APPENDIX J
PRELIMINARY SURFACE WATER CALCULATIONS

Subject	Jungo Landfill	Made by	PM	Job	063-7079300
25-Year 24hr Retention		Checked by		Date	4/2/09
Hydrologic & Hydraulics		Approved by		Sheet	1 of 2

OBJECTIVE:

Retention basins and perimeter channels for the proposed Jungo Landfill are required to retain the 24-hour 25-year storm event. All runoff from the drainage configuration shall be routed to the proposed retention basin located on the southwest section of the proposed landfill and the perimeter channel. The perimeter channel shall also serve to provide retention capacity.

METHOD:

The 24-hour rainfall event for the 25-Year storm event was used for evaluating the volume required to retain the 25-year storm on-site in a proposed retention basin. The 24-hour precipitations for the 25-year and 100-year storm events were derived from the Point Precipitation Frequency Estimates from NOAA Atlas 14 (Reference Attachment). The surface water parameters as described below were used to model the proposed Jungo Landfill. Attachment A presents the watershed delineation map for sub-basins used for the HEC-HMS modeling program. Basin areas and curve numbers (CNs) were entered into HEC-HMS modeling software (USACE) and routed to calculate the volumes

ASSUMPTIONS:

- The 24-hour rainfall event for the 25-year storm equals 1.62 inches. Ref. Attachment A.
- SCS Type II rainfall synthetic distribution.
- Landfill final cover SCS Curve Numbers (CN):

Location	Soil Type	Hydrologic Soil Group	Assumed Cover	SCS CN
Landfill Final Cover	Silty Sand	C	Herbaceous: fair cover	81

- Run-off from active operations will be directed to interior basins that will be pumped and discharged to a lined basin for temporary storage.
- Run-off from inactive areas will be directed to perimeter ditch that will discharge water to SW unlined basin. The perimeter ditch will also serve to store run-off.

CALCULATIONS:

The HEC-HMS modeling software (USACE) was used to calculate the proposed 25-year volume at the proposed retention pond and 100-year peak flows at design points. The calculated run-off for the proposed 640-acre (1 square mile) site for final build-out (plus RR yard area) is 0.38 inches for the 25-year 24-hour storm. The volume of stormwater from 0.38-inches over the site conveyed to the proposed retention basin is 20.20 acre-feet.

The capacity of the basins and perimeter trench are as follows:

- Unlined Basin w/ one foot of freeboard: 6.8 ac-ft
- Unlined Basin with no freeboard: 7.6 ac-ft
- Perimeter Ditch w/ one foot of freeboard: 37.5 ac-ft
- Perimeter Ditch w/ one foot of freeboard: 54.2 ac-ft
- Lined Basin with w/two foot of freeboard: 6.3 ac-ft

Combined perimeter ditch and unlined basin with one foot of freeboard is 44 ac-ft (more than 2 time the run-off from 25-yr storm).

Assuming similar percent of run-off for operational conditions, the lined basin can accommodate storm-water run-off from 200-acre area under 25-year storm event (6.3 ac-feet/(0.38in/12in/ft)). Maximum operational run-off directed to the basin is expected to be only approximately 87 acres – see attached development plan at end of year 50 as an example.

CONCLUSIONS/RESULTS:

The proposed basins have sufficient capacity to accommodate two 25-yr, 24-hour storms back-to-back without discharging. This applies to the run-on/run-off control basin and unlined basin.

REFERENCES:

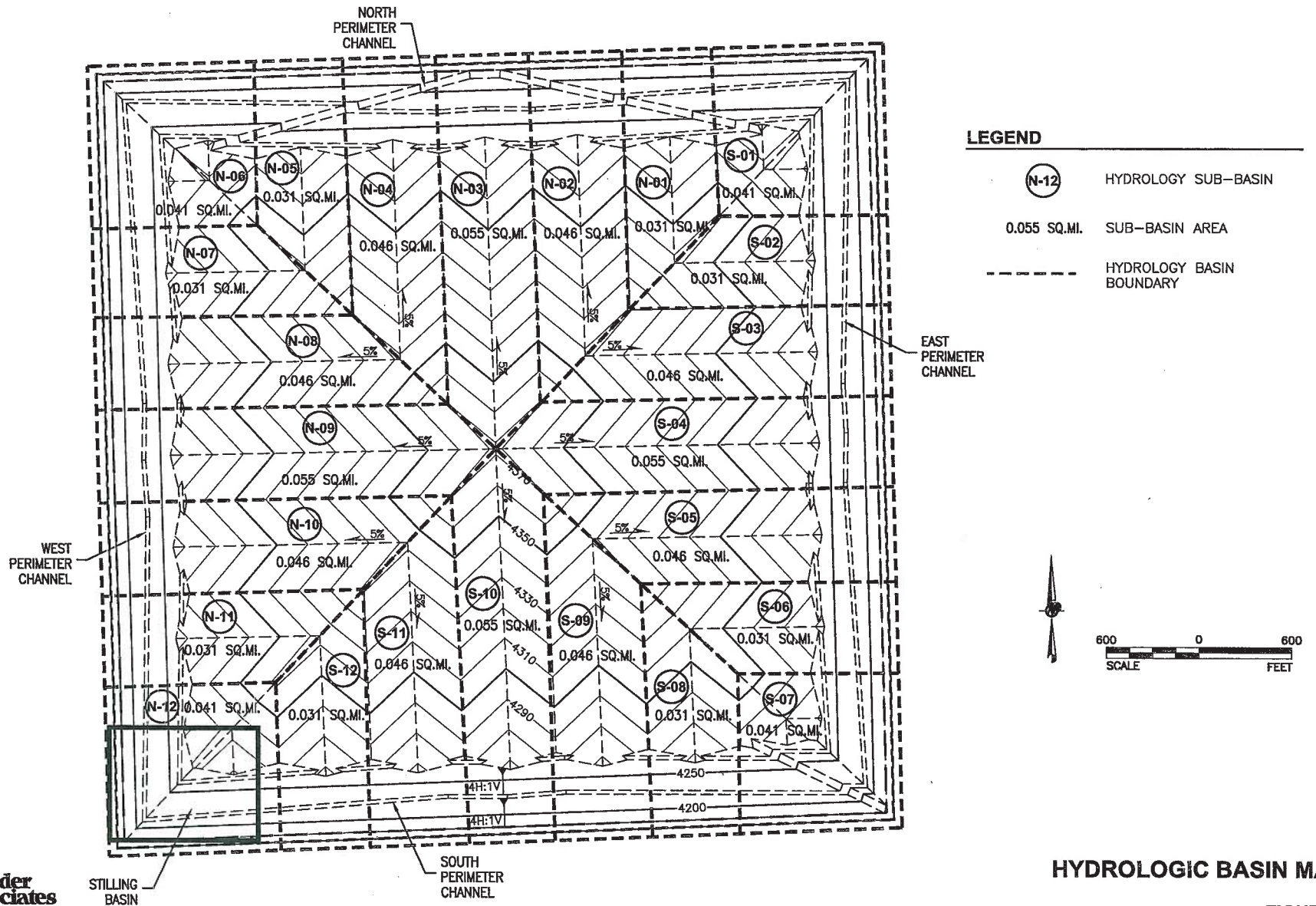
HEC-HMS Hydrologic Modeling System [computer software] US Army Corps of Engineers Version 3.1.0

Bentley FlowMaster [computer software] 2005 Bentley Systems Inc. Service Pack 3

Natural Resource Conservation Service. 1986. Technical Release 55: Urban Hydrology for Small Watersheds. United States Department of Agriculture.

Ernest F. Brater and Horace H. King 1976. Handbook of Hydraulics, 6th edition. McGraw-Hill Inc.

U.S Department of Commerce, National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers. 1999. *Hydrometeorological Report No. 59* Probable Maximum Precipitation for California.



Golder Associates
Sacramento, CA

PROJECT No. 083-7079 FILE No. Fig 1 CADD PM DATE 04/08/09

Drawing file: Hydro-basins.dwg Apr 06, 2009 - 12:00pm

HYDROLOGIC BASIN MAP

FIGURE 1

TABLE 1
SUBBASIN SUMMARY TABLE

Jungo Landfill - Hydrology
Project Number: 063-7079300

Date:	4/2/09
By:	PM
Chkd:	
Apprvd:	

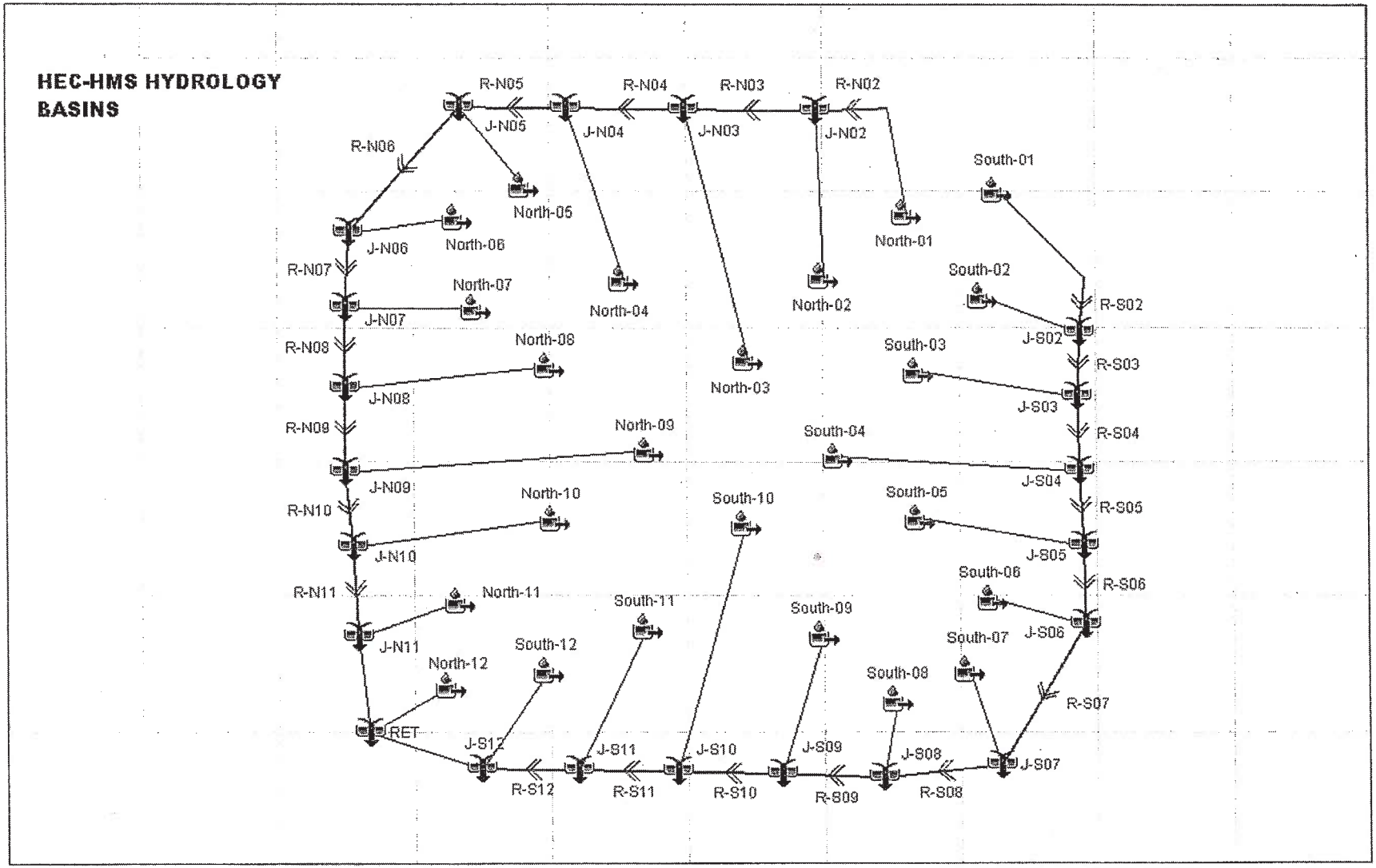
Design Storm 25-year - Recurrance Interval

Storm Duration (hours)	25-year - Depth (inches)	Storm Distribution
24	1.62	II

Subbasin ID	Subbasin Area (ft^2)	Subbasin Area (acres)	Subbasin Area (sq mile)	CN = 81 Covered Landfill HSG C (acres)	Composite SCS Curve No.	$S = \frac{1000}{CN} - 10$	Unit Runoff Q (in)	Runoff Volume (ac-ft)	Runoff Volume (ft^3)
North-01	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
North-02	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
North-03	1,533,312	35.20	0.0550	35.20	CN = 81	2.35	0.38	1.11	48,401
North-04	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
North-05	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
North-06	1,143,014	26.24	0.0410	26.24	CN = 81	2.35	0.38	0.83	36,081
North-07	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
North-08	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
North-09	1,533,312	35.20	0.0550	35.20	CN = 81	2.35	0.38	1.11	48,401
North-10	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
North-11	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
North-12	1,143,014	26.24	0.0410	26.24	CN = 81	2.35	0.38	0.83	36,081
South-01	1,143,014	26.24	0.0410	26.24	CN = 81	2.35	0.38	0.83	36,081
South-02	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
South-03	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
South-04	1,533,312	35.20	0.0550	35.20	CN = 81	2.35	0.38	1.11	48,401
South-05	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
South-06	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
South-07	1,143,014	26.24	0.0410	26.24	CN = 81	2.35	0.38	0.83	36,081
South-08	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
South-09	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
South-10	1,533,312	35.20	0.0550	35.20	CN = 81	2.35	0.38	1.11	48,401
South-11	1,282,406	29.44	0.0460	29.44	CN = 81	2.35	0.38	0.93	40,481
South-12	864,230	19.84	0.0310	19.84	CN = 81	2.35	0.38	0.63	27,281
Total:	27,878,400	640.00	1.00					20.20	880,027

TOTAL RUNOFF TO RETENTION POND: **20.20 AC-FT**

HEC-HMS Basin Model Schematic



Attachment A
HEC-HMS Screen Captures and Inputs

Sub Basin Area	
Subbasin	Area (mi^2)
North-01	0.0280
North-02	0.0430
North-03	0.0520
North-04	0.0430
North-05	0.0280
North-06	0.0380
North-07	0.0280
North-08	0.0430
North-09	0.0520
North-10	0.0430
North-11	0.0280
North-12	0.0380
South-01	0.0380
South-02	0.0280
South-03	0.0430
South-04	0.0520
South-05	0.0430
South-06	0.0280
South-07	0.0380
South-08	0.0280
South-09	0.0430
South-10	0.0520
South-11	0.0430
South-12	0.0280

Loss SCS Curve Number			
Subbasin	Initial Abstraction (in)	Curve Number	Impervious (%)
North-01	0.2	81	0
North-02	0.2	81	0
North-03	0.2	81	0
North-04	0.2	81	0
North-05	0.2	81	0
North-07	0.2	81	0
North-08	0.2	81	0
North-09	0.2	81	0
North-10	0.2	81	0
North-11	0.2	81	0
South-02	0.2	81	0
South-03	0.2	81	0
South-04	0.2	81	0
South-05	0.2	81	0
South-06	0.2	81	0
South-08	0.2	81	0
South-09	0.2	81	0
South-10	0.2	81	0
South-11	0.2	81	0
South-12	0.2	81	0

Transform SCS Unit Hydrograph	
Subbasin	Lag Time (min)
North-06	7.2
North-12	7.2
South-01	7.2
South-07	7.2

Routing Kinematic Wave Channel								
Reach	Length (ft)	Slope (ft/ft)	Manning's n	subreaches	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)
R-N02	600	0.005	0.030	2	Trapezoid		10	4
R-N03	600	0.005	0.030	2	Trapezoid		10	4
R-N04	600	0.005	0.030	2	Trapezoid		10	4
R-N05	600	0.005	0.030	2	Trapezoid		10	4
R-N06	1850	0.005	0.030	2	Trapezoid		10	4
R-N07	600	0.005	0.030	2	Trapezoid		10	4
R-N08	600	0.005	0.030	2	Trapezoid		10	4
R-N09	600	0.005	0.030	2	Trapezoid		10	4
R-N10	600	0.005	0.030	2	Trapezoid		10	4
R-N11	600	0.005	0.030	2	Trapezoid		10	4
R-S02	600	0.005	0.030	2	Trapezoid		10	4
R-S03	600	0.005	0.030	2	Trapezoid		10	4
R-S04	600	0.005	0.030	2	Trapezoid		10	4
R-S05	600	0.005	0.030	2	Trapezoid		10	4
R-S06	600	0.005	0.030	2	Trapezoid		10	4
R-S07	1850	0.005	0.030	2	Trapezoid		10	4
R-S08	600	0.005	0.030	2	Trapezoid		10	4
R-S09	600	0.005	0.030	2	Trapezoid		10	4
R-S10	600	0.005	0.030	2	Trapezoid		10	4
R-S11	600	0.005	0.030	2	Trapezoid		10	4
R-S12	600	0.005	0.030	2	Trapezoid		10	4

Attachment B
Time of Concentration and Mannings Flow Coefficients

TR-55 (1986)

Sheet Flow Travel time (SCS Upland Method)

$$T_t = \frac{0.007\ (n'\ L)^{0.8}}{(P_2)^{0.5}\ S^{0.4}}$$

Where: T_t = travel time (hr); n' = roughness coefficient; L = flow length (ft);
P_2 = 2-yr storm depth (inches); s = slope (ft/ft)
flow velocity = $L/(60T_t)$

Flow Type	Surface Type	roughness n	Surface Description	Short Description
Sheet/Overland Flow	A	0.011	Smooth surfaces (concrete, asphalt, gravel, bare soil)	Smooth
	B	0.05	Fallow (no residue)	Fallow
	C	0.06	Cultivated soils: Residue cover <= 20%	Cover<20%
	D	0.17	Cultivated soils: Residue cover > 20%	Cover>20%
	E	0.15	Grass: Short grass prairie	Short Grass
	F	0.24	Grass: Dense grasses	Dense Grass
	G	0.41	Grass: Bermuda grass	Bermuda Grass
	H	0.13	Range (natural)	Range
	I	0.40	Woods: Light underbrush	Light woods
	J	0.80	Woods: Heavy underbrush	Heavy Woods

Shallow Concentrated Flow Velocity (SCS Upland Method)

$v = mS^{0.5}$

Where: v = velocity (fps); m = roughness coeffient; S = slope (ft/ft)

Flow Type	Surface Type	Roughness m	Surface Description	Short Description
Shallow Conc. Flow	P	20.3282	Paved Surfaces	Paved
	U	16.1345	Unpaved Surfaces	Unpaved

Channel Flow Velocity (Mannings Velocity)

$v = 1.49/n\ Rh^{2/3}S^{1/2}$

Where: v = velocity (fps); n = roughness coeffient; Rh = Hydraulic Radius (ft), S = slope (ft/ft)

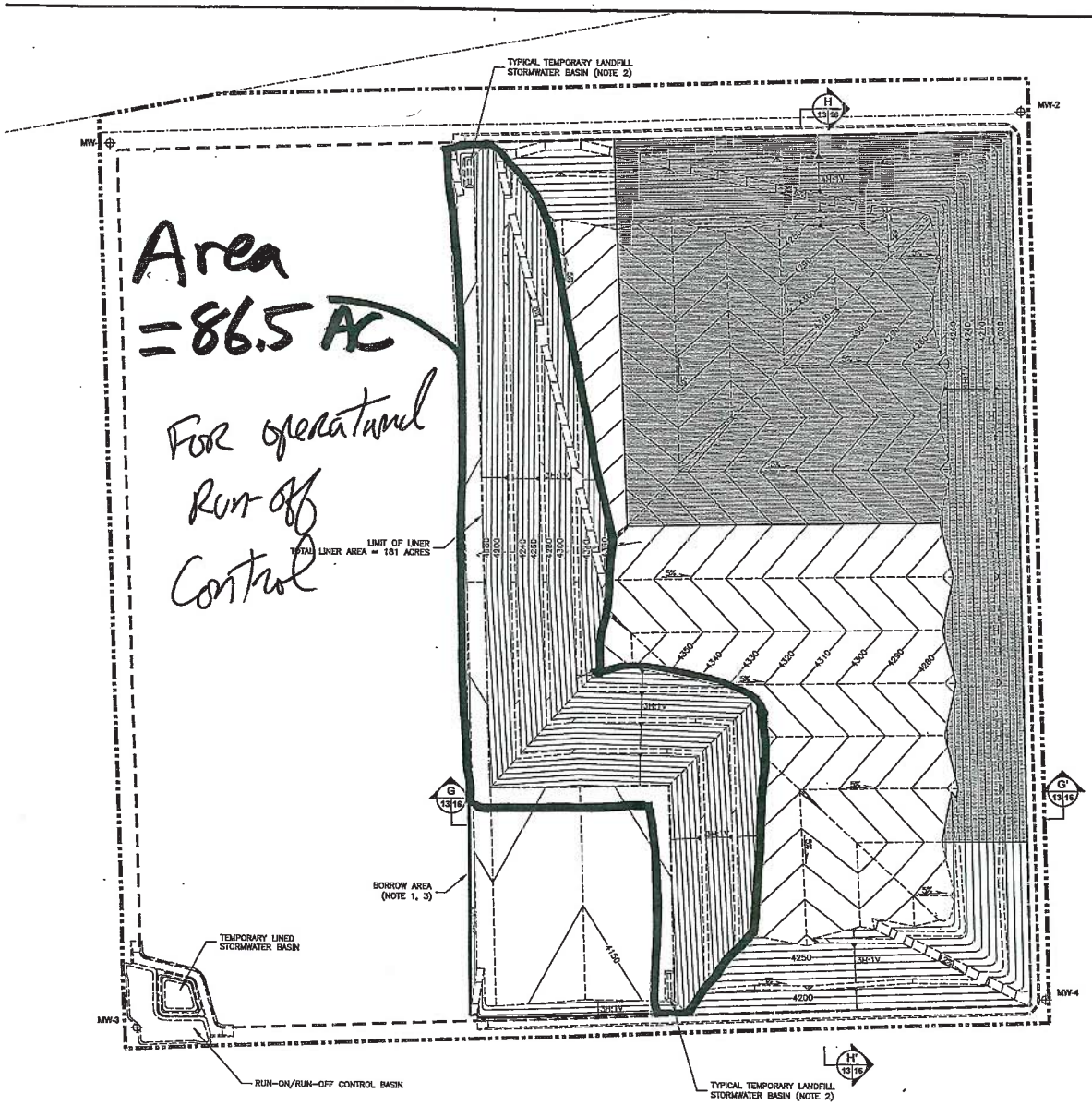
Lining Type	Mannings n for Depth	Mannings n for Velocity	Material	Maximum Velocity	Maximum Shear Stress
A	0.026	0.026	ACB	25	
B	0.016	0.016	Asphalt	25	
C	0.024	0.022	CSP	50	
E	0.025	0.022	Earth-lined	3	
G	0.035	0.030	Grass-lined	7	
I	0.017	0.013	Ductile Iron	50	
P	0.012	0.009	Plastic	25	
R	0.040	0.035	Riprap	15	
T	0.035	0.030	Turf Reinf.	10	1.5
Z	0.060	0.005	Other	25	

Attachment C
NOAA Precipitation Frequencies from Atlas 14

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.09	0.13	0.16	0.22	0.27	0.34	0.39	0.50	0.62	0.71	0.80	0.92	1.06	1.18	1.46	1.70	2.05	2.33
2	0.11	0.17	0.20	0.28	0.34	0.43	0.49	0.63	0.79	0.90	1.01	1.16	1.33	1.49	1.84	2.15	2.59	2.96
5	0.15	0.23	0.28	0.38	0.47	0.56	0.63	0.81	1.01	1.15	1.28	1.47	1.69	1.90	2.34	2.72	3.29	3.75
10	0.19	0.28	0.35	0.47	0.58	0.69	0.76	0.96	1.19	1.34	1.50	1.72	1.96	2.20	2.71	3.16	3.81	4.34
25	0.24	0.37	0.46	0.62	0.77	0.87	0.94	1.16	1.44	1.62	1.79	2.05	2.33	2.62	3.20	3.73	4.49	5.09
50	0.30	0.46	0.57	0.76	0.94	1.03	1.09	1.33	1.64	1.83	2.01	2.31	2.62	2.94	3.57	4.16	4.98	5.64
100	0.37	0.56	0.69	0.93	1.15	1.22	1.28	1.50	1.84	2.06	2.25	2.57	2.90	3.26	3.94	4.59	5.48	6.17
200	0.44	0.67	0.83	1.12	1.39	1.45	1.50	1.71	2.06	2.29	2.49	2.85	3.20	3.58	4.30	5.01	5.96	6.69
500	0.56	0.86	1.06	1.43	1.77	1.82	1.85	2.07	2.35	2.61	2.82	3.22	3.59	4.01	4.77	5.57	6.57	7.34
1000	0.68	1.03	1.28	1.72	2.13	2.16	2.17	2.39	2.62	2.86	3.07	3.50	3.89	4.33	5.12	5.98	7.01	7.81

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.



LEGEND

- PROPERTY BOUNDARY
- LIMIT OF LANDFILL
- LIMIT OF LINER
- BORROW AREA
- CLOSED PORTION OF LANDFILL
- MW-1 APPROXIMATE LOCATION OF MONITORING WELLS
- 14% GRADE INDICATOR
- 3H:1V SLOPE INDICATOR
- A 3/8 DRAWING DETAIL

NOTES

1. BORROW AREA GRADES SHOWN REPRESENT THE MAXIMUM EXCAVATIO ELEVATIONS) OF SOIL REMOVAL PRIOR TO SUBSEQUENT LINER SYSTI
2. TEMPORARY LANDFILL STORMWATER BASIN WILL COLLECT STORMWATE THE ACTIVE DISPOSAL AREA. THE WATER IN THIS BASIN WILL BE P ROUTED TO THE TEMPORARY LINED STORMWATER BASIN WHERE IT W AND TESTED. IF IT IS FREE OF WASTE CONSTITUENTS, THE WATER DISCHARGED TO THE UNLINED RUN-ON/RUN-OFF CONTROL BASIN.
3. STORMWATER RUN-OFF WITHIN THE BORROW AREA WILL BE ROUTED TOPOGRAPHIC LOW POINT WITHIN THE BORROW AREA WHERE IT WILL IT EVAPORATES OR INFILTRATES INTO THE SUBSURFACE SOILS.

N

300 0 300
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION
1	5/08	KGH	REVISED DEVELOPMENT SEQUENCE

PROJECT

JUNGO ROAD LANDFILL CONCEPTUAL
WINNEMUCCA, HUMBOLDT COUNTY,

TITLE

CELL DEVELOPMENT PL
END OF YEAR 50

Golder Associates
Sacramento, CA

PROJECT No. 083-7079-100			FILE
DESIGN	KGH	10/01/07	SCA
CADD	JDR	03/05/08	
CHECK	KGH	03/06/08	
REVIEW	REK	03/08/08	

Appendix A: Design Use Values of Manning's n

channel material	n
clean, uncoated cast iron	0.013–0.015
clean, coated cast iron	0.012–0.014
dirty, tuberculated cast iron	0.015–0.035
riveted steel	0.015–0.017
lock-bar and welded	0.012–0.013
galvanized iron	0.015–0.017
brass and glass	0.009–0.013
wood stave	
small diameter	0.011–0.012
large diameter	0.012–0.013
concrete	
with rough joints	0.016–0.017
dry mix, rough forms	0.015–0.016
wet mix, steel forms	0.012–0.014
very smooth, finished	0.011–0.012
vitrified sewer	0.013–0.015
common-clay drainage tile	0.012–0.014
asbestos	0.011
planed timber	0.011
canvas	0.012
unplaned timber	0.014
brick	0.016
rubble masonry	0.017
smooth earth	0.018
firm gravel	0.023
corrugated metal pipe	0.022
natural channels, good condition	0.025
natural channels with stones and weeds	0.035
very poor natural channels	0.060

down-drains

vegetated ditches

Source: Lindberg, 1986, Civil Engineering