

(l) The monthly inspections of the closed landfill site will include monitoring for landfill gas, and surface water. Ground water is estimated to be at a minimum depth of 660 feet.

(iv) The Post-Closure costs anticipated at $360.00 yearly will be a budgeted item for the Town of Manila, P.O. box 189, Manila Utah, 84046, Telephone (435)784-3143. The current mayor would be appropriately contacted. The Town of Manila Budget, specifically the garbage fund account, should be addressed for funding.

RECEIVED
OCT 22 2007
UTAH DIVISION OF
SOLID & HAZARDOUS WASTE
07.03081

TOWN OF MANILA
UTAH

SOLID WASTE MANAGEMENT PLAN

2007

PREPARED BY
AZA PLANNING & PUBLIC INVOLVEMENT, HEBER CITY, UTAH

COMPLETED WITH FINANCIAL ASSISTANCE FROM
U.S. DEPARTMENT OF AGRICULTURE, RURAL DEVELOPMENT

SEPTEMBER 2007

TOWN OF MANILA
SOLID WASTE MANAGEMENT PLAN

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1 CELL SEQUENCING PLAN

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TOWN OF MANILA
SOLID WASTE MANAGEMENT PLAN

1. INTRODUCTION

BACKGROUND

The Town of Manila Solid Waste Management Plan was undertaken as a U.S. Department of Agriculture, Rural Development grant project, approved in June 2006, and entered into agreement with the Town of Manila in October 2006 that extends through September 30, 2007. The intent of the grant proposal is to assist the Town of Manila in planning to improve waste management practices and to save capacity in the Town's landfill through maximum diversion.

The goal of the solid waste plan, as submitted in the application for grant funding, is the following:

> *Maximize the life of the Manila Landfill and ensure regulatory compliance and the protection of the environment, and conduct the maximum economically feasible waste diversion through recycling and wood waste processing and recovery supported by public education and operator training.*

Three categories of materials are emphasized in this plan: difficult to manage wastes; materials for which diversion will save significant landfill space; and high-value recyclables.

Difficult to Manage Wastes: These are materials that under best practices or State law should be banned from the landfill, and there should be positive alternative programs for their management. These materials include:

- Tires
- Automotive batteries
- Used oil
- Electronic waste (Especially, should a landfill ban on electronic waste be approved by the State of Utah).
- Household hazardous waste

Materials for which Diversion Saves Significant Landfill Space: These are materials that interfere with compaction of the landfill and other communities have successfully diverted them from the landfill at low cost.

- Metals (ferrous and non-ferrous)
- Wood waste
- Construction and Demolition Debris

High-Value Recyclables: The haul distances from remote Manila makes some recycling not cost effective, and for long hauls, materials like corrugated (cardboard) and plastics require baling to consolidate them for effective transport. For this study, materials with strong markets and high prices will be considered for recycling. Should recycling of these materials prove theoretically

feasible, programs will be recommended. A recycling program for other materials can later be expanded, as can the service area. For this study these materials will be considered for recycling:

- Aluminum containers
- Office paper
- Old corrugated containers

PLAN APPROACH AND ORGANIZATION

To guide the planning efforts, a Solid Waste Planning Steering Committee formed, chaired by the Mayor, Chuck Dickison. The Committee discussed the overall approach to expend the funds for planning and education, and directed efforts. Members include: Mayor Chuck Dickison, Manila; Brian Raymond, Daggett County; Darrin Brown, Tri-County Health Department; Del Avis, Manila Town Council; Judy Kelley, Town Clerk; and Roy Van Os, Utah Department of Environmental Quality, Division of Solid and Hazardous Waste.

At the first meeting, consulting planner, Ann Zimmerman, reviewed the purpose and approach of the solid waste plan. Mr. Van Os made the point that he thought the most important planning need in Manila is a cell-sequencing plan for the landfill to guide operations like soil stockpiling and to provide an indication of landfill capacity. After discussions with Lynn Sagers, USDA Rural Development Contract manager, the landfill cell-sequencing plan was added to the scope of services of the grant and the cell-sequencing plan findings and recommendations are incorporated into this plan.

The Plan is organized into sections:

Section 1, Introduction:
- Background,
- Plan Approach & Organization
- Acknowledgements.

Section 2, Current Conditions
- Community Overview
- Regulatory Environment
- Demographics
- Waste Management Practices
  - Collections
  - Landfill
  - Special Wastes
  - Public Outreach
  - Recycling Diversion
  - Green Waste and Composting Diversion
  - Wood Waste Chipping
- Waste Quantity Estimates
- Waste Composition Estimates
- Potential Changes in the Planning & Regulatory Environment

Section 3, Opportunities for Program Enhancements
- Recommended Actions and Programs
- Prioritization of Recommended Actions and Programs.

Section 4, Recommendations
- Implementation Steps and Schedule for Recommended Programs
- Future Planning and Monitoring

Attachments

- Cell-Sequencing Plan
- Sign Recommendations

ACKNOWLEDGEMENTS

We would like the acknowledge the assistance of the following people, who contributed data, ideas, knowledge, and their time to assist in preparing, reviewing, and finalizing this solid waste plan.

Town of Manila: Mayor Chuck Dickison; Town Councilmember Del Alvis; Jerry Muir, Public Works Director; Judy Kelley; Andrea Scott; Lynnette Asay

Daggett County: Brian Raymond

Tri-County Health Department: Darrin Brown

Utah Department of Environmental Quality: Roy Van Os and Jeff Emmons

Citizen: Lynn Kurtz

US Forest Service: Bill Conroy and Ross Catrone (for maps)

We would like to acknowledge the financial and staff support from USDA Rural Development, Lynn Sagers.

Consultants:

Terry Warner, P.E. (Cell-Sequencing Plan), Salt Lake City, Utah
Ann Zimmerman, AZA (Ann Zimmerman & Associates Planning & Public Involvement), Heber City, Utah

2

2. CURRENT CONDITIONS

COMMUNITY OVERVIEW

This solid waste plan focuses on waste management practices in the Town of Manila, Utah. Because there are potential opportunities for cooperative efforts inclusive of the unincorporated northern portion of Daggett County and recreational visitors, some of the background data extends beyond just the town itself.

The Town of Manila is located just south of the Wyoming border at the junction of Highways 43 and 44 in western half of Daggett County. Daggett County is the furthest northeastern corner of Utah, sharing a border with Colorado as well as Wyoming (Figure 1: Location Daggett County and Town of Manila). Originally an area for grazing sheep and cattle, it became a farming area with the introduction of irrigated agriculture the 1890's.

While it is still sparsely populated with permanent residences, it is a popular summer recreation area for visitors. Flaming Gorge National Recreation Area and Reservoir lie to the east, popular destinations for boating, fishing, and camping, and South Ashley National Forest is to the south. The dam is an important generator for electrical power to the region.

In keeping with the national trend for a growing number of second residences, Manila and Daggett County also host an increasing number of part-time residences and pre- and post-retirement homes.

Daggett County extends 682 square miles. The northern boundary is the Utah-Wyoming state line and Sweetwater County, to the east is the Colorado-Utah state line and Moffat County, to the South are Uintah County and Duchesne Counties, Utah, and to the west is Summit County, Utah. Sources state that approximately 80% of the land in Daggett County is under the control of either the US Forest Service or Bureau of Land Management. Public lands include the Flaming Gorge National Recreation Area (and reservoir) and the Ashley National Forest.

Manila is the County seat for Daggett County, and the only incorporated area in the County. The permanent population of Manila is in the range of 310-325 people and varies greatly seasonally. Dutch John, a clustered population area for people primarily working at the dam, remains as an unincorporated settlement six miles south of the Wyoming State line and 20 miles west of the Colorado State line. The population of Dutch John seasonally fluctuates between 150-250 people. Dutch John's population is included in the Unincorporated Daggett County estimated population.

An elected Mayor and four-member Town Council govern the Town of Manila, operating under the strong mayor model, where the mayor is responsible for the day-to-day operations of the town and supervising the Town's personnel. Solid waste collections and the landfill are under the authority of the Public Works Director and his staff. Revenues and expenses for solid waste collection and the landfill are managed through the general fund and not a dedicated enterprise fund.

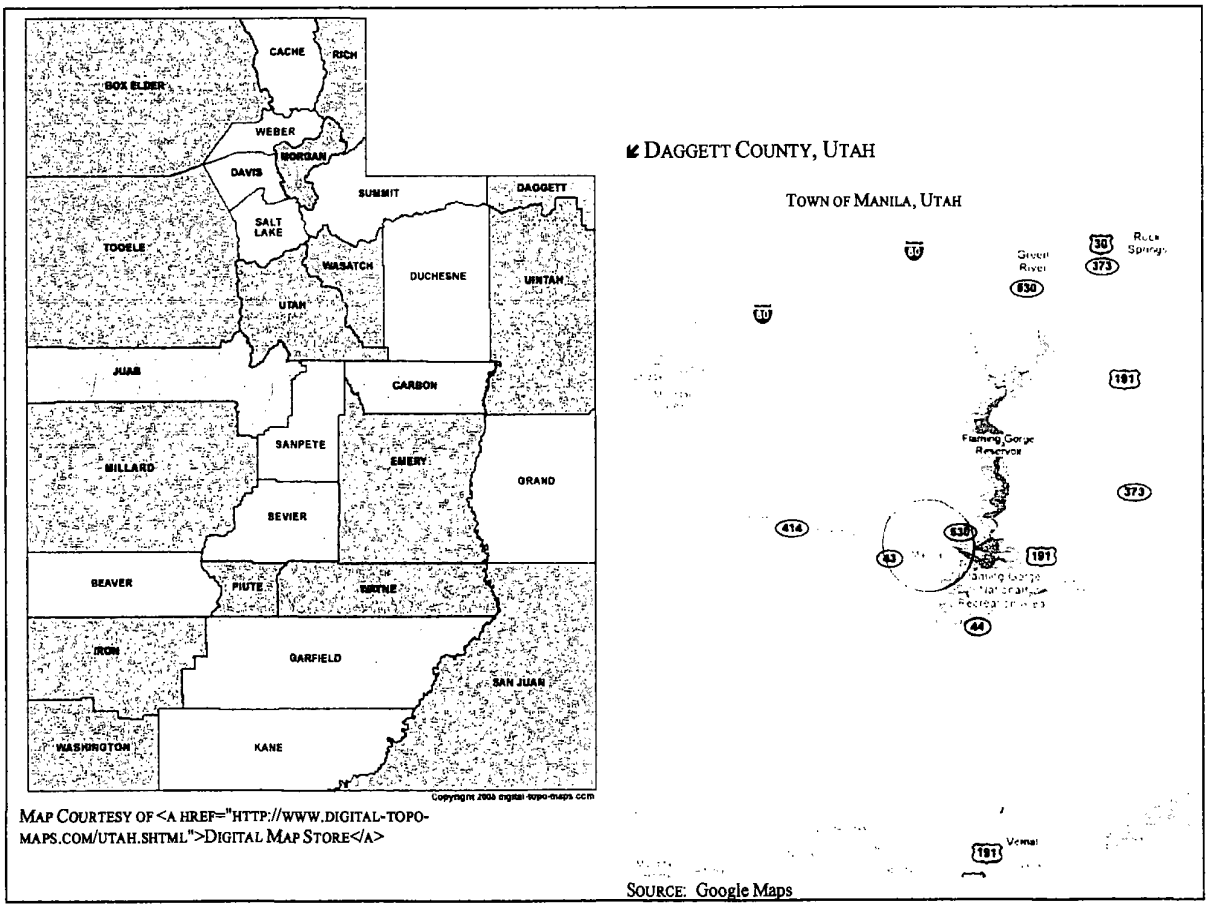
A three-member elected County Commission governs Daggett County. While it is the smallest populated county in Utah with approximately 1,000 residents, the County operates a full range of

county services, including a correctional facility in Manila. The County no longer shares in the ownership of the landfill and does not offer public solid waste collection services.

There is one school district in the county with approximately 160 students, and three schools: Manila Elementary School, Flaming Gorge Elementary School, and Manila Junior-Senior High School.

The rugged Uinta Mountains' topography limits the available transportation corridors serving the area. Highway 43 enters Manila from two directions to the north: a connection to Wyoming 414 that links to Fort Bridger and Lyman, Wyoming; and a connection to Wyoming 530 that links to Green River, Wyoming. Both these connect to US Highway I-80 for high-speed travel in an east-west direction. Scenic Highway 44 leads southeast from Manila to connect with US Highway 191. It connects to US Highway 40 in Vernal, leading east and west, and eventually connecting to US Highway 80 to Salt Lake or Highway 189 to Provo and I-15. There are no rail lines serving the area and there is not commercial air service. However, there is an airport and paved landing strip at Dutch John. Manila's elevation is approximately 6,300 feet, and there is a four-season climate with icy travel conditions and occasional road closures due to snow.

Figure 1: Location Daggett County and Town of Manila



MAP COURTESY OF <A HREF="HTTP://WWW.DIGITAL-TOPO-MAPS.COM/UTAH.SHTML">DIGITAL MAP STORE</A>

REGULATORY ENVIRONMENT

The preparation of this solid waste plan is not driven by regulations. In 1991, the State of Utah required preparing county solid waste management plans, and since there hasn't been a requirement for an update. There has been a State goal for diverting 25% of the waste from disposal in place since 1991, but there are no mandates for attaining this goal at the local level, nor penalties attached. Instead, Utah Department of Environmental Quality Division of Solid and Hazardous Waste (UDEQ) provides resources and contacts for recycling assistance. EPA sets a National goal for a 35% recycling rate, and similarly sets no mandates or penalties, but offers technical assistance. The desire to improve solid waste practices and extend the life of the landfill is self-driven by the Town of Manila. Consequently, the format and content of this plan follows the usefulness of the document to the Town, and it is not regulatory-driven.

The UDEQ regulations govern landfills and wastes to be disposed in the landfill under Utah State Regulations, R315. These regulations also govern tires, special wastes, infectious wastes, and asbestos.

UDEQ regulates permitting for the design and operation for solid waste facilities, including landfills and conducts regular inspections. The TriCounty (Daggett, Duchesne and Uintah Counties) Health Department, Environmental Health Division has responsibilities also for solid and hazardous waste, including household hazardous waste, landfill inspections and investigations (including illegal dumping), used oil, and waste tire inspection.

There is not a county system to limit waste collection routes through permitting or franchising in place. Solid waste policies in Daggett County are set by the County Commission and in the Town of Manila set by the Town Council, and at this time neither body convenes an advisory committee to recommend programs and policies.

DEMOGRAPHICS

Because current population is important for estimating and verifying waste volumes and the future population will determine the demand for services, the following demographics are provided.

In Utah, the Governor's Office of Planning and Budget provides United States census data and forecasts that are utilized for most planning studies in the state because of the data's reliability and consistency. The following table presents the forecasted population reported by the census to be residents of the County and the Town. This does not include people with secondary homes or cabins who live in the area part-time.

Table 1: Population Forecast for Daggett County & the Town of Manila

Area	Census 2000	2005	2010	2020	2030	2040	2050	AARC
Daggett County	921	967	1,024	1,141	1,209	1,258	1,305	0.70%
Manila town	308	323	342	381	404	420	436	
Balance of Daggett County	613	644	682	760	805	838	869	

Notes:
1. AARC is average annual rate of change.
2. All populations are dated July 1.

Source: Governor's Office of Planning and Budget, 2005 Baseline Projections.

The 2000 census reflects resort lifestyle in the number of housing units. In 2000 there were 1,084 housing units (more units than reported population in the County). Of this amount, 340 were occupied, leaving 63.8% (692) that were considered seasonal for recreation or occasional use. The remaining 52 units were classified as vacant.

According to these census figures, approximately one-third of the Daggett County population is located in Manila, and the ratio holds through 2050. The average annual rate of change (AARC) of 0.70% annually reflects a low growth rate with little in-migration anticipated. The Town states that in spring 2007, there were approximately 400 seasonal units.

Daggett County claims to have an older average population than any other Utah County. According to State figures, county residents reflect a median age of 39.2 years, compared to the Utah median age of 27.1 years. Almost 95% people in the 2000 census self-reported as white.

In 2004, the Utah Department of Workforce Services reported 454 jobs, and of these 29 % (131 jobs) were in leisure & hospitality services, and 57% (260 jobs) were related to government. Again, this reflects the majority land designated National Forest or BLM land, and that Manila and Daggett County are a tourist destination. Other important sectors were trade/transportation/utilities and construction.

In reviewing the data, the State predicts very low permanent population growth and relatively small job growth to coincide.

The uncertainty in anticipating the future is the growth in part-time residences. The National Association of Realtors reported in May 2007 that more than one-third of property transactions

the previous month nationwide were vacation homes, and that this section of the market is forecasted to remain strong and grow with the "Baby-Boom" generation reaching pre-retirement and retirement with an unprecedented level of wealth.

Retirees now find Daggett County attractive. In the 2000 census, 344 households reported income, and over half of these reported income related to Social Security or retirement. While there is little research available to forecast how many part-time residents will retire at their vacation homes, one 2005-2006 Colorado Council of Governments study estimates 20% for their area.

Based on newly subdivided land and interest in building permits, Manila's recent general plan update estimates that there would be an increase of 2.5% in dwelling units. To reconcile the difference between the .7% growth forecasted by the Governor's office, and Manila's projection, for purposes of estimating the waste, in this plan it is assumed that Manila's permanent population will grow at 1%, and the part-time households, estimated at 400, will grow by 2.5%. The waste collected by private companies was a combination of permanent residents, part-timers, and commercial, and so was projected to grow at a rate of 2%.

The other uncertainty related to solid waste generation is visitor-generated waste. Government leaders estimate two million visitor-days, primarily concentrated between May 1 and September 30th. This data is not collected and reported, and a survey of literature indicates there have been no studies to measure or characterize the per capita generation or make up of the recreational waste stream.

WASTE MANAGEMENT PRACTICES

This summary of waste management practices pertains to the Manila Landfill waste shed (the wastes destined for disposal at the Manila landfill), consistent with this planning grant. While incidental data reporting of the county waste not destined for this landfill was pursued, there was limited reporting from the private firms collecting in Daggett County and disposing out-of-county.

COLLECTIONS

The Town of Manila offers curbside collection services for residential waste. Weekly, a crew of three picks up bags of garbage using a flatbed truck. In Spring 2007, there were 308 residences being served year-round, and an additional 400 residences served part-time, generally between May 1 and September 30th. Waste collection services are billed with the water bill at a rate of $10/month that includes collections, disposal, and a subsidy for the community clean up. Charges occur year-round, regardless of whether the homes set out wastes. There are no separate collections for yard waste or recyclables. Collections are conducted on Mondays to coincide with the opening of the landfill unless it falls on a holiday, such as Memorial Day and Labor Day, when collections occur on Tuesdays and the opening of the landfill similarly coincides.

Community Clean Up: Annually the City conducts a community clean up for five days in May. During the clean up, City staff picks up large items by request for no charge and there is landfill amnesty for self-haulers.

Three private front-loaders pick up commercial loads in Manila and a marina outside of town. The front loaders routes pick up homes, businesses and ranches in the unincorporated area before making their way to Manila. These routes are configured for efficiencies, and may be redesigned as new customers sign on or customers resign service. The private collectors set their own collection rate schedule and bill these customers. Their rate schedules are unregulated by the Town or County, a practice typical of Utah and most of the west with the exception some urban areas. There are no local fees for licenses or local government surcharges on the bill. When the front-loaders complete their routes, they call the Town, and personnel drive to the landfill to open the gate. Landfill personnel estimate the volume of waste from the collection vehicles, and the Town office personnel bill them.

Private collection service also varies seasonally. G&H reports that by the first of November routes are cut from weekly to twice a month, and from December through January drop to once per month, increasing in February to twice per month, and becoming weekly in March and extending through October. RTD reports one route per week during the high-visitor season from mid-May to the end of September that reduces to once per month off-season.

The haulers transport the remainder of the waste from private collection routes out of county to Green River, Wyoming or Vernal, Utah for disposal. The haulers could not provide records of tonnages collected in Daggett County, and neither landfill keeps records of these tonnages.

Private haulers take roll-off containers to the landfill site, much of which can be characterized as construction and demolition debris. These loads are generally related to construction activity and teardowns in the Manila area. The landfill operator estimates yardage and bills the customer if they have an account, but generally collects the fee at the gatehouse. Data on roll-off trucks versus other delivered waste is not collected separately.

Citizens from Manila and Daggett County self-haul waste to the site. The landfill allows self-haulers only on Saturdays and Mondays, and charges fees by load. Fees are collected at the gate rather than billed with the exception of some of the town's businesses. While not required to cover loads, the operator has the option of charging double for uncovered loads as an incentive to decrease litter on roadways and at the site.

LANDFILL

History and Location: The Manila Landfill is a Class II landfill located six miles south of Manila on the east side of State Highway 44, coordinates township 2 north, range 20 east, section 5 NE. The facility began accepting waste in 1974 under an arrangement of joint ownership with Daggett County under which the Town operated the landfill. This arrangement continued until 2003. In April 2003, citing concerns about liability, Daggett County deeded its interest over to Manila. The terms included access to the landfill by County citizens for disposal and continued coordination with the County for special uses such as the County clean-ups.

Permitting and Regulatory Status: DEQ lists the Manila Landfill as an unlined, Class II site of approximately 20 acres exempt from groundwater monitoring. The permit is pending.

Class II permitting requirements for performance, design, maintenance and operations are set by regulations (R315-303). Small landfill designs are allowable for Class II landfills (R315-303-3(3)(e). This is an important exemption for small communities with no other practicable waste management alternative, as it may exempt Class II Landfills from a liner, leachate collection system, and ground waster monitoring. DEQ makes the following findings in issuing a Class II permit:

- There is no evidence of ground water contamination
- The landfill serves a community that has no practical alternative
- The area receives less than 25 inches of precipitation annually
- The landfill accepts 20 tons or less of solid waste daily, based on a yearly average.

Under the Class II designation, DEQ may waive requirements to monitor explosive gases at the landfill.

Closure funds are being accumulated with annual contributions. They are now held in escrow, and in 2006 the amount accrued is $14,513. In 1974 when the site was permitted, a 50-year landfill life was assumed, setting the useful life of the landfill through 2024. Accrual of post-closure funds has not begun, nor is there a closure-post closure plan on file with DEQ

Since 2003 (when the County quitclaimed ownership) through 2005, there have been 3,500 cubic yards reported to DEQ, equivalent to 525 tons/per year based on a 0.15 tons/cubic yard conversion factor for uncompacted waste.

Hours of Operation: The landfill opens Mondays from 9:00 am to noon, except holidays, when it opens the following day for the same hours, and Saturdays from 9:00 am to 2:00 pm. Saturday openings vary seasonally. During the summer there is more material coming in, so the landfill opens every Saturday from April 1 through October 31. From November 1 through March 31, the landfill operates only one Saturday per month, scheduled on the first Saturday of the month. Site personnel open the site for the private front-loaders by arrangement on other days.

Rate Schedule: Fees are set by the Manila Town Council and collected at the landfill. There is a small unheated and non-electrified shack that serves as a gatehouse at the landfill along the entrance road to the landfill. There are no scales, so the fees are structured as volume-based. The following fees were in effect in May 2007.

Small, self-hauled loads like a pick-up truck or small trailer: $5.00 per load
Large loads: $7.75 per cubic yard
Tires: $1.00 each
Double fees for uncovered loads

Site Operations:

Personnel: The Mayor of Manila is the designated contact person for the landfill on the permit for the landfill and assigns day-to-day responsibilities to the Public Works Director who works with a crew of two. During the hours when the site is open, two people staff it. One is assigned to the gatehouse to collect fees and direct customers, and the other works at the face to oversee unloading, screens the waste, and operates the equipment.

The public works director and two operators were trained in 2006 in landfill operations through a landfill operator training program jointly sponsored by SWANA and UDEQ funded by this same planning and education grant. The two employees have departed Town employment, and two new operators now work at the site.

Communications: There is not a telephone cable to the landfill site, so the site personnel rely upon cellular telephone communications. During office hours, Town office personnel take calls related to the landfill, and after normal business hours, the Sheriff dispatch and jail telephone number is posted for emergencies.

Equipment: In 2006, the Town purchased a dozer, a CAT D5NXL, for moving and compacting the garbage. There is also an older excavator on site for digging and hauling cover material. At this time there is not a water wagon or water truck and there is not a source for water on-site or nearby.

Operational Procedures: Until spring, 2007, the site operated as a trench-fill, where the operator would dig a trench or pit, fill it with waste, and cover. In early 2007, the Town switched to an area fill method to achieve better compaction and efficiencies, control litter, cover the waste, and to extend the landfill life.

Restricted Wastes: The Manila Landfill prohibits all hazardous, infectious and liquid wastes. Also not accepted at the wastes are PCB's, asbestos, sludge, contaminated soil, infectious medical wastes, Freon-containing appliances, mercury switches, oil, or televisions or computer monitors. Televisions and computer monitors were banned in anticipation of statewide regulations and because of the lead hazards, particularly because the landfill is unlined.

Signage: Funds from this solid waste planning and education grant provided signs for the landfill. Signs indicate the location of the landfill for vehicles traveling either direction on Highway 44. At the gate a sign indicates the landfills hours of operation, and numbers to call for information or for emergency. Within the landfill there are signs indicating prohibited materials, alerting customers to special unloading areas, and directing customers to the disposal area. Signs provide additional instructions at the waste unloading area to remind customers of prohibited waste, and to prohibit scavenging. Likewise, at the tree, limb and brush area, signs indicate that treated and painted wood is not allowed; at the metal unloading area there are reminders that mercury switches and Freon units must be removed and that there is no scavenging of metals; at the tire area signs limit tires to four per load, prohibit wheels and foam-filled tires, and set a maximum diameter of 24½-inch wheel diameter. The Town has also posted no trespassing signs along the site's perimeter.

Diversion Activities: The Town conducts some diversion activities at the landfill. Special areas are designated for:

- **Auto (lead-acid) Batteries for Recycling**
  These are accumulated on palettes. Standard Battery in Rock Springs, Wyoming collects by van. They remove approximately two vanloads twice per year.
- **Dead Animal Trench**
  The landfill receives few dead animals, but has capacity to handle them at the landfill if there is a need.
- **Tires for Authorized Hauling and Disposal**
  There are approximately 5,000 tires stockpiled at the landfill. The Town has instituted a policy to only accept up to four from a customer, prohibit tires with wheels or foam, charge $1.00 per tire, and to observe a size restriction of a maximum of 24.5 inches in diameter.
- **Metals for Recycling**
  Currently there is a pile of metals, but no bins on site and no contracted metal recycler. Previously, Basin Industries in Vernal, provided two 30-yd roll-off bins for metals. The hauler followed a practice of dropping off two empty bins and picking up the full bins. They hauled the materials to NuCor Steel in Box Elder County. Approximately 10 roll-off bins per year were hauled from the landfill. The Town plans on finding another metal recycler.
- **Trees, Limbs and Brush for Burning**
  Non-treated wood is separately collected and burned on days it is permitted. Approximately 20 cubic yards per month are accumulated and burned.

Litter Pick-Up: Periodically, the Town enlists the prisoners from the jail to conduct litter clean ups at the landfill.

Cell-Sequencing Plan: In December 2006, the Town commissioned a cell-sequencing plan for the landfill from Terry Warner, PE, funded by the planning and education grant for the purpose of planning the use of the landfill in a manner that could best extend the life of the landfill, and that would guide the operators in the future placement of wastes and cover material. Completed in February 2007, the sequencing plan advocates the area fill method of operations to place waste in lifts over the area of previously disposed wastes, and the operator covers the wastes daily.

The sequencing plan made a series of assumptions as far as current and future waste generation that will be used in this plan for consistency. These assumptions were conservative in that the generation estimates were assumed to the higher end of the range in order to give the Town the utmost assurances of how long the important public resource provided by a local landfill would be available.

Landfill Capacity Estimates

According to the cell-sequencing plan, two phases are proposed. Phase 1 would place wastes above the existing waste in the 4-5-acre trench-fill area. According to calculations, two 8-foot lifts over this area should provide about 51,400 cubic yards of capacity (approximately 26,000 tons), and projections anticipate this area to serve the needs of the community through 2030. Phase 2 extends landfilling into the southwest portion of the site that has been previously used for excavating cover material. It recommends two 8-foot lifts. The entire site is anticipated to have capacity through 2057, and accommodate approximately 155,000 cubic yards (77,303 tons). While difficult to estimate the landfill life if trench-fill operations were to continue, it may well have been less than eight to ten years of life versus the 50 years possible with the area-fill method described in the cell-sequencing plan.

Cell-Sequencing Plan Recommendations

In order to maximize the potential gains of over 40-years of life, the cell-sequencing plan made the following seven recommendations.

1. For maximizing landfill life, the operator should concentrate operations by limiting the working face and compact waste to the extent possible to maximize the capacity of the landfill.

   Note:
   Efficient spreading and compaction operations should reduce the volume of incoming solid waste by at least 50%. A thickness of one-two feet of waste is optimum for maximum compaction and consistency. After two-feet of thickness, achievable densities drop off precipitously.
   Source: "Landfill Operations, Getting the Most from your Equipment" by Daniel Duffy, MSW Management, July/August 2007.

   (Mr. Duffy also recommends in the same article protecting the radiator and sensitive areas of the dozer with metal plating and installing a trash rack on top of the dozer blade. The trash rack consists of welded steel beams connected at right angles with the vertical beam directly welded to the top of the blade. The resulting metal lattice doubles the height of the blade without significantly adding to the weight and does not obscure the vision of the operator.)

2. To transition to the area-fill method, the operator will need to move soil a greater distance. The operator will need to use a loader, a backhoe, or there may be bucket attachments or modifications that can be made to the dozer (CAT D5N) to move the material.

3. Daily operation in the winter months could be a challenge in providing the required cover, considering the very small amount of waste volumes received and snow cover. The landfill operator should research alternative daily cover methods and work with UDEQ representatives in determining an acceptable approach and gaining written approval. *Please note that continued lack of daily cover could lead to a violation and possible regulatory action, including landfill closure.*

4. As a policy, the Town should accept and stockpile clean soil for the area fill operations.

5. With the UDEQ landfill facility permit, the permit application should include a more detailed operating plan to support the landfill-sequencing plan.

6. A scale at the landfill would provide better data on current quantities for improved planning and financial management. *(A scale would require an electrical power source).*

7. Metal and wood waste recovery should be relocated out of the landfill operational area to an area toward the gatehouse.

SPECIAL WASTES

A number of wastes are banned from the landfill.

- PCB's (polychlorinated biphenyls)
- Asbestos, friable and non-friable
- Sludges
- Contaminated soil

- Infectious medical waste
- Freon and appliances containing Freon
- Mercury switches
- Oil
- Television and computer monitors
- Liquids

Hazardous waste, liquids, Freon, mercury switches, and oil are banned pursuant to State regulations. While some landfills, like Salt Lake Valley, accept asbestos, medical wastes, mildly contaminated soil, and dry sludges, these landfills provide strict guidelines for screening, acceptance, testing and management, and charge additional fees to compensate for additional management time and effort. To accept these materials in the future would be a management decision by the Town and would require DEQ's concurrence.

Neither the Town, Daggett County, nor the Tri-County Health Department operate a household hazardous waste program within Daggett County, offering no publicly sponsored alternative for used pesticides, garden chemicals, household cleaners, automotive products, paint, anti-freeze, oil, or electronics (televisions and monitors).

There are two facilities in Daggett County as of July 3, 2007 permitted by Utah DEQ to accept up to five gallons of oil per visit from do-it-yourself changers and up to 55 gallons of oil per visit from farmers. They are:

- Reeds Motor & Marine, Corner of Highway 43 and 44, Manila (435) 784-3124
- Flaming Gorge Lodge, 155 Greendale, US Highway 191, Dutch John (434) 885-3191

The Town reported that older mobile homes are a disposal problem, since relocating them can't be approved if they precede a manufacture date of 1976, when national manufacturing standards changed. Research demonstrated that they are a problem nation-wide. There has been discussion in Vermont for statewide legislation to assist rural communities with dismantling and disposal. Practices are to securely remove asbestos, and recycle the metal siding and plumbing fixtures, and then chip the treated wood to save space in the landfill. A May 2007 call to Public Works Director Jerry Muir communicated that a private party is now conducting mobile home dismantling, and it is not the municipal problem reported in fall 2006.

Public Outreach

The Town staff issues flyers and information for the community clean up. Similarly the Town staff answers questions regarding solid waste services. There is not currently public information on household hazardous waste, recycling, backyard composting, or waste reduction. There is not a school outreach program.

Recycling Diversion

None of the private waste collection companies offer recycling services to customers at this time, nor is there a public or private recycling center in Manila or Daggett County.

Office Paper

Since late 2006, there is a recently organized informal recycling in the Manila Forest Service office and the County Courthouse and schools offices for office paper. To coincide with trips to Green River, the Forest Service hauls the materials to the Green River, Wyoming Public Works recycling center. The center accepts donated material including corrugated cardboard containers, aluminum cans, white computer paper, and all printed material. Lynn Kurtz estimates that one

dozen loads have been hauled to the Green River Recycling Center in the six-month period between winter 2006 and mid-summer 2007.

Green River, Wyoming Recycling Center

The City of Green River operates a drop off center located in a metal building. Inside the building are gaylord boxes (a standard-size cardboard box that fits neatly on a standard shipping pallet measuring 48 inches by 40 inches by 36 inches) for aluminum containers, white computer paper, and printed material with the exception of neon-colored paper. Recycle-broker Rocky Mountain Recycling, based in Salt Lake City, sends a truck and trailer to pick up these materials, and the public works staff uses their forklift to load the trailer two gaylords high.

The City also collects corrugated cardboard from businesses in a rear-loader solid waste collection truck. Within the center, citizens drop off corrugated cardboard in a chain-link fence enclosure. The City hauls the cardboard to the recycling center in Rock Springs for baling.

The City reports that recycling costs and revenues approximately break even. However, personnel expenses are not charged against the program, but instead are absorbed by landfill and collections. City staff offers public awareness through school presentations and tours.

Rock Springs, Wyoming Curbside Recycling and Recycling Center

Rock Springs operates their own drop-off center and collects recyclables. They also have vertical baling for cardboard. Rocky Mountain Recycling picks up these bales and hauls them to their Salt Lake facility.

Vernal, Utah Recycling Opportunities

-Vernal Public Program

The "Can Do Crew" is a recycling program begun by the Chamber of Commerce Environmental Committee. It operates with small subsidies from the City of Vernal ($6,000) and from Uintah County ($10,500). Organizationally, the program operates through the school district's vocational education program for developmentally disabled students, which is designed to prepare participants for independent living and the workforce. The District employees a teacher, Josh Graham (home number 435.781.1154; cell 435.828.6234). He directs the program and heads the recycling efforts. The program places bins out in the community for drop off recycling at the Smith's, Wal-Mart, and Jubilee stores, and picks up recyclables from the BLM and Ashley National Forest and charges for the service.

In the past the program sold mixed paper, OCC (old corrugated containers), and aluminum. It transported mixed paper in gaylords to Green Fiber in Salt Lake City (formerly Redi-Therm), a cellulose insulation manufacturer. Rocky Mountain Recycling picked up baled OCC, and hauled it to their facility in Salt Lake City. The program sells aluminum to a Vernal metal broker. Because of the long haul, the costs for the haul offset any revenues with the exception of aluminum recycling. The program recently lost the lease on the building they were using for separation and baling.

The program is now redesigning operations. They are pursuing a lease on a new building. They also are exploring free transportation of recyclables through student truck-driving training at Uinta Basin Applied Technology. Another opportunity Josh Graham has experimented with is the use of shredded paper in place of sawdust for blowing down oil wells. By shredding paper to the oil industry standards, paper could be sold locally. He wishes to pursue this in the future and estimates the shredder would cost $10,000, and that an aluminum moving floor trailer would be most effective for transport.

Some of the challenges they have faced in addition to the high cost of shipping to Salt Lake City are 1) the poor efficiency of horizontal balers versus a vertical baler; 2) contamination at two of the three grocery store drop-offs; 3) the manpower requirements for loading paper into the gaylords; and 4) the difficulty obtaining gaylords for shipping. He found that augmenting program participant labor with help from jail inmates to be valuable.

Josh Graham indicated interest in working with Manila and Daggett County.

-Vernal Private Companies
One company, Montgomery Recycling, advertises buy-back recycling in Vernal. They pay for copper, aluminum cans, brass, radiators, stainless steel, scrap iron, insulated copper, and aluminum wire.

Capps Auto Wrecking and Basin Industries are reported to also buy metals.

Rocky Mountain Recycling (communication with Becky Day, Rocky Mountain Recycling, 801.975.1820) states that they buy baled paper and OCC from Vernal, and would consider a route that collects separated recyclables from Manila if the material is baled and sufficient material is stored to warrant sending a semi to collect it. The Town would be responsible for loading, which requires a forklift. A dry storage area is needed for the bales so the fiber isn't damaged by mold.

Evanston, Wyoming Recycling and Recycle Utah, Park City, Utah
Evanston, Wyoming has a drop-off recycling program that was set up with technical assistance by Recycle Utah, a non-profit recycling center in Park City, Utah. The Evanston recycling center emulates the Park City model both in the recycling center design and the organizational structure.

The recycling center has separate roll-off containers for each material with a hinged lid for depositing the materials to keep them dry. Materials are hauled to market in the roll-off container by a contracted hauler. The center staff selects the best market for the material based on price and terms. A non-profit group operates the recycling center with financial support from the city and county. The non-profit group provides recycling education.

The Executive Director for Recycle Utah, Insa Rippen, volunteered to assist setting up a new center to serve Manila based on this same model, providing there is agreement for a regional effort minimally between Manila, Daggett County, Vernal, and Uintah County that includes a commitment to support the facility and program with public monies. She would assist filing papers for non-profit status and advise on locating, preparing, and equipping the center free of charge, funded by her own non-profit group. It is her opinion that Manila and Daggett are too small and remote for a dedicated recycling center, and could benefit by a drop-off recycling center where residents on their way to shop in the Vernal area would haul in recyclables. Ms. Rippen invites anyone interested to tour the Park City recycling center and to meet with her.

Forest Service Concessionaire Recycling
The federal government encourages its concessionaires to recycle. The Flaming Gorge Corporation does not recycle at this time, as they couldn't secure collection services. At American Land and Leisure in the Dutch John area, campground hosts at the Mustang and Firefighters Memorial campgrounds offer separate areas for discarding recyclables for campers, and the hosts take them to the most convenient drop-off centers.

Recycling Market Development Zones

In 1996, the Utah Legislature created the Utah Recycling Market Development Zone Program, which focuses on used recycled materials in their manufacturing operations, or compost. The purpose is to attract new business and jobs. Eligible recycling businesses that are located in designated Recycling Market Development Zones qualify for a 5% tax credit on machinery and equipment; a 20% state tax credit (up to $2,000) on eligible operating expenses; technical assistance from state recycling economic development professionals; and various local incentives.

In order to be designated by the Governor's Office of Economic Development as a Recycling Market Development Zone, the government applying for the designation must offer some incentives to businesses. Examples of incentives are 1) financing, such as grants; 2) expedited permitting assistance; 3) infrastructure assistance; 4) competitive utility rates; 5) reduced business license fees; 6) zoning assistance; and 7) an established process for getting into the zone.

The Governor's Office of Economic Development (GOED) offers technical assistance for completing the application. The application's requirements are identification of the local incentive; summary of the local recycling programs; support from local elected officials; and a recycling market development plan. Contact are: Les Prall, GOED, (801) 538-8804 or Brad Mertz, Recycling Coalition of Utah, (801) 832-1157.

Reuse Businesses

No businesses in Manila were identified that resell previously used items such as clothing, household goods, or building materials.

Waste Reduction Education

Neither the Town of Manila nor Daggett County offer a public information program to reduce amount of waste discarded, such as backyard composting, buying in bulk, choosing items with less packaging, opting for reusable products versus disposable, and donating used clothing and appliances. For motivated citizens, access to this type of public education materials is available through the Internet.

Buy Recycled Programs

There is not a preferential purchasing program in either Daggett County or Manila for materials made from recycled content.

According to the American Forest and Paper Association, the State of Utah's 1990 state law requires public procurement units to give preference to recycled paper products if the purchase price for recycled is within 5% of the bid for virgin products. In order to qualify as recycled, the product must contain at least 50% secondary material. For fiscal year 1990-91, the law requires that recycled paper represent at least 50% of each procurement unit's annual paper purchases. At this point, recycled content paper is still more expensive than virgin material paper.

GREEN WASTE AND COMPOSTING DIVERSION

There are not publicly sponsored green waste or composting programs. The landfill accepts untreated wood waste and diverts it for burning.

None of the local government agencies has a wood chipper operating to make wood chips for landscaping or to chip treated wood in order to reduce the volume in the landfill. There is interest in exploring the cooperative use of a wood chipper.

WASTE QUANTITY ESTIMATES

The following waste quantity estimates are consistent with the estimates in the cell-sequencing plan, and are based on a series of assumptions regarding population, population growth, and deliveries to the landfill from private haulers from the unincorporated.

To make these forecasts, the following assumptions were applied to waste generation.

1. The **full-time population of Manila** generates waste 52 weeks per year, and the population will grow 1%, rounded from the 0.7% per year projected by the Governor's Office of Planning and Budget. The generation rate is assumed at the 2005 national average of 4.5 lbs/person/day. This is the most recent posted (7/31/2007) generation rate on the EPA website, www.epa.gov/epaoswer/non-hw/muncpl/facts. This is material collected by the Town of Manila or self-hauled to the site.
2. The **part-time population of Manila** is assumed to generate waste only 16 weeks per year, and this population is projected to grow 2 ½% annually, consistent with the Town of Manila's planning projections. The generation rate is also assumed at 4.5 lbs/person/day. This material is collected by the Town of Manila or self-hauled to the site.
3. **Private haulers** are assumed to haul 16 weeks per year, and because this is related to part-time residence and tourism, it is anticipated to grow at a rate of 2%, slightly less than the 2½% for part-time residents because some full-time residents are included. While some waste is hauled year around, the assumptions project that the waste collected for the four months will compensate for the minimal routes off-season, accounting for the building up and winding down in volumes with the tourism season. As this waste varies as routes are modified, it is the most difficult quantity to project.

In summary, the 900 tons per year forecast was calculated as follows:

- Permanent Manila residents 5-tons/week year round, or 260 tons per year.
- Part-time residents assumed 20 tons/week for 16 weeks, or 320 tons per year.
- Private collections assumed at 20 tons/week for 16 weeks, or 320 tons per year, and include construction and demolition debris.

Several factors make projections difficult and underline the importance to the Town of monitoring the volumes of incoming waste and to match them against projections. One is that there is not a scale at the landfill to confirm weights. Second, since the Town operates the landfill from the general fund, there hasn't been a need to charge Town-collected waste against an account and to keep records of volumes. Better data will make for more accurate planning and better financial controls.

Some solid waste planners question the validity of using the national generation rate of 4.5 lbs./person/day for the intermountain area, as county-level studies in Colorado indicate a generation rate in the range of 6.5 lbs./person/day (personal communication with Laurie Batchelder Adams, Denver). Unfortunately, a Utah four season municipal generation study has not been conducted and published. In these communities, if you subtract out some of the construction and demolition debris, the generation figures better approach national averages. This seems reasonable, as construction rates are much higher in the intermountain west than most other parts of the country. Waste generation increases with income, and as Manila and Daggett County residents are below median income, the EPA generation rate was selected with an add-on for construction and demolition tied with the projected growth. Also, a generous occupancy for part-time residents was assumed, both to make a safe assumption, and recognizing that part-time residents generate more waste (sometimes as high as 5.5 to 7.5 lbs./person/day) because of

additional discards from moving in and out of temporary residence and higher incomes that reflect in additional packaging.

The 900 tons per year is roughly equivalent to the Town's estimated 3,500 cubic yards annually, depending upon compacted versus uncompacted conversion factors. For compacted waste, the estimate is low. Better record keeping will make the accrual of closure funds more accurate.

Table 2: Yearly Waste Stream

Group	2007 Population	Ton/Week [1]	Weeks/year	Ton/Year (TPY)
Manila	308	5	52	260
Part-Time	1,200	20	16	320
Other Waste [2]	NA	20	16	320
			Total	**900**

[1] Values are rounded up to be conservative
[2] Assumed waste from the two private collection services in addition to construction and demolition wastes.

Table 3: 50-Year Population and Waste Estimates

	Population		Waste Tons per Year (TPY)			
Year	Manila Town	Part-time	Manila Town	Part-time	Extra [1] (Private Waste Collections)	Total TPY
2007	308	1,200	252	302	345	**900**
2008	311	1,230	255	310	352	917
2009	314	1,261	257	318	359	934
2010	317	1,292	260	326	366	952
2020	*351*	*1,654*	*287*	*417*	*446*	*1,150*
2030	*387*	*2,118*	*317*	*534*	*544*	*1,395*
2040	*428*	*2,711*	*350*	*683*	*663*	*1,697*
2050	*472*	*3,470*	*387*	*874*	*808*	*2,070*
2057	*507*	*4,125*	*415*	*1,039*	*929*	*2,383*

[1] Assumed 20 tons/week for 16 weeks and a 2% growth rate

WASTE COMPOSITION ESTIMATES

The US EPA also provides estimates of municipal solid waste composition, based on national averages. In preparing this study, we sought to get figures more specific to recreation area and campground waste, including asking national beverage container associations and researching the National Forest Service and National Park Service websites. Thus far, no composition studies have been identified that would be germane. There are composition studies for California recreation areas, but this may not be applicable because of the beverage container redemption program (communication with Denise Burrell, Region Manager, Anheuser-Busch Recycling Corporation).

Consequently, the approach used in this section is to apply the national waste composition percentages to the estimated 2007 Manila waste stream of 900 tons, and to discuss probable variations.

Table 4: Composition of Manila's Annual Waste Stream (2007)

Material	Waste Stream Percentage	Quantity per Year Based on 900 TPY
Paper	34.2%	307.8
Yard Trimmings	13.1%	117.9
Food Scraps	11.7%	105.3
Plastics	11.9%	107.1
Metals	7.5%	67.5
Rubber, Metal, Textiles	7.3%	65.7
Glass	5.2%	46.8
Wood	5.7%	51.3
Other	3.4%	30.6

Figure 2 and Figure 3 display this information. The figures address only the current waste stream of 900 tons per year. The waste stream is anticipated to grow to approximately 2,400 tons per year 50 years in the future, substantially increasing the amount of materials to be managed and the potential for diversion. Over the years, the waste composition has shifted. Notably, the percentages of plastics have risen, glass has dropped, and food waste increased. The composition of municipal solid waste is anticipated to change in coming years as packaging changes and consumer practices shift. Also, these are national figures. Better regional information and optimally a local waste characterization study that samples the waste stream in a statistically valid manner would provide much more reliable data.

Figure 2

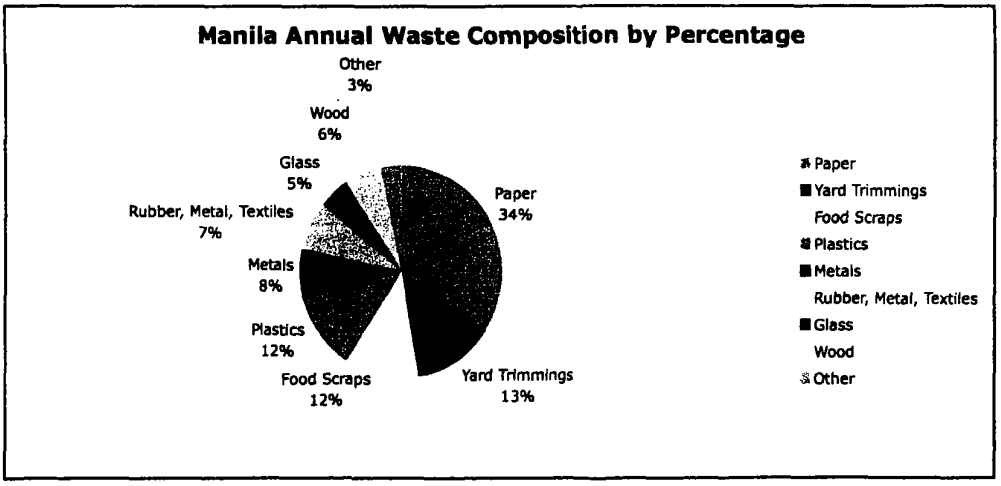
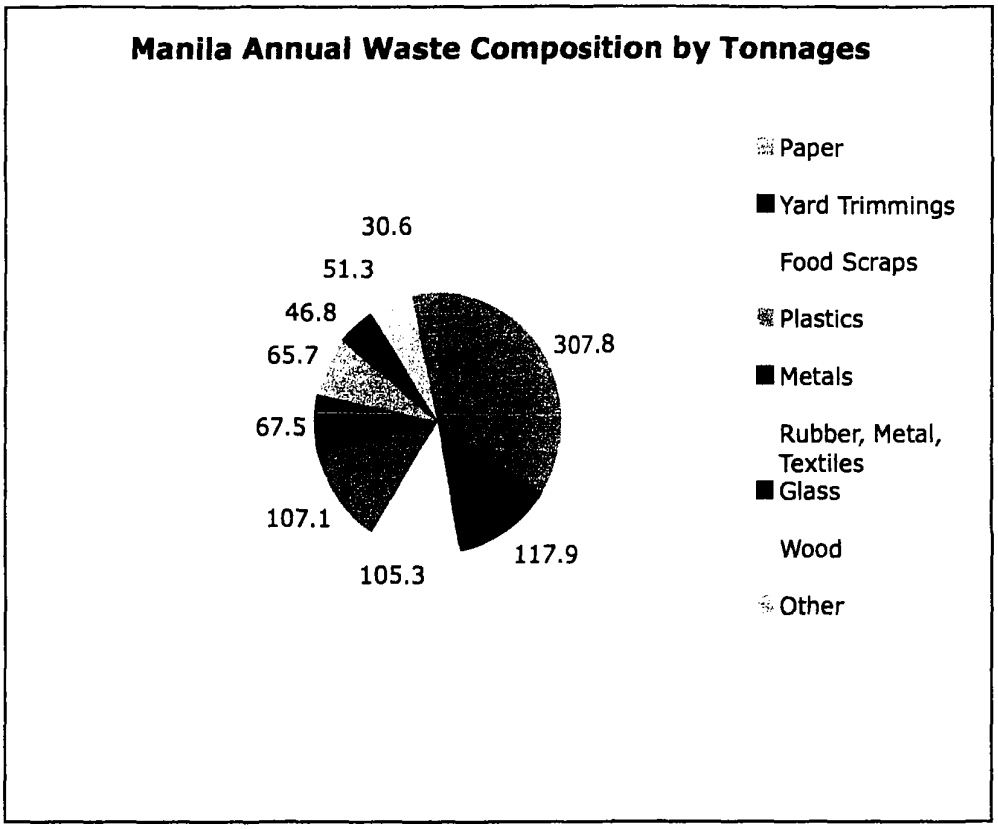


Figure 3



By greatest weight, the largest component of the waste stream is paper at 34%. National figures can further break down this composition. Metals, the material currently recovered at the landfill comprises 8% by weight.

POTENTIAL CHANGES IN THE PLANNING AND REGULATORY ENVIRONMENT

Solid waste management and planning are dynamic, and deserve a strategic planning approach of monitoring the environment and verifying the assumptions made in planning and establishing programs. Many of the changes to solid waste systems are externally motivated through larger trends that become institutionalized through legislation and regulations. The following are issues to watch during the implementation of this plan.

Electronic Waste: Last Utah legislative year, the Recycling Coalition of Utah worked with a State Senator and Legislator to introduce a bill for banning electronics from landfills, and paying for recycling of electronic goods in advance at the point of sale. The bill failed, but it is very possible to be reintroduced, or for the federal government to approve a nationwide program, as it is a recommendation of a Commerce Department committee.

Fuel Costs: Fuel cost have far exceeded predictions from the State of Utah, which two years ago forecasted this year's rates more in the range of $2.40 a gallon. Fuel prices affect collections and landfilling, especially since area-fill is more machinery intensive than trench-fill. The cost of fuel and energy has an interesting affect on reyclables: recycle collection and hauling costs increase, but the benefit or recovering materials also rise because of the energy savings from manufacturing goods from recycling versus virgin materials. This increases the prices paid for secondary materials. Thus, program costs will go up, but so should revenues. Whether they rise equally is an important question.

Markets for Secondary Materials: Foreign demand for recycled goods continues to rise, especially from China, and an increased demand is forecasted from India during the next 10 years (Pete Grogan, International Director, Weyerhaeuser, presentation in Keystone, Colorado, 2006). There is a strong market for buying recovered goods. Up to this point, however, recyclers are not seeing proportionately increased prices for the demand the national vendors from the paper, steel and plastic industries state. Rural recycling program continue to look for cost-saving methods to lower the program subsidies, or to try to develop cottage industry markets nearby.

Green House Gases and Global Warming: Methane production from landfills is a concern. At this point, some Class II Utah landfills are exempt from monitoring, or the UDEQ inspector will use a hand-held monitor during inspections. Methane comprises about 9% of greenhouse gases, with a high (21) green house gas production factor. It is a stationary source, and may well be regulated by the EPA in the future. A gas system is a substantial cost for a small landfill, like Manila, and may be sufficiently involved and expensive to choose closure over continued operation. This issue should be closely watched through the Conference of Mayors and League of Cities and Counties, and conversations with UDEQ and TriCounty Health.

Carbon Credit Markets: The Chicago Climate Exchange trades money for credits for controlling and reducing green house gases. Two Utah landfills sell landfill gas removal. A requirement is that the gas control system is not regulatory-driven. Both Utah landfills selling credits are large and lined facilities. The Chicago Climate Exchange enters into agreements through 2010.

The National Recycling Coalition (NRC) is in discussion with the Senate Environmental Committee chaired by Senator Boxer to sponsor legislation that would enable recycling programs to sell carbon (offset) credits (Kate Krebbs, Director of NRC, Recycling Coalition of Utah Annual Meeting, June 2007). No legislation is pending as of August 2007.

Section 3 follows and suggests program enhancements for the Town of Manila.

3

3. OPPORTUNITIES FOR PROGRAM ENHANCEMENT

OVERVIEW

Manila operates an effective solid waste system that meets the current basic service needs of the citizens. The local landfill ensures nearby, convenient disposal. Replacing the landfill with a transfer station and hauling waste out of the county would substantially increase costs.

This section identifies a number of possible programs that would enhance the solid waste service. The format is to identify them with a brief discussion of benefits, as well as costs, staffing demand, and other implementation considerations. Organization is by program.

A matrix follows this discussion that prioritizes these programs as to importance to the Town with input from the advisory committee as: very high, high, moderate, low, slight, and not important.

Section 4 that follows sets a timeframe for implementation as immediate (six months), short-term (one to three years), medium-term (three to eight years), and long-term (nine to twenty years). More detailed implementation for programs with very high, high and moderate importance are detailed in Section 4.

In preparing this range of services, we recognize that Manila and Daggett County, like many small local governments, face meeting the challenges of providing the same services as are required for larger cities and counties without realizing economies of scale and without a commercial and industrial base to provide more tax revenues. This means limited staff and revenues to support programs.

The goal of the solid waste plan, as stated in Section 1, drove the selection of these alternatives.

> *Maximize the life of the Manila Landfill and ensure regulatory compliance and the protection of the environment, and conduct the maximum economically feasible waste diversion through recycling and wood waste processing and recovery supported by public education and operator training.*

A discussion follows the program suggestion with emphasis on providing continued reliable service, providing education and alternatives for difficult to manage wastes, looking at measures for significant diversion from the landfill and to maximize capacity, and recycling high-value recyclables or participating in cooperative programs that will reduce costs. Public awareness and education are addressed as important potential programs, especially since education is an eligible expense under the grant funding,

POTENTIAL ACTIVITIES AND PROGRAMS

The discussion of potential activities programs follows. The organization is by program areas in the same order as presented in Section 2, Current Conditions.

COLLECTIONS (COL)

1. Purchase Used Solid Waste Compactor Collection Vehicle:
   Description: The practice of throwing bags on to the flat bed truck appears effective at present. The practice is labor intensive, and there is an increased risk of employee injury. The bagged wastes arrive at the landfill uncompacted, and unloading takes time. A used compacting collection truck would reduce required time and manpower for collection and allow for greater efficiency. As the waste stream grows, a threshold of efficiency will be reached where a collection truck will do a better job in less time. Purchase of an automated side loader or front loader would necessitate providing compatible carts or bins, while a rear-loader could work with the practice of continuing to bag. With solid waste collections, a backup truck is an important consideration, so by continuing with the bags, the flat bed truck can serve as backup if the collection truck is out of service for more than a week. There are partially automated systems for rear loaders that allow workers to not lift as high.
   Costs: $14,000-$60,000 for a used rear loader. Because of small volumes and light use, the lower range is applicable.

2. Track Data on Collections to Confirm Waste Projections
   Description: Prepare a monthly report on solid waste deliveries, calling out the sources of the waste: Town collections; citizens; private haulers; and roll-offs. Private waste deliveries to landfills can fluctuate greatly as private collectors usually shop for the best pricing and convenience for disposal. Less waste affects the Town's revenues, and taking more will cause the landfill life to be shortened to less than the cell-sequencing plan projects. As Town waste quantities grow, better data will provide data for sizing the collection truck recommended previously.
   Include tracking roll-off loads, as these a largely construction & demolition debris. With more building, construction and demolition debris can increase dramatically. (For a 4% growth rate, construction and demolition debris can reach 30% of the waste stream. The example is Logan, Utah). This material does not compact well and takes more space in the landfill. However, much of the material can be separated for reuse (example, the Good Wood Project, Park City, Utah, funded with a start up grant from the US Forest Service).
   Costs: Incorporate monthly report into existing staff's workload. (Staffing may approach a threshold sooner.)

LANDFILL (LF)

1. Complete Landfill Facility Permit and Closure/Post Closure Plan
   Description: The permit is pending for the Class II permit. Completing the permit preserves the protections of the Class II status, and to delay may mean new and more restrictive standards. The Closure/Post Closure Plan will design the final appearance, cover contours, and use of the landfill when the landfill closes. The plan provides cost figures to ensure the Town will have accrued sufficient monies for closing and maintaining the landfill during post-closure. The sequencing plan can provide direction for both these required submittals.
   Costs: Estimated at $10,000-$40,000, depending upon how much work may be done in-house.

2. Continue Regular Operator Training
   Description: As landfilling and the laws regulating operations continue to grow more complex, the trainings co-sponsored by the Solid Waste Association of North America (SWANA) and Utah DEQ will update the operators. SWANA also offers courses electronically on specific issues. Operator certifications are also available through SWANA conferences.
   Costs: $100 or less per person for the Utah training registration, plus travel and lodging. The electronic courses vary between $150 and $300, depending upon the length of the course.

3. Apply to DEQ to Use Alternative Daily Cover for Winter Operations
   Description: Consistent with the recommendation of the cell-sequencing plan, apply to the Utah DEQ to use a tarp or other approved alternative daily cover for the winter when there is minimal waste, and cover material is difficult to move because of snow. This will conserve soil, which is limited at the site.
   Cost: Possible to prepare the written request in-house. Cost of tarp $200-400.

4. Upgrade New Dozer
   Description: Install a trash rack on top of the CAT D5N blade for more efficient compaction, while allowing visibility, and protect the radiator from perforation by installing metal plating.
   Cost: $1,500-3,000

5. Overhaul Excavator or Replace with Used, or Fit Bucket to CAT D5N
   Description: With the area fill method, there is a greater need to frequently move material, and to move it greater distances. The dozer is not effective for moving soil, and the excavator has a history of frequent breakdowns. For the area fill method, a reliable working excavator is essential for operations.
   Cost: $20,000-$50,000 for a used mini excavator

6. Provide First Aid and Emergency Supplies at Gatehouse
   Description: Provide first aid, portable eyewash, drinking water, fire extinguisher and other emergency equipment at gatehouse or Town truck. Equip collection vehicle with first aid kit and fire extinguisher.
   Cost: $400-$750

7. Relocate Metal Recycling and Wood Pile to Area Near Gatehouse
   Description: The cell-sequencing plan calls for these relocations in order to clear the way to bury waste when the current area is filled. By moving the metal bin and wood near the gatehouse, there will be greater oversight of the bins to prevent scavenging the high-value metals and mixing in treated wood.
   Cost: If the new metal broker provides bins, there should be staff effort, but no purchases.

8. Establish a Town Policy to Incentivize Taking Clean Soil to the Landfill for Future Cover
   Description: The cell-sequencing plan calculates a need for more clean soil for landfill cover. Incentives through Town contracts, County contracts, and landfill pricing would encourage clean soil to be hauled to the landfill and stockpiled.
   Cost: Difficult to determine, but will be less than purchasing and hauling cover material to the landfill.

SPECIAL WASTES (SPW)

1. Pursue a Household Hazardous Waste Collection Event and Electronic Waste Collection with TriCounty Health Department
   Description: Where a community doesn't have a permanent household waste collection center, one or two-day events to collect household hazardous waste are held annually to take paint, antifreeze, rechargeable (cadmium and lithium) batteries, insecticides, herbicides, fertilizers, cleaners, aerosols, automotive chemicals, and other hazardous materials that shouldn't go into the garbage. They are expensive to coordinate, staff, and to dispose of the materials and require specific skills to reduce the risk of accidents. It reduces toxic materials that make their way to the landfill and operator exposure.
   Cost: $20,000-$50,000 hopefully shared

2. Remove Stockpiled Tires
   Description: The Utah Department of Environmental Quality Division of Solid and Hazardous Waste offers partial funding for hauling tires through an approved transporter to a registered facility for tires collected after 2002. The transporters and facilities are posted on the Department's website. Costs are approximately $120/ton, with ~65 tires comprising a ton. UDEQ pays 60%, and the Town is liable for 40%. For approximately 5,000 tires, the weight is about 80 tons. The cost for removal is about $120/ton, or about $9,600, and the Department would pay $5,700-5,600 and the Town the difference. Applications are available through Wade Hansen, UDEQ.
   Cost: In the range of $4,000, depending upon actual number and weight of tires and current costs.

3. Institute Freon Removal from Appliances
   Description: It is against regulations to accept refrigerators and air conditioning appliances with Freon units intact. Beyond the Manila landfill there isn't a place locally to take them. An alternative is to train and equip a landfill operator in removal and disposal. There has been some discussion that SWANA and UDEQ may offer this training. There is a training and set up cost, and it is assumed that the Town will establish a fee to offset operational costs. An alternative is to hire a private person trained in removal and to reimburse him/her for time through a fee.
   Cost: Approximately $1,000 for training and equipment.

PUBLIC OUTREACH AND EDUCATION (POR)

1. Publish a Handout on Non-Acceptable Waste
   Description: The handout would be intended to enlist the public's cooperation for complying with regulations and protecting the landfill from environmental problems. It could be a folded 8-1/2 by 11 sheet, distributed at the gatehouse and Town offices, and the same data may be reformatted and included in the utility bills. It would identify non-acceptable wastes and provide alternatives for managing materials, if available.
   Costs: Paper and copying $200-$400. (Eligible for Grant Funding)

2. Publish a Recycling Directory
   Description: In order to promote the efforts citizens are making to recycle, it would be useful to publish a directory of recycling available in the cities they travel to for errands, Vernal and Green River, and mail-in recycling like print cartridges and some small electronics. This could be handed out at the City offices, given to people signing up for utilities, or mailed to residents. (Eligible for Grant Funding)
   Costs: Paper and copying $300-$600; Mailing $400.

3. Publish Handouts on Waste-Reduction and Backyard Composting

Description: Producing less waste is the most environmentally sound approach to consumer habits. Education includes suggestions like buying in bulk, avoiding individual serving packaging, reuse, and how to backyard compost food scraps. Separate handouts on waste reduction and composting would probably be most useful. These could be distributed through the City offices, and USU Extension may cooperate with backyard composting outreach. (Eligible for Grant Funding)
Costs: Paper and copying $300-$600.

4. School Curriculum
Description: Meet with school district officials to determine whether they will implement lessons, or information on sustainable waste management practices in the district curriculum. There are a number of publicly accessible curriculum exercises available for reprint providing credit is given to the originator, and SWANA offers an interactive CD entitled "Ollie Saves the Planet." (Eligible for Grant Funding)
Costs: "Ollie Saves the Planet" is available for approximately $25/copy each with shipping for the two elementary schools ($50), and the curriculum lessons will require reformatting and printing, approximately $400 per school.

RECYCLING DIVERSION (RCY)

A range of recycling opportunities is available. Even though markets for recovered materials are high and remaining somewhat steady after dips in the mid-90's, the research in Section 2 demonstrated that for recycling goods other than aluminum cans, the revenues do not offset costs, and programs require financial support. There are other considerations when evaluating recycling: offsetting landfilling costs and extending the life of the landfill; the difference in carbon emissions and energy use between manufacturing with recovered material versus virgin; saving forests from harvest and land from being mined; and the environmental education inherent in promoting recycling programs.

1. Continue and Expand Informal Recycling
Discussion: Promote and expand the current efforts for informal recycling. Strategies include the recycling directory mentioned under public outreach, initiating recycling in the Town offices, and promoting participation to other generators.
Costs: Insignificant

2. Contract with New Vendor to Continue Metal Recycling at the Landfill
Discussion: Pursue a new vendor that will provide a bin for metals and assist moving the metal pile, possibly through a competitive bid. To keep costs down, consider a vendor who will drop off an empty roll-off when they pick up the full. Control scavenging, as the former vendor reported a high level of metal scavenging. Lacking materials like brass and copper that bring a higher price, it was difficult for him to recover costs.
Costs: Revenue positive to revenue neutral due to the high market value for metals.

3. Work with the Can-Do Program to Expand Service to Manila
Discussion: The Can-Do program manager is interested in possibly working with the Town, County or School District. Access to student truck drivers and locally shredding paper to be used in the oil industry would reduce the hauling costs to take the paper to Salt Lake. In addition, the program already has balers for aluminum, corrugated and plastic. The program is not self-supporting and receives subsidies. If there are developmentally disabled students in the Daggett School District, the program offers training in skills for independent living.
Costs: Undetermined, but would be less than the Town starting up their own program. Other agencies subsidize the program in the range of $10,000-$15,000 annually.

4. Initiate an Aluminum Can Recycling Program

Discussion: There are a large number of aluminum cans in marina and campground waste, and recycling aluminum can be cash positive. Programs need containers with a small, restrictive circular opening and good signage for collection in order to limit trash. Operators line the containers with plastic bags. These could be collected in the same way

the Public Works crew picks up trash by throwing the bags on the flatbed truck, and hauling to a metal broker incidental to other trips for picking up supplies. Another alternative is to weigh and securely store the aluminum cans in bags until the metal broker picks up the metal roll-off bin, and have the broker buy them. Some communities invite a service group or a number of groups to adopt the program. In this way, they can provide the up-front cost of the containers, help sign and promote the program, and share in the revenues.

Anheuser-Busch Recycling organized an aluminum-recycling program for Lake Powell, and may be interested in organizing one for Flaming Gorge, if there is an existing aluminum can recycling program in place to work with (Contact person: Denise Burrell, 510.471.4776).

Costs: The cost of a locking lid can like the one shown above is about $400 each. Labor will depend upon the program arrangements. Revenue from aluminum is in the range of $.90/lb with 34 cans making up a pound.

WOOD WASTE DIVERSION (WW)

1. Cooperative Wood Grinding Program

Discussion: Open Discussions with the Forest Service for a Cooperative Wood Grinding Program. With deadfall and fire damage at the Ashley National Forest, there may be interest in a cooperative program with the town to grind wood. The landfill operators could grind untreated wood at the landfill and distribute the chips to the public, use the chips in public landscape projects, and use it as cover at the landfill, since there is a shortage of cover. Treated wood could similarly be ground for landfill cover. There is not a surplus of working space at the landfill, but there is five acres adjoining, that was formerly designated as landfill property but has reverted to the Forest Service. This could be a possible working area for the chipper and is away from the public. A consideration in this decision is to provide a water source near the chipper, as fires are one of the operational hazards. This could be accomplished a number of ways, including leaving a water truck on site during operations. Operating a grinder requires in-depth safety training and precautions. Grinders vary in ability to manage material, depending on the diameter and density of the wood, and the potential for contaminants like metal fasteners. They also produce varying sizes of chipped products, depending upon the consumer demand and end use. Some are mobile on tracks, others can be towed, and some are stationary.

Costs: A large horizontal or tub grinder can cost upwards to $300,000. A larger sized tree chipper, like those used by utility companies to clear lines that can be towed to different locations would be a possibility if the wood diameter is smaller. These range in costs from $75,000 (Sundance Equipment) to $180,000 for the large Doppstadt with Moorbark's popular models between the cost range of the other two. Smaller tub grinders, as used in composting operations, like the Farmhand range between $25,000-$35,000. Amortization is generally over 10 years. A 5,000-gallon water truck (new) costs about $60,000, while a used 2,000-gallon truck costs about $18,000.

2. Recycling Market Development Zone Using Wood Waste

Discussion: Consider designating a Recycling Market Development Zone for using wood waste. If the wood waste project goes forward and promises sufficient material, designating a Recycling Market Development Zone may attract new business and jobs to the area.
Costs: Varies by the incentive the Town or County offers in the application (financing, expediting permits, infrastructure assistance, competitive utility rates, reduced business license fees, etc.).

PRIORITIZATION OF POTENTIAL ACTIVITIES AND PROGRAMS

This following table lists and prioritizes the potential activities and programs from the preceding portion as to importance. Representatives from the Town prepared this prioritization with review and input from the Solid Waste Plan Steering Committee. The rating categories are A-very high importance, B-very important, C-moderate importance, D-slight importance, and E-not important. Similarly, representatives from the Town set the period for implementation: Immediate (6 months); Short Term (1-3 years); Medium Term (4-9 years); and Long Term (10-20 years).

Table 5: Prioritized Programs and Activities

AREA	#	PROGRAM OR ACTIVITY	PRIORITY	IMPLEMENT
COL	1	Purchase Used Solid Waste Compactor Collection Vehicle	C	Medium Term
COL	2	Track Data on Collections to Confirm Waste Projections	B	Short Term
LF	1	Complete Landfill Facility Permit and Closure/Post Closure Plan	A	Immediate
LF	2	Continue Regular Operator Training	B	Short Term
LF	3	Apply to DEQ to use Alternative Daily Cover for Winter Operations	A	Immediate
LF	4	Upgrade New Dozer	B	Short Term
LF	5	Overhaul Excavator or Replace with Used, or Fit Bucket to CAT D5N	C	Medium Term
LF	6	Provide First Aid and Emergency Supplies at Gatehouse	A	Immediate
LF	7	Relocate Metal Recycling and Wood Pile to Area Near Gatehouse	B	Short Term
LF	8	Establish a Town Policy to Incentivize Taking Clean Soil to the Landfill for Future Cover	C	Medium Term
SPW	1	Pursue a Household Hazardous Waste Collection Event and Electronic Waste Collection with TriCounty Health Department	C	Medium Term
SPW	2	Remove Stockpiled Tires	B	Short Term
SPW	3	Institute Freon Removal from Appliances	C	Medium Term
POR	1	Publish a Handout on Non-Acceptable Waste	B	Short Term
POR	2	Publish a Recycling Directory	B	Short Term
POR	3	Publish Handouts on Waste-Reduction and Backyard Composting	B	Short Term
POR	4	School Curriculum	A	Immediate
RCY	1	Continue and Expand Informal Recycling	C	Medium Term
RCY	2	Contract with New Vendor to Continue Metal Recycling at the Landfill	A	Immediate
RCY	3	Work with the Can-Do Program to Expand Service to Manila	C	Medium Term
RCY	4	Initiate an Aluminum Can Recycling Program	C	Medium Term
WW	1	Cooperative Wood Grinding Program	C	Medium Term
WW	2	Recycling Market Development Zone Using Wood Waste	C	Medium Term

TOWN PRIORITIES

In preparing the levels of priority and the targets for implementation, representatives of the Town stated the following priorities, especially as they pertain to the Manila owned and operated landfill.

Landfill Management

- An Engineered Closure-Post Closure Plan for submission
- Finalizing the Class II permit
- Continuation of operator training
- Submitting a request to DEQ for alternative daily cover during the winter months
- Plan for collecting and diverting household hazardous waste

Public Outreach

- Handouts on waste and mailings
- Recycling directory
- School materials

Waste Diversion

- Selection of a metal vendor
- Explore aluminum recycling
- Explore wood chipping

In Section 4 that follows, Selected Programs and Activities, programs and activities of categories A-C will be presented with implementation steps and schedule.

4

4. RECOMMENDATIONS

BACKGROUND

This final section of the Manila Solid Waste Management Plan recommends programs to maintain and enhance the Manila solid waste program. The last portion of Section 3 identifies the potential programs and actions and the Town of Manila set their priorities. This section lists the programs and actions by the priority for implementation and outlines the steps to accomplish them.

The implementation periods set are Immediate (within six months), Short Term (one to three years), Medium Term (four-nine years), and Long Term (10-20 years). The Town prioritized all the recommendations to be accomplished within nine years, and did not set any for the Long Term period.

The level of priority set for each recommendation ranges as A-Very High Importance, B-Very Importance, and C-Moderate Importance. No recommendations received ratings for D-Slight Importance or E-Not Important. The Town found all recommendations to be of very high to moderate importance (A-C).

IMPLEMENTATION BY PERIOD

IMMEDIATE IMPLEMENTATION (Within Six Months; Spring 2008)

LF-1: Complete the Landfill Facility Permit and Closure/Post Closure Plan
A-Very High Importance
Status: The Class II facilities permit is pending with Utah DEQ. The Town contacted an engineering firm, Sunrise Engineering, for an estimated cost to finish the permit document by preparing the regulatory-required landfill closure and post closure plans in a letter dated August 21, 2007.
Steps:

1. Meet with DEQ to determine whether with the completion of the cell-sequencing plan, operator training, and signage, there are any other outstanding issues except the closure and post closure plan to obtain full landfill compliance and to submit the Class II landfill permit for final approval. Obtain a list and description of outstanding issues from UDEQ.
2. Obtain a cost to complete for the closure and post closure plans, as well as for any other outstanding issues.
3. Review the costs against available funds in this year's budget, and proceed if they are adequate, or budget for the next fiscal year.
4. Complete documents and file for final permit.

LF-3: Apply to DEQ to use alternative daily cover during winter operations
A-Very High Importance
Status: On August 21, 2007, Mayor Dickison sent a letter to Roy Van Os, Department of Environmental Quality, Division of Solid and Hazardous Waste, requesting the use of a tarp to cover the solid waste during the winter months when waste quantities are small and the ground is frozen and snow-covered.

Steps:
1. Follow-up with Mr. Van Os on the status of this request.
2. Write an operational protocol for using the alternative cover.

LF-6: Provide First Aid and Emergency Supplies at Gatehouse and Collection Truck
A-Very High Importance
Status: In 2006-2007, there lacked a supply or water or a first aid kit or eyewash at the gatehouse or in the Town truck. Safety is an important concern with solid waste operations.
Steps:
1. Buy a supply of water for the gatehouse and/or operator's truck
2. Review the current requirements for health and safety with someone with recent training in current regulations (UDEQ or TriCounty Health). Purchase first aid and safety supplies, including such items as fire extinguishers, first aid kit, and portable eyewash for either the gatehouse or Town truck as well as either sharing the supplies for the collection truck or buying a dedicated set.

POR-4: School Curriculum
A-Very High Importance
Status: On August 17, 2007, Mayor Dickison sent a letter to Dr. Bruce Northcott, Superintendent of the Daggett School District, offering to provide material without charge for use in the classroom. These materials include: *Ollie Saves the Planet*, waste reduction education bibliography, the *Planet Protector's Club*, a copy of the lessons prepared for Chaffee County, Colorado.
Steps:
1. If Dr. Northcott approves the materials, deliver them before the grant funding expires on September 30, 2007.
2. Otherwise, purchase and deliver materials for the district, if the time allocated before the grant funding expires is not sufficient for the School District to consider the request.

RCY-2: Contract with new Vendor to Continue Metal Recycling at the Landfill
A-Very High Importance
Status: The prior contract has expired, and the contractor removed the metal recycling bins. Metal is being stockpiled in an area designated for the next phase of landfill operations. The market for metals is strong. Prices for ferrous are high and especially high prices are being paid for aluminum, copper and brass. The waste stream composition estimates 7.5% of material coming into the landfill or about 68 tons per year are metals.
Steps:
1. Follow Town typical purchasing protocol. Vendor procurement usually follows these steps:
2. Make calls to metal buyers like auto wreckers in Vernal and Green River, and Rock Springs and ask if they are interested in receiving an opportunity to bid on buying metals from the Town and to provide hauling.
3. Draft a letter specifying the service requested: provide roll-off bins to landfill, haul an empty out when picking up the full, haul to market. State the frequency with which the bins have filled in the past. Request prices to be paid for different commodities and escalation factors and the price of the haul. (Such as, will Town be paid posted prices or greater because of the preferential terms.) State terms for payment to Town and the nature of the record of materials to be provided. State terms in which Town will pay for haul if the materials do not offset haul. State contract term and cancellation provisions.

Discuss extra services, if necessary, such as moving the metal recycling area to the front of the landfill or brokering aluminum cans.

4. Evaluate responses, call for references and history of business practices, and contract with provisions for rollover renewal if the service is satisfactory.
5. Monitor bins closely for scavenging, as removal of copper, brass, aluminum, and stainless steel material may mean the price paid for the metals will not cover the haul and loan of bins.

SHORT TERM IMPLEMENTATION (One-Three Years; 2008 through 2011)

COL-2 Track Data on Collections to Confirm Waste Projections
B-Very Important
Status: Records are maintained of cash receipts and billed customers, but waste quantities are not tracked from collections and private deliveries. Tracking quantities is very difficult to estimate because of the lack of scale. Waste quantities are key to budgeting and forecasting for the landfill, and for confirming the quantity assumptions in this plan that drove the estimates for landfill life. A logbook will be very useful for monitoring equipment issues and suspicious waste and haulers.
Steps:

1. Create a spreadsheet of weekly solid waste quantities. Create a graph for the year and compare it to future years.
2. Create a form for the landfill personnel to fill out and submit to the office weekly for incorporating data into the spreadsheet.
    a. Measure the height of the waste collected in the truck, and the area of the truck bed filled so that office staff can calculate the cubic yards collected. After this is done a few weeks, work out a system to estimate the waste.
    b. Record number of self haul loads, and estimate waste yardage in the self-haul loads
    c. Estimate metal yardage in self-haul loads
    d. Count the number of tires received
    e. Estimate wood in self-haul loads: treated and untreated
    f. Record number and the yardage of the commercial trucks
    g. Record number and the yardage of roll-off trucks
    h. Offer an "other" category to provide for future adjustments to report form and the spreadsheet record.
3. Buy a bound journal-style book. Have the operators record a log of events for the days they collect waste and the landfill is open that includes weather conditions, unusual events, problems with equipment, unusual loads and efforts to inspect them, addresses for non-compliant loads, and license plate numbers for suspicious vehicles entering the landfill.

LF-2: Continue Regular Operator Training
B-Very Important
Status: The public works director and two operators took part in the SWANA landfill training in fall of 2006, and are registered for fall of 2007 for customer service and waste acceptance. The registration and travel for both these sessions is funded by the grant. All found the 2006 training to be very beneficial with the transition to the area fill method.
Steps:

1. Request that the DEQ Division of Solid and Hazardous Waste keep the Town informed of future scheduled trainings.

2. Budget approximately $300 per year per person for registrations and travel for landfill trainings.

LF-4: Upgrade New Dozer
B-Very Important
Status: The purchase of the new CAT has allowed city forces to take over landfill operations and switch to the area-fill method that allows the approximately 40 years of additional capacity. Continued performance of the CAT dozer is important to future operations. Two upgrades are suggested for optimizing the working life of CAT dozer.
Steps:
1. Install a metal lattice trash rack on top of the CAT D5N Dozer blade for more efficient compaction and retain operator visibility.
2. Install metal plating to protect the radiator from perforation.

LF-7: Relocate Metal Recycling and Wood Pile to the Area Near the Gatehouse
B-Very Important
Status: The metal and wood storage areas occupy land that will be used for landfill operations in the short-term. Relocation will clear the area, and the new location by the gatehouse will provide for improved operator over-site and more convenience.
Steps:
1. After the next wood burn, relocate the signs for wood drop-off to the area near the gatehouse.
2. With the new metals contract, load up the metal pile and haul it off. Locate the roll-off bin(s) from the new metal contractor near the gatehouse. Relocate signs.

SPW-2: Remove Stockpiled Tires
B-Very Important
Status: The tires have been stockpiled since 2002, and are eligible for the State tire program administered through Utah DEQ. Since spring, the Town collects fees for tire disposal to offset removal costs.
Steps:
1. Budget for tire removal (Determine amount of cash on hand required. DEQ pays 60%, Town pays 40%)
2. Contact DEQ for the application form (Wade Hansen is contact in recent listing), DEQ can provide list of approved tire haulers, and approved tire disposal location (probably Holcim Cement Manufacturing, Morgan, UT).
3. Proceed with removal.
4. Continue tire disposal fee.

POR-1: Publish a Handout on Non-Acceptable Wastes
B-Very Important
Status: The Town has posted signs stating wastes not allowed. For customers who are turned away, it is important to have information on what waste is not allowed and alternatives for managing these materials. Providing the information before they try to dispose of them prevents wasted time and embarrassment.
Steps:
1. Working with the TriCounty Health Department and DEQ develop alternatives for the materials not accepted at the landfill.
2. Write a clear description of these materials.
3. Explain how to manage them, and provide addresses, phone numbers, and websites where available.

4. Design a simple to read format and print.
5. Hand out at the landfill, include in the utility bills, and distribute at Town Hall to new customers when they sign up for service.

POR-2: Publish a Recycling Directory
B-Very Important
Status: Research for this Solid Waste Management Plan indicated considerable citizen interest in recycling, but a lack of information on where to take materials, how the materials need to be sorted, and hours of operation.
Steps:
1. Summarize the information collected in Section 2 of this plan.
2. Place calls to update the information.
3. Print a short recycling directory.
4. Hand out at the landfill to people who ask, maintain copies in the Town, County, and Forest Service offices.
5. Mail as a utility bill insert
6. Hand out to new water and solid waste customers when they sign up for service.

POR-3: Publish Hand-Outs on Waste Reduction and Back-Yard Composting
B-Very Important
Status: There are a number of publicly available materials available to guide consumers to discard less waste that advise on shopping choices and reuse. There are also good guides to set up effective backyard composting for yard waste and vegetative food waste. Compost has the additional benefit of lowering the need for water when used in the planting beds and is highly effective adding acid to Utah's alkaline soils.
Steps:
1. Contact USU Extension and research websites for backyard composting. Recycle Utah in Park City has materials prepared they are willing to share, including sale of a backyard unit.
2. Contact the Recycling Coalition of Utah and Utah DEQ to assemble their available materials on waste reduction, and research various websites like National Recycling Coalition, Earth 911, and a web search for "waste reduction." Recycle Utah has materials available on waste reduction.
3. Assemble in a simple format. Research shows positive wording directed toward future behavior to be most effective.
4. Print
5. Make available at the landfill, Town and County offices, and mail as a utility bill insert.
6. Hand out to new water and solid waste customers when they sign up for service.

<u>MEDIUM TERM IMPLEMENTATION</u> (Four To Nine Years; 2011 through 2016)

COL-1: Purchase Used Solid Waste Compaction Vehicle
C-Moderate Importance
Status: Currently the system of throwing bagged garbage on a flatbed truck appears to work adequately. With the growing population and related increased material, the efficiency of a solid waste collection truck will benefit the Town.
Steps:
1. Monitor waste deliveries and the crew's diary regularly to verify that the current system is working, reviewing records every year during budget preparation.

2. Contact equipment dealers in the region and ask to be notified when a truck in good condition is turned in on trade or lease. Request cost range for accruing capital funds.
3. Contact surrounding local governments that collect waste, and asked to be notified when they surplus a truck in good condition.
4. Seek a vehicle with low-use hours, a high level of regular maintenance, and if possible, a warrantee or service contract. Ask communities with similar conditions which makes and models have proven most reliable.

LF-5: Overhaul (or Replace with Reliable Used Model or Dozer Attachment) Landfill Excavator
C-Moderate Importance
Status: The excavator was out of service for a number of days in 2006-2007. The area-fill method requires moving more soil than with trench-fill, and the Dozer is inefficient at excavating and moving soil from one area to another for daily cover.
Steps:
1. Monitor the operator logs regularly and during budget planning for excavator performance.
2. When the excavator proves unreliable, compare costs and benefits of overhaul versus replacement with a used unit.
3. Discuss with the CAT dealer the feasibility of an attachment for the CAT D5N for digging and hauling soil.
4. Budget for the replacement or upgrade and purchase.

LF-8: Establish a Town Policy to Create an Incentive for Bringing Clean (Uncontaminated) Soil to the Landfill
C-Moderate Importance
Status: While there is sufficient soil now for daily cover, the cell-sequencing plan indicates a need for soil in the future.
Steps:
1. Create a Town policy to amass as much clean soil as needed at the landfill.
2. Examples are contracts involving excavation for building public projects, or requirements in building permits
3. Write protocols for managing the soil at the landfill site.

SPW-1: Pursue a Household Hazardous Waste Collection Event and Electronic Waste Collection with the TriCounty Health Department
C-Moderate Importance
Status: There are not appropriate ways to dispose of household hazardous wastes or electronic wastes like televisions and computer monitors. There is neither expertise for conducting a program nor funds available at the Town.
Steps:
1. Discuss with TriCounty Health the feasibility of these programs
2. Participate with the program as resources allow, such as by offering a location and contacting the public through water bill mailers.

SPW-3: Institute Freon Removal from Appliances
C-Moderate Importance
Status: Freon containing appliances are banned from the landfill and the metal recycling program. Freon release is damaging to ozone and illegal.
Steps:

1. Contact Utah DEQ, Jeff Emmons, and determine if training for removing Freon is planned.
2. If no training available, or the Town prefers to privatize, contract with a remover and advertise for the days the removal service is available, such as during the community clean up.

RCY-1: Continue and Expand Informal Recycling
C-Moderate Importance
Status: During 2007, the County and the Forest Service organized an informal recycling program and haul the materials to Green River.
Steps:
1. Meet with the organizers, and determine how the program can continue and grow.
2. A possible step is to organize an email network to notify the parties of trips anyone makes to Green River or Vernal for supplies, where the truck could carry recyclables over on the way to pick up goods.
3. The Town office begins participating in the recycling program.
4. The Town promotes participation to other offices.

RCY-3: Work with the Can-Do Program
C-Moderate Importance
Status: The Can-Do Program is reorganizing in the Vernal area and is a potential partnership opportunity for recycling in Manila.
Steps:
1. Organize a meeting with the Can-Do Program director and other potentially interested parties, like the Daggett School District, since the program is based in the schools and serves the educational needs of the developmentally disabled. Include the Forest Service and Daggett County.
2. Evaluate the interest in the program, the commitment required to participate and the benefits.

RCY-4: Initiate an Aluminum Can Recycling Program
C-Moderate Importance
Status: Aluminum cans are being recycled informally. Other programs show that revenues can offset program costs of hauling to market.
Steps:
1. Call for a meeting with non-profit groups, including the schools to determine interest in sponsoring the program.
2. Contact the Recycling Coalition of Utah to see if any recent grants have been announced to fund aluminum recycling. Contact Anheuser-Busch Recycling Corporation to determine if there is interest in organizing and publicizing a summer collection program, as they did for Lake Powell. [Note they will only organize events if there is an ongoing recycling program.]
3. Review the markets for aluminum cans and current revenues by calling metal brokers.
4. Consider the community interest and available resources for purchasing locking receptacles, providing public education, picking up the aluminum, storing the aluminum, and getting the cans to market either as a haul to Wyoming or Vernal as part of other trips, or as part of the Town's metal contract. Make a program decision.
5. If program is started, obtain copies through the U.S. Conference of Mayors of the Cans for Cash program, a City recycling challenge and enter contest. (Awards are in the range of $5,000. There is a category for rural communities.)

WW-1: Cooperative Wood Grinding Program
C-Moderate Importance
Status: Untreated wood is now burned. The Forest Service may have interest in a cooperative program for chipping. The landfill can use treated wood chips and surplus untreated wood chips that are not otherwise purchased or used for landscape as cover material. Based on standard waste stream composition, wood is about 6%, or 51-52 tons per year at the landfill, plus other sources from the Forest Service.
Steps:
1. Meet with the Forest Service and County to determine whether there is interest in establishing a cooperative wood-grinding program. As there is limited space at the landfill, discuss with the Forest Service allowing use of the acreage adjacent to the landfill.
2. Enter into an interagency agreement for purchase and operation.
3. Measure and record the dimensions of the wood pieces entering the landfill and the wood the Forest Service intends to chip for best sizing the chipper.
4. If dimensions allow, consider a mobile chipper that can go to locations and haul the chips back to the landfill for storage.
5. Buy wood chipper.
6. Plan for water on site to control fires, such as a water truck.
7. Review pricing for resale of wood chips in Salt Lake Valley, Logan, and South Utah County, and sell chips to the public as a program cost offset.

WW-2: Recycling Market Development Zone Using Wood Waste
C-Moderate Importance
Status: The Market Development Zone is contingent on an ongoing diversion program. This recommendation is only applicable if the wood waste grinding program is actualized. The Market Development Zone rewards new businesses that locate in a community and utilize recovered materials.
Steps:
1. Contact the Governor's Office of Economic Development Department (currently the contact is Les Prall) for an application for a Utah Recycling Market Development Zone designation and technical assistance.
2. Determine incentive that the Town is willing to provide for bringing in businesses that would use the wood chips in a commercial application.
3. Comply with the application requirements: incentive, program summary, statement of elected official support, and a recycling market development plan.

SUMMARY

POTENTIAL ACCOMPLISHMENTS THROUGH IMPLEMENTING RECOMMENDATIONS

With the implementation of the above recommendations, the Town of Manila should realize a number of benefits.
Administration:
- Better data tracking will allow for improved management of collections and landfilling by spotting trends and problems earlier. This is easily accomplished through weekly reporting and assembling the data in the office and comparing data.
- An operator's diary will track equipment performance, unusual events and weather, and suspicious loads. It will be useful for planning for equipment and staffing changes.

Collection:

- As the Town grows, a garbage collection truck will be easier physically for the operators to collect waste, take less time, and will compact the garbage, providing for better compaction at the landfill to preserve landfill life.

Landfill:

- The signage should improve smooth operations at the landfill by better directing customers and should reduce the amount of illegal material entering the landfill.
- The operator training improves customer communications, identifying problem materials, and better use of the equipment for covering the wastes.
- The cell-sequencing plan and move to area fill significantly expands the capacity and years of life in the landfill to approximately 50 years. Measures such as alternative daily cover for winter, reliable equipment and stockpiling more cover through an incentive for clean dirt and the use of wood chips will help realize this potential capacity.

Special Wastes:

- Improving special waste management like a household hazardous waste program or electronics round up will keep materials dangerous to the environment and personnel out of the waste stream.
- Freon removal will allow more metals to be recycled and properly contain an ozone-damaging compound.
- Removing the stockpiled tires reduces the chances of a noxious tire fire. Tires also attract animals and pooled water can breed mosquitoes.

Public Outreach and Education:

- A handout on waste banned from the landfill will reduce the amount of materials entering the collection stream and the landfill for safer and environmentally sound management, and provide good local alternatives.
- The recycling and waste reduction guides will be a useful local resource for the number of citizens and businesses who wish to take positive environmental actions to save materials, energy, carbon footprint, and landfill capacity.
- The school materials will involve children in better understanding waste systems so that they will be better citizen decision-makers on these issues, and build a bridge to the school system, which is a large waste generator and a potential partner for future programs.

Recycling and Wood Waste Recovery:

- There is an opportunity to significantly reduce the waste stream through recycling and wood waste recovery in a range of 15-20% without significant financial investment. A 20% reduction can extend the life of the landfill as much as 10 years. Estimates for available material in the waste stream are wood waste are 6%, metals 8%, paper 34%, and plastics 12%. Both the informal recycling program and partnering with the Can-Do program are good recycling opportunities given the limitations like the rural area and remoteness from markets.
- Because of the high number of tourist visits and their high generation of beverage containers, aluminum can recycling may be a positive way to earn revenues through recycling.
- If the wood waste chipping partnership proves feasible, the Recycling Market Development Zone may result in new businesses and jobs for the area.

FUTURE PLANNING AND MONITORING

Solid waste management is a dynamic field with continuing changes in technologies, regulations, and the materials that find their way to the waste stream. It is important to monitor the activities

in the solid waste program and the planning environment for changes, and maintain close relationships with local regulators and professional groups that watch trends, legislation and regulations. Two areas are flagged as especially important for monitoring. Plan review and updates are addressed.

Carbon Credits & Stricter Methane Standards

Because landfills are stationery sources for emissions and landfills generate methane as waste decomposes, it is highly possible there will be new green house gas reduction rules that affect landfills. Gas control presents opportunities for revenues through carbon exchange, but at this point in time, landfill owners must put the control systems in place before regulations require them in order to qualify for financial offsets through carbon exchange markets. This is very important to monitor.

Construction and Demolition Debris

Given western trends, the Town of Manila may experience far more growth in the future because of retirees and second residences than currently projected by the Governor's Office of Planning and Budget. As other Utah communities have experienced, growth results in more building debris at the landfill. Often this debris is bulky and takes more landfill space by weight than household garbage. Monitoring building permits and deliveries of roll-off bins will help the Town anticipate the potential of more rapidly using up landfill space than projected in this plan. Should development reach high levels (above 4 or 5%), the Town is advised to amend this plan with recommendations for construction and demolition debris management.

Plan Updates

It is recommended that the Town of Manila review this plan at least annually during budget planning, and prepare an update revision in five years (2012) and a new plan in ten years (2017).

RECEIVED
APR 30 2008
UTAH DIVISION OF
SOLID & HAZARDOUS WASTE
08.01486

SUNRISE ENGINEERING

Letter of Transmittal

To: Dennis R. Downs, Division of Solid and Hazardous Waste

CC:

From: Aaron Jones

Date: 4/29/2008

Re: Manila Landfill Closure Plan

Copies	Purpose of Sending		Action to be Taken
1	For your review	☐	Please Return by: At your earliest convenience
	For distribution:	☐	Please distribute by: [Insert Date]
	For your files	☐	No further action necessary

Mr. Downs,

This letter accompanies the closure plan document, which includes the Closure Plan, the Post-Closure Plan, and the Quality Assurance Plan. Also attached are the Inspection form, and the Plan Set Drawings (4 sheets), which are referred to in the document. These documents are being submitted as part of the Manila Landfill permit.

Please call me with any questions or comments at the number listed below.

Thank you,

Aaron K. Jones

Aaron Jones, P.E.

12227 SOUTH BUSINESS PARK DR, STE 220 • DRAPER, UTAH 84020 • TEL 801.523.0100 • 888.523.2221 • FAX 801.523.0990 *www.sunrise-eng.com*

SUNRISE ENGINEERING

CLOSURE, POST-CLOSURE, AND QUALITY ASSURANCE PLAN

FOR

THE MANILA LANDFILL

Project No. 02793
April, 2008

Prepared for:

The City of Manila
Manila, Utah 84046

Prepared by:

SUNRISE ENGINEERING, INC.
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REGISTERED PROFESSIONAL ENGINEER
5048468-2202
AARON KEVIN JONES
4-29-08
STATE OF UTAH

Aaron K. Jones, P.E.
State of Utah, No. 5048468

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1.0 INTRODUCTION

1.1 General Information

This report, the landfill Closure, Post-Closure, and Quality Assurance Plan shall be kept at the Manila Town Hall and followed throughout the closure and post-closure periods. Upon approval by the Executive Secretary of the Solid and Hazardous Waste Control Board (Executive Secretary), this report will be considered part of the permit.

The Manila Landfill has been given a Class II designation. As part of this designation, the landfill is exempt from certain restrictions. These exemptions include the liner, leachate collection system, and groundwater monitoring requirements. In order to receive the Class II designation, a landfill must:

1. Have no sign of groundwater contamination.
2. Serve a community with no practicable alternative.
3. Receive less than 25 inches of annual precipitation.
4. Receive less than 20 tons of waste per day.
5. Meet other rules applicable to Class II landfills in UAC sections R315-301 to -320.

The Town of Manila Solid Waste Management Plan estimates that the service life of the current landfill site is adequate for a 50-year planning period. The landfill is being operated in cells using the area-fill method in order to prolong its useful life.

Procedures for the closure plan are described in the Quality Assurance Plan, including third-party testing and quality control.

Post-Closure activities shall end at the approval by the Executive Secretary.

2.0 CLOSURE PLAN

2.1 FINANCIAL ASSURANCE

The financial assurance requirement, as it relates to the closure and post-closure plans, has not been performed by Sunrise and is not included in this portion of the closure plan.

2.2 CLOSURE STRATEGY

Closure Operations at the Manila Landfill site will be performed on an ongoing basis. The landfill as it exists today has enough capacity to operate for many years. A final closing date cannot be determined at this time. Ongoing closure operations will generally be performed from April through November, the normal frost free construction period, or as weather permits. No area larger than 2 acres that has achieved final elevation will remain open longer than 6 months.

2.2.1 Closure Timetable

The Utah Administrative Code outlines the time table in the landfill closure process. The Executive Secretary of the Solid and Hazardous Waste Control Board shall be notified, in writing, at least 60 days prior to the last acceptance of waste, that the landfill is approaching closure. The closure process will start within 30 days after the last acceptance of waste, and shall be completed within, and no longer than, 180 days from its commencement. Within 90 days of the completion of the closure process, the owner shall submit to the Executive Secretary four items. These four items are:

1. Design drawings of the final site grading stamped and signed by a professional engineer registered in the state of Utah.
2. Second, As-Built drawings, stamped and signed by a professional engineer registered in the state of Utah.
3. Certification by the owner or operator that the site has been closed according to the approved Closure Plan.
4. Fourth, certification by a professional engineer registered in the state of Utah that the site has been closed in accordance with the approved Closure Plan, and the Quality Assurance Plan.

Any modification to this timeline must be approved by the Executive Secretary. These deadlines are summarized in the chart below.

Table 2.1

Deadline	Description
By 60 days prior to Last Acceptance	Notify Executive Secretary[1]
By 30 days after Last Acceptance	Start Closure Process
By 180 days from Process Start	Complete Closure Process
By 90 days from Process Completion	Notify Executive Secretary[1,2]

[1] Notification is to be submitted in writing.

[2] Design and As-Built drawings, and both certifications shall also be submitted.

The Landfill will be closed in two portions, Phase 1 and Phase 2. The Executive Secretary will be notified of closure progress by reviewing the annual reports, and by Division of Solid and Hazardous Waste inspectors who have visited the site.

2.2.2 Inspections

The landfill owner shall allow the Executive Secretary of the Utah Solid and Hazardous Waste Control Board or an authorized representative, including representatives from the Tri-County Health Department, upon representation of credentials, to enter during operating hours and/or inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under this permit. A copy of the record of the inspection shall be made by reasonable means, and shall be provided to the owner or the operator.

2.2.3 Quantity of Waste

According to the Town of Manila Solid Waste Management Plan (Section 2, page 7), the landfill accepts waste on a volume basis. The landfill had accepted approximately 3,500 cubic yards in 2004, or approximately 525 tons. On page 15 in Section 2 of the Plan, the amount of waste to be accepted in 2007 is 900 tons, and future projections were based on this number.

The total quantity of waste to be deposited at this site can be estimated from the Final Grading Plan (**Appendix A**). Phase 1 of the landfill, as shown, contains approximately 210,000 cubic yards of volume below the 2' thick final cover. Phase 2 consists of about 81,000 cubic yards. The total volume, as depicted in the drawings, is approximately 291,000 cubic yards. The tonnage represented by this number depends on the average density of the landfill. At 0.45 tons (900 lbs) per cubic yard, the site has a capacity of approximately 130,000 tons.

2.3 Final Cover and Vegetation

Closure operations will consist of leveling, contouring, placement of appropriate covers and seeding as necessary to reduce infiltration and preserve the integrity of the completed areas of the landfill. Areas of the landfill reaching final elevation will be closed within 180 days. Intermediate cover shall be used to reduce infiltration and ponding. Top surface slopes are to be graded at no less than 2%, and side surface slopes are to be graded at no more than 33%. Excess material not meeting permeability requirements may be stripped and utilized in other operations or left in place. After grading operations promoting drainage are complete, a geosynthetic clay liner or 18 inches of compacted material with a permeability of 1×10^{-5} cm/sec or less will be installed. Alternate designs meeting the performance standard of impermeable material may be used if approved by the Executive Secretary prior to placement. **Appendix A** shows final site work for the landfill, including contours and details. As depicted, the total area requiring the final cover is approximately 12 acres. The volume of clay is nearly 30,000 cubic yards. The volume of topsoil is approximately 10,000 cubic yards. Upon completion of the impermeable cover, 6" of native material similar to existing topsoil will be placed and seeded. The seed mixture shall be developed after consultation with local range specialists and verifying

availability of local seed markets. Recently closed sections of the landfill will be evaluated as part of the quarterly inspection process during the first year and then placed on post-closure status.

2.3.1 Run-On and Run-Off

No active or technical devices are proposed to control run-on and runoff systems at the Manila Landfill. No surface waters exist in close proximity to the landfill. Run on is anticipated to be minimal due to the natural topography of the landfill site. Native soils, regional hydrology, and topography at the site minimize the run-on of all surface waters resulting from a minimum flow of a 25 year storm into the active area of the landfill. Best management practices will be implemented to minimize infiltration and assure the integrity of the run-on/run-off system. Evaluation of the system will be made during the quarterly and annual inspections. Corrective measures, if any, will be implemented. Run-on and run-off from events smaller than the 25-year storm will be controlled.

2.3.2 Verification

Verification of thicknesses, permeability, elevations, slopes, compaction, and other requirements shall be completed by third-party as set forth in the Quality Assurance Plan. **Appendix A** is the plan set. Included in these drawings are the final grading plan and the associated details.

2.4 Environmental Control Systems

The State of Utah recognizes the Manila Landfill as a Class II landfill, and as such, it is exempt from liner, leachate collection system, and groundwater monitoring requirements. The landfill receives less than 20 tons of waste per day, the annual precipitation is less than 25 inches per year, and there is currently no sign of groundwater contamination.

Due to the arid nature of the climate at the Manila Landfill and the nature of waste accepted at the facility, landfill gas concentrations are not anticipated to reach significant levels. The Executive Secretary is requested to waive requirements to monitor landfill gas. Monitoring requirements inside buildings will be met by installing methane detectors in any building on the site.

The waiver is justified because characteristics at the landfill prohibit the generation of landfill gases in amounts that pose a threat to human health or the environment. As described above, the climate at the landfill is extremely arid. The largest storm events occur in the form of thunder showers, which result in a significant amount of the moisture running off the site prior to contacting the waste. These climatic conditions, coupled with relatively dry waste and soils which help absorb moisture, eliminate the production of significant amounts of landfill gases.

2.5 Closure Procedures and Record Keeping

All records of the Manila Landfill shall be kept and maintained at the Manila Town Hall. These records will include inspection reports, annual reports, design drawings, as-built drawings, what maintenance has been performed, and what repairs have been made.

Upon approval of the Closure Plan by the Executive Secretary, it shall be included as part of the permit. Any modification to the Closure Plan shall be only by the approval of the Executive Secretary.

Closure costs are estimated in **Tables 2.2**, **2.3**, and **2.4** below. These numbers are based on a full, one-time closure of the completed area indicated, and assume no previous closure work has been completed.

Table 2.2

Phase 1 Closure Costs				
	Quantity	Unit	Cost per Unit	Cost
Final Cover	21,000	CY	$2.00	$42,000
Final Grading	8.6	AC	$500	$4,300
Topsoil	7,000	CY	$1.50	$10,500
Revegetation	8.6	AC	$1,000	$8,600

TOTAL: $65,400

Table 2.3

Phase 2 Closure Costs				
	Quantity	Unit	Cost per Unit	Cost
Final Cover	9,000	CY	$2.00	$18,000
Final Grading	3.7	AC	$500	$1,850
Topsoil	3,000	CY	$1.50	$4,500
Revegetation	3.7	AC	$1,000	$3,700

TOTAL: $28,050

Table 2.4

Total Closure Costs				
	Quantity	Unit	Cost per Unit	Cost
Final Cover	30,000	CY	$2.00	$60,000
Final Grading	12.2	AC	$500	$6,100
Topsoil	10,000	CY	$1.50	$15,000
Revegetation	12.2	AC	$1,000	$12,200

TOTAL: $93,300

An annual report will be generated and placed in the facility operating record, and a copy of the report shall be submitted to the Executive Secretary. This report is due by March 1st for the previous complete calendar or fiscal year. Included in the report shall be:

1. Name and location of the facility.
2. Calendar year covered by the report.
3. Amount of waste received, in tons. (For no weight scale, See **Table 2.5**)
4. Financial assurance update
5. All ground water monitoring, and gas monitoring results.
6. Training programs or procedures completed.

Table 2.5

Non-Weighted Conversion Factors (tons per cubic yard)	
Municipal Solid Waste	
Uncompacted	0.15
Compacted	0.3
Construction/Demolition Waste	0.5
Municipal Incinerator Ash	0.75
Other Ash	1.1
Pick-up truck/trailer	0.25[1]
Industrial Waste	*

* - Owner-developed factor.
1 - Tons per vehicle.

3.0 POST CLOSURE PLAN

3.1 POST-CLOSURE STRATEGY

Post-closure activities will continue for 30 years, or until the site becomes stabilized, as determined by the Executive Secretary. These post-closure activities shall be provided by the owner or operator of the landfill. The activities are to include monitoring, maintenance, repairs, and periodic inspections. Items to be included in these activities include gas monitoring and the status of the final cover.

3.2 POST-CLOSURE INSPECTIONS AND MAINTENANCE

As a Class II landfill, this facility is exempt from leachate and groundwater monitoring requirements. Gas monitoring of the landfill may be required by the Executive Secretary.

3.2.1 Inspections

Regular inspections are to be performed quarterly by landfill personnel, as indicated in the Quality Assurance Plan.

The landfill owner shall allow the Executive Secretary of the Utah Solid and Hazardous Waste Control Board or an authorized representative, including representatives from the Tri-County Health Department, upon representation of credentials, to enter during operating hours and/or inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under this permit. A copy of the record of the inspection shall be made by reasonable means, and shall be provided to the owner or the operator.

3.2.2 Run-On and Run-Off

No active or technical devices are proposed to control run-on and runoff systems at the Manila Landfill. No surface waters exist in close proximity to the landfill. Run-on is anticipated to be minimal due to the topography of the landfill site. Native soils, regional hydrology, and topography near at the site minimize the run-on of all surface waters resulting from a minimum flow of a 25 year storm into the active area of the landfill. Best management practices will be implemented to minimize infiltration and assure the integrity of the run-on/run-off system. Run-on and run-off from events smaller than the 25-year storm will be controlled.

Monitoring will be limited to identifying situations which promote infiltration. Evaluation of the system will be made during the quarterly and annual inspections by landfill personnel, and corrective measures, if any, will be implemented. Erosion channels deeper than 10% of the total final cover thickness shall be repaired as soon as possible after discovery.

3.2.3 Gas Monitoring

The performance of gas monitoring of the actual landfill shall be at the discretion of the Executive Secretary. Notwithstanding, gas monitoring in all on-site buildings shall be conducted continually by use of methane detectors in each structure which measures the concentration.

3.3 Post-Closure Land Use

Plats and a statement of fact concerning the location of any disposal site for the landfill will be recorded as part of the record of title with the county recorder no more than 60 days after the certification of closure. The landfill owner will comply with additional requirements established by the local zoning authority.

The property will continue to be fenced and will not be actively used after closure. The area will be returned to a natural setting, planted to native vegetation similar to the surrounding environment. Perimeter fencing will remain to discourage the use of the area and disruption of the final cap.

3.4 Record Keeping and Reporting Procedures

The contact person is:
Mayor, Town of Manila
1st East Highway 43
Manila, Utah 84046
(435) 784-3143

End of post closure documentation will be included in the records.

Table 3.1

Post Closure Costs				
	Quantity	Unit	Cost per Unit	Cost
Inspection/Reporting	240	HRS	$75.00	$18,000
Final Cover Repair	80	HRS	$100.00	$8,000
Vegetation Repair	1	EA	$6,000.00	$6,000
			TOTAL:	$32,000

3.5 End of Post-Closure Procedures

At the end of the post-closure period, as determined by the Executive Secretary, the owner or operator shall submit to the Executive Secretary a certification stating why the post-closure activities are no longer needed. This certification shall be signed by both the owner and a

professional engineer registered in the state of Utah. The Executive Secretary may then authorize the termination of part or all of the post-closure activities.

4.0 QUALITY ASSURANCE PLAN

4.1 TESTING AT CLOSURE

The contact person is:
Mayor, Town of Manila
1st East Highway 43
Manila, Utah 84046
(435) 784-3143

4.1.1 Permeability

Permeability testing, where required, shall be performed at the rate of one test per 3000 cubic yards, with the locations being randomly selected throughout the working area. Permeability tests may include in-field or laboratory tests, nuclear density extrapolations, or other industry wide procedures and practices. The permeability requirement is $1x10^{-5}$ cm/sec or less.

4.1.2 Density

Density testing shall be performed on the 18" clay liner at a rate of one test per 3000 square feet, with the location of the test being randomly selected. Required density is 90% of the modified proctor.

4.1.3 Depth

Depth tests for the 18" clay liner will utilize standard cross section survey methods and will be performed at a rate equal to or greater than tests performed for permeability.

Depth gauges shall be used for the topsoil layer and shall be lengths of 6" PVC pipe placed at 20' intervals, center to center. These pipes are to be placed on the top of the 18" clay liner, and within the 6" topsoil layer. The depth of the topsoil layer shall be verified by visual inspection of these pipes.

4.2 MONITORING

The landfill site shall be monitored on a quarterly basis throughout the post-closure period. Items to be monitored include gas, soil, vegetation, infiltration, settlement, erosion, fencing, and gates. Problems shall be identified and resolutions proposed, and submitted to Executive Secretary. Appendix B is the inspection form to be completed.

4.2.1 Erosion

The landfill shall be visually inspected for signs of erosion. Erosion channels deeper than 10% of the total final cover thickness shall be repaired as soon as possible after discovery.

REFERENCES

Town of Manila, Utah, Solid Waste Management Plan. 2007. AZA Planning and Public Involvement.

Utah Annotated Code. February 1, 2007. State of Utah.

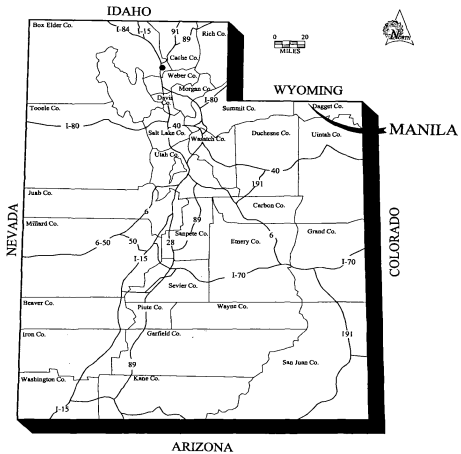
Utah Division of Solid and Hazardous Waste website:
www.hazardouswaste.utah.gov/SWBranch/SWSection/PermittedSolidWasteLandfills.htm

APPENDIX A

Plan Set

MANILA LANDFILL CLOSURE PLAN
2008

AREA MAP



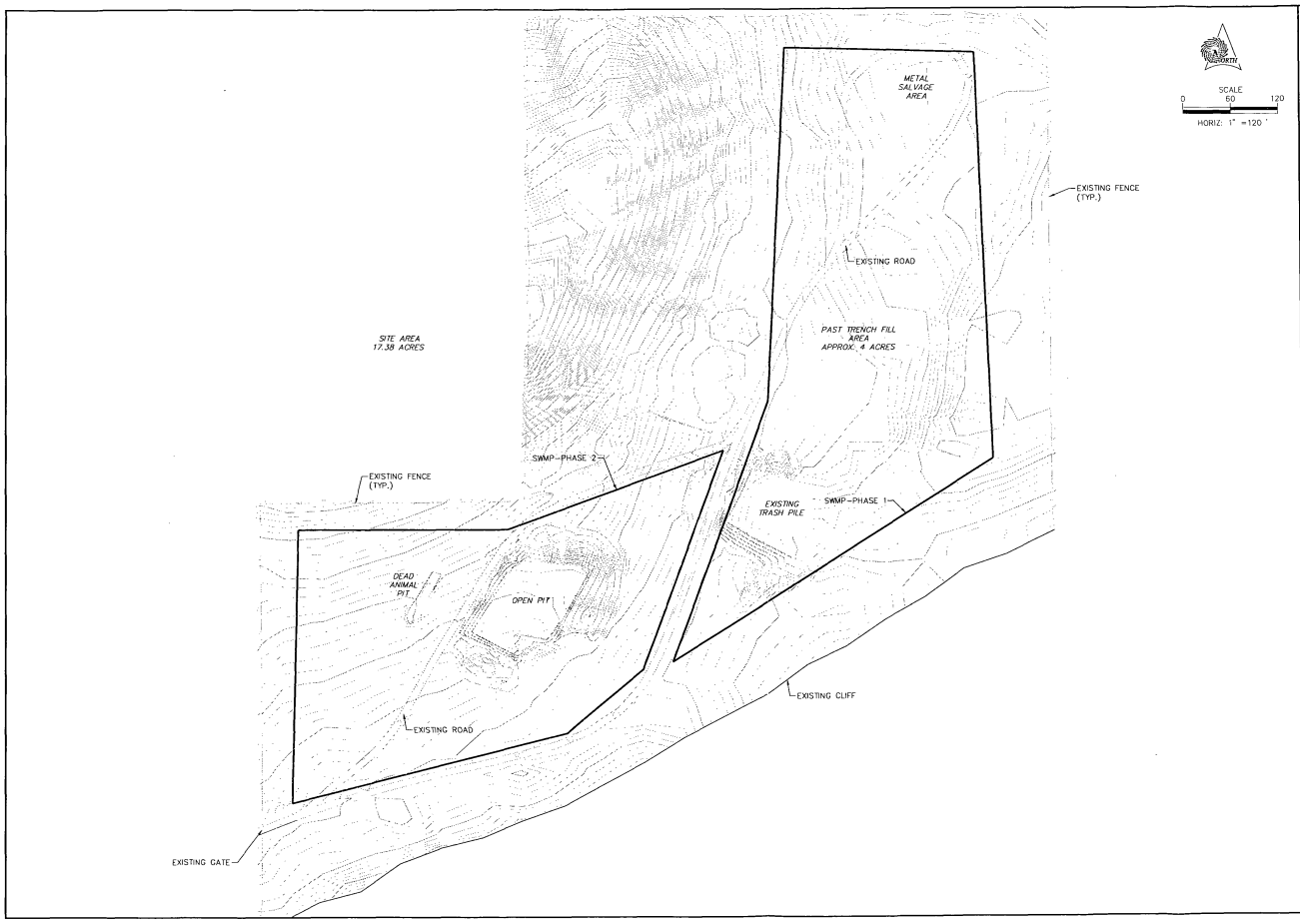
LOCATION MAP

SHEET INDEX

DESCRIPTION	DWG NO.	SHEET NO.
COVER SHEET	C-01	1
EXISTING SITE	S-01	2
GRADING PLAN	S-02	3
DETAILS	T-01	4

REGISTERED PROFESSIONAL ENGINEER
5048468-2202
AARON KEVIN
JONES
4-29-08
STATE OF UTAH

SUNRISE ENGINEERING
12227 S. BUSINESS PARK DRIVE, SUITE 220
DRAPER, UT 84020
TEL 801.523.0100 · FAX 801.523.0990
www.sunrise-eng.com



REGISTERED PROFESSIONAL ENGINEER
5048468-2202
AARON KEVIN JONES
4-29-08
STATE OF UTAH

REV NO.	COMMENT	DATE

SUNRISE ENGINEERING
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DRAPER, UTAH 84020
TEL 801.523.0100 · FAX 801.523.0990
www.sunrise-eng.com

MANILA

LANDFILL CLOSURE PLAN
SITE PLAN
EXISTING SITE

SET NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
02943	AKJ	AKJ	KMB	2 of 4	S-01

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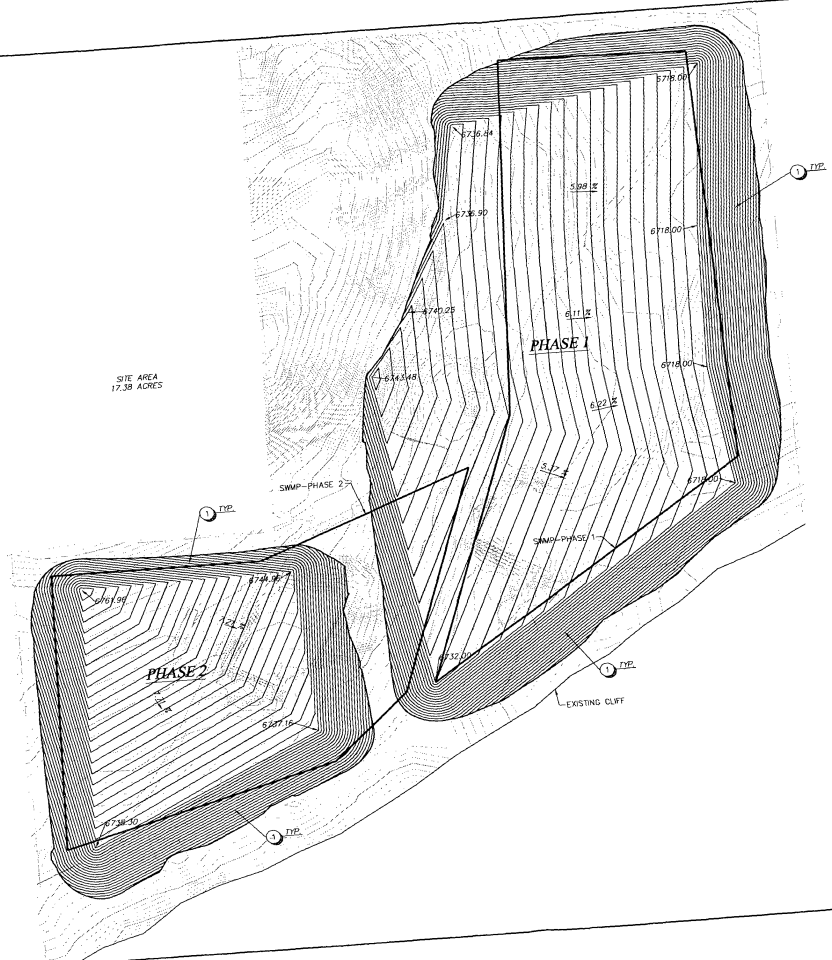

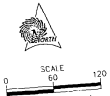

1 CONTRUCT 30% SIDE SLOPE.

REGISTERED PROFESSIONAL ENGINEER
5048468-2202
AARON KEVIN JONES
4-24-08
STATE OF UTAH

NOTES:

1. "SWMP" REFERS TO THE SOLID WASTE MANAGEMENT PLAN, 2007.
2. SEE SHEET T-01 FOR DETAILS.

REV NO	COMMENT	DATE

SUNRISE ENGINEERING
12227 SOUTH BUSINESS PARK DRIVE, SUITE 220
DRAPER, UTAH 84020
TEL 801.523.0100 · FAX 801.523.0990
www.sunrise-eng.com

MANILA
LANDFILL CLOSURE PLAN
SITE PLAN
FINAL GRADING

JOB NO	DESIGNED	DRAWN	CHECKED	SHEET NO	
02943	AKJ	AKJ	KWB	3 of 4	S-02

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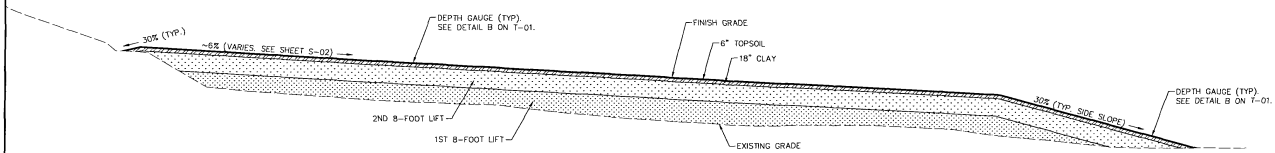
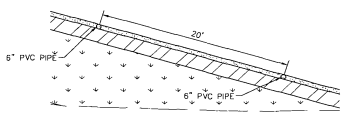


A T-01 **TYPICAL SECTION**
NOT TO SCALE



B T-01 **SECTION-DEPTH GAUGES (TYP.)**
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
5048468-2202
AARON KEVIN
JONES
4-29-08
STATE OF UTAH

REV NO.	COMMENT	DATE

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MANILA

LANDFILL CLOSURE PLAN
TYPICAL DETAILS

JOB NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	T-01
02943	AKJ	AKJ	KWB	4 of 4	

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APPENDIX B

Inspection Form

MUNICIPAL SOLID WASTE LANDFILL
POST-CLOSURE INSPECTION FORM

Facility Coordinator: _____ Phone: _____

Inspector: _____ Date: _____ Time: _____

Weather Conditions: _____

Landfill Cell Status: Active ____ Closed ____ Photographs: Yes _____ No _____ Attached _____

Location or Cell #: _____

Drawing/Schematic of Landfill Cell or Facility:

GENERAL OBSERVATIONS/ RECOMMENDED COURSE OF ACTION:

_____
_____
_____
_____
_____
_____
_____
_____

OVERALL CAP INTEGRITY:

Complete the following checklist. If the answer is yes to any of the items, please provide an explanation, photograph and identify item location on the drawing/schematic of landfill cell.

A. Erosion (gullies or washouts) on the cap: YES _____ NO _____ Depth/Length _____

B. Sloughing of embankments: YES _____ NO _____ Est. of Area _____

C. Sparsely vegetated areas or stressed vegetation: YES _____ NO _____ Est. of Area _____

D. Subsidence, depressions or settlement of soil: YES _____ NO _____ Est. of Area _____

E. Cracks in cover cap: YES _____ NO _____ Depth/Length _____

F. Damage to cap due to wildlife: YES _____ NO _____ Type _____

G. Growth of woody vegetation on cap: YES _____ NO _____ Type _____

H. Non-landfill related use of the cap? YES _____ NO _____ Type _____

EXPLANATION/COMMENTS:

_____

_____

_____

_____

GROUNDWATER MONITORING:

Is monitoring of groundwater required? YES ____ NO ____

Any evidence of potential groundwater contamination? YES ____ NO ____ If yes, explain.

_____

_____

Monitoring Testing Results completed: YES _____ NO_____ Attached: _____

_____

_____

LANDFILL GAS MONITORING:

Is monitoring of gas required? YES ____ NO ____

Evidence of methane odors at/or around this landfill cell or facility? YES ____ NO _____ If yes, explain.

_____

_____

_____

Concentration Level: _____ Location of Source _____

LEACHATE MANAGEMENT:

Are there any leachate breakouts on the side slopes or at the toe of the landfill, noticeable seeps, ponded or discolored water, or any areas of concern? YES _____ NO _____ If yes, explain.

_____

_____

_____

STORM WATER MANAGEMENT:

Are swales, culverts and catch basins free of leaves and other debris? YES _____ NO _____

Do all swales and culverts have positive slope? YES _____ NO _____

Is there erosion within swales? YES _____ NO _____

Are there areas of ponding on the landfill or at the toe? YES _____ NO _____

Has there been any storm water damage at the facility? YES _____ NO _____

Provide explanation of all observed problems:

_____

_____

_____

_____

OTHER:

Is the public access control adequate? YES _____ NO _____

Any vandalism noted, what type, location? YES _____ NO _____

Are there any holes or damaged fence? YES _____ NO _____

Is maintenance access in good condition? YES _____ NO _____

Has the cap vegetation been mowed? YES _____ NO _____
Date (if known) was last mowed (mo./yr.): _____/_____

Provide explanation of all observed problems:

_____

_____

_____

_____