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NCBC GULFPORT
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TECHNICAL MEMORANDUM TO PRESENT AND EVALUATE THE FINAL GRADING PLAN ALTERNATIVES FOR THE HERBICIDE ORANGE STORAGE AREA SITE 8A NCBC GULFPORT MS

11/11/2002

TETRA TECH

TECHNICAL MEMORANDUM

Date: 11 November 2002

To: Art Conrad (SOUTHDIV)
Gordon Crane (NCBC Environmental)
Don Ficklen (AFCEES)
Bernie Walker (NCBC Public Works)

From: Jody Magilson (TtNUS – Pittsburgh, PA)
Bob Mertz (TtNUS – Pittsburgh, PA)

c: Bob Fisher (TtNUS – Tallahassee, FL)

RE: Site 8A Final Grading Plan Evaluation
Remedial Design
Site 8 – Herbicide Orange Storage Area
Naval Construction Battalion Center
Gulfport, Mississippi

The purpose of the technical memorandum is to present and evaluate final grading plan alternatives for the Herbicide Orange Storage Area (Site 8A), Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. Design criteria and variables are presented followed by viable alternatives. This technical memorandum provides conceptual final grading plan alternatives, one of which may be developed in detail in the remedial design submissions. Several alternatives evaluated do not, by themselves, satisfy the design criteria and are therefore not described herein, but are provided as Attachment I. If desired, these Attachment I alternatives may be coupled with other alternatives or the viable alternatives presented herein modified to provide an alternative suitable to the Navy and the Air Force.

DESIGN CRITERIA

Final grading plan alternatives were developed based on the remedial action to be performed at Site 8A and the following design criteria:

- provide adequate volume for consolidated material
- maintain consolidation area footprint
- provide suitable grades for drainage
- retain existing railroads, streets, loading platform, and utilities
- minimize grades to provide for post-remedial action access and maximize area for material storage and staging to the extent practicable.

Each design criteria is described below.

Consolidated Material Volume

As presented in the Focused Feasibility Study (FFS) (TtNUS, 2001), the remedial action involves the excavation, chemical stabilization and on-base landfilling, and capping of

stabilized soil, soil ash, and sediment. Dioxin-contaminated sediment from on-base drainage ditches and off-base wetlands will be excavated and combined with Site 8A incinerated soil ash and contaminated sediment from previous excavation activities. The resultant material blend will then be stabilized and a cap placed to protect the stabilized material and provide equivalent pre-action usability as a storage and staging area. Bench-scale treatability study test results indicated that the mixture of soil, soil ash, and sediment (referred to hereinafter as the "material blend" or "consolidated material") will not support H20 loading without the addition of a stabilizing agent. Test results also revealed that the addition of Type I Portland cement to the material blend improved the load bearing capacity so that it will support H20 loading.

The volume of contaminated soil, soil ash, and sediment reflected in the FFS to be stabilized on Site 8A is 58,000 cubic yards (cy) (TtNUS, 2001). Since the publishing of the FFS, several actions were taken that have resulted in changes to the FFS volume estimate as follows:

- The FFS assumed the depth of contamination in the off-base sediment to be 9-inches. However, a vertical delineation study conducted in April 2002 concluded that the depth of contamination in the off-base sediment actually included the top 18-inches of sediments. The FFS volume estimate for off-base sediments therefore increases by approximately 13,000 cy.
- The volume of contaminated sediments associated with the Site 8B and 8C drainage channels increased above the quantity estimated in the FFS based on the Interim Removal Action (IRA) performed in 2002. A total of 2,600 cy of sediment was excavated during the IRA, including a Site 8C ditch and a surface soil "hot spot" on Site 8B that were not included in the FFS volume estimate. These factors resulted in an additional 1,100 cy of material not accounted for in the FFS volume estimate.
- The 3,200 cy of Portland cement to be added to the material blend was not included in the FFS volume estimate. The amount of Portland cement to be used is 7.5 percent by weight of the material blend. This Portland cement volume estimate is conservative because the Portland cement will occupy available pore space within the material blend and/or absorb water such that additional volume is not occupied.
- The revised estimate of material to be stabilized on Site 8A is 75,100 cy. Based on activities up to and including the pilot-scale work, it is estimated that 23,400 cy of unstabilized material consisting of soil ash and on-base ditch sediment is stockpiled on Site 8A. Therefore, 51,700 cy of contaminated material and Portland cement requires excavation and placement on Site 8A. The revised material volume calculation is provided as Attachment II.

The final grading plan for Site 8A will be designed to meet the goals of the above stated design criteria. The volume estimate includes a contingency for potential increases in material volume is already included in the volume estimate.

Consolidation Area Footprint

The 13-acre area identified as Site 8A in the FFS defines the minimum planar area or "footprint" that will be utilized for storage of the stabilized materials. The footprint may be increased to satisfy any of the other design criteria (e.g., increase footprint to

increase storage volume). The consolidation area footprints evaluated in this technical memorandum include the following:

- Area identified in the FFS bounded by Goodier and Greenwood Avenues and remaining limits defined by the fence on-site. This area is referred to hereinafter as "Site 8A". Site 8A is approximately 13 acres and is shown on Figure 1. For the purpose of this technical memorandum, the Site 8A southeastern limit is assumed to be the west side of Greenwood Avenue. Greenwood Avenue may therefore be left intact if desired (refer to Figure 1).
- Area contiguous to west side of Site 8A between Site 8A, Goodier Avenue, and Building 356 located within the railroad loop. The area is referred to hereinafter as the "rectangular area" or "rectangle". The rectangular area combined with Site 8A is approximately 15.6 acres and is shown on Figure 1.
- Area contiguous to north side of Site 8A between Site 8A, Goodier Avenue, Ninth Street, and Greenwood Avenue located within the railroad loop. This area, including Site 8A and the rectangular area, is hereinafter referred to as the "loop". (The loop limits are Track "D" to the north and west, Track "E" to the south, and an arbitrary line just within the North Main Track to the east.) The loop including the rectangular area and Site 8A is approximately 19.5 acres and is shown on Figure 1.

Drainage Grades

The final surface grades must be capable of providing drainage from the surface of the concrete pad. Minimum grades of 0.5% and 1.0% were evaluated. The minimum grades selected are, in part, dependent on design of the surface water drainage system, type of equipment and material that may be stored on the pad, stacking height of materials, type of materials handling equipment, etc. 4H:1V sideslopes may be constructed for a portion of the consolidation area to maximize consolidated material storage in the smallest possible area. The sideslopes could be armored with plain or reinforced concrete.

The Mississippi Department of Environmental Quality (MDEQ), Office of Pollution Control (OPC), Hazardous Waste Division (HWD) regulations were identified as Relevant and Appropriate in the FFS and incorporate, by reference, the 40CFR264 hazardous waste landfill closure performance criteria. However, no specific information regarding design grades for landfill final covers was provided in these regulations. MDEQ's Non-Hazardous Solid Waste Management regulations and criteria were therefore reviewed. MDEQ's non-hazardous waste regulations Section 4E titled "Closure and Post-Closure Care" requires that landfill final covers have a minimum slope of 4 percent (25H:1V) and a maximum slope of 25 percent (4H:1V). It is judged that the 0.5 and 1.0% slopes, if used, may be justified by demonstrating that these slopes meet the remedial action objectives and satisfy the performance criteria provided in the HWD's regulations / 40CFR264.

Retention of Existing Features

Existing features will be retained to the extent practical so as to not reduce the mission capability and readiness of NCBC and to limit the cost of the remedial action. It is judged that the remedial design and action can be implemented effectively while

accomplishing these objectives. Existing features that will be maintained consist of the horizontal and vertical alignment of the railroad, Goodier and Greenwood Avenues, the Greenwood Avenue end-loading platform, and utilities. Surface water drainage features will remain to the extent practical; however, existing surface water drainage features may require upgrading and additional surface water drainage features may need to be installed to address the increase in surface water drainage from Site 8A. It is judged that perimeter surface water drainage features will be required for Site 8A as well as surface water drainage features within Site 8A to rapidly convey surface water from, and reduce the depth of flow on, the concrete pad. The stormwater detention evaluation was provided in the TtNUS technical memorandum dated November 1, 2002.

Post-Remedial Action Access and Storage

Following the remedial action, Site 8A will be used as a storage area for equipment and materials. Final grades within the storage area should therefore be established to provide access, be minimized to provide for safe and effective equipment operation and material storage, and provide traversable grades for materials handling equipment.

ALTERNATIVE VARIABLES

Final grading alternatives were developed to satisfy most or all of the design criteria presented above and to address criteria identified by the Navy at the October 22 and 23, 2002 design kick-off meeting. The Navy's suggested criteria consisted of providing grades no steeper than 10H:1V, grades of approximately 1% for storage areas, and consideration of providing a side-loading platform to serve the dual function of a retaining wall. The primary criteria of storage volume must be met; however, not all alternatives developed satisfied this design criteria and are therefore not presented herein. These alternatives are, however, provided in Attachment I as they may be coupled with other alternatives to form combined alternatives that satisfy the storage volume criteria.

Variables used to generate alternatives consisted of consolidation area footprints (i.e. 8A, 8A + rectangle, loop), perimeter conditions (i.e., ramp, curb with ramp, loading platform), sideslope (i.e., 4H:1V and 10H:1V) and plateau grades (i.e., 0.5% and 1%), and sideslope and plateau final elevations. Viable final grading plan alternatives are presented on Table 1. The variables and associated alternatives are briefly described below.

- Consolidation Area Footprint. The consolidation area footprint could consist of Site 8A, Site 8A plus the rectangular area, or the loop as described under "Design Criteria" above. The Site 8A footprint alternatives may all be graded to provide adequate volume for consolidated materials; however, the resultant grades may not be desirable for post-remedial action access and storage.
- Total Surface Area. Reinforced concrete will be placed on the consolidation material within all or part of the consolidation area footprint. Other surface finishes such as aggregate or bituminous concrete pavement may be used on all or a portion of the Site 8A consolidation area. Approximate unit costs for bituminous concrete and reinforced concrete surfaces are noted on Table 1.
- Perimeter Condition. The perimeter or limits of the consolidation area and associated reinforced concrete surface may be graded to a seamless transition

to existing grade (i.e., ramp on Table 1), may incorporate a curb around the perimeter of the consolidation area, or a combination thereof. In addition, a side-loading platform could be constructed between Goodier Avenue and Site 8A.

- Geometric Design. The COE states that for sustained operations, gasoline and LP powered forklift trucks can generally negotiate a maximum grade of 20% satisfactorily and electric powered forklift trucks can perform sustained operations on a maximum grade of 10% (COE, 1987). The COE recommends that ramp grades within special storage areas have a maximum grade of 10 percent (COE, 1994). A slope of 10 percent (10H:1V) was therefore used as the maximum slope for access and storage areas. The rise of the sideslopes, associated crest elevation, plateau slope, peak elevation, and plateau surface area may also vary and should be selected to satisfy the design criteria. Representative alternatives are presented to aid in selection. A sideslope of 4H:1V was evaluated for a portion of the consolidation area to maximize consolidated material storage in the smallest possible area thus maximizing the area that can be used for readily accessible storage. The 4H:1V may be constructed using stabilized consolidated material. It is judged that steeper slopes (e.g., 2H:1V) may not be feasibly and cost effectively constructed. In addition, steeper slopes would not provide a significantly greater storage volume compared to the 4H:1V due to the large area of the site.
- Storage Volume. The storage volume is the amount of material that can be consolidated within the alternative footprint. The selected alternative must accommodate this estimated volume including the potential loss of storage volume due to installation of the surface water drainage system. The required storage volume is 51,700 cy plus the potential storage volume lost due to surface water drainage system installation.

ADDITIONAL INFORMATION

Basis of design, design criteria, design assumptions, data gaps, and questions related to the selection of the final grading plan and preparation of the remedial design are presented below.

- Loading Platform. NCBC indicated that a side-loading platform may be desirable to provide additional storage volume for the consolidated area as well as to provide post-remedial action access and storage. The COE (COE, 1994) recommends that side-loading platforms be at least 20-feet wide, at least one rail car length long, and preferably two rail car lengths long. The COE recommendations were used to develop Alternatives 4, 4A, and 4B as presented in Attachment I with the exception that a 500-foot long side-loading platform (excluding ramps) was assumed such that the side-loading ramp served a dual function as a retaining wall to maximize storage volume for consolidated materials. A side-loading platform using twice the length of the largest rail car (i.e., 2 x 89-feet or 178-feet) was used to develop Alternative 4C.
- Base Elevation. The base elevation of the perimeter of the consolidation area footprint varies based on existing topographic mapping. The high point along the perimeter of Site 8A appears to be along the southern side (El 32.0) and the low point is in the northwest corner (El 29.0). Final grading plan alternatives that utilize Site 8A as the footprint have a base elevation that varies with existing ground surface. For the other alternatives, a general base elevation was conservatively assumed because topographic mapping is not available.

ALTERNATIVE DESCRIPTION

Alternative 1A: Alternative 1A is the simplest alternative to grade. Alternative 1A utilizes Site 8A with 10H:1V sideslopes rising approximately 2 feet above highest grade and a 10.5-acre plateau area sloped at 1% rising an additional 1.9 feet (for a total height of 3.9 feet above highest grade). This alternative provides sufficient storage volume for the consolidated material. Alternative 1A is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 1A is provided on Figure 2. The final grading plan for Alternative 1A is provided on Figure 4.

Alternative 4C: Alternative 4C is a combination of alternatives utilizing the rectangular area and consists of, from southwest to northeast, a 4H:1V sidesloped area, a 178-foot long side-loading platform with associated 1%+ and 4H:1V sloped area, and a waffle patterned area. The bulk of the consolidated material would be stored in the 4H:1V sidesloped area and the remaining volume would be stored in the side-loading platform area. It was assumed that cut material (5,000 cy) would result from installation of surface water drainage features; this cut material volume would be incorporated within the 1% and 4H:1V sloped area. Advantages of this alternative include the following:

- The southwestern portion of the site is judged to be the least desirable portion of the site from an access perspective due to presence and horizontal alignment of the railroad tracks. This area is therefore judged to be the most desirable location for placing the bulk of the consolidated material. In addition, a larger portion of Site 8A is available for storage, staging, and laydown area during the remedial action. A trade-off exists in that railroad access in the form of the side-loading platform is gained along Goodier Avenue but access from Greenwood Avenue is lost in the 4H:1V sloped area.
- Access along the straight portions of the railroad track and along Goodier and Greenwood Avenues is the most desirable. Conversely, access along the curved portion of the railroad tracks is not desirable. The optimal location of the side-loading platform is along the straight portions of the railroad track adjacent to the storage area. Specifically, a side-loading platform may be constructed anywhere along Goodier Avenue from points northeast of the railroad track point of curvature.
- The sideslope crest and top of platform elevation would be set equal as well as the slopes to the peak of the plateau to simplify construction, site grading, and to maximize the storage space of the resultant plateau area. The elevation of the resultant plateau area, located at least 4 feet above existing grade, would provide a storage area for equipment requiring protection from potential flooding.
- The northeastern limit of the platform area would be sloped approximately 10% down to the waffle patterned area, thus providing an access ramp for nearly the full breadth of the site.
- The waffle pattern area provides storage area equivalent to pre-remedial activity conditions. The waffle pattern alternative is more desirable than other alternatives based on the substantial reduction in drainage distance provided within the storage area.

A schematic cross-section of Alternative 4C is provided on Figure 3 and a plan view of final grades is provided on Figure 5.

CONCLUSIONS AND RECOMMENDATIONS

It is judged that Alternatives 1A and 4C satisfy all of the design criteria. Alternative 4C provides an acceptable and balanced solution for both environmental and post-remedial action end-use objectives whereas drainage lengths associated with Alternative 1A may be excessive. Alternative 1A or 4C may be easily modified to provide an alternative suitable to the Navy and the Air Force.

Alternative 1A provides a relatively simple grading plan utilizing the "ramp" concept and Alternative 4C combines the three remaining concepts (4H:1V slopes, side-loading platform, and waffle as presented in Attachment I) that should stimulate productive discussion and subsequent refinement of design criteria and prioritization of objectives.

REFERENCES

Department of the Army (COE), 1994. TM 5-840-2, Storage Depots, 7 October 1994.

Department of the Army (COE), 1987. TM 5-809-1/AFM 88-3, Chapter 15, Concrete Floor Slabs on Grade Subjected to Heavy Loads, 25 August 1987.

Mississippi Department of Environmental Quality (MDEQ), 1996. Nonhazardous Solid Waste Management Regulations and Criteria, Office of Pollution Control (OPC), Hazardous Waste Division (HWD).

Tetra Tech NUS, Inc. (TtNUS), 2001. Draft Focused Feasibility Study, Site 8, Herbicide Orange Storage Area at Naval Construction Battalion Center, Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, Charleston, South Carolina. August.

LE 1

SITE 8A FINAL GRADING PLAN ALTERNATIVE EVALUATION
REMEDIAL DESIGN
SITE 8A - HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

Alternative	Reference Figure(s)	Area Identification	Total Surface Area (acres)	Perimeter Condition[1]	Sideslope	Crest Elevation (ft)	Plateau Slope (%)	Peak Elevation (ft)	Plateau Surface Area (acres)	Storage Volume[2,3] (cy)	Comments[4]	Estimation Method[5]
1A	2,4	8A	13.0	Ramp	10H:1V	34.0	1.0	35.9	10.5	60,200	A	T
4C	*3,5*	*8A + Rectangle*	*8.5*	*Ramp*	*4H:1V*	*35.0*	*1.0*	*37.0*	*7.6*	*44,200*		*T*
		8A + Rectangle	*2.0*	*4' ht. platform, 178' long*	*4H:1V*	*39.0*	*1.0*	*39.0*	*1.6*	*12,600*	*A*	*T*
		8A + Rectangle	5.1	Waffle	TBD	TBD	TBD	TBD	TBD	4,900		R

Notes:

1. 8-inch high curb and 8-inch thick reinforced concrete pavement rounded to 0.75 ft.
2. Storage volume represents volume available for storage of stabilized contaminated material and does not include volume occupied by surface covering.
3. Areas, elevations, and volumes provided are approximate.
4. A - storage volume adequate, M - storage volume marginal, I - storage volume inadequate. From the Material Volume Calculation (Attachment II), storage of 51,700 cy of material is required.
5. T - volume determined using Terramodel software; R - rough volume estimate based on hand calculations and associated alternative(s).

* Remedial costs for material stabilization are essentially equal. However, remedial costs for perimeter construction, if applicable, surface covering, and support/ancillary improvements may be substantially different. The cost of 8-inch thick reinforced concrete pavement is estimated to range from approximately $4.80/sq ft (TtNUS) to $6.00/sq ft (NCBC and supply A/E) and the cost for 6-inch thick bituminous concrete pavement is estimated at $1.97/sq ft (TtNUS; updated FFS).

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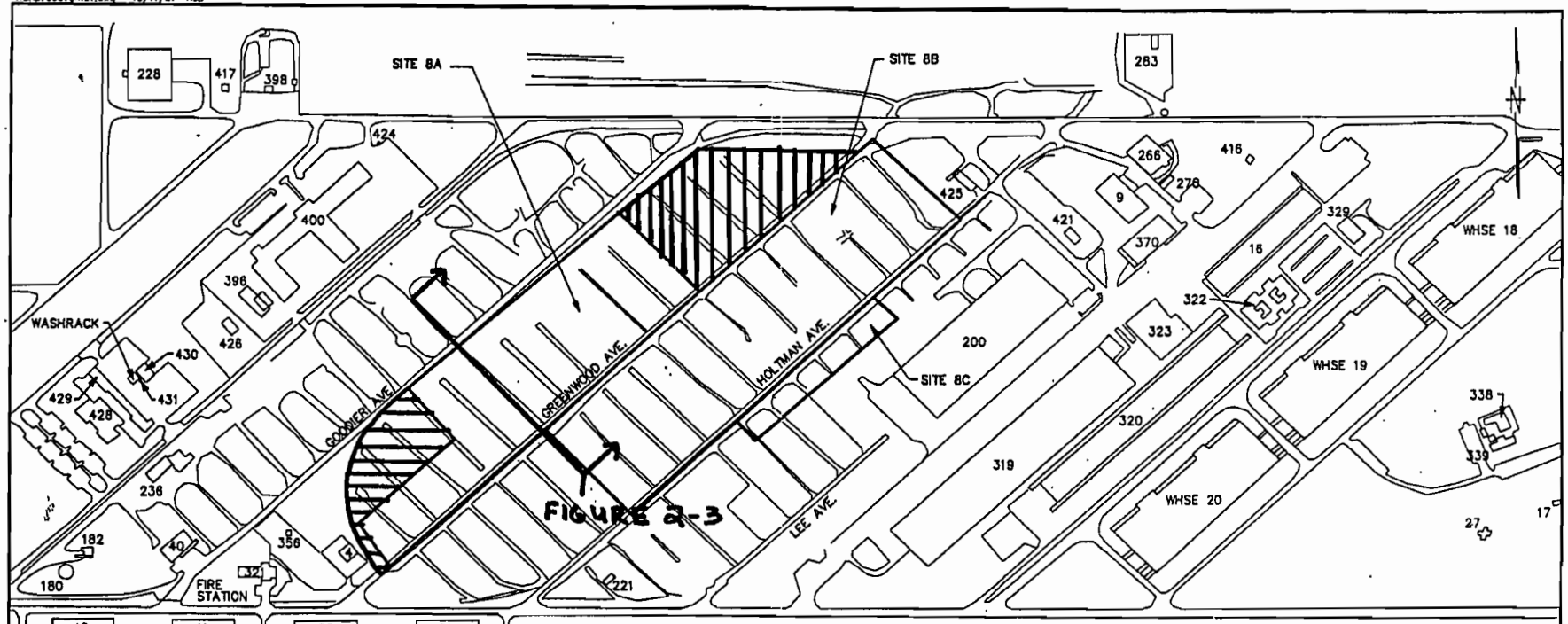

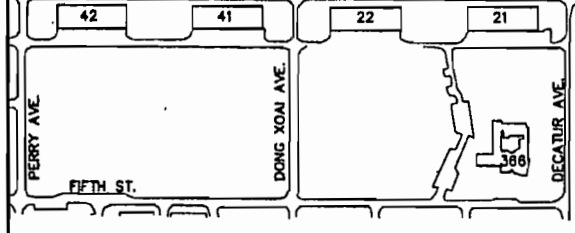

FOOTPRINTS

SITE 8A = □

SITE 8A + RECTANGLE = □ + ▤

LOOP = □ + ▤ + ▥

NOTE

BOUNDARIES FOR SITE 8B AND SITE 8C ARE APPROXIMATE.

0 400 800

APPROXIMATE SCALE IN FEET

DRAWN BY MF DATE 7/5/01		SITES 8A, 8B, AND 8C LOCATION MAP PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
CHECKED BY SH DATE 7/5/01			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1 REV. 0

SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

FORM CADD NO. SDIV_BLDVG - REV 0 - 1/28/98

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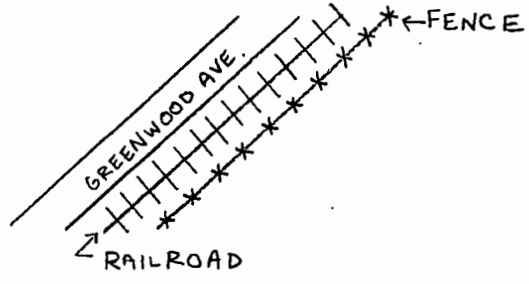
SITE 8A SOUTHEAST BORDER (GREENWOOD AVE.)



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CTO 0143

FIGURE 1

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE ____ OF ____

CLIENT	JOB NUMBER
NCBC GULFPORT	7379 NX0 140-105
SUBJECT FINAL GRADING PLAN EVALUATION	
BASED ON	**DRAWING NUMBER** FIGURE 2

BY	CHECKED BY	APPROVED BY	DATE
JLM	RCM 11/11/02		11-7-02

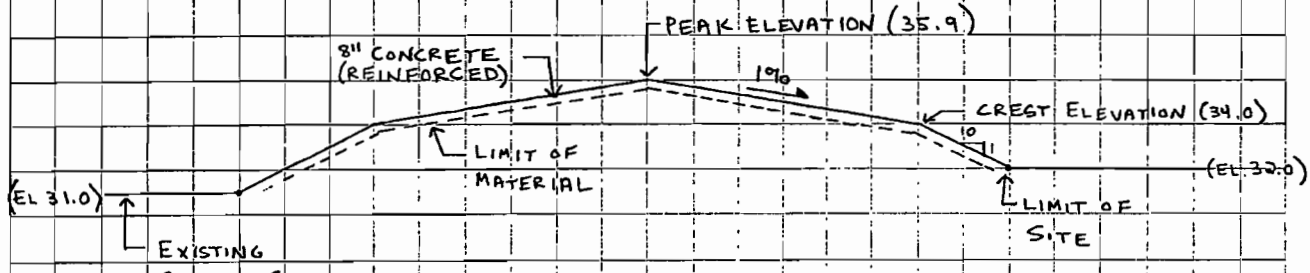


FIGURE 2
ALTERNATIVE 1A
NTS

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE _____ OF _____

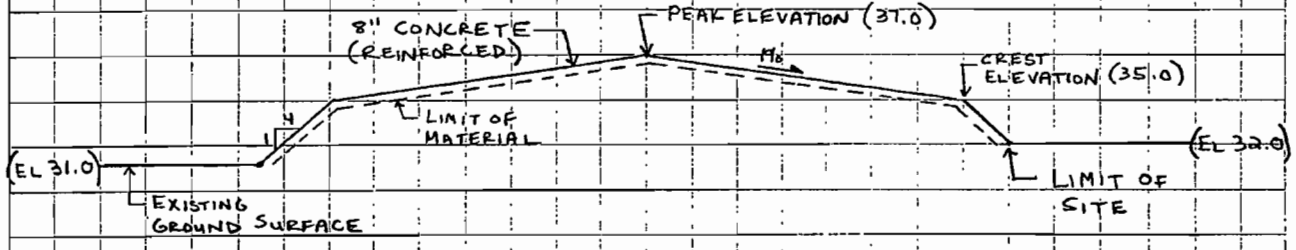
CLIENT	JOB NUMBER
NCBC GULFPORT	7379 NXO 140-105

SUBJECT: FINAL GRADING PLAN EVALUATION

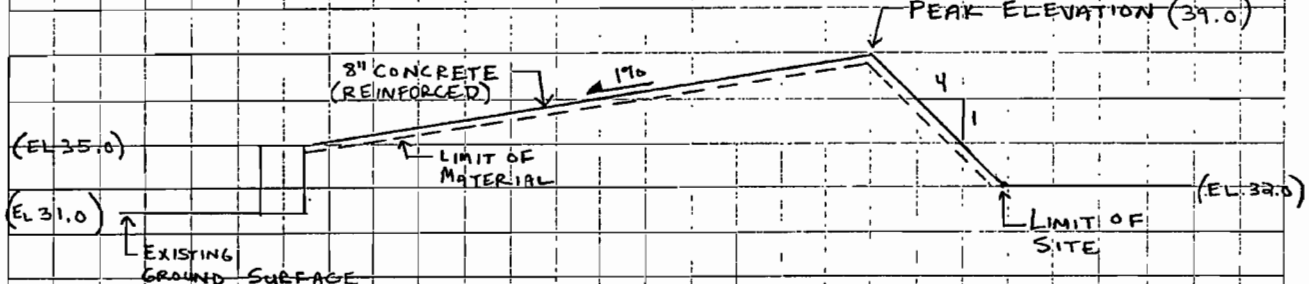
BASED ON: | DRAWING NUMBER: FIGURE 3

BY	CHECKED BY	APPROVED BY	DATE
JLM	RCM 11/11/02		11-7-02

4H:1V SIDE SLOPED AREA



SIDE-LOADING PLATFORM AREA



WAFFLE AREA

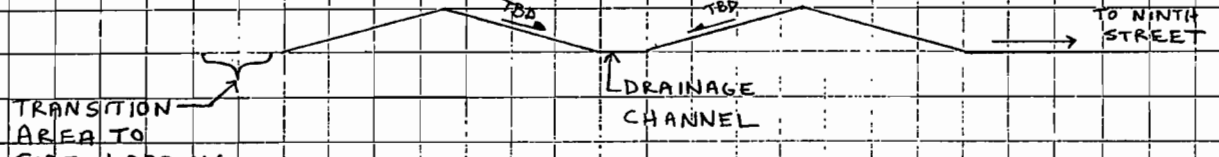


FIGURE 3
ALTERNATIVE 4C
NTS

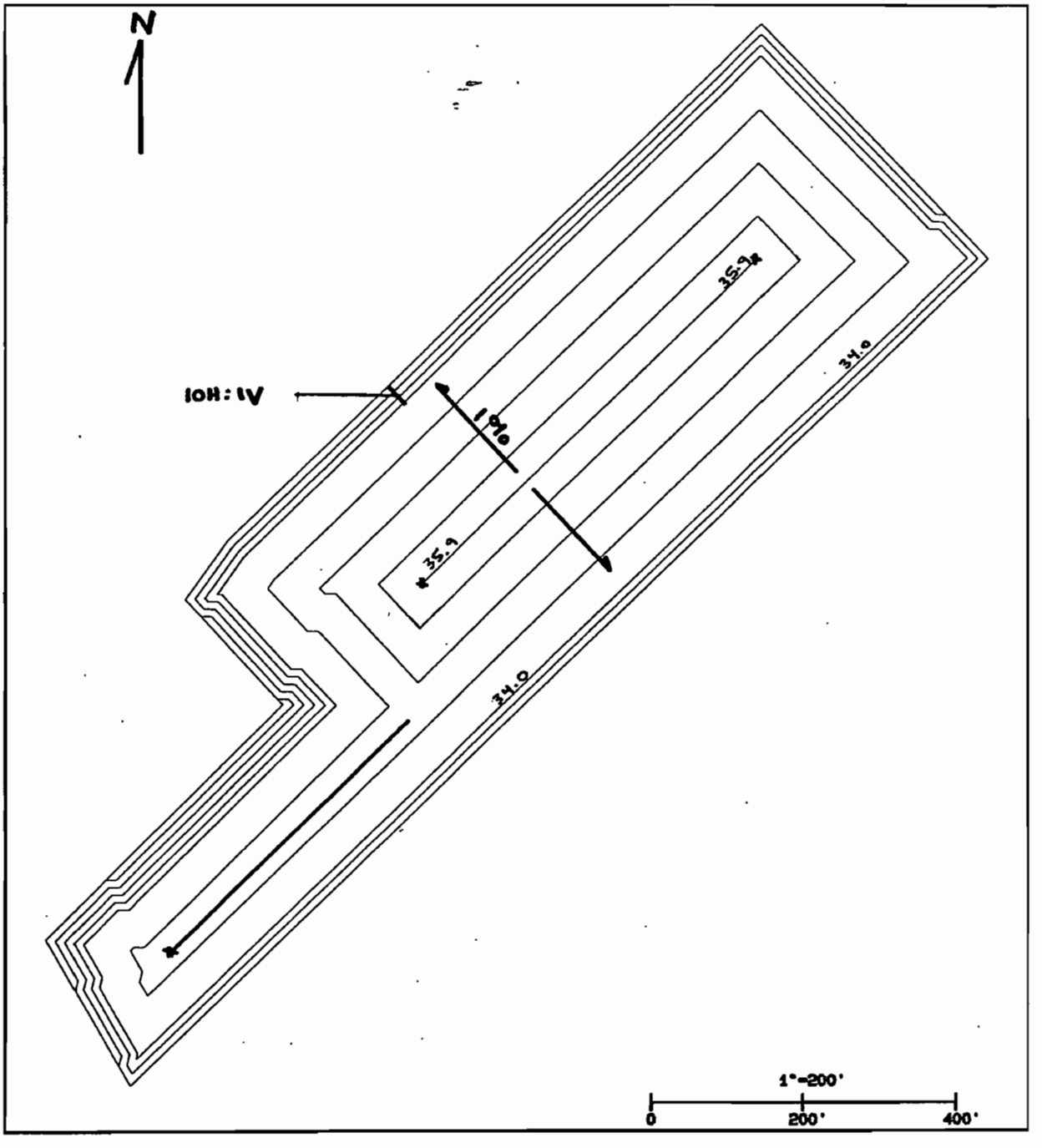


FIGURE 4
ALTERNATIVE 1A
FINAL GRADES

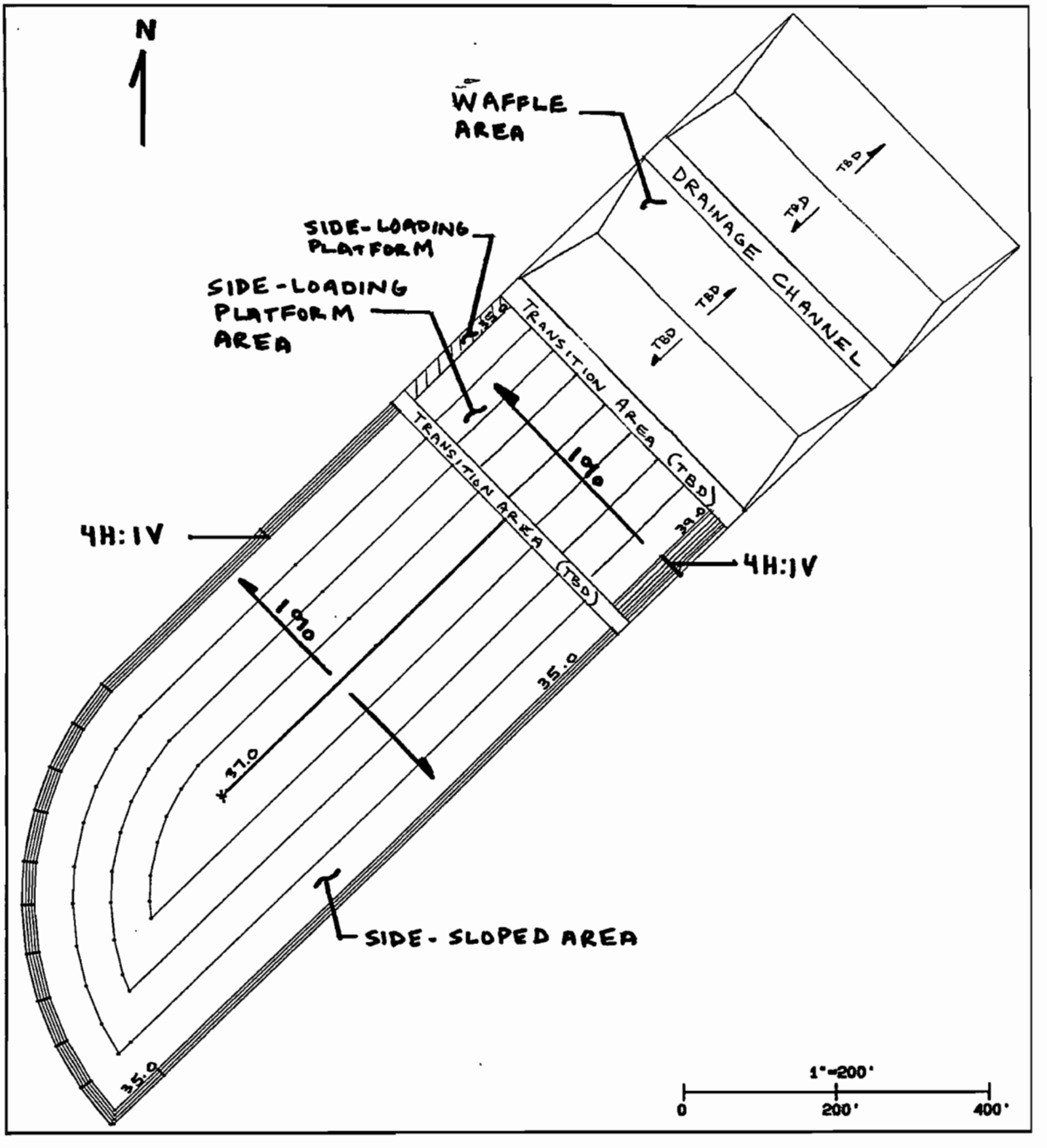


FIGURE 5
ALTERNATIVE 4C
FINAL GRADES

ATTACHMENT I

GRADING ALTERNATIVES

This attachment is provided in support of the Technical Memorandum and two viable alternatives presented therein. This attachment presents all the alternatives developed, viable or not. Figure 1 is reproduced from the Technical Memorandum as a reference. Refer to Table 1A for a summary of the alternative descriptions.

ALTERNATIVE DESCRIPTION

Alternative 1: Alternative 1 is the simplest alternative to grade; however, the storage volume is inadequate. Alternative 1 may be coupled with other alternatives that provide significant storage volume for consolidated materials. Alternative 1 is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 1 is provided on Figure 2.

Alternative 1A: Alternative 1A is the simplest alternative to grade. Alternative 1A utilizes Site 8A with 10H:1V sideslopes rising approximately 2 feet above highest grade and a 10.5-acre plateau area sloped at 1% rising an additional 1.9 feet (for a total height of 3.9 feet above highest grade). This alternative provides sufficient storage volume for the consolidated material. Alternative 1A is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 1A is provided on Figure 2. The final grading plan for Alternative 1A is provided on Figure 10.

Alternative 2: Alternative 2 expands on Alternative 1 by adding an 8-inch high curb around the perimeter of the consolidation area. With the addition of the curb, the storage volume is still inadequate. Alternative 2 may be coupled with other alternatives that provide significant storage volume for consolidated materials. Alternative 2 is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 2 is provided on Figure 3.

Alternative 2A: This alternative evaluated increasing the plateau slope of Alternative 2 from 0.5% to 1%. With the increased plateau slope, the storage volume is still inadequate for the consolidated material. Alternative 2A may be coupled with other alternatives that provide significant storage volume for consolidated materials. Alternative 2A is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 2A is provided on Figure 3.

Alternative 2B: Alternative 2B was developed from Alternative 2A by increasing the curb height around the perimeter of the consolidation area from 8 to 12-inches. The storage volume calculated for Alternative 2B is marginal. An increase in the grades of this alternative may be necessary to accommodate the anticipated consolidated material volume. Alternative 2B is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 2B is provided on Figure 3. The final grading plan for Alternative 2B is provided on Figure 11.

Alternative 3: Alternative 3 is the first alternative to evaluate the area of Site 8A plus the rectangular area. Alternative 3 uses the characteristics of Alternative 2A. With the addition of the rectangle area, the storage volume is marginal (an increase from Alternative 2A which was inadequate). A schematic cross-section of Alternative 3 is provided on Figure 3. Alternative 3 is not the most desirable alternative due to the relatively long drainage distance within the storage area. The final grading plan for Alternative 3 is provided on Figure 12.

Alternative 4: This alternative is a partial alternative because it would be constructed on only a portion of the consolidation area and must be coupled with other alternatives to provide adequate storage volume. The intention of developing alternatives using a loading platform (i.e., retaining wall) was to maximize storage volume in the smallest reasonable area. The Alternative 4 storage volume includes only the volume provided by the 500-foot side-loading platform and associated consolidation area which is approximately 38% of the Site 8A footprint. Final grade from the loading platform will slope down to meet existing grade. The storage volume provided by Alternative 4 coupled with any other Alternative using only the Site 8A footprint is likely inadequate for the consolidated material. Alternative 3A is not the most desirable alternative due to the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 4 is provided on Figures 4 and 7.

Alternative 4A: This alternative is a partial alternative because it would be constructed on only a portion of the consolidation area and must be coupled with other alternatives to provide adequate storage volume. The intention of developing alternatives using a loading platform (i.e., retaining wall) was to maximize storage volume in the smallest reasonable area. The Alternative 4A storage volume includes only the volume provided by the 500-foot side-loading platform and associated consolidation area which is approximately 38% of the Site 8A footprint. Final grade from the loading platform will slope up at 1% and then down at 10H:1V to meet existing grade. The 32,300 cubic yards (cy) volume provided by Alternative 4A provides 62% of the required storage volume and occupies only 38% of the available area. The remaining available volume in the consolidation footprint is a function of the desired final grading and is not addressed herein. It should be noted that the length of the platform, rise of the sideslope, or plateau peak elevation for Alternative 4A may be increased or Alternative 4A coupled with another alternative to provide 100% of the required storage volume. For example, the total storage volume may be roughly estimated by adding the Alternative 4A storage volume and volume provided by the desired Alternative X 62% [e.g., Alternative 4A + (0.62 x Alternative 1A) = 32,300 cy + 0.62 (60,200 cy) = 32,300 cy + 37,320 cy = 69,620 cy). Alternative 4A is not the most desirable alternative due to the relatively long drainage distance within the storage area. Schematic cross-sections of Alternative 4A are provided on Figures 5 and 8.

Alternative 4B: This alternative is a partial alternative because it would be constructed on only a portion of the consolidation area and must be coupled with other alternatives to provide adequate storage volume. The intention of developing alternatives using a loading platform (i.e., retaining wall) was to maximize storage volume in the smallest reasonable area. The Alternative 4B storage volume includes only the volume provided by the 500-foot side-loading platform and associated consolidation area which is approximately 38% of the Site 8A footprint. Final grade from the loading platform will slope up at 1% and then down at 2H:1V to meet existing grade. The 35,700 cy volume provided by Alternative 4B provides 69% of the required storage volume and occupies only 38% of the available area. The remaining available volume in the consolidation footprint is a function of the desired final grading and is not addressed herein. It should be noted that the length of the platform, rise of the sideslope, or plateau peak elevation for Alternative 4B may be increased or Alternative 4B coupled with another alternative to provide 100% of the required storage volume. Alternative 4B is not the most desirable alternative due to constructability issues associated with the 2H:1V sideslopes and the relatively long drainage distance within the storage area.

Alternative 4C: Alternative 4C is a combination of alternatives utilizing the rectangular area and consists of, from southwest to northeast, a 4H:1V sidesloped area, a 178-foot long side-loading platform with associated 1%± and 4H:1V sloped area, and a waffle

patterned area. The bulk of the consolidated material would be stored in the 4H:1V sidesloped area and the remaining volume would be stored in the side-loading platform area. It was assumed that cut material (5,000 cy) would result from installation of surface water drainage features; this cut material volume would be incorporated within the 1% and 4H:1V sloped area. Advantages of this alternative include the following:

- The southwestern portion of the site is judged to be the least desirable portion of the site from an access perspective due to presence and horizontal alignment of the railroad tracks. This area is therefore judged to be the most desirable location for placing the bulk of the consolidated material. In addition, a larger portion of Site 8A is available for storage, staging, and laydown area during the remedial action. A trade-off exists in that railroad access in the form of the side-loading platform is gained along Goodier Avenue but access from Greenwood Avenue is lost in the 4H:1V sloped area.
- Access along the straight portions of the railroad track and along Goodier and Greenwood Avenues is the most desirable. Conversely, access along the curved portion of the railroad tracks is not desirable. The optimal location of the side-loading platform is along the straight portions of the railroad track adjacent to the storage area. Specifically, a side-loading platform may be constructed anywhere along Goodier Avenue from points northeast of the railroad track point of curvature.
- The sideslope crest and top of platform elevation would be set equal as well as the slopes to the peak of the plateau to simplify construction, site grading, and to maximize the storage space of the resultant plateau area. The elevation of the resultant plateau area, located at least 4 feet above existing grade, would provide a storage area for equipment requiring protection from potential flooding.
- The northeastern limit of the platform area would be sloped approximately 10% down to the waffle patterned area, thus providing an access ramp for nearly the full breadth of the site.
- The waffle pattern area provides storage area equivalent to pre-remedial activity conditions.
- The waffle pattern alternative is more desirable than other alternatives based on the substantial reduction in drainage distance provided within the storage area.

Portions of the cross-section of Alternative 4C can be found in Figures 2, 5, and 6. A final grading plan is provided on Figure 13.

Alternative 5: Alternative 5 is the only alternative that evaluates the loop as the consolidation area. The storage volume calculated for this alternative is adequate. Alternative 5 is not the most desirable alternative due to the cost for providing final surfacing over the additional 6.5 acre area and the relatively long drainage distance within the storage area. A schematic cross-section of Alternative 5 is provided on Figure 2. The final grading plan for Alternative 5 is provided on Figure 14.

Alternative 6: Alternative 6 evaluates a "waffle pattern" of grading for Site 8A, similar to site conditions that existed prior to remedial activities. The waffle pattern alternative is more desirable than other alternatives based on the substantial reduction in drainage distance provided within the storage area. An initial rough storage volume estimate was made assuming the distance between Site 8A ditches is approximately 120 ft (i.e., pre-remedial activity conditions) and the prevailing grades were set at 1%. The resultant estimate illustrates that the 8-inch thick reinforced concrete pad would occupy the entire storage volume. The waffle pattern alternative was therefore evaluated using a distance between ditches of 250 feet and prevailing grades were set at 1%. The storage volume provided by this alternative (4,900 cy), although inadequate to address all of the

consolidated material, when coupled with other alternatives may provide the most advantageous final grading plan for the site. For example, this alternative may be coupled with alternatives that include 4H:1V sideslopes and a side-loading platform for a portion of the consolidation area to provide adequate storage volume while minimizing the loss of valuable storage area. Schematic cross-sections of Alternative 6 are provided on Figures 6 and 9. Waffle pattern iterations with distance between waffles and the prevailing grades as variables are provided on Table 2A

TABLE 8A

SITE 8A FINAL GRADING PLAN ALTERNATIVE EVALUATION
REMEDIAL DESIGN
SITE 8A - HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT
GULFPORT, MISSISSIPPI

Alternative	Reference Figure(s)	Area Identification	Total Surface Area (acres)	Perimeter Condition[1]	Sideslope	Crest Elevation (ft)	Plateau Slope (%)	Peak Elevation (ft)	Plateau Surface Area (acres)	Storage Volume[2,3] (cy)	Comments[4]	Estimation Method[5]
1	2	8A	13.0	Ramp	10H:1V	32.0	0.5	33.0	12.3	20,300	I	T
1A	2, 10	8A	13.0	Ramp	10H:1V	34.0	1.0	35.9	10.5	60,200	A	T
2	3	8A	13.0	8" curb w/ramp	10H:1V	32.75	0.5	33.75	12.3	34,500	I	T
2A	3	8A	13.0	8" curb w/ramp	10H:1V	32.75	1.0	34.75	12.3	42,600	I	T
2B	3, 11	8A	13.0	12" curb w/ramp	10H:1V	33.0	1.0	35.0	12.3	47,800	M	T
3	3, 12	8A + Rectangle	15.6	8" curb w/ramp	10H:1V	32.75	1.0	34.75	15.1	46,900	M	T
4[6]	*4, 7*	*NA*	*4.9*	*4' ht. platform, 500' length*	*NA*	*NA*	*0.7*	*35.0*	*4.7*	*12,300*	*NA*	*T*
4A[6]	*5, 8*	*NA*	*4.9*	*4' ht. platform, 500' length*	*10H:1V*	*38.5*	*1.0*	*38.5*	*4.0*	*32,300*	*NA*	*T*
4B[6]		*NA*	*4.9*	*4' ht. platform, 500' long*	*2H:1V*	*39.0*	*1.0*	*39.0*	*4.5*	*35,700*	*NA*	*T*
4C[7]	*2, 5, 6 13*	*8A + Rectangle*	*8.5*	*Ramp*	*4H:1V*	*35.0*	*1.0*	*37.0*	*7.6*	*44,200*		*T*
		8A + Rectangle	*2.0*	*4' ht. platform, 178' long*	*4H:1V*	*39.0*	*1.0*	*39.0*	*1.6*	*12,600*	*A*	*T*
		8A + Rectangle	5.1	Waffle	TBD	TBD	TBD	TBD	TBD	0		R
5	2, 14	Loop	19.5	Ramp	10H:1V	33.0	1.0	35.0	18.3	52,200	A	T
6	6, 9	8A	13.0	Waffle	10H:1V	NA	1.0	32.6	12	-1,300	I	R

Notes:

1. 8-inch high curb and 8-inch thick reinforced concrete pavement rounded to 0.75 ft.
2. Storage volume represents volume available for storage of stabilized contaminated material and does not include volume occupied by surface covering.
3. Areas, elevations, and volumes provided are approximate.
4. A - storage volume adequate, M - storage volume marginal, I - storage volume inadequate. From the Material Volume Calculation (Attachment II), storage of 51,700 cy of material is required.
5. T - volume determined using Terramodel software; R - rough volume estimate based on hand calculations and associated alternative(s).
6. Alternatives 4, 4A, and 4B reflect a partial volume associated only with the stabilized material located within the side-loading platform portion of the site. Refer to Technical Memorandum for discussion of Alternative 4, 4A, and 4B volumes.
7. Alternative 4C reflects a partial volume associated only with the stabilized material located within the 4H:1V sloped and side-loading platform portions of the site. Refer to Technical Memorandum for discussion of Alternative 4C volume.

- Remedial costs for material stabilization are essentially equal. However, remedial costs for perimeter construction, if applicable, surface covering, and support/ancillary improvements may be substantially different. The cost of 8-inch thick reinforced concrete pavement is estimated to range from approximately $4.80/sq ft (TtNUS) to $6.00/sq ft (NCBC and supply A/E) and the cost for 6-inch thick bituminous concrete pavement is estimated at $1.97/sq ft (TtNUS; updated FFS).

2A

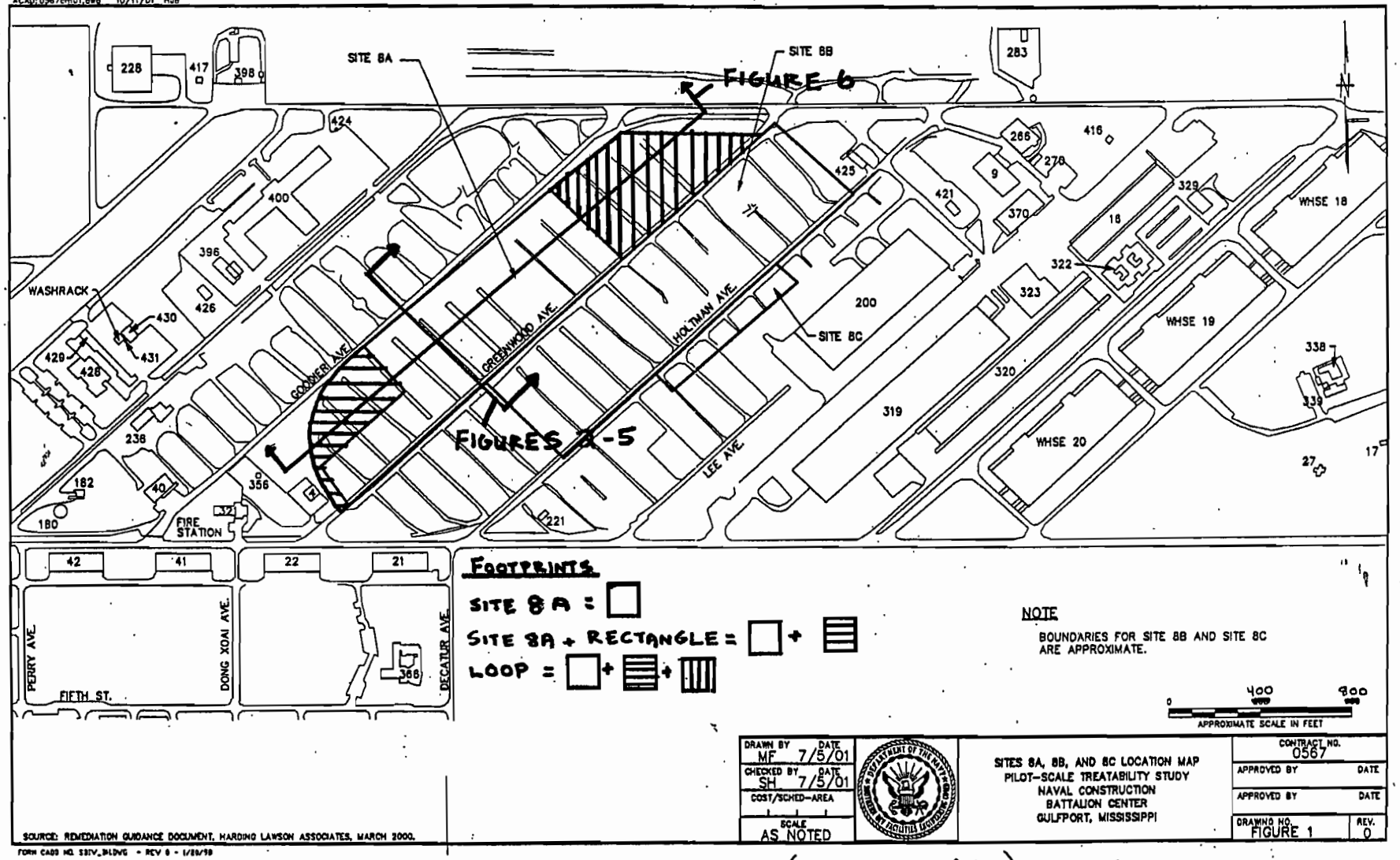
SITE 8A FINAL GRADING PLAN WAFFLE EVALUATION
REMEDIAL DESIGN
SITE 8A - HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

GRADE OF WAFFLES = 1%

Area 1		Area 2							Area 1						Area 2							
Length (ft)	Width (ft)	Length (ft)	Width (ft)	Distance Between Ditches (ft)	Grade	Slope	Height of Waffles (ft)	Length of Ends (ft)	Length of Middle (ft)	Volume of Ends (cy)	Volume of Middle (cy)	Total Volume of 1 Waffle (cy)	Number of Waffles	Storage Volume (cy)	Length of Middle (ft)	Volume of Ends (cy)	Volume of Middle (cy)	Total Volume of 1 Waffle (cy)	Number of Waffles	Storage Volume (cy)	Total Storage Volume (cy)	Available Consolidated Waste Storage Volume (cy)
469.95	224.22	1,032.62	422.01	123	1.0	10	0.615	6.15	211.92	8.62	296.86	305.48	3.8	1,167	409.71	17.23	573.94	591.17	8.4	4,963	6,130	-1,337
469.95	224.22	1,032.62	422.01	150	1.0	10	0.750	7.50	209.22	15.63	435.88	451.50	3.1	1,415	407.01	31.25	847.94	879.19	6.9	6,052	7,467	0
469.95	224.22	1,032.62	422.01	175	1.0	10	0.875	8.75	206.72	24.81	586.19	611.00	2.7	1,641	404.51	49.62	1,147.05	1,196.67	5.9	7,061	8,702	1,235
469.95	224.22	1,032.62	422.01	200	1.0	10	1.000	10.00	204.22	37.04	756.37	793.41	2.3	1,864	402.01	74.07	1,488.93	1,563.00	5.2	8,070	9,934	2,467
469.95	224.22	1,032.62	422.01	225	1.0	10	1.125	11.25	201.72	52.73	945.56	998.30	2.1	2,085	399.51	105.47	1,872.70	1,978.17	4.6	9,079	11,164	3,697
469.95	224.22	1,032.62	422.01	250	1.0	10	1.250	12.50	199.22	72.34	1,152.89	1,225.23	1.9	2,303	397.01	144.68	2,297.51	2,442.19	4.1	10,087	12,391	4,924
469.95	224.22	1,032.62	422.01	275	1.0	10	1.375	13.75	196.72	96.28	1,377.50	1,473.78	1.7	2,519	394.51	192.56	2,762.48	2,955.05	3.8	11,096	13,615	6,148
469.95	224.22	1,032.62	422.01	300	1.0	10	1.500	15.00	194.22	125.00	1,618.50	1,743.50	1.6	2,731	392.01	250.00	3,266.75	3,516.75	3.4	12,105	14,836	7,369
469.95	224.22	1,032.62	422.01	325	1.0	10	1.625	16.25	191.72	158.93	1,875.04	2,033.97	1.4	2,941	389.51	317.85	3,809.44	4,127.30	3.2	13,114	16,055	8,588
469.95	224.22	1,032.62	422.01	400	1.0	10	2.000	20.00	184.22	296.30	2,729.19	3,025.48	1.2	3,555	382.01	592.59	5,659.41	6,252.00	2.6	16,140	19,694	12,227
469.95	224.22	1,032.62	422.01	425	1.0	10	2.125	21.25	181.72	355.40	3,039.18	3,394.58	1.1	3,754	379.51	710.79	6,347.13	7,057.92	2.4	17,149	20,902	13,435
469.95	224.22	1,032.62	422.01	500	1.0	10	2.500	25.00	174.22	578.70	4,032.87	4,611.57	0.9	4,334	372.01	1,157.41	8,611.34	9,768.75	2.1	20,175	24,509	17,042
469.95	224.22	1,032.62	422.01	525	1.0	10	2.625	26.25	171.72	669.92	4,382.44	5,052.36	0.9	4,523	369.51	1,339.84	9,430.20	10,770.05	2.0	21,184	25,706	18,239
469.95	224.22	1,032.62	422.01	550	1.0	10	2.750	27.50	169.22	770.25	4,739.73	5,509.98	0.9	4,708	367.01	1,540.51	10,279.68	11,820.19	1.9	22,192	26,900	19,433
469.95	224.22	1,032.62	422.01	575	1.0	10	2.875	28.75	166.72	880.14	5,103.87	5,984.01	0.8	4,891	364.51	1,760.27	11,158.90	12,919.17	1.8	23,201	28,092	20,625
469.95	224.22	1,032.62	422.01	600	1.0	10	3.000	30.00	164.22	1,000.00	5,474.00	6,474.00	0.8	5,071	362.01	2,000.00	12,067.00	14,067.00	1.7	24,210	29,281	21,814

GRADE OF WAFFLES = 2%

Area 1		Area 2							Area 1						Area 2							
Length (ft)	Width (ft)	Length (ft)	Width (ft)	Distance Between Ditches (ft)	Grade	Slope	Height of Waffles (ft)	Length of Ends (ft)	Length of Middle (ft)	Volume of Ends (cy)	Volume of Middle (cy)	Total Volume of 1 Waffle (cy)	Number of Waffles	Storage Volume (cy)	Length of Middle (ft)	Volume of Ends (cy)	Volume of Middle (cy)	Total Volume of 1 Waffle (cy)	Number of Waffles	Storage Volume (cy)	Total Storage Volume (cy)	Available Consolidated Waste Storage Volume (cy)
469.95	224.22	1,032.62	422.01	75	2.0	10	0.750	7.50	209.22	7.81	217.94	225.75	6.3	1,415	407.01	15.63	423.97	439.59	13.8	6,052	7,467	0
469.95	224.22	1,032.62	422.01	123	2.0	10	1.230	12.30	199.62	34.46	559.27	593.73	3.8	2,268	397.41	68.92	1,113.41	1,182.33	8.4	9,926	12,194	4,727
469.95	224.22	1,032.62	422.01	150	2.0	10	1.500	15.00	194.22	62.50	809.25	871.75	3.1	2,731	392.01	125.00	1,633.38	1,758.38	6.9	12,105	14,836	7,369
469.95	224 22	1,032.62	422.01	175	2.0	10	1.750	17.50	189.22	99.25	1,073.12	1,172.37	2.7	3,148	387.01	198.50	2,194.85	2,393.34	5.9	14,122	17,271	9,804
469.95	224.22	1,032.62	422.01	200	2.0	10	2.000	20.00	184.22	148.15	1,364.59	1,512.74	2.3	3,555	382.01	296.30	2,829.70	3,126.00	5.2	16,140	19,694	12,227
469.95	224.22	1,032.62	422.01	225	2.0	10	2.250	22.50	179.22	210.94	1,680.19	1,891.13	2.1	3,950	377.01	421.88	3,534.47	3,956.34	4.6	18,157	22,107	14,640
469.95	224.22	1,032.62	422.01	250	2.0	10	2.500	25.00	174.22	289.35	2,016.44	2,305.79	1.9	4,334	372.01	578.70	4,305.67	4,884.38	4.1	20,175	24,509	17,042
469.95	224.22	1,032.62	422.01	275	2.0	10	2.750	27.50	169.22	385.13	2,369.86	2,754.99	1.7	4,708	367.01	770.25	5,139.84	5,910.09	3.8	22,192	26,900	19,433
469.95	224.22	1,032.62	422.01	300	2.0	10	3.000	30.00	164.22	500.00	2,737.00	3,237.00	1 6	5,071	362.01	1,000.00	6,033.50	7,033.50	3.4	24,210	29,281	21,814
469.95	224.22	1,032.62	422.01	325	2.0	10	3.250	32.50	159.22	635.71	3,114.37	3,750.08	1.4	5,423	357.01	1,271.41	6,983.18	8,254.59	3.2	26,227	31,650	24,183
469.95	224.22	1,032.62	422.01	400	2.0	10	4.000	40.00	144.22	1,185.19	4,273.19	5,458.37	1.2	6,413	342.01	2,370.37	10,133.63	12,504.00	2.6	32,280	38,693	31,226
469.95	224.22	1,032.62	422.01	425	2.0	10	4.250	42.50	139.22	1,421.59	4,656.78	6,078.37	1.1	6,721	337.01	2,843.17	11,272.67	14,115.84	2.4	34,297	41,018	33,551
469.95	224.22	1,032.62	422.01	500	2.0	10	5.000	50.00	124.22	2,314.81	5,750.93	8,065.74	0.9	7,581	322.01	4,629.63	14,907.87	19,537.50	2.1	40,350	47,931	40,464
469.95	224.22	1,032.62	422.01	525	2.0	10	5.250	52.50	119.22	2,679.69	6,085.19	8,764.88	0.9	7,846	317.01	5,359.38	16,180.72	21,540 09	2.0	42,367	50,213	42,746
469.95	224.22	1,032.62	422.01	550	2.0	10	5.500	55.00	114.22	3,081.02	6,398.44	9,479.45	0.9	8,100	312.01	6,162.04	17,478.34	23,640.38	1 9	44,385	52,484	45,017
469.95	224.22	1,032.62	422.01	575	2.0	10	5.750	57.50	109.22	3,520.54	6,687.20	10,207.74	0.8	8,343	307 01	7,041.09	18,797.26	25,838.34	1.8	46,402	54,745	47,278
469.95	224.22	1,032.62	422.01	600	2.0	10	6.000	60.00	104.22	4,000.00	6,948.00	10,948.00	0.8	8,575	302.01	8,000.00	20,134.00	28,134 00	1.7	48,420	56,995	49,528



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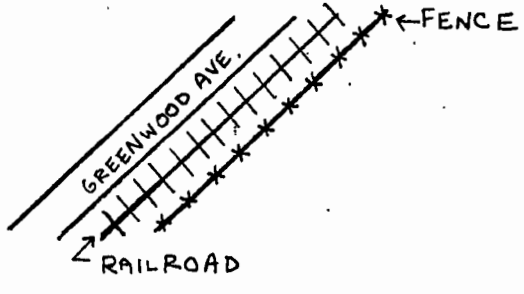
SITE 8A SOUTHEAST BORDER (GREENWOOD AVE.)



1-5

CTO 0143

FIGURE 1

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE ____ OF ____

CLIENT: NCBC GULFPORT	JOB NUMBER: 7379 NXO 140-105
SUBJECT: SITE 8 REMEDIAL DESIGN - GRADING PLAN OPTIONS - SCHEMATICS	
BASED ON: TERRAMODEL	DRAWING NUMBER: FIGURES 2-4 NTS
BY: JLM / CHECKED BY: RCM 11/11/02	APPROVED BY: / DATE: 10-31-02

FIGURE 2 - ALTERNATIVES 1, 1A, 4C, & 5

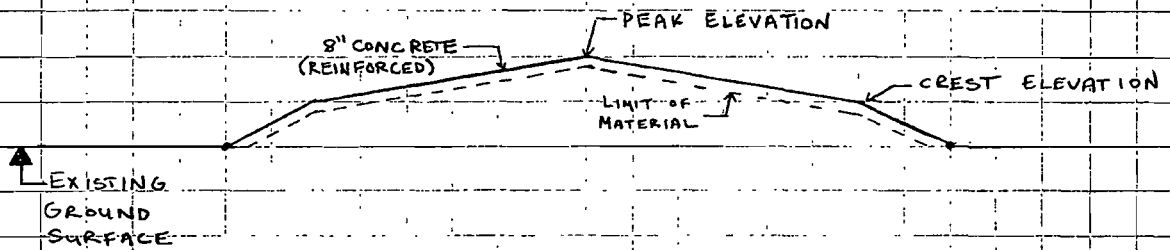


FIGURE 3 - ALTERNATIVES 2, 2A, 2B, & 3

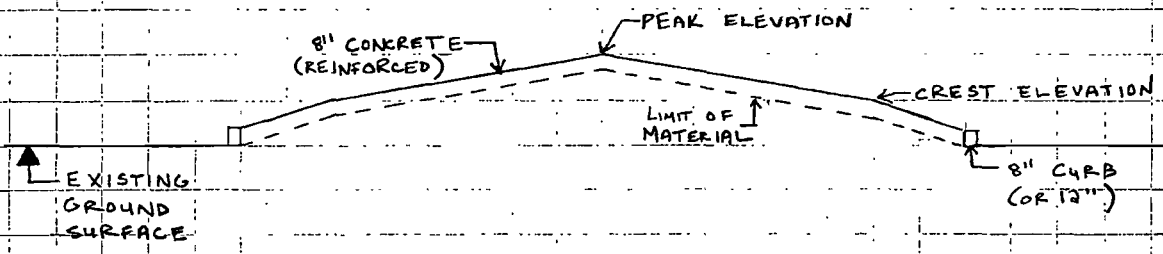
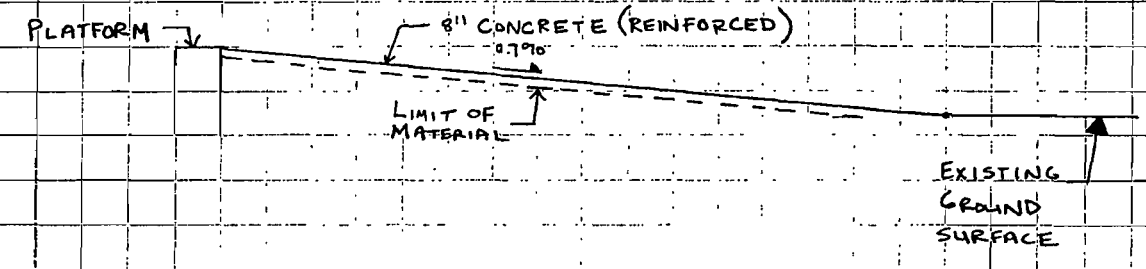


FIGURE 4 - ALTERNATIVE 4



FIGURES 2→4
NTS

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE _____ OF _____

CLIENT	JOB NUMBER
NCBC GULFPORT	7379 NXO 140-105
SUBJECT	
SITE 8 REMEDIAL DESIGN - GRADING PLAN OPTIONS - SCHEMATICS	
BASED ON	**DRAWING NUMBER**
TERRAMODEL	FIGURES 5-6 NTS
BY / **CHECKED BY**	**APPROVED BY** / **DATE**
JLM / RCM 11/11/02	10-31-02

FIGURE 5 - ALTERNATIVE 4A & 4C

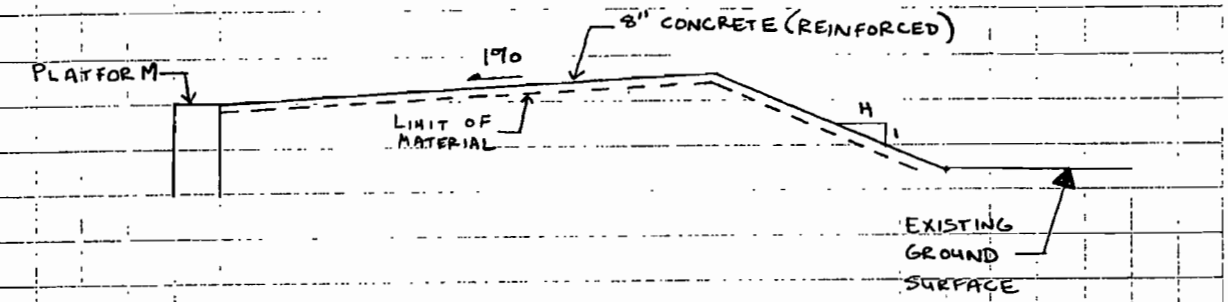
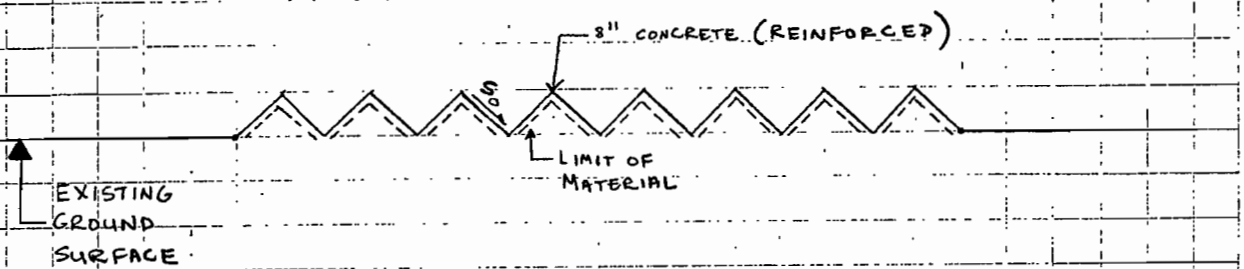


FIGURE 6 - ALTERNATIVE 4C & 6



FIGURES 5 → 6
NTS

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE ____ OF ____

CLIENT	JOB NUMBER
NCBC GULFPORT	7379 NXO 140-105
SUBJECT	
SITE 8 REMEDIAL DESIGN - GRADING PLAN OPTIONS - ALTERNATIVE 4	
BASED ON	**DRAWING NUMBER**
NCBC RAIL ROAD RAMP	FIGURE 7 NTS
BY JLM	**CHECKED BY** RCM 11/11/02
APPROVED BY	**DATE** 11-1-02

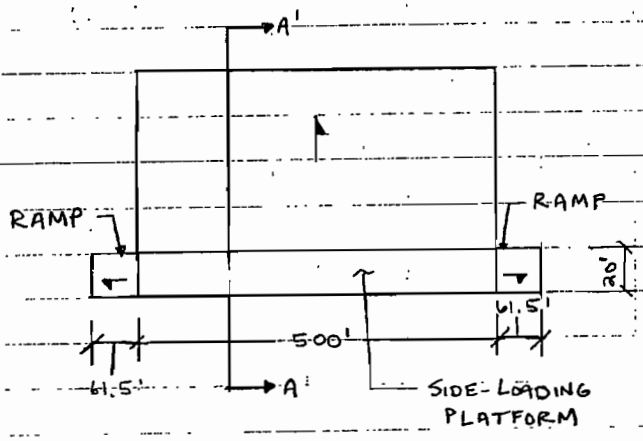
ASSUMPTIONS

LENGTH OF PLATFORM = 500 ft

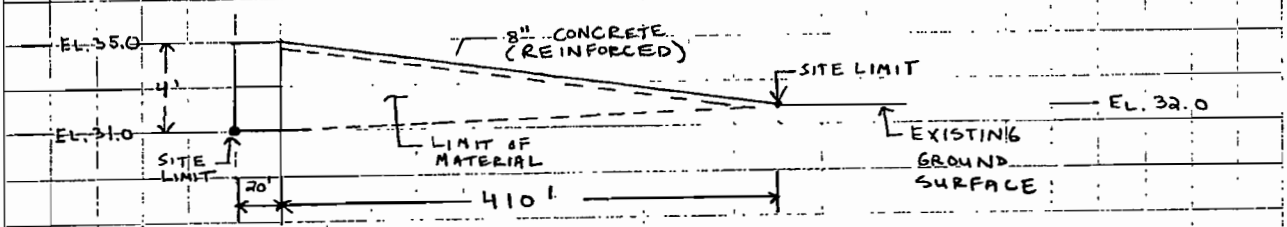
WIDTH OF PLATFORM = 20 ft

HEIGHT OF PLATFORM = 4 ft

PLAN VIEW:



SECTION VIEW A-A':



FROM TERRAMODEL:

STORAGE VOLUME = 12,330.2 cy = 12,300 cy

AREA (INCLUDING PLATFORM) = 4.9 acres

AREA (EXCLUDING PLATFORM, CONSOLIDATION AREA ONLY) = 4.7 acres

FIGURE 7
ALTERNATIVE 4

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE ____ OF ____

CLIENT	JOB NUMBER
NCBC GULFPORT	7379 NXO 140-105
SUBJECT	
SITE 8 REMEDIAL DESIGN - GRADING PLAN OPTIONS - ALTERNATIVE 4A	
BASED ON	**DRAWING NUMBER**
	FIGURE 8 NTS
BY / **CHECKED BY**	**APPROVED BY** / **DATE**
JLM / RCM 11/11/02	11-5-02

ASSUMPTIONS

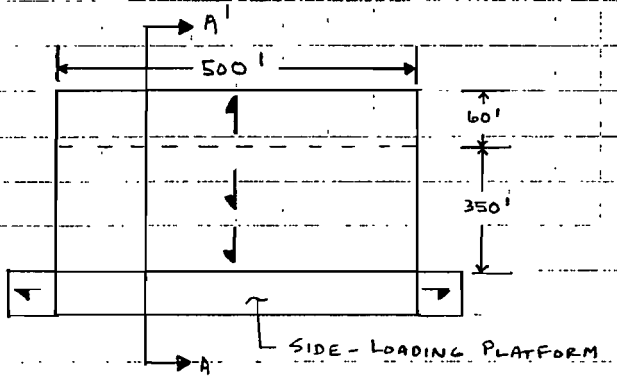
LENGTH OF PLATFORM = 500 ft

HEIGHT OF PLATFORM = 4 ft

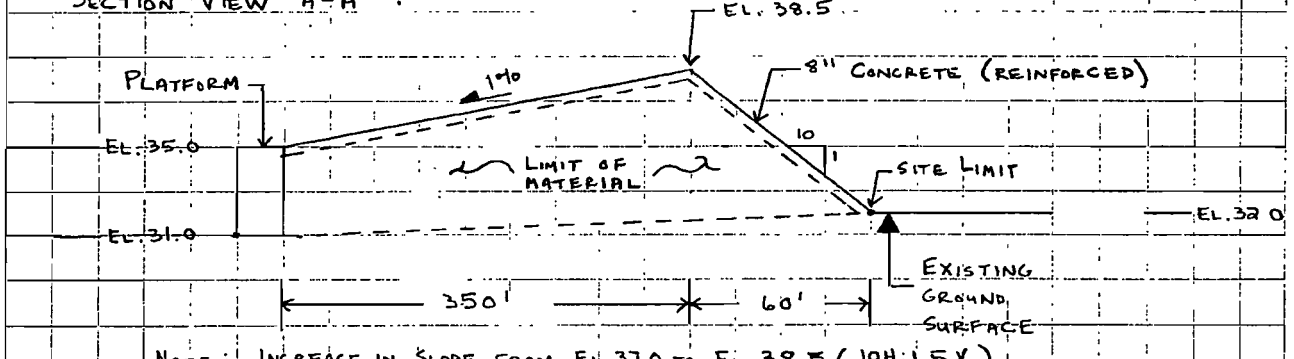
SLOPE FROM PLATFORM = 1%

SLOPE FROM SOUTHERN EDGE OF SITE = 10H:1V

PLAN VIEW:



SECTION VIEW A-A':



NOTE: INCREASE IN SLOPE FROM EL 37.0 TO EL 38.5 (10H:1.5V)

FROM TERRAMODEL:

STORAGE VOLUME = 32,344.7 cy = 32,300 cy

AREA (INCLUDING PLATFORM) = 4.9 acres

AREA (EXCLUDING PLATFORM, CONSOLIDATION AREA ONLY) = 4.7 acres

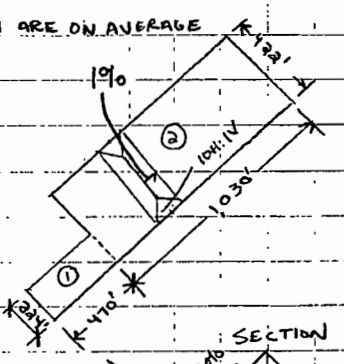
AREA (PLATEAU, EXCLUDING PLATFORM) = 4.0 acres

FIGURE 8
ALTERNATIVE 4A

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE ____ OF ____

CLIENT	JOB NUMBER
NCBC GULFPORT	7379 NXO 140-105
SUBJECT	
SITE 8 REMEDIAL DESIGN – GRADING PLAN OPTIONS – ALTERNATIVE 6	
BASED ON	**DRAWING NUMBER**
	FIGURE 9 NTS
BY / **CHECKED BY**	**APPROVED BY** / **DATE**
JLM / RCM 11/11/02	11-4-02

* LENGTH SHOWN ARE ON AVERAGE



FROM FIGURE 1 (USING 90 SCALE)

AVERAGE DISTANCE BETWEEN DITCHES = $0.4'' \times \frac{400'}{1.3''} = 123'$

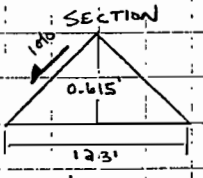
ASSUME 1% GRADES ON SIDES

ASSUME 10H:1V AT ENDS

HEIGHT OF WAFFLES → $\frac{H}{(123'/2)}(100) = 1$

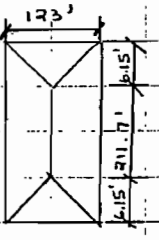
$H = 0.615'$ (0.75' CONCREE ASSUMED)

LENGTH OF ENDS → $\frac{10\,H}{1V} = \frac{x\,H}{0.615\,V}$ $x = 6.15'$



AREA ①

LENGTH OF MIDDLE = $224' - 12.30' = 211.7'$



VOLUME OF ENDS $\approx \frac{1}{2}(6.15')\left(\frac{0.615'}{2}\right)(123') \times 2 = 233$ cf /WAFFLE

VOLUME OF MIDDLE $= \frac{1}{2}(61.5)(0.615)(211.7') \times 2 = 8,007$ cf /WAFFLE

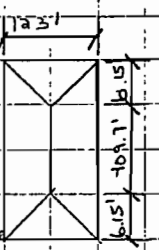
TOTAL VOLUME OF 1 WAFFLE ≈ 233 cf $+ 8,007$ cf $= 8,240$ cf

NUMBER OF WAFFLES = $470'/123' = 3.8$

STORAGE VOLUME OF AREA 1 = $(8,240\text{ cf})(3.8)/27 = 1,160$ cy

AREA ②

LENGTH OF MIDDLE = $422' - 12.30' = 409.7'$



VOLUME OF ENDS $\approx \frac{1}{2}(6.15')\left(\frac{0.615'}{2}\right)(123') \times 2 = 233$ cf /WAFFLE

VOLUME OF MIDDLE $= \frac{1}{2}(61.5')(0.615')(409.7') \times 2 = 15,495$ cf /WAFFLE

TOTAL VOLUME OF 1 WAFFLE ≈ 233 cf $+ 15,495$ cf $= 15,728$ cf /WAFFLE

NUMBER OF WAFFLES = $1,030'/123' = 8.4$

STORAGE VOLUME OF AREA 2 = $(15,728\text{ cf})(8.4)/27 = 4,893$ cy

TOTAL STORAGE VOLUME $1,160$ cy $+ 4,893$ cy $= 6,053$ cy

SURFACE AREA $\approx [(211.7' \times 470') + (409.7' \times 1,030')]/43,560 = 12$ acres

* SINCE 0.75' CONCRETE, NO STORAGE VOLUME FOR CONSOLIDATED MATERIAL *

FIGURE 9
ALTERNATIVE 6

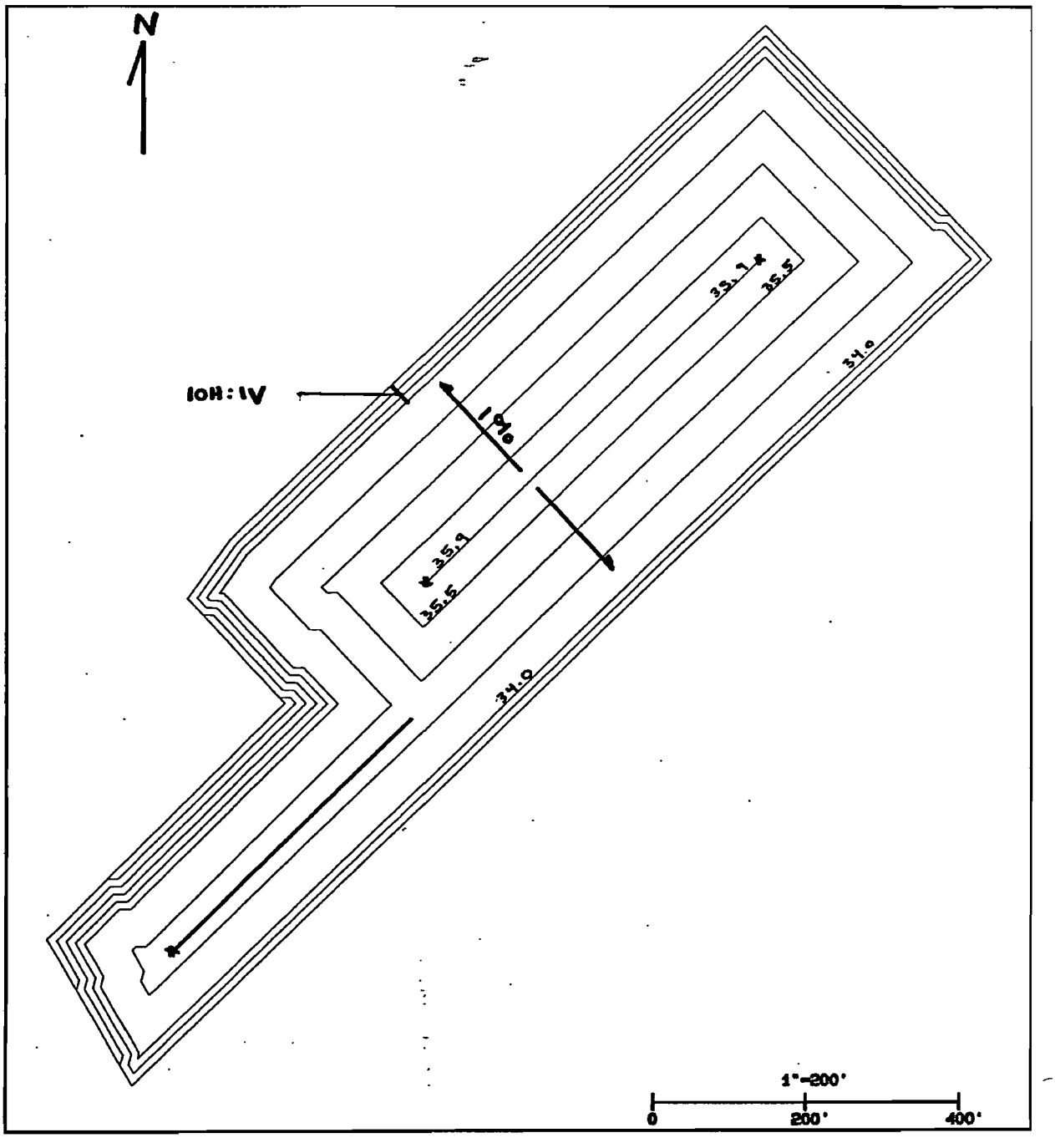


FIGURE 10
ALTERNATIVE 1A
FINAL GRADES

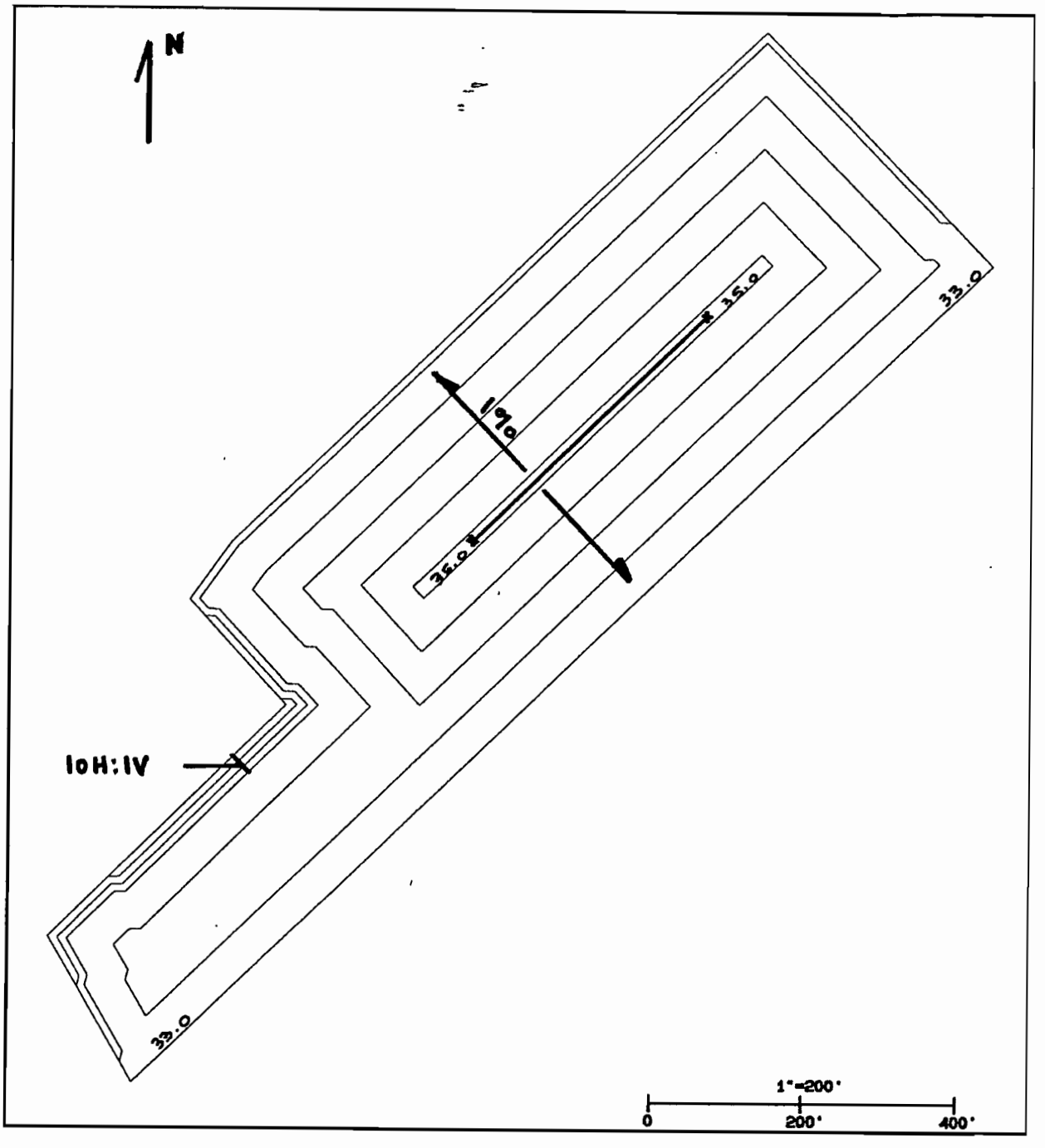


FIGURE 11
ALTERNATIVE 2B
FINAL GRADES

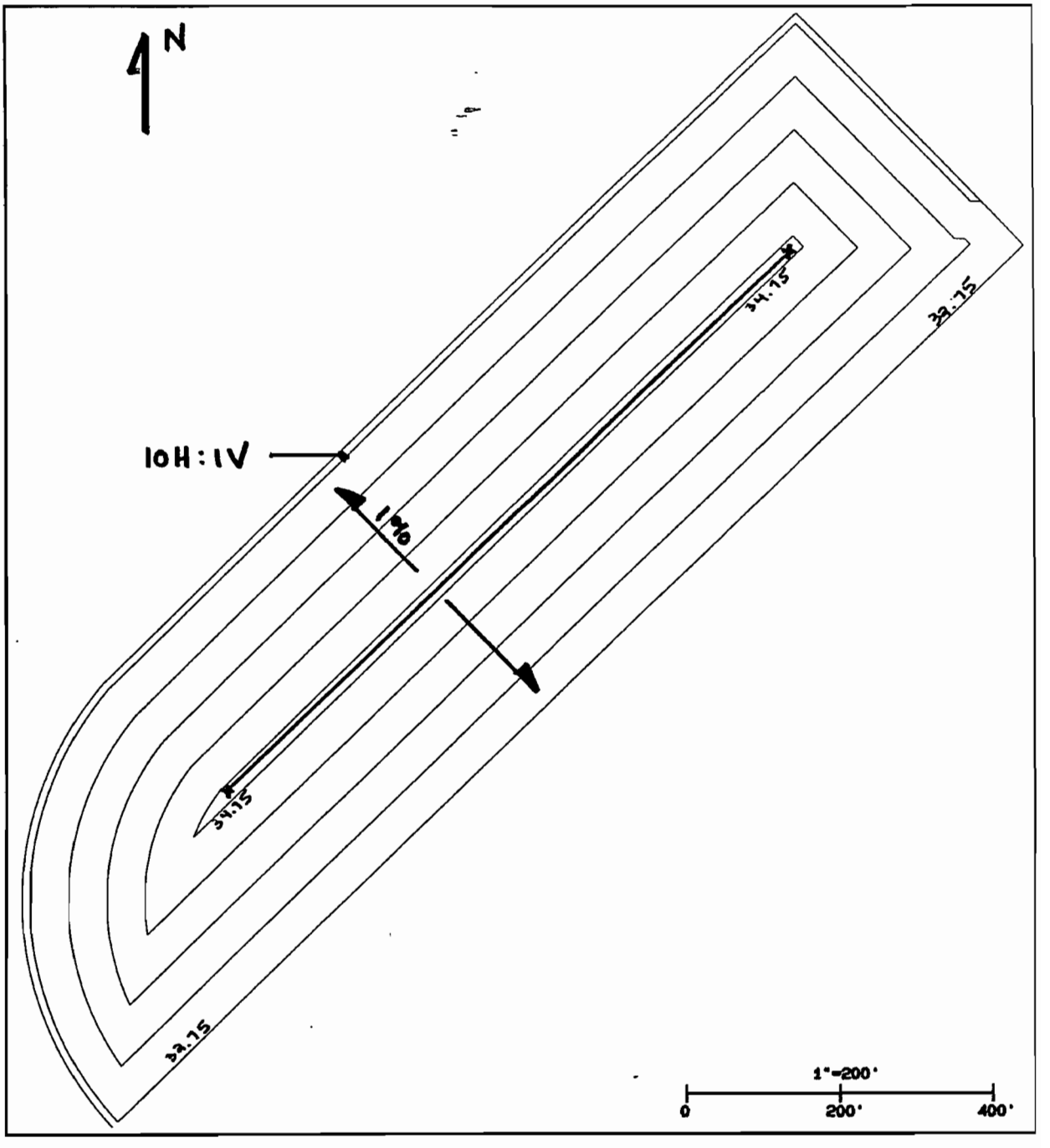


FIGURE 12
ALTERNATIVE 3
FINAL GRADES

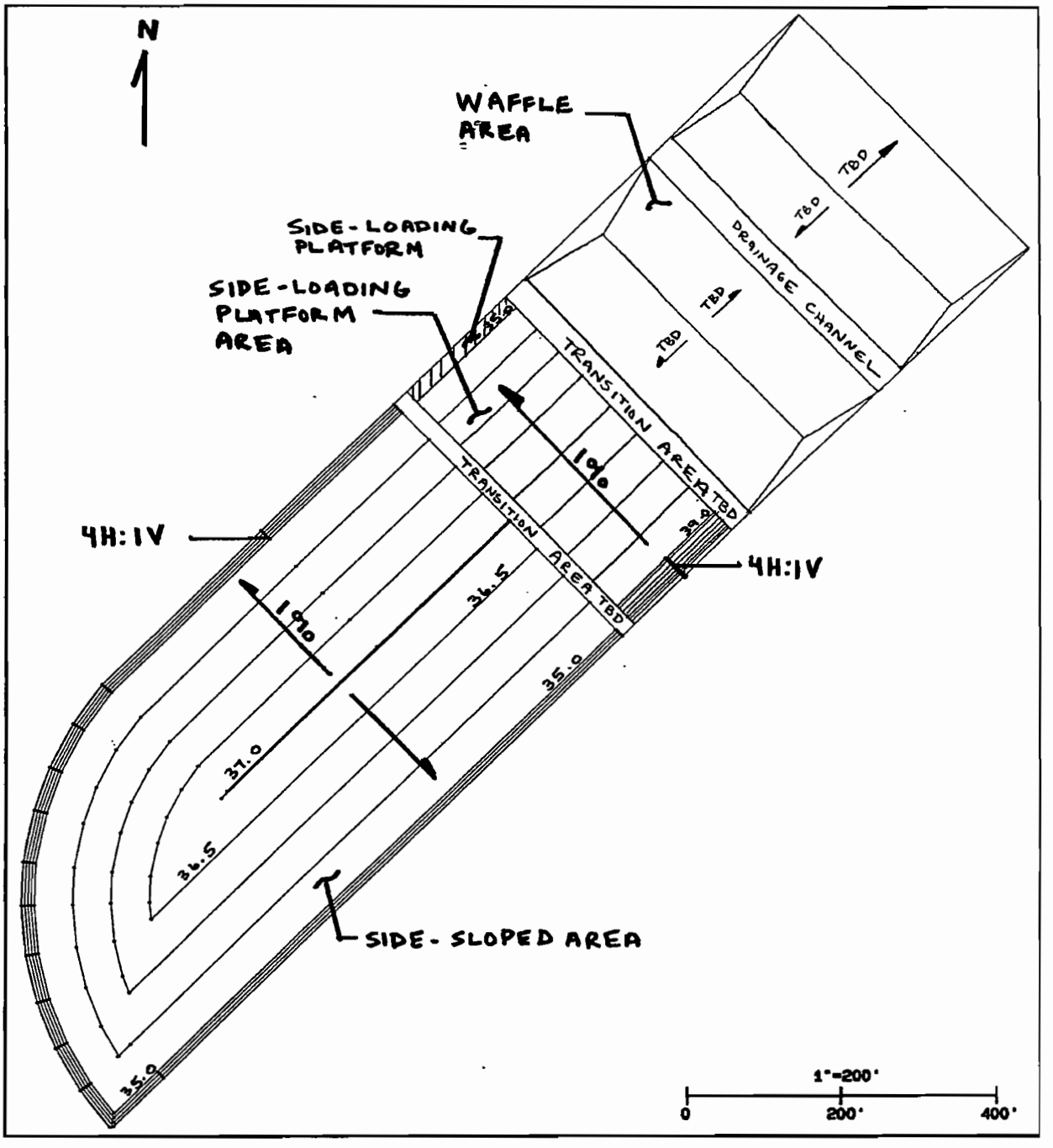


FIGURE 13
ALTERNATIVE 4C
FINAL GRADES

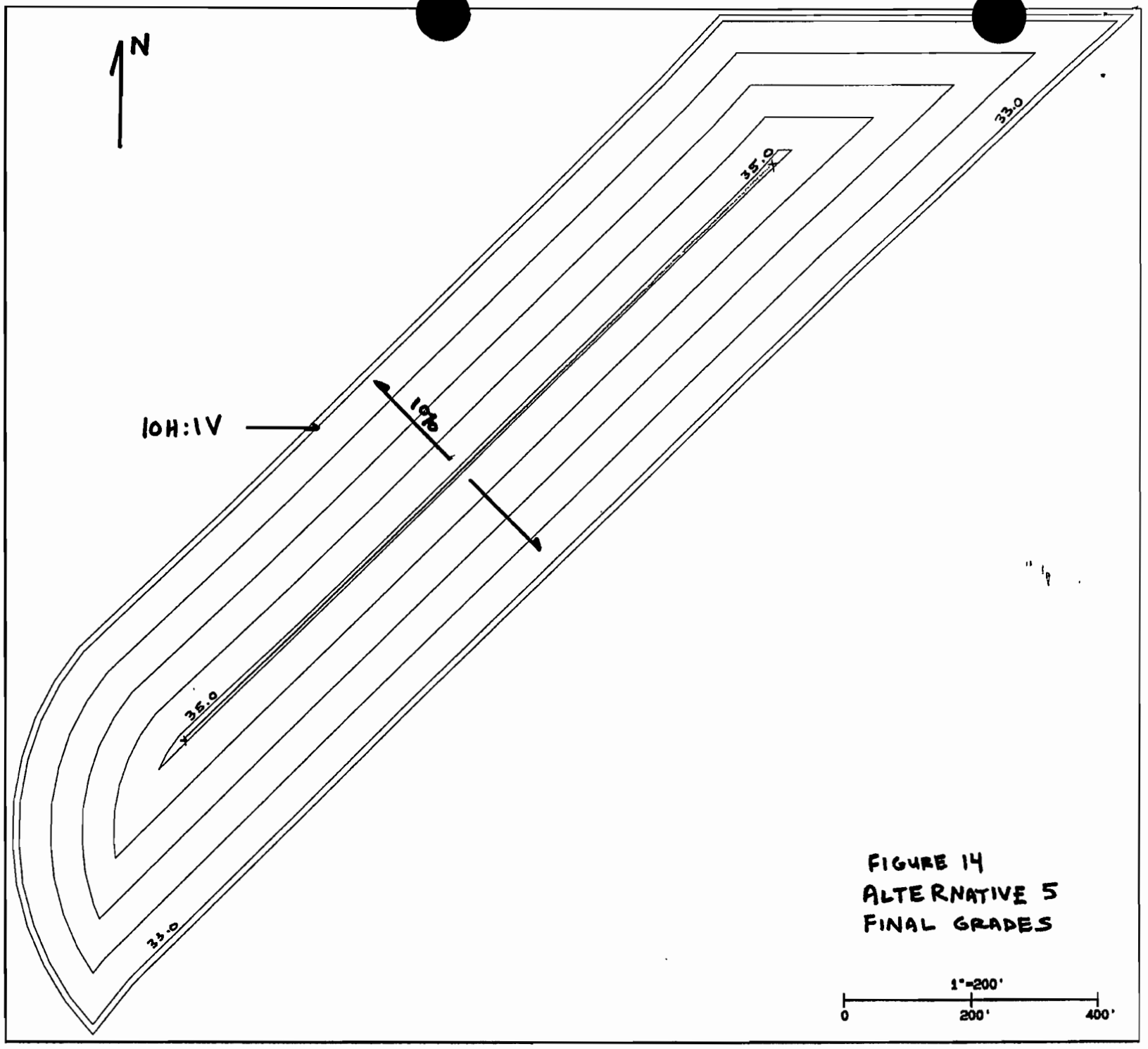


FIGURE 14
ALTERNATIVE 5
FINAL GRADES

1"=200'
0 200' 400'

ATTACHMENT II

MATERIAL VOLUME CALCULATION

CLIENT: NCBC GULPORT			JOB NUMBER: 7379 NXO 140-105
SUBJECT: REMEDIAL DESIGN - GRADING PLAN OPTIONS - MATERIAL VOLUME CALCULATION			
BASED ON:			DRAWING NUMBER:
BY: JLM Date: 10-31-02		CHECKED BY: Date: JSB 11/01/02	APPROVED BY: DATE:

2) Excavation and Confirmation Sampling Report for the Edwards Property, Site 8 Herbicide Orange Study Area at Naval Construction Battalion Center, Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, Charleston, South Carolina, August 2002.

3) Merritt, Frederick S., 1983. Standard Handbook for Civil Engineers, Third Edition.

CALCULATIONS:A6

1. Volume of Material Blend

Site 8A Soil Ash = 21,000 cy (Reference 1)

On-Base Ditches = 25,100 cy (Page 4 of 6)

Off-Base Swampland = 25,800 cy (Figure 1-2 of Reference 2)

Area (si)	Area (sf)	Excavation Depth (ft)	Volume (cy)
0.4650009	465,001	1.5	25,833

Total Volume of Material Blend = 71,900 cy

2. Estimated Weight of Material Blend

Wet Density of Material Blend (Appendix B of Reference 1)

Lift 1 (pcf)	Lift 2 (pcf)	Average (pcf)
123.3	118.5	120.9

Weight of Material Blend (With Top 9" of Off-Base Swampland)
Weight = (Soil Ash + On-Base + Top 9" Off-Base) x Average Wet Density
Weight = 96,297 ton

Weight of Material Blend (Bottom 9" of Off-Base Swampland)
Weight = (Bottom 9" Off-Base) x Unit Weight
Assume Unit Weight = 105 pcf (Reference 3, Average of range for silty clays)
Weight = 18,286 ton

Total Weight of Material Blend = 114,583 ton

CLIENT:	NCBC GULPORT	JOB NUMBER:	7379 NXO 140-105
SUBJECT:	REMEDIAL DESIGN - GRADING PLAN OPTIONS - MATERIAL VOLUME CALCULATION		
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 10-31-02	CHECKED BY: Date: JJB 11/01/02	APPROVED BY:	DATE:

3. Volume of Portland Cement

Total Weight of Portland Cement = Total Weight of Material Blend x 7.5%
Weight = 8,594 ton

Specific Gravity = 3.15 (Page 6 of 6)
Unit Weight of Water = 62.4 pcf
Unit Weight of Portland Cement = 196.6 pcf

Volume of Portland Cement = Total Weight of Portland Cement / Unit Weight
Volume = 3,239 cy

4. Volume of Material to be Consolidated on Site 8A

Volume of Material = Site 8A Soil Ash + On-Base Ditches + Off-Base Swampland + Portland Cement
Volume = 75,139 cy

Volume of Material Currently Consolidated on Site 8A = Site 8A Soil Ash + Site 8A Ditches
(Based on topography provided by Land Surveying, Inc. in January 2001)
Volume of Site 8A Soil Ash = 21,000 cy
Volume of Site 8A Ditches = 2,400 cy (Page 4 of 6)
Volume = 23,400 cy

Volume of Material to be Consolidated on Site 8A
Volume = Volume of Material - Volume of Material Currently Consolidated on Site 8A
Volume = 51,739 cy

Volume of Material to Consolidate on Site 8A = 51,700 cy

Assumptions

8A Ditch Segments[1]

Stream Segment	Soil Composition	Width (W)	Vertical Depth from Top of Bank to Top of Sediment (T)(ft)	Excavation Thickness	Segment Length (L) (ft)	Volume Total (ft3)[(3)]	Excavation Volume (cy)
2a	sand	11	3	2	250	4,621	171
3	sand	14	3	3	600	19,491	722
4	sand	10	2	3	200	4,731	175
5	sand	9	3	4	690	14,135	524
6	sand	22	4	2	240	9,435	349
7a	sand	16	4	2	200	5,463	202
C1	sand	13	3	2	200	4,497	167
J1	sand	11	2.5	2	190	3,623	134
						65,997	2,444

CH2M Hill Excavation[2]

Stream Segments	Soil Composition	Width (W)	Vertical Depth from Top of Bank to Top of Sediment (T)(ft)	Excavation Thickness	Segment Length (L) (ft)	Volume Total (ft3)	Actual Excavation Volume (cy)
A, B, C, D, E, and J	sand	NA	NA	NA	2510	70,200	2,600

Non - 8A, B, and C Areas

Stream Segment	Soil Composition	Width (W)	Vertical Depth from Top of Bank to Top of Sediment (T)(ft)	Excavation Thickness	Segment Length (L) (ft)	Volume Total (ft3)	Excavation Volume (cy)
1	sand	11	2	2	800	15,725	582
2	sand	11	3	2	350	6,470	240
7	sand	16	4	2	540	14,749	546
8	sand	13	3	2	1050	23,609	874
9	sand	16	5	2	240	6,274	232
10	organic/sand	22	5.5	2	900	33,801	1,252
11	organic/sand	22	5	2	430	16,401	607
12	organic/sand	30	5	3	2150	159,405	5,904
13	organic/sand	24	5	3	280	15,720	582
14	organic/sand	22	5	3	660	33,094	1,226
15	organic/sand	21	6	4	300	15,891	589
16	organic/sand	24	5	3	2100	117,898	4,367
17	sand	11	2	3	700	18,660	691
F	organic/sand	8	1.5	2	580	8,261	306
G	organic/sand	23	3	2	400	16,994	629
H	organic/sand	25	5	2	0	-	-
I	organic/sand	24	4	2	650	28,154	1,043
K	sand	11	2	2	550	10,811	400
						541,918	20,071

	Volume Total (ft3)	Excavation Volume (cy)
TOTALS	541,918	20,071

1. Consists of ditch segments found within the footprint of Site 8A. Ditch segments will require excavation for solidification purposes.
2. Volume based on actual quantities observed during the August/September 2002 excavation of Area 8B and 8C ditch segments.
3. Volume calculation methodology can be referenced in the Focused Feasibility Study for Site 8, December 2001.

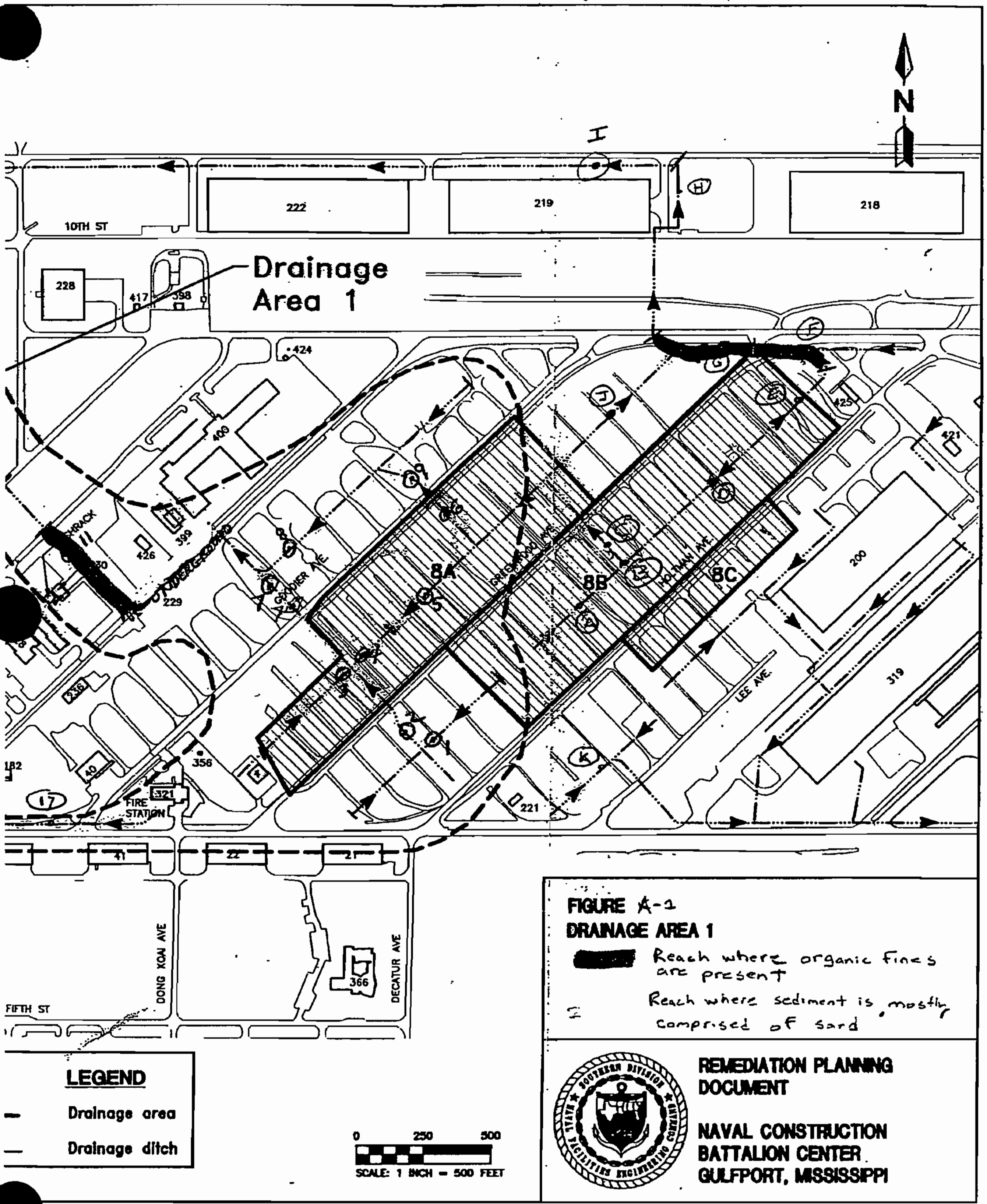


FIGURE A-1
DRAINAGE AREA 1

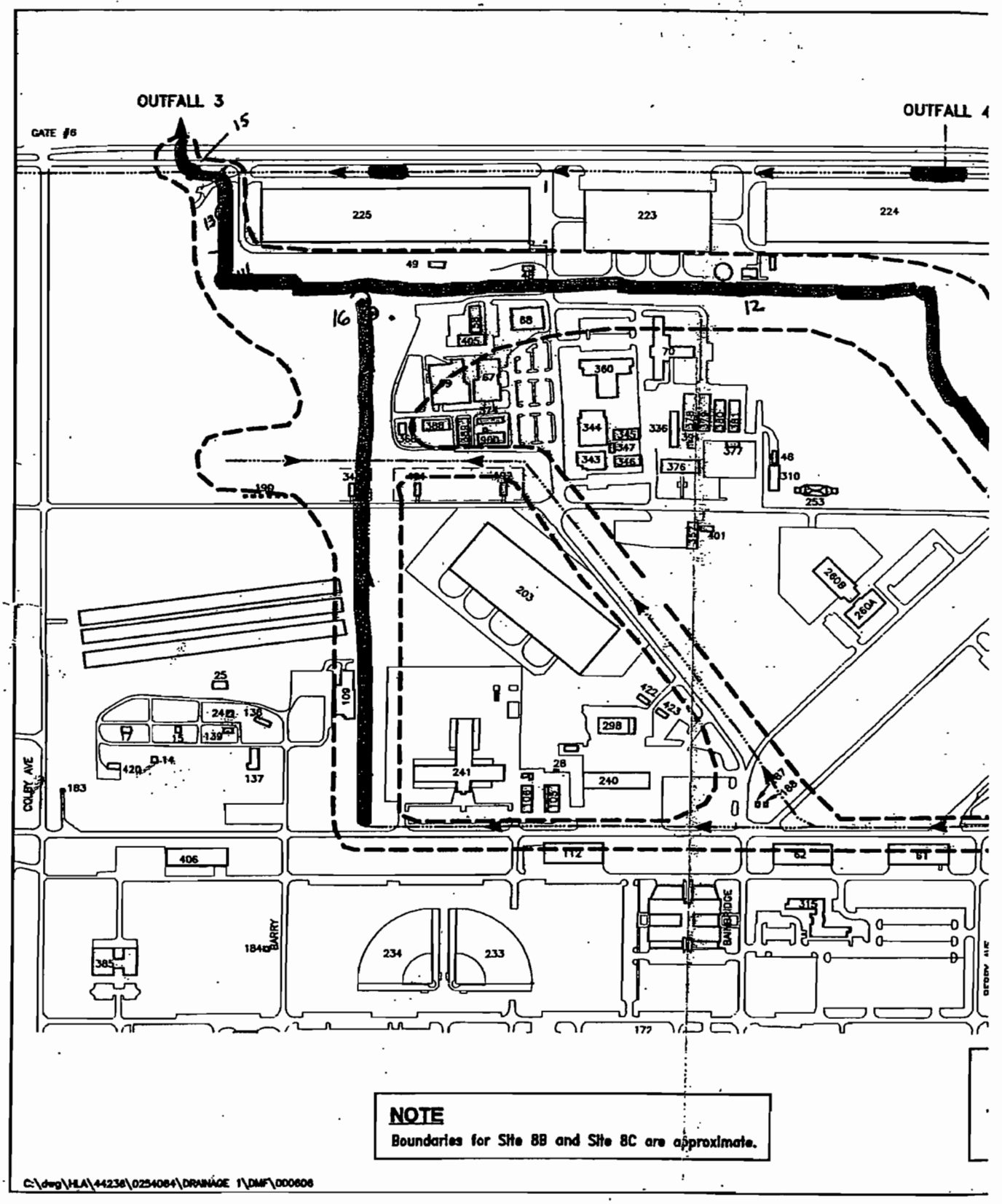
Reach where organic fines are present

Reach where sediment is mostly comprised of sand

REMEDIATION PLANNING DOCUMENT

NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI

curin LLM 11-3-00



NOTE
Boundaries for Site 8B and Site 8C are approximate.

C:\dwg\HLA\44236\0254084\DRAINAGE 1\DMF\000606

Section VIII - Exposure Control/Personal Protection

Skin Protection: Prevention is essential to avoiding potentially severe skin injury. Avoid contact with unhardened wet portland cement products. If contact occurs, promptly wash affected area with soap and water. Where prolonged exposure to unhardened portland cement products might occur, wear impervious clothing and gloves to prevent skin contact. Where required, wear sturdy boots that are impervious to water to eliminate foot and ankle exposure. **Do not rely on barrier creams; barrier creams should not be used in place of gloves.** Periodically wash areas contacted by dry portland cement or wet cement or concrete with a pH neutral soap. Wash again at the end of the work. If irritation occurs, immediately wash the affected area and seek treatment. If clothing becomes saturated with wet concrete, it should be removed and replaced with clean, dry clothing.

Respiratory protection: Avoid actions that cause dust to become airborne. Use local or general ventilation to control exposures below applicable exposure limits. Use NIOSH/MSHA-approved (under 30 CFR 11) or NIOSH-approved (under 42 CFR 84) respirators in poorly ventilated areas, if an applicable exposure limit is exceeded, or when dust causes discomfort or irritation. (Advisory: Respirators and filters purchased after July 10, 1998, must be certified under 42 CFR 84.)

Ventilation: Use local exhaust or general dilution ventilation to control exposure within applicable limits.

Eye Protection: In conditions where user may be exposed to splashes or puffs of cement, wear safety glasses with side shields or goggles. In extremely dusty or unpredictable environments, wear unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when working with portland cement or fresh cement products.

Section IX - Physical & Chemical Properties

Appearance:	*Gray or white powder*	Vapor Pressure:	*Not applicable*
Odor:	*No distinct odor*	Vapor density:	*Not applicable*
Physical state:	*Solid (powder)*	Boiling point:	*Not applicable (i.e., > 1000 °C)*
pH (in water):	*12 to 13*	Melting point:	*Not applicable*
Solubility in water:	*Slightly (0.1 to 1.0%)*	Specific gravity (H_2O = 1.0):	*3.15* ←
Evaporation Rate:	*Not applicable*		

Section X - Stability & Reactivity

Stability:	*Stable.*
Incompatibility:	*Wet portland cement is alkaline. As such it is incompatible with acids, ammonium salts, and aluminum metal.*
Conditions to avoid:	*Unintentional contact with water.*
Hazardous decomposition:	*Will not spontaneously occur. Adding water produces (caustic) calcium hydroxide as a result of hydration.*
Hazardous polymerization:	*Will not occur.*

Section XI - Toxicological Information

For a description of available, more detailed toxicological information, contact Holcim (US) Inc. (in Section I).

Section XII - Ecological Information

Ecotoxicity:	*No recognized unusual toxicity to plants or animals*
Relevant physical and chemical properties:	*See Sections IX & X*

Section XIII - Disposal

Dispose of waste material according to local, state, and federal regulations. (Since portland cement is stable, uncontaminated material may be saved for future use.) Dispose of bags in an approved landfill or incinerator.

Section XIV - Transportation Data

Hazardous materials description/proper shipping name:	*Portland cement is not hazardous under U.S. Department of Transportation (DOT) regulations*
Hazard class:	*Not applicable*
Identification class:	*Not applicable*
Required label text:	*Not applicable*
Hazardous substances/reportable quantities (RQ):	*Not applicable*

REFERENCE: HOLCIM
www.grancem.com