376

2-209.8

TRANSMITTAL OF RESPONSES TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY AND THE OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS AND THE FINAL DESIGN OF THE WASTE HAUL ROAD AND REROUTED NORTH ENTRANCE ROAD

08/22/96

DOE-1263-96
DOE-FN EPAS
75 70
RESPONSES

Department of Energy
Ohio Field Office
Fernald Area Office
P. O. Box 538705
Cincinnati, Ohio 45253-8705
(513) 648-3155

AUG 22 1996
DOE-1263-96

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF RESPONSES TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY AND THE OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS AND THE FINAL DESIGN OF THE WASTE HAUL ROAD AND REROUTED NORTH ENTRANCE ROAD

This letter transmits the responses to comments from the U.S. Environmental Protection Agency (U.S. EPA) and Ohio Environmental Protection Agency (OEPA) on the Pre-Final Design of the Waste Haul Road and Rerouted North Entrance Road. Due to the schedule established in the Operable Unit 2 (OU2) Remedial Design Work Plan (RDWP), the Certified for Construction (CFC) package was sent to the U.S. EPA and the OEPA on August 7, 1996. Therefore, instead of duplicating what was sent earlier this month, this submittal includes only change pages and requested drawings.

If you have any questions, please contact Rod Warner at (513) 648-3156.

Sincerely,

Johnny Reising
Fernald Remedial Action
Project Manager

FEMP:Warner

Enclosure: As Stated

cc w/enc:

R. L. Nace, EM-425/GTN
G. Jablonowski, USEPA-V, 5HRE-8J
R. Beaumier, TPSS/DERR, OEPA-Columbus
T. Schneider, OEPA-Dayton (3 copies of ens.)
F. Bell, ATSDR
D. S. Ward, GeoTrans
R. Vandegrift, ODOH
S. McLellan, PRC
T. Hagen, FERMCO/65-2
J. Harmon, FERMCO/90
AR Coordinator/78 [redacted]

cc w/o enc:

J. Patterson, DOE-HQ
J. Jalovec, DOE-FEMP
S. Peterman, DOE-FEMP
J. Reising, DOE-FEMP
S. Garland, FERMCO, MS52-2
M. Hickey, FERMCO, MS52-2
J. Jenkins, FERMCO, MS52-2
C. Little, FERMCO, MS2
T. Walsh, FERMCO, MS65-2

TECHNICAL REVIEW COMMENTS ON THE PREFINAL DESIGN PACKAGE (90 PERCENT) AND DRAFT REMEDIAL ACTION WORK PLAN FOR THE HAUL ROAD AND REROUTED NORTH ENTRANCE ROAD FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, FERNALD, OHIO

Specific technical review comments on (1) the design criteria package (DCP), (2) design and construction calculations package, (3) prefixal design drawing package, and (4) draft remedial action work plan (RAWP) of the prefixal design package (PDP) (90 percent) are presented below.

SPECIFIC COMMENTS

DESIGN CRITERIA PACKAGE

Commenting Organization: U.S. EPA — Commentor: Saric
Section #: 2.3.1 — Page #: 2-10 — Line #: NA
Original Specific Comment #: 1

Comment: Section 2.3.1 states that temporary sedimentation basins will be used to prevent sedimentation from migrating off site. These sedimentation basins do not appear in any of the plans. The sedimentation basin locations should be shown in the final design package and in the temporary erosion control drawings for both the haul road and relocated north entrance road.

Response: Sediment basins and/or traps constructed for the Area 1 Phase I (East) Remedial Action Project will be used during construction of the Relocated North Entrance Road, Phase I. These will be in place when the road construction begins. The Haul Road has been designed to minimize the velocity in the ditches to less than two (2) feet per second, therefore ditch erosion should be minimal. The erosion and sediment control system shown on the 90 percent design drawings conservatively envelope ODOT standards, which allows much higher ditch velocities (i.e., 4 to 5 fps).

Action: The locations of the basins and traps constructed as part of Area 1, Phase I remedial activities were included in the CFC bid package as reference drawings. Drawings 75A-5500-G-00439, 75A-5500-G-00440, and 75A-5500-G-00441 are attached for your information.

Commenting Organization: U.S. EPA — Commentor: Saric
Section #: 2.3.1 — Pages #: 2-11 and 2-12 — Line #: NA
Original Specific Comment #: 2

Comment: The roads on which the non-woven geotextile is to be used are not clear. The last paragraph on Page 2-11 states that a non-woven geotextile will be used on the haul road. The first paragraph on Page 2-12 refers to the north entrance road and the pavement as bituminous with an aggregate sub-base but does not mention a non-woven geotextile layer. The last sentence of

the last paragraph on Page 2-11 should be revised as follows: "To reduce the risk of cross contamination and prevent fines from interfering with the sub-base, a non-woven geotextile will be used on both the haul road and the relocated north entrance road."

Response: Agreed. Non-woven geotextile will be used on both the Haul Road and Relocated North Entrance Road. See Drawing Nos. 92X-5900-G-00219 and 92X-5900-G-00184.

Action: The first two paragraphs on Page 2-12 will be revised as follows: "The Haul Road and Relocated North Entrance Road will be bituminous pavement with an aggregate base, which will improve structural stability and provide for subgrade drainage. To reduce the risk of cross-contamination and to prevent fines from interfering with the base, a non-woven geotextile will be used on both the Haul Road and the Relocated North Entrance Road." Please note that the drawings show non-woven geotextile being used for both applications. The revised Page 2-12 is attached for review.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.3.1 Page #: 2-12 Line #: NA
Original Specific Comment #: 3

Comment: This paragraph refers to the compaction of the subgrade of both roadways and is not consistent with the typical pavement cross section drawings. Drawing No. 92X-5900-G-00184 for the haul road and Drawing No. 92X-5900-G-00219 for the rerouted north entrance road show the subgrade compaction layer designated as Balloon No. 10 in both drawings. In the legend of both drawings, Balloon No. 10 indicates that the subgrade compaction layer is 12 inches thick. Page 2-12 describes the subgrade compaction layer as 6 inches thick in cut sections and 18 inches thick in fill sections. The legends of both drawings should be changed to be consistent with the DCP by indicating that the compaction is 6 inches thick in cut sections and 18 inches thick in fill sections.

Response: Page 2-12 states that "the upper six (6) inches of cut sections and upper eighteen (18) inches of fill sections will be compacted from 95 to 98 percent of Standard Proctor with moisture controlled within two (2) percent of optimum." This is to achieve a CBR of four and guard against soft spots. In both road cases, the subgrade design is twelve (12) inches. Therefore, in fill sections, the entire depth (twelve [12] inches) shall be compacted from 95 to 98 percent Standard Proctor. In cut, the upper six (6) inches (out of twelve [12]) will be from 95 to 98 percent Standard Proctor.

Action: None.

DESIGN AND CONSTRUCTION CALCULATIONS PACKAGE

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Calc. 15-01 Page #: Pavement Design and Summary Sheet
Original Specific Comment #: 4 Line #: NA
Comment: The summary of the conclusions portion of this page indicates a 7-inch thick bituminous aggregate base (ODOT 301). Sheet 2 of 2 of these calculations shows a typical pavement section of the haul road that indicates a 6-inch thick bituminous aggregate base (ODOT 301). This discrepancy should be resolved.
Response: The bituminous aggregate base should be six (6) inches.
Action: The revised Engineering Calculations Title and Summary Sheet, Calculation N. 15-01 is attached for review.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Calc. 15-02 Page #: 1 of 4-Conduit Design
Original Specific Comment #: 5 Line #: NA
Comment: In the assumptions/criteria section, the culvert design for the haul road is based on a 25-year discharge storm with a 24-hour storm duration and references ODOT Attachment "A," which is included with the calculations. The "rational" method is used to calculate the size of the culverts and is explained in Attachment "A." The average rainfall intensity in inches per hour should vary in these calculations and should not be based on a 24-hour storm duration. Instead, storm duration should be based on a duration equal to the time of concentration for each individual drainage area. Culvert calculations should either be reperformed based on the time of concentration and resized or the assumptions/criteria text should clarify why a 24-hour storm duration is used for the drainage areas shown.
Response: The calculations have been reperformed based on the Rational Method for a 25-year storm, using ODOT I-F-D rainfall curves and time of concentration. Note that the CFC drawings reflect the new calculations.
Action: Revised calculations sheets are attached for review.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Calc. 15-05 Page #: 1 of 4- Conduit Design
Original Specific Comment #: 6 Line #: NA
Comment: Specific Comment No. 5 above for the haul road also applies here to the north entrance road.
Response: The calculations have been reperformed based on the Rational Method for a 25-year storm, using ODOT I-F-D rainfall curves and time of concentration. Note that the CFC drawings reflect the new calculations.
Action: Revised calculation sheets are attached for review.

PREFINAL DESIGN DRAWING PACKAGE

Commenting Organization: U.S. EPA Commentor: Saric
Drawing #: 92X-5900-00187 and 92X-5900-00199
Original Specific Comment #: 7
Comment: Drawing No. 92X-5900-00199 shows an intersection detail of the haul road and 2nd Street and a hatched section running approximately 100 feet diagonally across the haul road pavement at Station 129 +00. This hatched section represents a railroad crossing section with tracks running on top of the pavement. Drawing No. 92X-5900-00187 shows the plan and profile of the railroad crossing area. Note No. 6 of this drawing refers to Drawing No. 91X-5900-00230 for railroad crossing details, but Drawing No. 91X-5900-00230 is not included in the design drawing package. A detailed drawing should be included in the final submittal that incorporates details of Drawing No. 91X-5900-00230 and that shows how pavement grades from the existing concrete railroad crossing at 2nd Street and at the haul road crossing are matched.
Response: Note 6 states that drawing 91X-5900-G-00230 will be furnished to subcontractor upon request.
Action: A copy of drawing 91X-5900-G-00230 has been included in the CFC bid package and is attached for your information.

Commenting Organization: U.S. EPA Commentor: Saric
Drawing#: 92X-5900-00204 Line #: NA
Original Specific Comment #: 8
Comment: Detail 2 shows a standard flared end section for a corrugated metal culvert pipe. A 15- and an 18-inch diameter section are shown with dimensions for each size. The drainage subsummary Drawing No. 92X-5900-00210 indicates three culvert pipes to be used on the haul road. Two of these pipes are 15 inches in diameter and the other is 21 inches in diameter. Detail 2 should be revised to indicate the 21-inch-diameter dimensions and to eliminate the 18-inch-diameter if not applicable.
Response: Agreed.
Action: Detail 2 has been corrected in the CFC bid package to reflect the required corrugated metal pipe(s). Drawing 92X-5900-00204 is attached for review.

Commenting Organization: U.S. EPA Commentor: Saric
Drawing #: 92X-5900-00220 Page #: NA Line #: NA
Original Specific Comment #: 9
Comment: Drawing No. 92X-5900-00220 indicates the plan and profile for the north entrance road from Station 100 +00 to Station 113 +00. A Type I ODOT driveway is shown at Station 112 +50. A Type D conduit is also indicated. The diameter of the Type D conduit should be shown in the plan and also indicated in the profile consistent with other drawings. Also, at Station 106 +50, a rectangular area is indicated with two culverts or conduits. The purpose of this area and the conduits is unclear and should be explained.
Response: The plan and profile have been modified and conduit size and location shown in plan and profile. The rectangular area is the area identified for a crossing

for trucks from the OSDF borrow area. The driveway will be placed in accordance with ODOT Standard Drawing BP-4.1. The contractor will have access to the ODOT standard drawings. The CFC drawings have been clarified for the Borrow Area Haul Road Crossing at Sta. 106 + 49.

Action: Drawing 92-X-5900-00220is attached for review.

Commenting Organization: U.S. EPA Commentor: Saric
Drawing #: 92X-5900-00225 Page #: NA Line #: NA
Original Specific Comment #: 10

Comment: Drawing No. 92X-5900-00225indicates the rerouted north entrance road plan and profile from Station 200 +00 to 209 +00. The drawing contains a couple of discrepancies. First, the profile at Station 200 +92 and 200 +94 indicates a new 21-inch-diameter corrugated metal pipe (CMP) at each location to replace an existing, 12-inch-diameter CMP. Note 7 in this drawing indicates that the new CMPs are 30 inches in diameter. Second, the profile at Station 202 +65 indicates that a new, 24-inch-diameter CMP is to be installed. The plan view indicates this same pipe to be at Station 2 +92±. Drawing No. 92X-5900-00225should be revised to resolve these discrepancies.

Response: DOE agrees.

Action: The drawing has been revised to show 2-24" CMP at Sta. 200 + 90 and 200 + 93. The new 24 CMP at Sta. 202 + 65 has been eliminated. Drawing 92-X-5900-00225is attached for review.

Commenting Organization: U.S. EPA Commentor: Saric
Drawing #: 92X-5900-00240 Page #: NA Line #: NA
Original Specific Comment #: 11

Comment: As discussed under Specific Comment No. 8 for the haul road, the rerouted north entrance road requires 12-, 21-, 24-, and 30-inch-diameter corrugated metal flared end sections in addition to the 15- and 18-inch-diameters indicated in accordance with Drawing No. 92X-5900-00217. The missing diameters should be added to this detail and diameters that are not applicable should be eliminated.

Response: DOE agrees.

Action: Detail 2 has been corrected on the CFC drawings to reflect the applicable flared end sections with the exception of 21" diameter. Since the flared end sections are standard for pipe diameters, the flared end section for a 21" will be shown as an as-built. Drawing 92X-5900-00240is attached for review.

DRAFT REMEDIAL ACTION WORK PLAN

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.1 Page #: 1-1 Line #: NA
Original Specific Comment #: 12

Comment: The first paragraph discusses the purpose of the RAWP, which is to identify the implementation strategy and schedule for constructing the haul road and

rerouted north entrance road. The schedule, start date, finish date, and time required to complete the construction of these two roadways should be added to the text.

Response: A schedule will be added to Section 2.4 "Project Milestones".

Action: The following table has been inserted in Section 2.4:

TABLE 2-1
ROADS REMEDIAL ACTION PROJECT MILESTONES

ACTIVITY	DATE
Begin construction of Roads (award of contract)	October 15, 1996*
Complete construction of Roads	by March 27, 1998

* Contingent upon Congressional approval of budget

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.6 Page #: 2-3 Line #: NA
Original Specific Comment #: 13
Comment: "Section 2.6, Construction Sequencing," should read "Section 2.5, Construction Sequencing."
Response: Agreed
Action: Section 2.6 has been renumbered to Section 2.5.

Ohio EPA Comments on the Draft OU2 Remedial Action Work Plan
for the North Haul Road and Rerouted North Entrance Road

Commenting Organization: Ohio EPA Commentor: DSW
Section#: 3.1.1 Pg.#: 3-1 Line#: 11 Code:
Original Comment# 1
Comment: Reference should be to *Rainwater and Land Development* (see Section 6.1, Page 6-2 of the Site-Wide Stormwater Pollution Prevention Plan referred to on Line 13).
Response: Partially agree. The Sitewide Stormwater Pollution Prevention Plan will be referenced and used where applicable. NOTE: The preface in the Rainwater and Land Development document clearly states that the included standards are not requirements. The E&S control system shown on the 90% drawings envelopes ODOT design standards. DOE believes these standards are more appropriate for road construction.
Action: Reference Sitewide Stormwater Pollution Prevention Plan.

Commenting Organization: Ohio EPA Commentor: OFFO
Section#: 3.1.3 Pg.#: 3-2 Line#: 25-36 Code: c
Original Comment# 2
Comment: DOE has incorrectly cited Ohio Administrative Code (OAC) 3745-17-07(B)(4),(5), and (6) as the governing regulations for the particulate emissions from paved roads, unpaved roads and material storage piles. OAC 3745-31-05(A)(3) (please see Page A-53 of the OU2 ROD) requires that new sources employ the best available technology (BAT). Although the BAT determination is made on a case-by-case basis, determinations of BAT for similar activities have time and again resulted in standards that are more stringent than the reasonably available control measures (RACM) that are required by OAC 3745-17-07. Please see the following examples.

paved roadways:	OAC 3745-17-12(F)(2)	1 minute exceedence in any 60-min. period
unpaved roadways:	OAC 3745-17-12(F)(1)	3 " " "
Material storage piles:	OAC 3745-17-12(C)(2)	1 " " "

Ohio EPA will be available to assist DOE in determining BAT for the new roads.
Response: The OAC 3745-17-07(B) citations given in the Draft OU2 Remedial Action Work Plan for the North Haul Road and Rerouted North Entrance Road referred to in the comment are the OU2- (and OU5-) ROD-determined ARARs as pertinent to restriction of emission of fugitive dust. As stated previously in the response to OEPA's Original Comment #7 on the Intermediate Design Package submittal of the Impacted Material Placement Plan, these are the ARARs determined by USEPA (and concurred on by OEPA) in the OU2 (and

OU5) RODs as applicable for roadways, parking areas, and material storage piles.

The commentor also identifies OAC 3745-31-05(A)(3), which is another ARAR identified in the OU2 ROD (and OU5 ROD). As stated in the response to OEPA Original Comment #7 on the Intermediate Design Package submittal of the Impacted Material Placement Plan, DOE considers this OAC 3745-31-05(A)(3) requirement pertinent to new point sources of air pollution, such as material processing operations. Because OAC 3745-17-07(B)(4)-(6) establishes standards for roadways and material storage piles, and the OU2 (and OU5) ROD have determined these OAC 3745-17-07(B)(4)-(6) requirements as ARARs for roadways and material storage piles, DOE has always intended to comply with these OAC 3745-17-07(B)(4)-(6) requirements for the Roads remedial action project. DOE has always intended to comply with BAT standards for any new point sources.

Action: DOE will comply with the roadway and material storage pile fugitive emission limits stated in OAC 3745-17-07(B)(4)-(6), as designated in the OU2 (and OU5) ROD as the ARARs for roadways and material storage piles.

DOE will also discuss BAT type ARARs with OEPA, as appropriate. These discussions should focus on BAT in relation to implementability, cost, and performance (risk reduction).

Ohio EPA comments on the RtC
on the Haul Road and Rerouted North Entrance Road Design Criteria Package

Commenting Organization: Ohio EPA Commentor: OFFO
Section#: Pg.#: Line#: Code:
Original Comment# 3

Comment: Ohio EPA's comment has been misunderstood or misconstrued. The intention of the comment was to evaluate the use of 'contaminated' concrete rubble in the aggregate base of the Haul Road not the Rerouted North Access Road. Since the Haul Road is designed to be a 'dirty' road, the Ohio EPA did not intend that the concrete rubble should be 'clean'. For this reason, Ohio EPA considers DOE's reference to the Fernald Citizens' Task Force recommendation irrelevant to the discussion of the Haul Road. In the case of the North Access Road, Ohio EPA agrees that since the road will be permanent the construction materials should be clean.

Ohio EPA has consistently maintained the position that waste minimization would be an integral part of the remediation of the FEMP. DOE should continue to explore all appropriate means of reducing waste volume by recycling, re-use, innovative technologies, etc. The value of a smaller OSDF that would result from maximizing re-use/recycling should be included in the cost/benefit analysis.

DOE's determination of potentially available concrete appears to have been artificially underestimated by restricting the evaluation to only the Fire Training Facility stockpile. Including the concrete from Plant 7 would provide economy of scale.

Response: Currently, there are no substantial stockpiles of material to be considered for reuse as aggregate base or embankments (i.e., major D&D of building foundations and other concrete structures has not begun). The volume of concrete from Plant 7 is identified in the *Plant 7 Remedial Action Final Report,* May 1996. All Plant 7 concrete was shipped to NTS, approximately 161,000 pounds, which equates to about 40 cubic yards. The estimated quantity for aggregate base for the Haul Road (ODOT 304) is over 6,000 cubic yards. The D&D of Plant 7 floor slab and foundation has not begun, however, DOE remains committed to reusing materials generated from remediation activities to the maximum extent possible. In the case of the Haul Road, suitable and substantial amounts of materials from remediation efforts are not available in our construction time frame.

Action: DOE will keep the regulatory agencies appraised of activities relating to recycle and reuse of D&D materials. One of the major barriers to reuse and recycle continues to be the concerns over "fill release" criteria for all types of D&D material. DOE would appreciate any guidance the regulatory agencies can provide in this area.

Ohio EPA Comments Pre-Final Design Package

Commenting Organization: Ohio EPA Commentor: DSW
Section#: Drawings 92X-5900-G-0200 & 0201 Pg.#: Line#:
Code:
Original Comment# 4
Comment: There is insufficient detail on the drawings for erosion and stormwater management. Drawings should include soils information, schedule of activity, stabilization measures for disturbed soils, limit of disturbance, inspection frequency, etc. (See Storm Water Pollution Prevention Plan (SWP3) Checklist for Construction Sites, Essential Components, Ohio EPA, May, 1995.)
Response: The E&S system design shown on the drawings envelopes ODOT requirements. Available soil data was considered in the design and will be made available to the contractors during the bid period. It should also be noted that a 2-feet per second velocity threshold has been incorporated into the design (see Design and Construction Calculations) to mitigate ditch erosion.
A milestone schedule will be included in the RAWP and in the procurement package. Stabilization measures for disturbed soils, such as moisture conditioning, will be addressed in the Contractor's Work Plan as mandated in the Sitewide Stormwater Pollution Prevention Plan. Inspection is required on a weekly basis or within 24 hours of a 0.5 inch rainfall event.
Action: Drawing 90X-6000-X-00012, Sheet X-12, Rev. E and Stormwater Pollution Prevention Plan, RM-0039 Title sheet and Page 6-7 (Figure 6-2) are attached for your information.

Commenting Organization: Ohio EPA Commentor: DSW
Section#: Drawings 92X-5900-G-0200 & 0201 Pg.#: Line#:
Code:
Original Comment# 5
Comment: Areas that have check dams appear to be appropriate areas for sediment traps.
Response: Check dams and/or straw bales are routinely used by ODOT as observed on other similar ODOT Road projects throughout the State. Again, please keep in mind that a 2-feet per second velocity threshold has been incorporated into the design to mitigate ditch erosion.
Action: None.

Commenting Organization: Ohio EPA Commentor: DSW
Section#: Pg.#: Line#: Code:
Original Comment# 6
Comment: Check dams should conform to *Rainwater and Land Development.*
Response: The composite rock/straw check dams shown on the drawings are consistent with the FEMP waste minimization program as the straw can be composted while the high porosity rock available in the Tri-State area will probably be cross-contaminated and require permanent storage in the OSDF. Therefore

the use of an all rock check dam as proposed in the Rainwater and Land Development document will generate significant additional waste. Material properties of rock in the Tri-State area (i.e., porosity, etc.) are documented in the report entitled *Off-Site Borrow Materials Geotechnical Evaluation Report*, forwarded to EPA/OEPA on July 19, 1996 (see DOE-1146-96). Also, because of the environmental compliance inspections mandated in the Stormwater Protection Plan at FEMP, straw bales will be expeditiously replaced in the event of observed degradation.

Action: None.

CONTROL NO. FER-0684 376
REQUIREMENTS MANUAL RM-0039
REVISION NO. 0

STORMWATER POLLUTION PREVENTION PLAN

RM-0039

Effective Date: 05/01/96

Subject Expert: _____ 4/26/96
F. L. Johnston Date

AUTHORIZED BY: _____ 4/26/96
T. D. Hagen, Environmental Protection Functional Area Manager Date

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Fernald Environmental Restoration Management Corporation
P. O. Box 538704
Cincinnati, Ohio 45253-8704

Figure 6-2

CONSTRUCTION ACTIVITY MAINTENANCE/INSPECTION PROCEDURES

EROSION AND SEDIMENT INSPECTION PROCEDURES

- All control measures identified on the SWPPP Site Description for Construction Activity form will be inspected at least once per week and following any storm event of 0.5 inches in a 24-hour period.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of the report.
- Silt fence will be inspected for depth of sediment, tears, fabric securely attached to the posts, and the posts firmly in the ground. Built up sediment will be removed from the silt fence as directed by FERMCO (one-third the height of the fence).
- Sediment basins and sediment traps will be inspected for sediment depth. Berms will be inspected for breaches. Berms are appropriately stabilized. Sediment removal will be as directed by FERMCO.
- Diversion dikes will be inspected for breaches.
- Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.

HOUSEKEEPING INSPECTION PROCEDURES

- All materials stored will be stored in a neat, orderly manner in their original containers, and if possible, containers protected from weather.
- Products will be kept in their original containers with the original manufacturers label. MSDS will be checked for availability.
- Empty containers are not stored on site.

SPILL PREVENTION AND CONTROL INSPECTION PROCEDURES

- Vehicles will be checked for leaks. Petroleum products will be stored in tightly sealed containers.
- Spill equipment appropriate for the materials being stored including spill pigs, sand, sawdust, etc. available in the area. Secondary containment provided where appropriate.
- Fertilizers will not be stored in the open. New and used bags will be stored under cover or in a sealable container.

NON-STORMWATER INSPECTION PROCEDURES

- The area will be evaluated for non-stormwater discharges such as vehicle washing, pavement washing, groundwater from excavation, all of which can be expected to a certain degree, to ensure they are appropriately managed.

De Leuw, Cather
Engineers and Planners

Subject: North Entrance Road Job No. 660620
Sheet No. 1 of 2
Made by: AJS Date: 7/1/96
Checked by: JMC Date: 7/8/96

NORTH ENTRANCE RD DRIVE PIPES (PHASE I), Revised

Sta 140+50 Right

Drainage Area to pipe inlet = 7.58 Acres

Overland flow width ≈ 450 ft

Ground slope ≈ 1%

∴ T_o ~ 24 min

$$T_D = \frac{(152+00 - 140+50)}{4 \text{ fps}} \times \frac{1 \text{ min}}{60 \text{ sec}} = 4.79 \text{ say } 5 \text{ min}$$

T_c = 29 min

i_{25} = 4.1 in/hr

$Q_{25} = 0.3(4.1)(7.58)$

$= 9.3$ cfs

Check 18" Pipe

$A = \pi r^2 = 1.767 \text{ ft}^2$ $n = 0.024$ for CMP

$P = 2\pi r = 4.712 \text{ ft}$ $S = 0.00965$

$R = A/P = 0.375$

$$Q = \frac{1.49}{.024}(1.767)(.375)^{2/3}(0.00965)^{1/2}$$

$= 5.6$ cfs < 9.3

Use 21" (Attachment B)

Sta 149+00 Right

Drainage Area to Pipe Inlet = 2.42 acres

Overland flow width ≈ 400 ft

Ground slope ≈ 1%

T_o = 23 min

$$T_D = \frac{(152+00 - 149+00)}{4\ fps} \cdot \frac{1\ min}{60\ sec} = 1.25\ min$$

T_c = 24.25 min (Use 24)

i_{25} = 4.4 in/hr

$Q_{25} = C\,i\,A$

$= 0.3(4.4)(2.42)$

$= 3.19$ cfs

Use 15" CMP (Attachment B)

De Leuw, Cather
Engineers and Planners

Subject: North Entrance Road Job No. 660620
Sheet No. 1 of 6
Made by: AJS Date: 6/28/96
Checked by: AWC Date: 7/10/96

Revised Phase I Conduit Design

Assumptions / Criteria

- Use Inlet Control: Allowable $HW = D$ $\therefore \frac{HW}{D} = 1$
  Use ODOT L&D Manual, Fig 1100-245 (Attachment B)
- Use Corrugated Metal Pipes
- Design based on 25-year peak discharge, Rational Method
- 4 f.p.s. maximum ditch velocity

Sta 159+00

Based on 550' of overland flow with 1% ground slope & Attachment D

$A = 8.24$ acres $(.0129 mi^2)$ $T_{o_{max}}$ (Sta 155+00) = 27 min

$C = 0.3$ (grass) $T_D = \frac{400 ft}{4 fps} = 100 sec = 1.7 min \Rightarrow$ Use 2.0

$T_c = T_o + T_D = 27 + 2 = 29$ min

$i_{25} = 4.1$ in/hr (Attachment E, Area D)

$Q = C i A$
$= 0.3 (4.1) (8.24)$
$= 10.13$ cfs

Required Conduit Size is 24" (Attachment B)

Maximum allowable slope, $S_{MAX} = \left[\frac{V n}{1.49 (A/P)^{2/3}}\right]^2$

$V = 4$ fps, $A = \pi r^2 = 3.14 ft^2$, $P = 2\pi r = 6.28'$, $n = 0.024$ for CMP

$S_{MAX} = \left[\frac{(4.0)(0.024)}{(1.49)(0.5)^{2/3}}\right]^2 = 0.010 = 1\%$

000018

Sta 200+94

A = 93.36 Acres (worst case before Phase II is in place) 54.02 east side

C = 0.3 (grass)

T_c = 54 min (1400' overland flow @ 2% slope, 2900' ditch flow @ 4fps)

i_{25} = 2.6 in/hr

Q = 0.3 (2.6)(54.02) + Concentrated flow from left (west) ditch

= 42.1 cfs + 42.5 cfs (see below) = 84.6 cfs

Required pipe size is 54" (Attachment B) Area = 15.9 ft^2

Use 3-30" pipes for cover purposes

(2-24" pipes if left ditch flow is diverted)

Sta 202+65

A = 39.34 Acres

C = 0.3

T_c = 36 min, i_{25} = 3.6 in/hr

Q_{25} = 0.3 (3.6)(39.34)

= 42.5 cfs

Required pipe size is 42" (Attachment B), Area = 9.62 ft^2

Use 2-30" Pipes for cover purposes

De Leuw, Cather
Engineers and Planners

Subject: North Entrance Road
Job No. 660620
Sheet No. 3 of 6
Made by: AJS
Date: 7/1/96
Checked by: AMC
Date: 7/8/96

Revised Phase II Conduit Design

Assumptions/Criteria

- Same as Phase I

Sta 100+15

A = 71.17 Acres (assuming demolition of Phase I from Sta. 200+00 to Sta 215+73.71)

C = 0.3

Average overland flow width = 600 ft

Ground slope is 1.67%

T_o = 27 minutes (Fig 1101-1, L&D Manual: Attachment D)

$T_D = \frac{5185\ ft}{4\ ft/sec} \cdot \frac{1\ min}{60\ sec}$ = 21.6 min. say 22 min

$T_C = T_o + T_D$ = 49 min

i_{25} = 2.8 in/hr

$Q_{25} = CIA$

$= 0.3(2.8)(71.17) = 59.78$ say 60 cfs

Required pipe size is 48" (Attachment B), Area = 12.6 ft²
Use 42" for cover purposes

If pipe at 202+65 is drained to the west (under the existing entrance road), the required pipe size at 200+94 will be reduced to 42" (2-30" pipes)

If water is to be constricted to avoid flooding downstream at both locations (i.e. 2-24" pipes at 200+94 and 2-30" pipes at 202+65) the resulting headwater depths will be

Sta 200+94 2.8 ft (Elev 584.8 Assuming pipe inlet elev 582.0)

Sta 202+65 2.4 ft (Elev 586.4 Assuming pipe inlet elev. 584.0)

Flow to existing 12" At fence:

$$\text{Capacity of } 2\text{-}30" = \frac{1.49}{0.024}(4.91\,ft^2)(0.625)^{2/3}(.006 \text{ max. slope})^{1/2}(2)$$

$$= 34.6 \text{ cfs}$$

$$\text{Capacity of } 2\text{-}24" = 2\left(\frac{1.49}{.024}\right)(3.14)(.500)^{2/3}(.010 \text{ max slope})^{1/2}$$

$$= 24.6$$

Total Discharge to existing pipe = 59.2 cfs

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∴ Use 2-24" @200+94 and 2-30" @ 202+65

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Made by: AJS
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Checked by: [illegible]
Date: 7/8/96

Pipe Slopes (Revised)

Assumptions / Restrictions

- Allowable velocity of 4 fps maximum
- Velocity based on full flow using Mannings Equation

$$S_{(max.allowable)} = \left[\frac{Vn}{1.49(A/P)^{2/3}}\right]^2 \quad \text{where}$$

$V = 4$ fps $P = 2\pi r$

$A = \pi r^2$ $n = 0.024$

Phase I Structures

Sta 159+60, 24" CMP

$S_{max} = 0.010$ (See sheet 1)

Sta 200+94, 2-24" CMP

$S_{max} = 0.010$ (Same as Sta 159+60)

Sta 202+65, 2-30" CMP

$A = \pi\left(\frac{15}{12}\right)^2 = 4.909\ ft^2$

$P = \pi(2.5) = 7.854$

$A/P = 0.625$

$$S_{max} = \left[\frac{4(.024)}{1.49(0.625)^{2/3}}\right]^2$$

$S_{MAX} = 0.0078$

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Sheet No. 6
Made by: AJS Date: 7/8/96
Checked by: AMC Date: 7/8/96

Phase II Structure

Sta 100+15, 42" CMP

$A = \pi (1.75\,ft)^2 = 9.621\,ft^2$

$P = 2\pi (1.75) = 10.996\,ft$

$A/P = 0.875\,ft$

$$S_{max} = \left[\frac{4\,(0.024)}{1.49\,(0.875)^{2/3}} \right]^2$$

$S_{max} = 0.005$

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Subject: North Entrance Road Job No. 660620
Sheet No. 1 of 11

Made by: AJS Date: 5/14/96
Checked by: [illegible] Date: 5/22/96

Phase I Drainage

Assumptions / Restrictions

- No flow over the road from east to west
- Out of ditch ponding is permitted
- Maximum allowable velocity of 4 ft/sec
- No Rock Channel Protection
- Trapezoidal Ditch Sections (2 ft bottom; 3:1 sideslopes)

1. Left Ditch: Length = 2735.05 ft
   From Sta 152+00 back to 137+73.66 (215+73.71) and 215+73.7
   back to 202+65 (Pipe inlet / point of concentration)

Drainage Area = 39.34 Acres

Approximate overland flow width = 625 ft

Overland Flow Time, T_o (Using ODOT L&D Manual, Fig 1101-1, Attachment D)

Strip Length = 625 ft
Average Grass Cover
Ground Slope $\approx \frac{605-590}{625'} = 0.024$ (2.4%)

$T_o = 25$ min

Ditch Flow Time, T_D, based on max. velocity of 4 f.p.s

$T_D = \frac{2735.05 \text{ ft}}{\text{[illegible]}} = 684 \text{ sec} = 11.4 \text{ min (say 11)}$

000024

Time of Concentration, $T_C = T_O + T_D = 36$ min

For peak flow, use a storm duration equal to the time of concentration, and ODOT L&D Manual, Fig 1101-2 (Attachment E)

$i_{25} \approx 3.6$ inches/hr

Q_{25} (max. peak) $= C i_{25} A$

$= 0.3(3.6)(39.34)$

$= 42.5$ cfs

2. Right Ditch: Length = 2906.05 ft.

From Sta. 152+00 back to 137+73.66 (215+73.71) and from 215+73.71 back to 200+94 (Pipe inlet/point of concentration)

Drainage Area = 93.36 Acres

Approximate overland flow width = 1400 feet

Overland flow time (ODOT L&D Manual, Fig 1101-1) for 1000 ft width, average grass cover and a 2% ground slope is 30 minutes, so

$T_O = 30\text{min}\left(\frac{1400\text{ft}}{1000\text{ft}}\right) = 42$ min

000025

$T_D = 2906.05\text{ft}/(4\text{ft/sec}) = 726.5\text{ sec} = 12.1$ min.

$T_C = T_O + T_D = 54$

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From ODOT L&D Manual, Fig 1101-2

$i_{25} \approx 2.6$ inches/hr

$Q_{25}(\text{max. peak}) = C i_{25} A$

$= 0.3(2.6)(93.36) = 72.8$ say 73 cfs

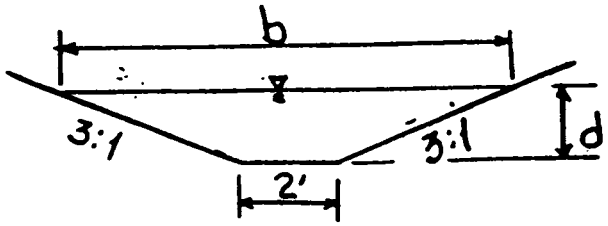
Concentrated flow from left ditch through conduit at Sta 202+65 gives $Q_{max} = 115$ cfs at the southern end of Phase I. Check that roadway overtopping does not occur to the south (rear) of Sta 202+65 due to additional flow.

The right ditch will control the required ditch depth. Check for roadway overtopping at location of minimum clearance (distance from the bottom of the ditch to the top of the road) and location of maximum flow.

Ditch size will be based on the 25 year discharge for a 24 hour storm event.
For a storm event longer than 3hrs, the storm intensity approaches 1 inch/hr, then

$Q_{25} = 0.3(1)(93.36) = 28.01$ (say 28) cfs

PROPOSED DITCH SECTION



for 3:1 side slopes $b = 2 + 6d$

$$A = \frac{1}{2}(2+b)(d)$$

$$= \frac{1}{2}(2+2+6d)(d) = 3d^2 + 2d$$

The Wetted Perimeter, $P = 2 + 2\sqrt{(d)^2 + (3d)^2}$

$$= 2 + 2\sqrt{10d^2} = 2 + 2d\sqrt{10}$$

The Hydraulic Radius, $R = A/P = \dfrac{3d^2 + 2d}{2 + 2d\sqrt{10}}$

Mannings Equation:

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

where $n = 0.04$ for sod (Attachment 4 ODOT Table 1102-2)

S = min. ditch slope to give maximum depth

$= 0.617\%$

Assume $d = 1$ ft then,

$A = 5$ ft^2
$P = 8.32$ ft
$R = 0.601$ ft

$$Q = \frac{1.49}{0.04}(5)(0.601)^{2/3}(0.00617)^{1/2} = 10.4 \text{ cfs}$$

000027

Assume $d = 1.5$ ft, then

$A = 9.75$ ft^2
$P = 11.49$ ft

$$Q = \frac{1.49}{0.04}(9.75)(0.849)^{2/3}(0.00617)^{1/2} = 25.6 \text{ cfs}$$

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Engineers and Planners

Subject: North Entrance Road
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Use a 1.5 foot ditch depth. Check, that at peak flow, there is sufficient out of ditch "flood plain" area to carry additional water.

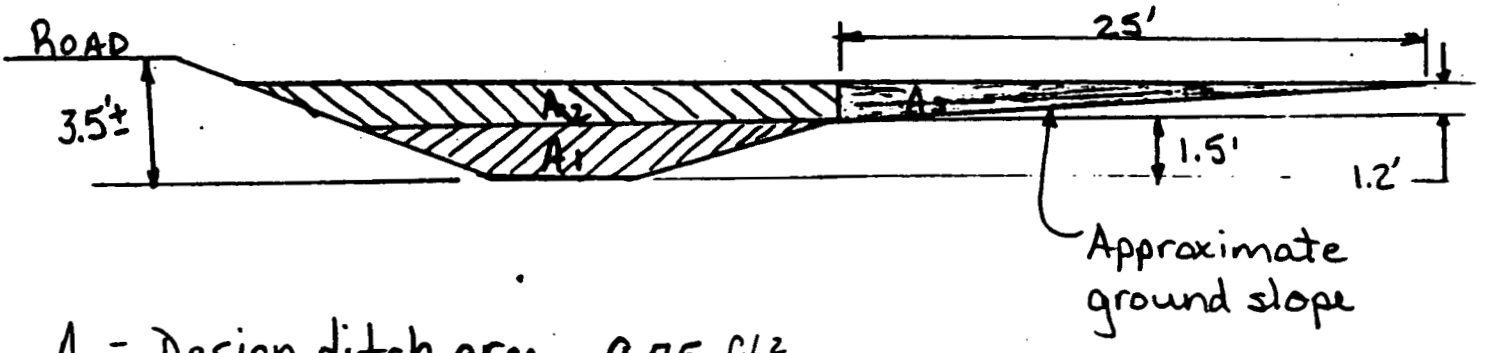
Sta 152+00 (Critical Clearance Section)

Since this is the high point of the ditch, only overland flow has occurred and $T_c = T_o = 42$ min. (Area ≈ 6.5 acres)

$i_{25} = 3.2$ inches/hr

$Q_{25} = 0.3(3.2)(6.5) = 6.24$ cfs < 25.6 cfs ditch capacity

Sta 200+94 (Critical Flow/Max. depth Section)



A_1 = Design ditch area = 9.75 ft²

$A_2 = \frac{1}{2}(11 + 14.6)(1.2) = 15.36$ ft²

$A_3 = \frac{1}{2}(25)(1.2) = 15.00$ ft²

$A_{Total} = 40.11$ ft²

$P = 2'\text{ bottom} + \sqrt{(2.7)^2+(8.1)^2} + \sqrt{(1.5)^2+(4.5)^2} + \sqrt{(25)^2+(1.2)^2}$

$= 40.31$ ft

$R = A/P = 40.11/40.31 = 0.995$ ft

Capacity $= \frac{1.49}{0.04}(40.11)(0.995)^{2/3}(0.0065)^{1/2}$ ← Ditch slope in immediate vicinity.

$= 120$ cfs > 115 cfs (calculated maximum)

∴ Out of bank area is sufficient to carry additional flow at peak discharge and roadway overtopping does not occur. Approximately 10" of "freeboard" exists.

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3. Left and Right Ditches : Length = 700.00+579.92 = 1279.92 ft
From Sta 152+00 to 159+00 and From Sta 164+79.92 to Sta 159+00 (Pipe Inlet at Sta 159+00)

Flow is from left side, Drainage Area = 13.52 Acres

Approximate Overland flow width = 500 ft

Overland Flow Time, T_o (ODOT L&D, Fig 1101-1)

Strip Length = 500 ft
Average Grass Cover
Ground Slope $\approx \frac{625-607}{500'} = 0.036$ (3.6%)

T_o = 22 min

Ditch Flow Time, T_D (based on 4 f.p.s. velocity and longest ditch)

$T_D = 700 \text{ ft} / 4 \text{ ft/sec} = 175 \text{ sec} \approx 3 \text{ min}$

$T_C = 22+3 = 25$ min

i_{25} (from ODOT L&D Fig 1101-2) = 4.4 inches/hr

$Q_{25}(\text{peak}) = 0.3(4.4)(13.52) = 17.8$ cfs < 25.6 cfs capacity of the design ditch 1.5 feet deep

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Subject: North Entrance Road
Job No. 6C
Sheet No. 8
Made by: AJS
Date: 5/15/96
Checked by: AMC
Date: 5/22/96

Phase II Drainage

Assumptions/Restrictions

- No flow over the road from east to west
- Out of ditch ponding is permitted
- Maximum allowable velocity of 4 ft/sec
- No Rock Channel Protection
- Trapezoidal Ditch Sections

660620 02300
Sheet 9 of 11
AJS 5/15/96
CK AMC 5/22/96

Phase II Drainage, North Entrance Rd

- No flow from east to west over the road
- Ditch flow velocity of 4 fps maximum
- Trapezoidal ditches with 2 foot bottom, 3:1 side slopes

Determine peak flows at point of concentration (pipe inlet at Sta 100+15)

Ditch Length:
From Sta 152+00 back to 100+15 = 5185.0 ft

Drainage Area (from previous calcs) = 71.17 acres
Average overland flow width ≈ 600 ft
Average ground slope ≈ $(10'/600') \times 100 = 1.67\%$

T_o (Fig 1101-1, ODOT L&D Manual) = 27 min

T_p (Based on 4 fps max velocity) = $\frac{5185 \text{ ft}}{4 \text{ ft/sec}} \times \frac{1 \text{ min}}{60 \text{ sec}} = 21.6 \text{ min}$

$T_c = T_o + T_p = 49$ min

From Fig 1101-2, ODOT L&D Manual, $i_{25} = 2.8$ inches/hour

Q_{25} (peak) = $0.3(2.8)(71.17) = 59.78$ say 60 cfs

Check normal flow depth based on ditch slope of 1.047% (0.01047 ft/ft) n = 0.04 (sod)

Try d = 1.5 ft, then A = 9.75 ft², R = 0.849 ft

$(1.49/n) A R^{2/3} S^{1/2} = 33.3$ cfs < 60 cfs

Try d = 2 ft, then A = 16 ft², R = 1.092 ft

$(1.49/n) A R^{2/3} S^{1/2} = 64.68$ cfs > 60 cfs

Since critical (max) discharge occurs in cut sections where ditch depths are greater than 2 feet, the roadway will not be overtopped at peak discharge. 2 feet will be the nominal (design) ditch depth.

Upstation of 116+00 (fill areas) embankment slopes typically meet existing ground (i.e. no ditch) and flow depths are insignificant due to large flow area (spread out over flat ground).

→ Check Adequacy of pipe at South end (Sta 100+15) for peak flow Existing size is (12")

Inlet Elev ≈ 581 ± Outlet Elev ≈ 580±

Approximate Pipe Length = 30 ft

Estimate required pipe diameter based on an assumption of full pipe with peak flow

$$D = 1.33\left(\frac{nQ}{\sqrt{S}}\right)^{3/8} = 1.33\left(\frac{0.04\,(60)}{\sqrt{0.033}}\right)^{3/8}$$

$D = 3.49$ ft say 3.5 ft = 42"

If pipe is sized using the 24 hour storm duration and a full pipe is assumed

$$D = 1.33\left(\frac{0.04\,(22)}{\sqrt{0.033}}\right)^{3/8} = 2.4 \text{ say } 2.5 \text{ ft} = 30"$$

Attachment A

1100 Drainage Design Procedures

1101 Estimating Design Discharge

1101.1 General

In order to properly design highway drainage facilities, it is essential that a reasonable estimate be made of the design and check discharges. Some of the more important factors affecting runoff are duration, intensity and frequency of rainfall, and the size, imperviousness, slope and shape of the drainage area. Also a proper evaluation should be made of probable changes in land use throughout the drainage area.

1101.2 Procedures

1101.21 Statistical Methods

The statistical methods developed by the U.S. Geological Survey and published in USGS Water Resources Investigations Reports 89-4126 and 86-4197 are recommended for estimating runoff from larger drainage areas. A description and limitations of these methods are described in Section 1003.

1101.22 Rational Method

The Rational method is considered to be more reliable for estimating runoff from small drainage areas, usually less than 6 acres; and for areas that contribute sheet flow only to the roadway ditch or pavement. The design discharge "Q" is obtained from the equation Q = CiA where:

C = Coefficient of runoff

i = Average rainfall intensity, in inches per hour, for a given storm frequency and for a duration equal to the time of concentration

A = Drainage area, in acres

The time of concentration is the time required for runoff to flow from the most remote point of the drainage area to the point of concentration. The point of concentration could be a culvert inlet or the checkpoint in a roadway ditch used to determine the need for protection. Time of concentration is ordinarily designated by T and is the summation of the time of overland flow "t_o" and the time of ditch flow "t_d".

Overland flow is that flow not carried in a discernible channel, and the time of such flow may be obtained from Figure 1101-1 or a similar overland flow chart.

1101.23 Coefficient Of Runoff

The recommended value for the coefficient of runoff for various contributing surfaces are shown in Table 1101-1. Where two values are shown, the higher value ordinarily applies to the steeper slopes.

Table 1101-1

Types of Surface	Coefficient of Runoff "C"
Pavement & Paved Shoulders	0.9
Berms and slopes 4:1 or flatter	0.5
Berms and slopes steeper than 4:1	0.7
Contributing Areas:	
Residential (single family)	0.4-0.6
Residential (multi-unit)	0.5-0.7
Woods	0.3
Cultivated	0.3-0.6

The total width contributing flow to a given point usually consists of surfaces having a variable land cover and thereby require a weighted coefficient of runoff "C". The weighted coefficient is obtained by averaging the coefficients for the different types of contributing surfaces, as noted in the following example:

Contributing Width "W"	Land Use	"C"	"CW"
20 Ft.	Paved Area	0.9	18
40 Ft.	Earth Berms & Slopes	0.7	28
140 Ft.	Residential Area	0.6	84
200 Ft.			130

$$\text{Weighted "C"} = \frac{130}{200} = 0.65$$

1101.24 Rainfall Intensity

The average rainfall intensity "I" in inches per hour may be obtained from the Intensity-Frequency-Duration curves shown on Figure 1101-2. Each set of curves applies to a specific geographic area, A, B, C or D as shown on the Rainfall Intensity Zone Map, Figure 1101-3. The geographic areas were established from an analysis of rainfall records obtained from Weather Bureau stations in Ohio. Some political subdivisions may have developed curves for their specific area similar to Figure 1101-2. Such curves may be based on a much longer period of record.

1100 Drainage Design Procedures

1101 Estimating Design Discharge

1101.1 General

In order to properly design highway drainage facilities, it is essential that a reasonable estimate be made of the design and check discharges. Some of the more important factors affecting runoff are duration, intensity and frequency of rainfall, and the size, imperviousness, slope and shape of the drainage area. Also a proper evaluation should be made of probable changes in land use throughout the drainage area.

1101.2 Procedures

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The statistical methods developed by the U.S. Geological Survey and published in USGS Water Resources Investigations Reports 89-4126 and 86-4197 are recommended for estimating runoff from larger drainage areas. A description and limitations of these methods are described in Section 1003.

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The Rational method is considered to be more reliable for estimating runoff from small drainage areas, usually less than 6 acres; and for areas that contribute sheet flow only to the roadway ditch or pavement. The design discharge "Q" is obtained from the equation Q = CIA where:

C = Coefficient of runoff
I = Average rainfall intensity, in inches per hour, for a given storm frequency and for a duration equal to the time of concentration
A = Drainage area, in acres

The time of concentration is the time required for runoff to flow from the most remote point of the drainage area to the point of concentration. The point of concentration could be a culvert inlet or the checkpoint in a roadway ditch used to determine the need for protection. Time of concentration is ordinarily designated by T and is the summation of the time of overland flow "T_o" and the time of ditch flow "T_d".

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Residential (single family)	0.4-0.6
Residential (multi-unit)	0.5-0.7
Woods	0.3
Cultivated	0.3-0.6

The total width contributing flow to a given point usually consists of surfaces having a variable land cover and thereby require a weighted coefficient of runoff "C". The weighted coefficient is obtained by averaging the coefficients for the different types of contributing surfaces, as noted in the following example:

Contributing Width "W"	Land Use	"C"	"CW"
20 Ft.	Paved Area	0.9	18
40 Ft.	Earth Berms & Slopes	0.7	28
140 Ft. / 200 Ft.	Residential Area	0.6	84 / 130

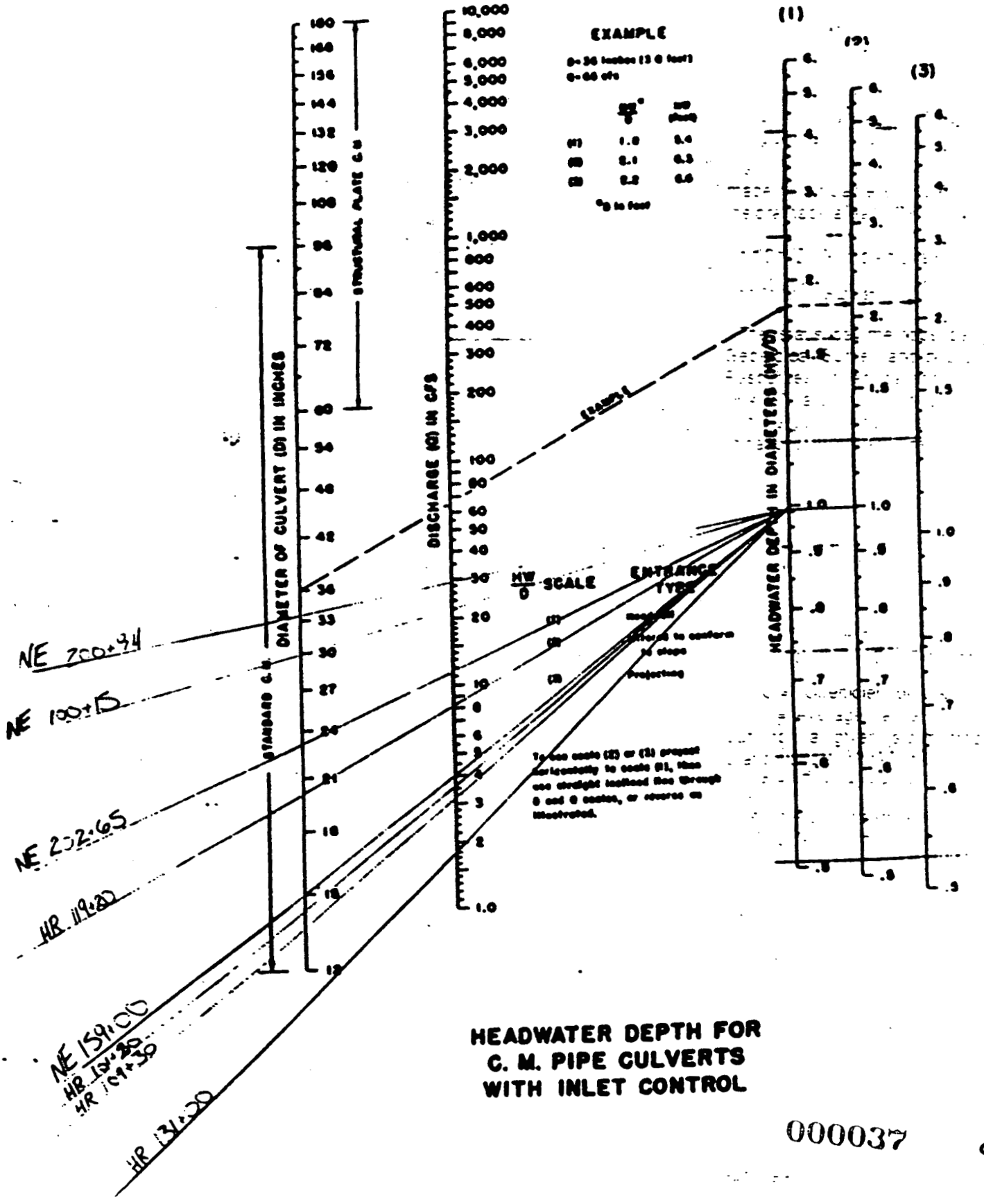
Weighted "C" = $\frac{130}{200}$ = 0.65

1101.24 Rainfall Intensity

The average rainfall intensity "I" in inches per hour may be obtained from the Intensity-Frequency-Duration curves shown on Figure 1101-2. Each set of curves applies to a specific geographic area, A, B, C or D as shown on the Rainfall Intensity Zone Map, Figure 1101-3. The geographic areas were established from an analysis of rainfall records obtained from Weather Bureau stations in Ohio. Some political subdivisions may have developed curves for their specific area similar to Figure 1101-2. Such curves may be based on a much longer period of record,

Attachment B

Fig. 1100-245



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

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TABLE 10.3 TYPICAL VALUES OF THE ROUGHNESS COEFFICIENT n

Lined Canals	n
Cement plaster	0.011
Untreated gunite	0.016
Wood, planed	0.012
Wood, unplaned	0.013
Concrete, troweled	0.012
Concrete, wood forms, unfinished	0.015
Rubble in cement	0.020
Asphalt, smooth	0.013
Asphalt, rough	0.016
Corrugated metal	0.024
Unlined Canals	
Earth, straight and uniform	0.023
Earth, winding and weedy banks	0.035
Cut in rock, straight and uniform	0.030
Cut in rock, jagged and irregular	0.045
Natural Channels	
Gravel beds, straight	0.025
Gravel beds plus large boulders	0.040
Earth, straight, with some grass	0.026
Earth, winding, no vegetation	0.030
Earth, winding, weedy banks	0.050
Earth, very weedy and overgrown	0.080

Manning Equation—Traditional System of Units

It can be shown that, in converting from SI to the traditional system one must apply a factor equal to 1.49 if the same value of n is used in systems. Thus in the traditional system the discharge equation using n is given as

[redacted]

EXAMPLE 10.16 If the channel of Example 10.15 has a slope what is the discharge in the channel and what is the numerical value ning's n for this channel?

Solution From Example 10.15, we have an f value of 0.130, and the mate value of R_h is 4.3 ft. In Example 10.14 it was shown that

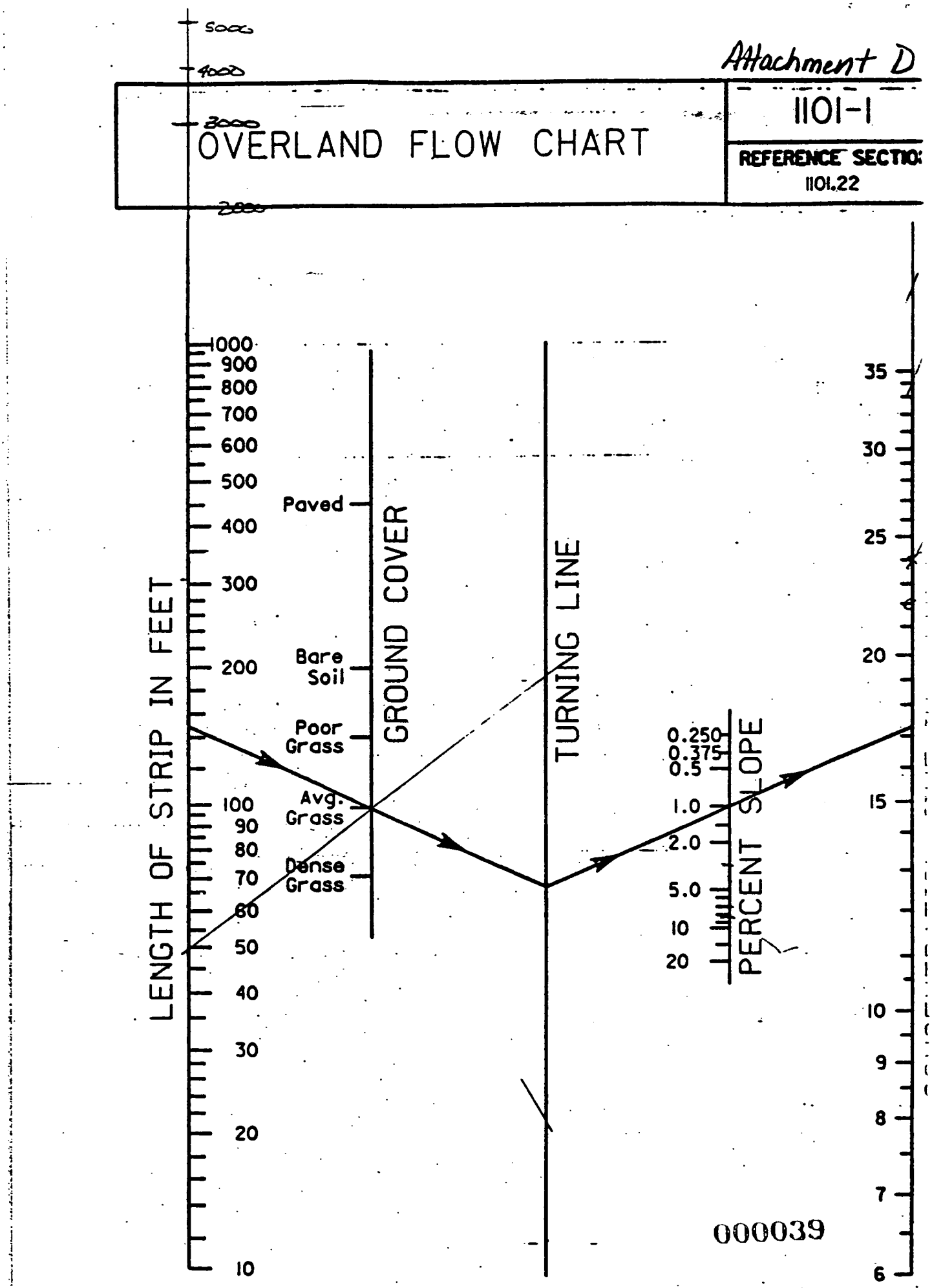
$$V = \sqrt{\frac{8g}{f}}\sqrt{R_h S_0}$$

Attachment D

OVERLAND FLOW CHART

1101-1

REFERENCE SECTION
1101.22



000039

PARSONS
ERA PROJECT

ENGINEERING CALCULATIONS TITLE AND SUMMARY SHEET

Date 7/22/96

Sheet 1 of 2

Proj. Order No. 158 Calculation No. 15-05

Project Title NORTH ENTRANCE ROAD CONSTRUCTION

Calculation Subject DRAINAGE Date Verified/Checked 5/21/96

STATUS: PRELIMINARY _____ FINAL X SUPERSEDED _____ VOID _____

STATEMENT OF PROBLEM

DITCH & CULVERT DESIGN CALCULATIONS FOR THE NORTH ENTRANCE ROAD. THE NORTH ENTRANCE ROAD MAXIMUM DITCH VELOCITY IS 4 FT/SEC (2 FT/SEC PREFERRED) TO MINIMIZE THE USE OF RCP.

SUMMARY OF CONCLUSIONS

DITCHES ARE DESIGNED AND PLOTTED IN THE PROFILE AND CROSS SECTIONS.

Originator's Signature and Date

AJ Shannon
5/21/96
REV 7/8/96

CHECKING METHOD

1. Review X
2. Alternate Calculation _____

Checker's Signature and Date

AM Christ
5/21/96
REV 7/8/96

Lead Discipline Engineer's Signature and Date

Thomas Wesley 7/23/96

Rev. No.	Sheet No.	Description	Reviser's Signature/Date	Checker's Signature/Date	Approved by Signature/Date
					000040

PARSONS
ERA PROJECT

ENGINEERING CALCULATIONS
BASIS SHEET

Revision No. —
Sheet 2 of —

Proj. Order No. 158 Calculation No. 15-05

Project Title NORTH ENTRANCE ROAD CONSTRUCTION

Calculation Subject DRAINAGE Date Verified/Checked 5/21

Prepared By: AJ Shannon Checked/Verified By: Ann Christ

Date 5/21/96 REV 7/8/96

SUMMARY OF DATA SOURCES - CODES - ASSUMPTIONS

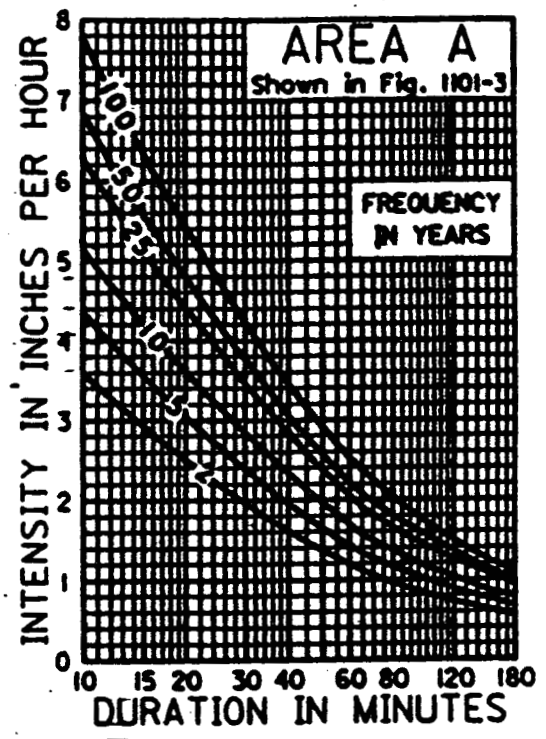
- ASSUMPTIONS - STATED IN CALCULATIONS
- CODES - ODOT LOCATION & DESIGN MANUAL
- SOURCES - PLAN DRAWINGS

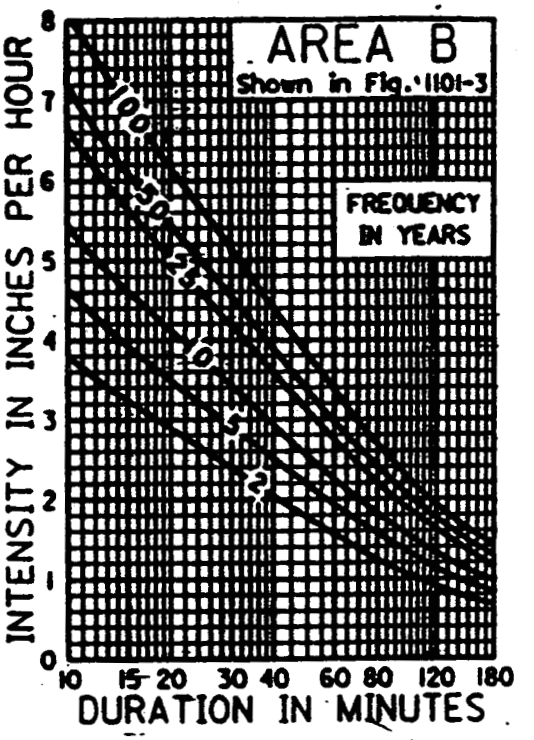
000041

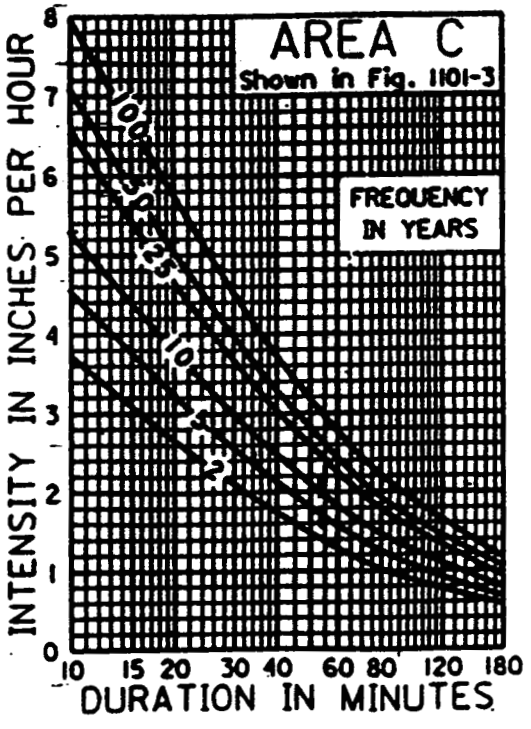
Attachment E

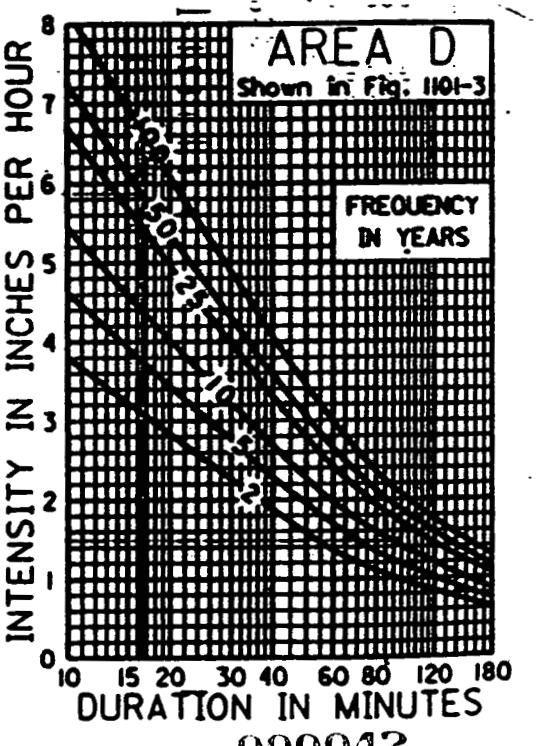
RAINFALL INTENSITY-FREQUENCY-DURATION CURVES	1101-2
	REFERENCE SECTION 1101.24

RAINFALL INTENSITY-FREQUENCY-DURATION CURVES









1102.3 Ditch Design Criteria - Design Traffic Exceeding 2000 ADT

1102.31 Design Frequency

It is recommended that a 10-year frequency storm be used to determine the depth of flow, and a 5-year frequency be used to determine the velocity of flow and the depth of ditch lining where needed. Where a flexible ditch lining is required for calculated velocities exceeding the allowable for seed, the minimum width of the lining shall be 7-1/2 feet. The depth of flow shall be limited to an elevation 12 inches below the edge of pavement for the design discharge. Other ditches, including toe of slope, should not be overtopped by the design discharge.

1102.32 Velocity

The velocity for the five-year frequency storm should not exceed the values shown in Table 1102-1 for the various soil types and flexible linings.

Table 1102-1

ALLOWABLE DITCH VELOCITIES
(Ft. Per. Sec.)

Soil Type	Seed Lining (659)	Sod Lining (660)	Jute or Excelsior Matting (667) or (668)
Sand	1.5	3.5	3.0
Firm Loam	2.0	4.0	4.0
Clay	2.5	5.0	4.0
Gravel	3.5	6.0	5.0
Weathering Shale	4.5	6.0	5.0

If the calculated velocity exceeds that shown in the table, a concrete lining should be considered only as a last resort. Also Type B, C or D Rock Channel Protection may be used to line the ditch if the nearest point of the lining is outside the design clear zone or located behind guardrail. Item 838 Seeding and Erosion Control with Matting may be used in lieu of rock, where average flow velocity is less than 10 feet per second and the ditch slope is less than 10%. Type B or C rock should be considered for lining ditches on steep grades that carry flow from the end of a cut section down to the valley floor.

1102.33 Roughness

Suggested values for Manning's Roughness Coefficient "n" for the various types of open water carriers covered in Section 1102.2 are listed in Table1102-2.

Table 1102-2

Type of Lining	Roughness Coefficient
Bare Earth	.02
Seeded	.03
Sod	.04
Jute Mat	.04
Excelsior Mat	.04
Item 838 Matting	.04
Concrete	.015
Bituminous	.018
Grouted Riprap	.02
Rock Channel Protection	.06 for ditches .04 for large channels

1102.34 Catch Basin Types

The Standard CB-4, 5 and 8 Catch Basins are suitable for the standard roadside designs covered in the Roadway Design Manual. The tilt built into the basin top provides a self-cleaning feature when the basins are used on continuous grades and the wide bar spacing minimizes clogging possibilities, thereby resulting in an efficient design. The bases of the 4, 5 and 8 Catch Basins can be expanded to accommodate larger diameter conduits by specifying 4A, 5A or 8A Basins, detailed on Standard Drawing CB-458A. The bar spacing can be decreased, when desirable for safety reasons, by specifying Grate E for the CB-4 and Grate B for CB-5. The following catch basin types are generally recommended based on the size and shape of the ditch.

A. Standard CB-4 for depressed medians wider than 40 feet.

B. Standard CB-5 for 40 foot radius roadside or median ditches (Use grate B where pedestrian traffic may be expected).

C. Standard CB-8 for 20 foot radius roadside or depressed medians 40 feet or less in width.

D. Standard CB-2-2-A catch basins may be used in trapezoidal toe ditches where the basin is located outside the design clear zone or behind guardrail and the protruding feature of the basin is

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PARSONS ERA PROJECT

ENGINEERING CALCULATIONS TITLE AND SUMMARY SHEET

Date 7/23/96

Sheet 1 of 2

Proj. Order No. ~~7558~~ Calculation No. 15-02

Project Title HAUL ROAD CONSTRUCTION

Calculation Subject DRAINAGE Date Verified/Checked 5/21/96

STATUS: PRELIMINARY • FINAL X SUPERSEDED VOID

STATEMENT OF PROBLEM

DITCH & CULVERT DESIGN CALCULATIONS FOR THE HAUL ROAD.
HAUL ROAD MAXIMUM DITCH VELOCITY IS 2 FT/SEC.

• 2

SUMMARY OF CONCLUSIONS 3

DITCHES ARE DESIGNED AND PLOTTED IN THE PROFILE AND CROSS SECTIONS

12.39

land

Originator's Signature and Date

AJ Hanlon 5/21/96

REV 7/8/96

CHECKING METHOD nd

Checker's Signature and Date

1. Review 33 X
2. Alternate Calculation (10 —

AM Christo 5/21/96 REV 7/8/96

Lead Discipline Engineer's Signature and Date

John Gilbertson 7/23/96

31

Rev. No.	Sheet No.	Description	Reviser's Signature/Date	Checker's Signature/Date	Approved by Signature/Date
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		ed			

05/93

ENG080

PARSONS
ERA PROJECT

ENGINEERING CALCULATIONS
BASIS SHEET

Revision No. 0
Sheet 2 of 2

Proj. Order No. 158 Calculation No. 15-02

Project Title HAUL ROAD CONSTRUCTION

Calculation Subject DRAINAGE Date Verified/Checked 5/21/96

Prepared By: AJ Stevenson Checked/Verified By: AM Clarke

Date 5/21/96 REV 7/8/96

SUMMARY OF DATA SOURCES - CODES - ASSUMPTIONS

- ASSUMPTIONS - STATED IN CALCULATIONS
- CODES - ODOT LOCATION & DESIGN MANUAL
- SOURCES - PLAN DRAWINGS

De Leuw, Cather
Engineers and Planners

Subject: Haul Road
Job No. 660620
Sheet No. 1 of 3
Made by: AJS
Date: 7/3/96
Checked by: Jane
Date: 7/8/96

Revised Conduit Design

Assumptions/Criteria

- Use Inlet Control: Allowable HW = D $\left(\frac{HW}{D} = 1\right)$
  Use ODOT L&D Manual, Fig 1100-245 (Attachment B)
- Use Corrugated Metal Pipe
- Design based on 25-year peak discharge, Rational Method
- 2 fps maximum ditch velocity ahead of Sta 121+00
- 3 fps maximum ditch velocity below Sta 121+00

Sta 101+20

A = 12.39 Acres

Overland flow width ≈ 800 ft

Ground slope = 0.01 = 1.0%

T_o = 33 min (Attachment D)

$T_D = \frac{(106+50 - 101+20)}{3 \text{ fps}} = 176.67 \text{ sec} = 2.9$ say 3 min

T_c = 36 min

i_{25} = 3.6 in/hr

$Q_{25} = 0.3(3.6)(12.39)$

= 13.4 cfs

Required Pipe Size is 24" (Attachment B)

Sta 109+30

A = 10.44 Acres

Overland flow width = 800 ft

Ground slope = 1.0%

T_o = 33 min

$$T_D = \frac{109+30 - 106+50}{3 \text{ fps}} = 93.3 \text{ sec} = 1.56 \text{ say } 2 \text{ min}$$

$T_C = T_o + T_D$ = 35 min

i_{25} = 3.65 in/hr

$Q_{25} = 0.3(3.65)(10.44)$

= 11.4 cfs

Req'd Pipe Size is 24" (Attachment B)

Sta 119+12

A = 9.15 Acres (East Side from Sta 116+50 to the K-65 Trench @ 126+50)

Overland flow width = 350 ft, Ground slope ≈ 0.8%

T_o = 26 min

$$T_D = \frac{(126+50 - 119+12)}{3 \text{ fps}} \times \frac{1}{60} = 4.1 \text{ min}$$

T_C = 30 min

i_{25} = 4 inches/hr

De Leuw, Cather
Engineers and Planners

Subject: Haul Road
Job No. 660620
Sheet No. 3 of 3
Made by: AJS
Date: 7/3/96
Checked by: [illegible]
Date: 7/8/96

Sta 119+12 (cont)

$Q_{25} = 0.3(4.0)(9.15)$

$= 10.98$ cfs say 11 cfs

Required pipe size is 24" (Attachment B)

Pipe Slopes

Assumptions/Restrictions

- Maximum velocity of 3 fps for stations below 121+00
- Velocity based on full flow using Mannings Equation

$$S_{MAX.\ ALLOWABLE} = \left[\frac{V\,n}{1.49(A/P)^{2/3}}\right]^2 \quad \text{where}$$

$V = 3$ fps

$A = \pi r^2 = 3.141$ ft²

$P = 2\pi r = 6.283$ ft

} All Pipes are 24" dia.

$n = 0.024$ (Attachment C)

$$S_{MAX.\ ALLOWABLE} = \left[\frac{(3\text{ fps})(0.024)}{1.49\,(0.500)^{2/3}}\right]^2$$

$S_{MAX.} = 0.0059$

De Leuw, Cather
Engineers and Planners

Subject: Haul Road
Job No. 660620
Sheet No. 1 of 5

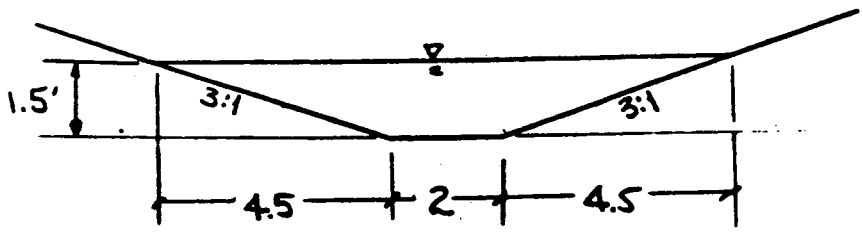
Made by: AJS
Date: 5/17/96
Checked by: AMC
Date: 5/22/96

Reiteration of Previous Calcs by DCB

Ditch Design

Assumptions/Restrictions

- Max velocity of 2 fps for Stations greater than 121+00
- Max velocity of 3 fps for Stations less than 121+00
- Trapezoidal Ditch Section; 2 foot bottom, 3:1 slopes
- Design Flow depth 1.5 ft. maximum



$A = 9.75\ ft^2$

$P = 11.49\ ft$

$R = A/P = 0.849\ ft$

Since capacity is not an issue on the Haul Rd due to small discharges, the main objective will be to control the velocity by means of restricting the allowable ditch slope.

De Leuw, Cather
Engineers and Planners

Subject: Haul Road
Job No. 660620
Sheet No. 2 of 5
Made by: A.J.S Date: 5/17/96
Checked by: dmc Date: 5/22/96

Reiteration of Previous Calc's by DCB

V = 3 fps (Sta 121+00 forward) n = 0.04 for sod lining
(ODOT L&D Manual, Table 1102-2 Attachment F)

$$S = \left[\frac{Vn}{1.49 R^{2/3}}\right]^2$$

$$= \left[\frac{(3\,fps)(0.04)}{(1.49)(0.849)^{2/3}}\right]^2$$

$$= 0.008$$

$$= 0.80\% \text{ maximum}$$

V = 2 fps (Sta 121+00 back)

$$S = \left[\frac{(2\,fps)(0.04)}{(1.49)(0.849)^{2/3}}\right]^2$$

$$= 0.0036$$

$$= 0.36\% \text{ maximum}$$

$$S = \left[\frac{(2\,fps)(0.06)}{(1.49)(0.849)^{2/3}}\right]$$

$$= 0.008$$

$$= 0.80\% \text{ max}$$

Sta 121+00 to Sta 128+35

000050

ΔElev = 573.05 − 569.10 = 3.95 ft

S = 3.95 ft / 735 ft = 0.0054

$$n = \frac{1.49}{?} R^{2/3} S^{1/2} = \frac{1.49}{?} (0.849)^{2/3} (0.0054)^{1/2} = 0.049$$

Use RCP, n = 0.06

Haul Road Ditch Checks (Steps)

- Restrict velocity to 2 fps maximum
- Minimize Use of Rock Channel Protection (try to limit to 'step' area)

Sta 130+07 to Sta 141+00
Ditch Length = 1093 ft
Drainage Area = 2.03 acres (from previous calcs)

From plans, the overland flow width to the high end of the ditch is 50 feet (±), and the ground slope is approximately 2% (0.02)

T_o = 10 min (L&D Manual, Figure 1101-1, Attachment D)

Based on a ditch velocity of 2 fps

T_D = 1093 ft / 2 ft/sec = 546.5 sec = 9 min

$T_c = T_o + T_D$ = 19 min

From Fig 1101-2, i_{25} = 5 inches/hr (Attachment E)

$Q_{25} = 0.3(5)(2.03) = 3.04$ cfs

Assume a flow depth of 1.5 feet, trapezoidal cross section with a bottom width of 2 feet and 3:1 side slopes, and sod lining ($n = 0.04$).

Then the flow area is

$$A = \tfrac{1}{2}[2 + 2 + 2(3)(1.5)](1.5) = 9.75\ ft^2$$

The wetted perimeter is

$$P = 2 + 2[(1.5)^2 + (4.5)^2]^{1/2} = 11.49\ ft$$

And the hydraulic radius is

$$R = A/P = 9.75/11.49 = 0.849\ ft$$

The ditch flow capacity is

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

For $S = 0.008$, $Q = 29.12$ cfs » Max. discharge = 3 cfs

For $S = 0.006$, $Q = 25.22$ cfs » 3 cfs

Let $S = 0.006$ and find normal depth for $Q = 3$ cfs (peak flow in the ditch 'step' area).

AJS 5/14/96
ck AMC 5/22/96

Let $d = 0.5$ ft.

$A = \frac{1}{2}[2 + (2 + 2(3)(0.5))](0.5) = 1.75 \text{ ft}^2$

$P = 2 + 2[(0.5)^2 + (1.5)^2]^{1/2} = 5.16 \text{ ft}$

$R = A/P = 0.339 \text{ ft}$

$Q = \frac{1.49}{0.04}(1.75)(0.339)^{2/3}(0.006)^{1/2} = 2.45 \text{ cfs}$

Let $d = 0.6$ ft

$A = \frac{1}{2}[2 + (2 + 2(3)(0.6))](0.6) = 2.28 \text{ ft}^2$

$P = 2 + 2[(0.6)^2 + (1.8)^2]^{1/2} = 5.79 \text{ ft}$

$R = A/P = 0.393 \text{ ft}$

$Q = \frac{1.49}{0.04}(2.28)(0.393)^{2/3}(0.006)^{1/2} = 3.53 \text{ cfs}$ OKAY

$V = Q/A = 3.53/2.28 = 1.55$ f.p.s. OKAY

∴ In step area, use 0.60% ditch grade and 2-foot drops lined with Rock Channel Protection locally. Remainder of ditch to be lined with sod. Step interval is 200 ft.

Attachment A

1101 Estimating Design Discharge

1101.1 General

In order to properly design highway drainage facilities, it is essential that a reasonable estimate be made of the design and check discharges. Some of the more important factors affecting runoff are duration, intensity and frequency of rainfall, and the size, imperviousness, slope and shape of the drainage area. Also a proper evaluation should be made of probable changes in land use throughout the drainage area.

1101.2 Procedures

1101.21 Statistical Methods

The statistical methods developed by the U.S. Geological Survey and published in USGS Water Resources Investigations Reports 89-4126 and 86-4197 are recommended for estimating runoff from larger drainage areas. A description and limitations of these methods are described in Section 1003.

1101.22 Rational Method

The Rational method is considered to be more reliable for estimating runoff from small drainage areas, usually less than 6 acres; and for areas that contribute sheet flow only to the roadway ditch or pavement. The design discharge "Q" is obtained from the equation Q = CiA where:

C = Coefficient of runoff

i = Average rainfall intensity, in inches per hour, for a given storm frequency and for a duration equal to the time of concentration

A = Drainage area, in acres

The time of concentration is the time required for runoff to flow from the most remote point of the drainage area to the point of concentration. The point of concentration could be a culvert inlet or the checkpoint in a roadway ditch used to determine the need for protection. Time of concentration is ordinarily designated by T and is the summation of the time of overland flow "t_o" and the time of ditch flow "t_d".

Overland flow is that flow not carried in a discernible channel, and the time of such flow may be obtained from Figure 1101-1 or a similar overland flow chart.

1101.23 Coefficient Of Runoff

The recommended value for the coefficient of runoff for various contributing surfaces are shown in Table 1101-1. Where two values are shown, the higher value ordinarily applies to the steeper slopes.

Table 1101-1

Types of Surface	Coefficient of Runoff "C"
Pavement & Paved Shoulders	0.9
Berms and slopes 4:1 or flatter	0.5
Berms and slopes steeper than 4:1	0.7
Contributing Areas:	
Residential (single family)	0.4-0.6
Residential (multi-unit)	0.5-0.7
Woods	0.3
Cultivated	0.3-0.6

The total width contributing flow to a given point usually consists of surfaces having a variable land cover and thereby require a weighted coefficient of runoff "C". The weighted coefficient is obtained by averaging the coefficients for the different types of contributing surfaces, as noted in the following example:

Contributing Width "W"	Land Use	"C"	"CW"
20 Ft.	Paved Area	0.9	18
40 Ft.	Earth Berms & Slopes	0.7	28
140 Ft. / 200 Ft.	Residential Area	0.6	84 / 130

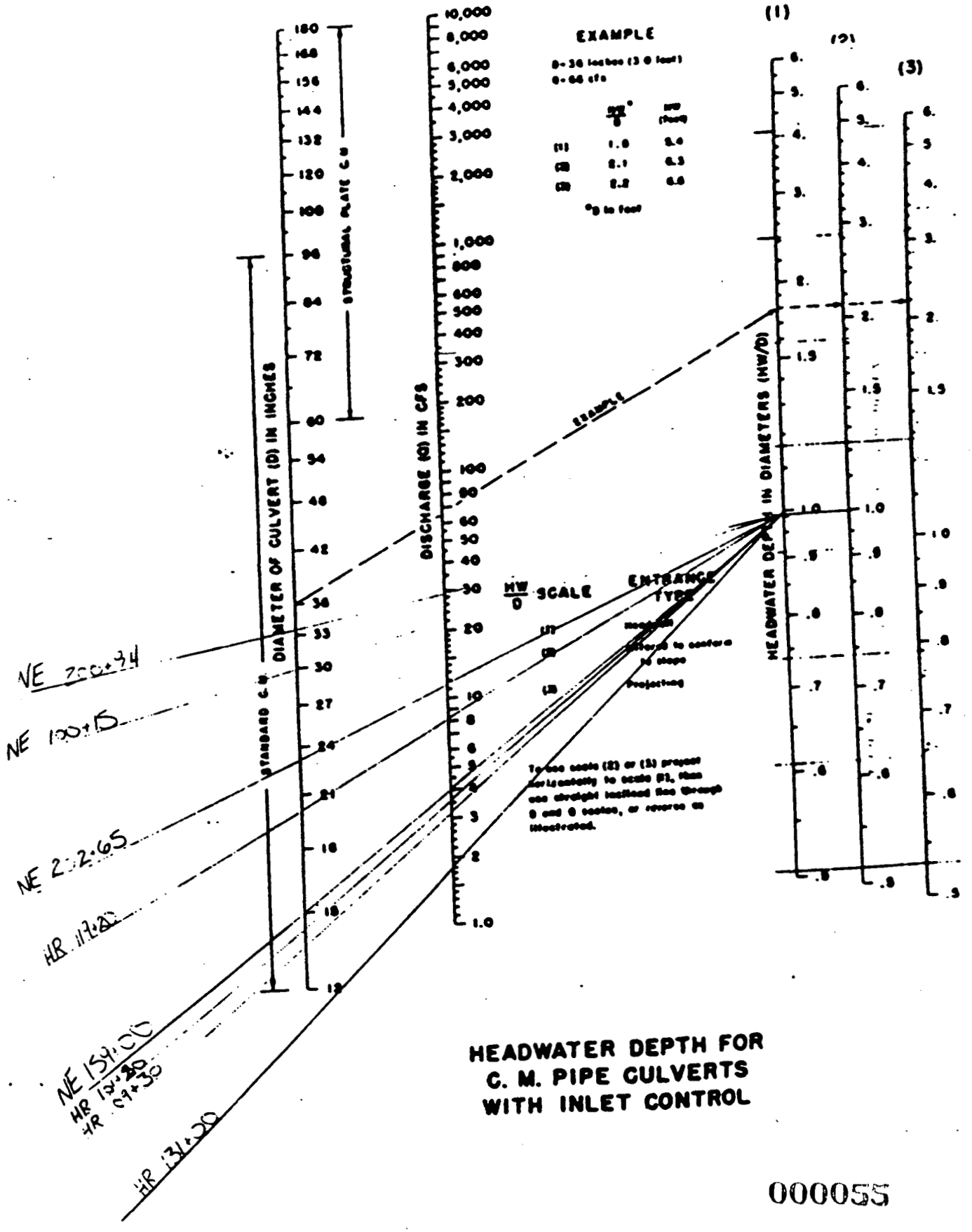
Weighted "C" = $\frac{130}{200}$ = 0.65

1101.24 Rainfall Intensity

The average rainfall intensity "I" in inches per hour may be obtained from the Intensity-Frequency-Duration curves shown on Figure 1101-2. Each set of curves applies to a specific geographic area, A, B, C or D as shown on the Rainfall Intensity Zone Map, Figure 1101-3. The geographic areas were established from an analysis of rainfall records obtained from Weather Bureau stations in Ohio. Some political subdivisions may have developed curves for their specific area similar to Figure 1101-2. Such curves may be based on a much longer period of record.

Attachment B

Fig. 1100-245



HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

91

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TABLE 10.3 TYPICAL VALUES OF THE ROUGHNESS COEFFICIENT n

	n
Lined Canals	
Cement plaster	0.011
Untreated gunite	0.016
Wood, planed	0.012
Wood, unplaned	0.013
Concrete, troweled	0.012
Concrete, wood forms, unfinished	0.015
Rubble in cement	0.020
Asphalt, smooth	0.013
Asphalt, rough	0.016
Corrugated metal	0.024
Unlined Canals	
Earth, straight and uniform	0.023
Earth, winding and weedy banks	0.035
Cut in rock, straight and uniform	0.030
Cut in rock, jagged and irregular	0.045
Natural Channels	
Gravel beds, straight	0.025
Gravel beds plus large boulders	0.040
Earth, straight, with some grass	0.025
Earth, winding, no vegetation	0.030
Earth, winding, weedy banks	0.050
Earth, very weedy and overgrown	0.080

Manning Equation—Traditional System of Units

It can be shown that, in converting from SI to the traditional system one must apply a factor equal to 1.49 if the same value of n is used in systems. Thus in the traditional system the discharge equation using n is given as

[redacted]

EXAMPLE 10.16 If the channel of Example 10.15 has a slope what is the discharge in the channel and what is the numerical value ning's n for this channel?

Solution From Example 10.15, we have an f value of 0.130, and the mate value of R_h is 4.3 ft. In Example 10.14 it was shown that

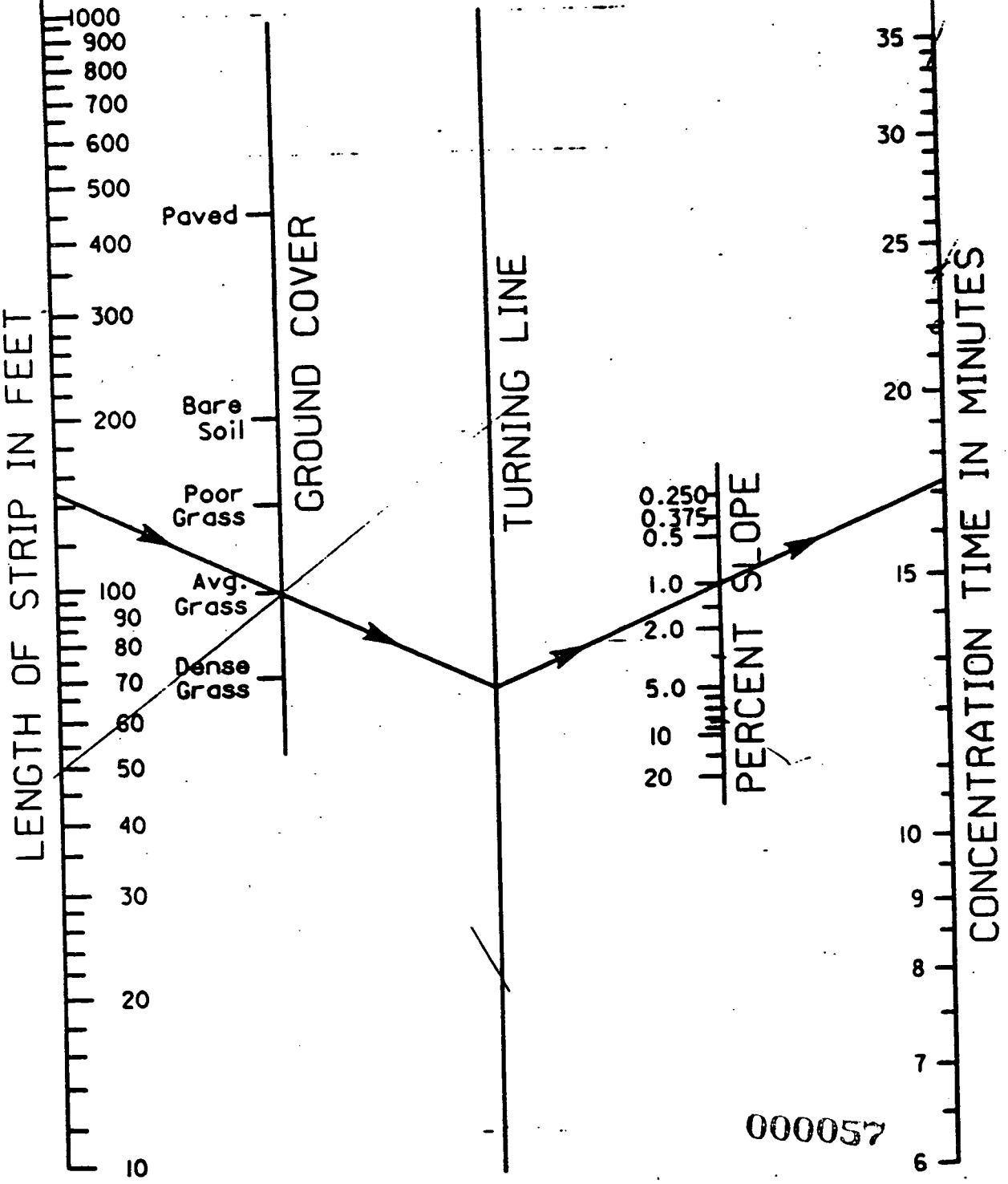
$$V = \sqrt{\frac{8g}{f}}\sqrt{R_h S_0}$$

Attachment D

OVERLAND FLOW CHART

1101-1

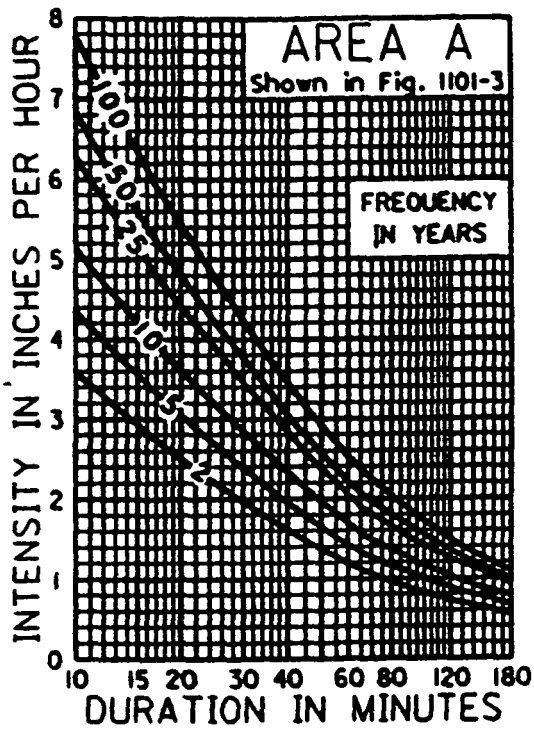
REFERENCE SECTION
1101.22

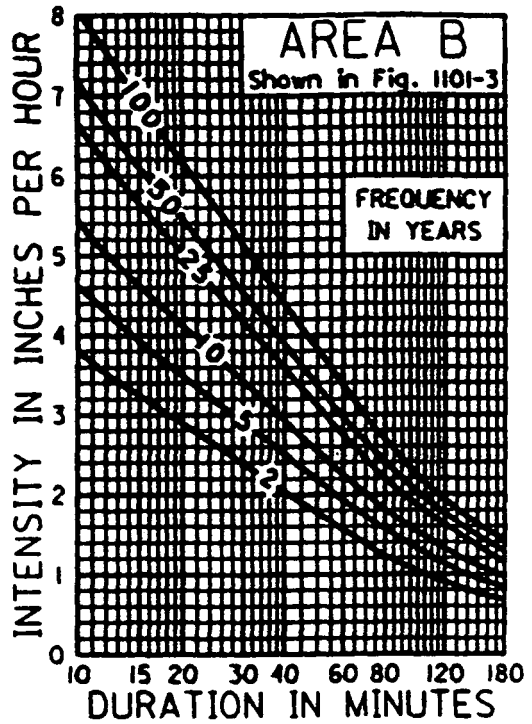


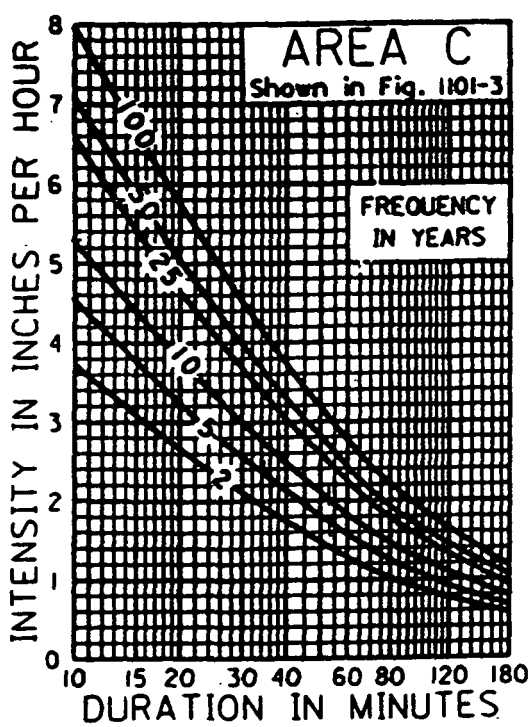
Attachment E

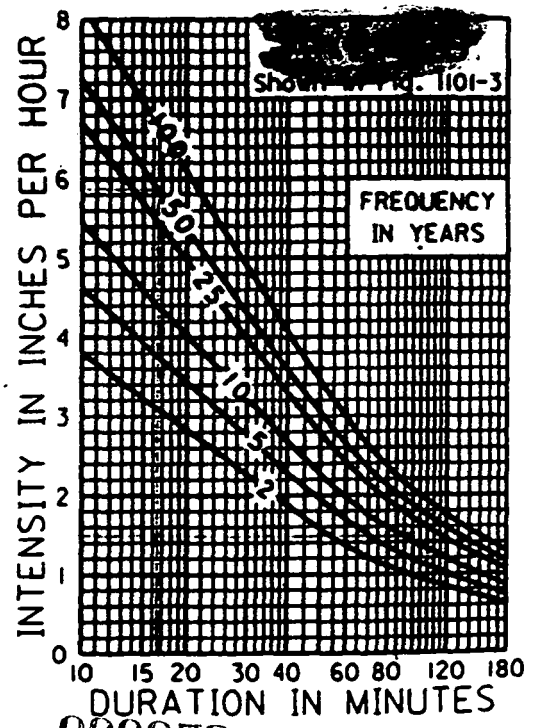
RAINFALL INTENSITY-FREQUENCY-DURATION CURVES	1101-2
	REFERENCE SECTION 1101.24

RAINFALL INTENSITY-FREQUENCY-DURATION CURVES









Attachment F

1102.3 Ditch Design Criteria - Design Traffic Exceeding 2000 ADT

1102.31 Design Frequency

It is recommended that a 10-year frequency storm be used to determine the depth of flow, and a 5-year frequency be used to determine the velocity of flow and the depth of ditch lining where needed. Where a flexible ditch lining is required for calculated velocities exceeding the allowable for seed, the minimum width of the lining shall be 7-1/2 feet. The depth of flow shall be limited to an elevation 12 inches below the edge of pavement for the design discharge. Other ditches, including toe of slope, should not be overtopped by the design discharge.

1102.32 Velocity

The velocity for the five-year frequency storm should not exceed the values shown in Table 1102-1 for the various soil types and flexible linings.

Table 1102-1

ALLOWABLE DITCH VELOCITIES
(Ft. Per. Sec.)

Soil Type	Seed Lining (659)	Sod Lining (660)	Jute or Excelsior Matting (667) or (668)
Sand	1.5	3.5	3.0
Firm Loam	2.0	4.0	4.0
Clay	2.5	5.0	4.0
Gravel	3.5	6.0	5.0
Weathering Shale	4.5	6.0	5.0

If the calculated velocity exceeds that shown in the table, a concrete lining should be considered only as a last resort. Also Type B, C or D Rock Channel Protection may be used to line the ditch if the nearest point of the lining is outside the design clear zone or located behind guardrail. Item 838 Seeding and Erosion Control with Matting may be used in lieu of rock, where average flow velocity is less than 10 feet per second and the ditch slope is less than 10%. Type B or C rock should be considered for lining ditches on steep grades that carry flow from the end of a cut section down to the valley floor.

1102.33 Roughness

Suggested values for Manning's Roughness Coefficient "n" for the various types of open water carriers covered in Section 1102.2 are listed in Table1102-2.

Table 1102-2

Type of Lining	Roughness Coefficient
Bare Earth	.02
Seeded	.03
Sod	.04
Jute Mat	.04
Excelsior Mat	.04
Item 838 Matting	.04
Concrete	.015
Bituminous	.018
Grouted Riprap	.02
Rock Channel Protection	.06 for ditches .04 for large channels

1102.34 Catch Basin Types

The Standard CB-4, 5 and 8 Catch Basins are suitable for the standard roadside designs covered in the Roadway Design Manual. The tilt built into the basin top provides a self-cleaning feature when the basins are used on continuous grades and the wide bar spacing minimizes clogging possibilities, thereby resulting in an efficient design. The bases of the 4, 5 and 8 Catch Basins can be expanded to accommodate larger diameter conduits by specifying 4A, 5A or 8A Basins, detailed on Standard Drawing CB-458A. The bar spacing can be decreased, when desirable for safety reasons, by specifying Grate E for the CB-4 and Grate B for CB-5. The following catch basin types are generally recommended based on the size and shape of the ditch.

A. Standard CB-4 for depressed medians wider than 40 feet .

B. Standard CB-5 for 40 foot radius roadside or median ditches (Use grate B where pedestrian traffic may be expected).

C. Standard CB-8 for 20 foot radius roadside or depressed medians 40 feet or less in width.

D. Standard CB-2-2-A catch basins may be used in trapezoidal toe ditches where the basin is located outside the design clear zone or behind guardrail and the protruding feature of the basin is

000059

~~The Haul Road will be bituminous pavement on an aggregate subbase. To reduce the risk of cross contamination, a non-woven geotextile will be used along with an aggregate subbase on the Haul Road.~~

~~The North Entrance Road will be bituminous pavement with an aggregate subbase. The use of the aggregate base will improve structural stability and provide for subgrade drainage.~~

The Haul Road and Relocated North Entrance Road will be bituminous pavement with an aggregate base, which will improve structural stability and provide for subgrade drainage.

To reduce the risk of cross-contamination and to prevent fines from interfering with the base, a non-woven geotextile will be used on both the Haul Road and Relocated North Entrance Road.

Pavement design for both roadways will be performed using ODOT design standards for flexible pavement design and using the 18-kip ESAL number for each respective roadway.

Culverts, utility tunnels, and other structures shall be designed for H20-44 loading.

Subgrade

To achieve the design CBR value of 4 and to guard against soft spots, the upper 6 inches of cut sections and the upper 18 inches of fill sections will be compacted from 95 to 98 percent of Standard Proctor with moisture content controlled within 2 percent of optimum. Soils with silt contents above 50 percent should be undercut to a minimum depth of 2 feet below subgrade for frost protection. A geofabric will be used to prevent fines from fouling the subbase. A geogrid may be used as added reinforcement if deemed necessary.

Calculations

Calculations will be provided for estimating all quantities used in the construction of the roadways. Specific calculations will be provided for drainage design, pavement design, and earthwork.

Nitrate Tank Removal Requirements

Removal of the nitrate tank will be part of ~~CRU-3~~ *OU3* Decontamination and Decommissioning work package. This project will define only the final requirements of backfilling and compaction to accomplish the road design.

Excavation and Disposal of Contaminated Materials

Contaminated soils will be removed by OU-5 in advance of North Entrance Road construction and completed under the provisions outlined in the final OU-5 ROD dated January 1996. Contaminated soil removal will be managed under the Final Soil Remediation Project Remedial Action Work Plan for Area 1, Phase I. Subsection 2.3.5 herein provides further discussion on soil management associated with road construction.

PARSONS ERA PROJECT

ENGINEERING CALCULATIONS TITLE AND SUMMARY SHEET

Date 7/23/96

Sheet 1 of 2

Proj. Order No. 158 Calculation No. 15-01

Project Title HAUL ROAD CONSTRUCTION

Calculation Subject PAVEMENT DESIGN Date Verified/Checked 2/20/96

STATUS: PRELIMINARY _____ FINAL X SUPERSEDED _____ VOID _____

STATEMENT OF PROBLEM

DESIGN PAVEMENT ACCORDING TO THE FOLLOWING PARAMETERS:
- ADT = 400 VPD (50/50 DISTRIBUTION), 100% CLASS B VEHICLES, 10 YR (MAX) DESIGN
- CBR = 4
- STANDARDS - ODOT LOCATION & DESIGN MANUAL

SUMMARY OF CONCLUSIONS

PAVEMENT SECTION:
- 1½" HSP ASPHALT CONCRETE (ODOT 404)
- 1½" ASPHALT CONCRETE (ODOT 402)
- 6" BITUMINOUS AGGREGATE BASE (ODOT 301)
- 6" AGGREGATE BASE (ODOT 304)

J.C.D.

Originator's Signature and Date

AM Chirsto 2/20/96

CHECKING METHOD

1. Review X
2. Alternate Calculation _____

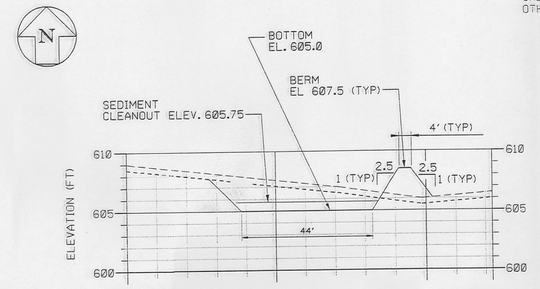
Checker's Signature and Date

DC Bird 2/20/96

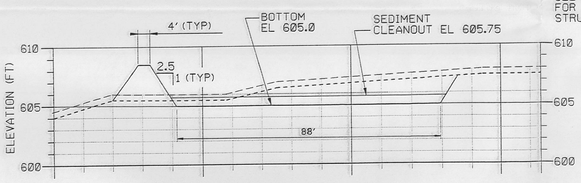
Lead Discipline Engineer's Signature and Date

John Washup 7/23/96

Rev. No.	Sheet No.	Description	Reviser's Signature/Date	Checker's Signature/Date	Approved by Signature/Date



SECTION A
SCALE: HOR 1"=20'
VER 1"=5'



SECTION B
SCALE: HOR 1"=20'
VER 1"=5'

LINE	GRADE
----	EXISTING
———	SEDIMENT
-----	DRAINAGE AREA

2- BURIED TELEPHONE CABLE RUNS ONE 3'-5' FROM EAST EDGE OF ROAD, THE OTHER 7'-0" (REF. DWG 00A-5500-G-01321)

SEE DWG X00452 FOR OUTLET STRUCTURE DETAIL

SEDIMENT TRAP #3 (SEE NOTE 6)

GRAVEL ROAD

MATCH LINE SHEET 1 OF 3
SEE DWG 75A-5500-G-00439

SEE NOTE 5 (TYP)

BUTLER COUNTY
HAMILTON COUNTY

℄ RELOCATED NORTH ACCESS ROAD (SEE NOTE 2)

TEST PAD AREA BY OTHERS (SEE NOTE 7)

EXISTING SOIL STOCKPILE TO BE RELOCATED TO EAST IMPACTED SOIL STOCKPILE AREA (APPROXIMATELY 2100 CUBIC YARDS).

SEE FIGURE 1

AREA 1 SOUTH
30.4 ACRES

NORTH ACCESS ROAD

END OF SILT FENCE SEE NOTE 3

END OF SILT FENCE

LIMIT OF 6" TOPSOIL REMOVAL SEE NOTES 3 AND 4 (TYP)

MATCH LINE SHEET 3 OF 3
SEE DWG 75A-5500-G-00441

NOTES:
1A. REMOVE EXISTING PILE TO ROUGH GRADE INDICATED.
1B. EXCAVATE ADDITIONAL 6' TO FINISHED GRADE

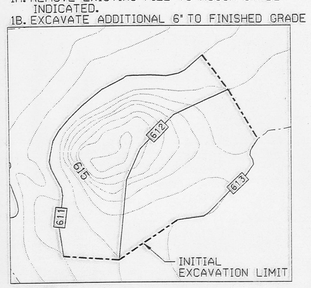


FIGURE 1

COORDINATES AND ELEVATIONS (NAD 83)					
POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
4	EXL	482638.89	1352002.96	N/A	LIMIT OF EXCAVATION
5	EXL	482640.69	1351852.17	N/A	LIMIT OF EXCAVATION
10	EXL	481991.25	1351269.59	N/A	LIMIT OF EXCAVATION
11	EXL	482088.70	1350958.62	N/A	LIMIT OF EXCAVATION
12	EXL	482273.33	1350952.50	N/A	LIMIT OF EXCAVATION
13	EXL	482692.40	1350976.41	N/A	LIMIT OF EXCAVATION
16	EXL	482723.22	1351387.92	N/A	LIMIT OF EXCAVATION
17	EXL	482400.08	1351389.32	N/A	LIMIT OF EXCAVATION
18	EXL	482398.68	1351042.22	N/A	LIMIT OF EXCAVATION
19	EXL	482721.68	1351040.82	N/A	LIMIT OF EXCAVATION
42	T3	482782.64	1351032.18	SEE SECTION	SEDIMENT TRAP #3 (NW CORNER)
43	T3	482739.03	1351120.18	SEE SECTION	SEDIMENT TRAP #3 (SE CORNER)
44	T3	482741.85	1351035.36	607	SEDIMENT TRAP #3 (OUTLET STRUCTURE CENTERLINE)
45	T3	482720.12	1351013.83	606.9	SEDIMENT TRAP #3 (OUTLET STRUCTURE CENTERLINE)
46	DL	482734.05	1351125.18	607	INLET DITCH CENTERLINE
47	DL	482718.38	1351143.76	**	INLET DITCH CENTERLINE
48	DL	482044.01	1351132.98	598.5	DIVERSION DITCH CENTERLINE (BEGIN 0.8% SLOPE)
49	DL	481997.94	1351278.70	N/A	DIVERSION DITCH CENTERLINE

** MEET EXISTING GRADE

GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
EXISTING SITE DATA SOURCE (IN PLANT FILES)

PARSONS TOPOGRAPHY, 1992
FEMP CADD GRID/UTILITY DRAWINGS
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE RELOCATED NORTH ACCESS ROAD IS TO BE BUILT BY OTHERS. THE LOCATION SHOWN IS APPROXIMATE AND PROVIDED FOR CONTRACTOR INFORMATION ONLY.

3. THIS AREA IS THE LIMITS OF 6" TOPSOIL REMOVAL SEE TABLE ON THIS DRAWING FOR COORDINATES OF LIMITS. INSTALL SILT FENCE ALONG LIMITS OF EXCAVATION BETWEEN AREAS INDICATED. SEE DWG 75X-5500-X-00452 FOR SILT FENCE DETAIL.

4. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5500-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.

5. REMOVE ALL EXISTING TREES WITHIN EXCAVATION LIMITS AND STOCKPILE AREAS.

6. INSTALL CONSTRUCTION FENCE ALONG THE OUTSIDE TOE OF SLOPE OF SEDIMENT TRAP #3 EMBANKMENT. CONTINUE CONSTRUCTION FENCE AS INDICATED ON PLAN. SEE DWG 75X-5500-X-00452 FOR CONSTRUCTION FENCE DETAIL.

7. WORK FOR THE TEST PAD AREA (INCLUDING THE DRAINAGE DITCH) WILL BE DONE BY OTHERS.

(1) PROTECT EXISTING WELLS SEE DWG 75X-5500-X-00452 FOR MONITORING WELL DETAIL
(2) EXISTING CONCRETE PAD AND FOUNDATION TO BE DEMOLISHED AND PLACED IN DEBRIS STOCKPILE AREA.
(3) REMOVE EXISTING SINGLE STRAND CATTLE FENCE IN ITS ENTIRETY INCLUDING OUTSIDE OF 6" TOPSOIL REMOVAL AREA (APPROXIMATELY 5000 L.F.)
(4) EXISTING CULVERTS TO BE REMOVED
(5) PROTECT EXISTING BENCHMARKS
(6) REMOVE EXISTING GRAVEL ROADS AND STOCKPILE SEE SPECIFICATION 02100 FOR DETAILS
(7) PROTECT EXISTING OVERHEAD ELECTRIC TOWER SEE DWG 75X-X-5500-X-00452 FOR DETAIL

EDC
CONTROLLED
CERTIFIED
002
CDC

FOR INFORMATION ONLY
06 05 96 1697 (10)

0 25 50 125 250
SCALE IN FEET

NO.	REVISIONS	DATE	DWN. BY	APPD.
0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB

NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
					75A-5500-G-00439
					75A-5500-G-00441
					75X-5500-X-00452

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE
1 2 3 (4) 5
BY: DJB DATE: 5/30/96

APPROVALS			
			SAFETY ENG.
CIVIL & STR.	C. NEUMANN	5/30/96	MAINTENANCE
ELECTRICAL			IQ A
ENGINEER			FIRE PROTECT.
INSTRUMENT			WASTE MANAGE
MECHANICAL			SECURITY
			CRU
CHECKED	[illegible]		SOIL REM. MGR. D. BRETSCHNEIDER
APPROVED	[illegible]	5/30/96	5/30/96

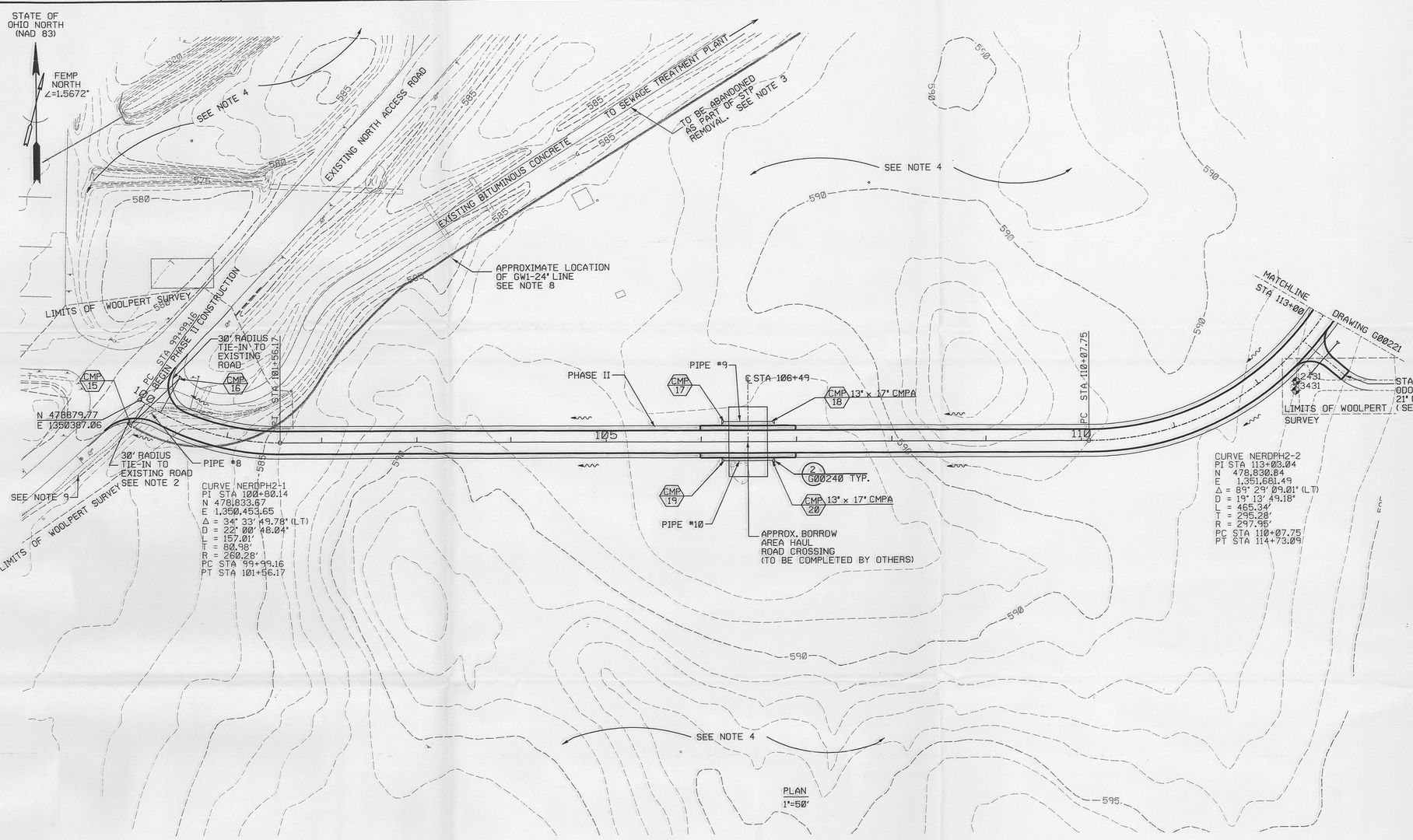
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

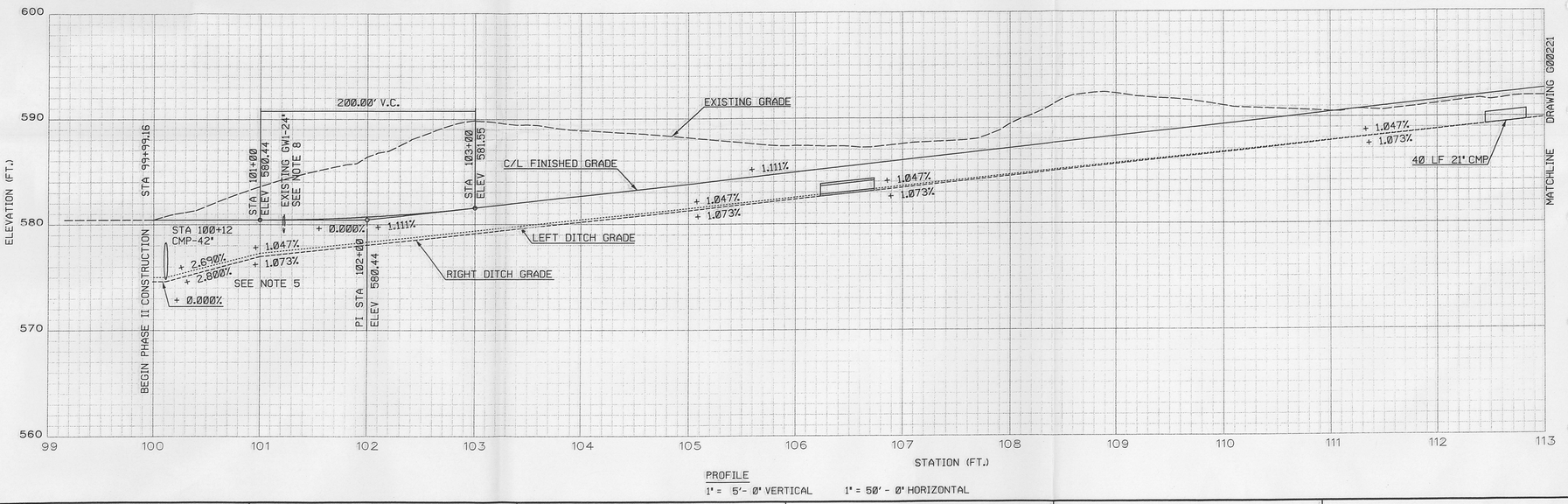
FEMP
AREA 1 PHASE 1 (EAST) SOIL REMEDIATION
REMEDIAL ACTION PROJECT
SITE PLAN 2 OF 3
SCALE: 1"=50'-0"

RES 2868
DATE 5/30/96
DRAWN M. TILLMAN
75A-5500-G-00440 C

FILE NAME: $$$$DGNSPEC$$$$ $$$$TIME$$$$

FORMAT REVISED 8/7/95





NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95 AND 5/96.
2. SEE DRAWING 92X-5900-G-00227 FOR CROSS SECTIONS FOR GRADING AND DRAINAGE.
3. THE EXISTING SEWAGE TREATMENT PLANT (STP) ROAD SHALL BE REMOVED PRIOR TO PHASE II (BY OTHERS).
4. PROPOSED GRADING IN THESE AREAS BY OTHERS. THE ON-SITE DISPOSAL FACILITY (OSDF) IN THIS DESIGN PHASE IS NOT SHOWN. TRANSITION OF GRADING BETWEEN AREAS TO BE COORDINATED THROUGH FERMCO.
5. FOR INFORMATION ON LOCATION AND ELEVATION OF STORM DRAINS, SEE DRAWING 92X-5900-G-00242.
6. WELLS ARE TO REMAIN. SUBCONTRACTOR SHALL PROTECT WELLS FROM DAMAGE DURING CONSTRUCTION. MODIFY SLOPE AND DITCH TO AVOID WELLS.
7. THE ODOT TYPE I DRIVEWAY WILL BE PLACED IN ACCORDANCE WITH ODOT STANDARD DRAWING BP-4.1. THE PAVEMENT SECTION WILL BE 1½" 404 ASPHALT CONCRETE, 6" 301 BITUMINOUS AGGREGATE BASE AND 3" 304 AGGREGATE BASE. THE DRIVEWAY SHALL BE CONSTRUCTED TO MEET THE EXISTING GRAVEL ACCESS ROAD.
8. THE RELOCATION OF THE GW1-24" LINE SHALL BE DONE BY FERMCO PRIOR TO PHASE II CONSTRUCTION.
9. AN OUTFALL CHANNEL IS REQUIRED FOR THE PROPOSED PIPE. THIS OUTFALL IS TO BE ESTABLISHED IN THE FIELD TO MATCH THE CONDITIONS AT THE START OF PHASE II CONSTRUCTION.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS AND SYMBOLS
92X-5900-G-00221	PLAN AND PROFILE - SHEET 2 OF 7
92X-5900-G-00227	CROSS SECTIONS - SHEET 1 OF 4
92X-5900-G-00240	GENERAL DETAILS - SHEET 1 OF 2
92X-5900-G-00242	DRAINAGE SUBSUMMARY

FOR INFORMATION ONLY

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
0	CERTIFIED FOR CONSTRUCTION	JMU	N/A 7/25/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 1 OF 7

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95		7/25/96	A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

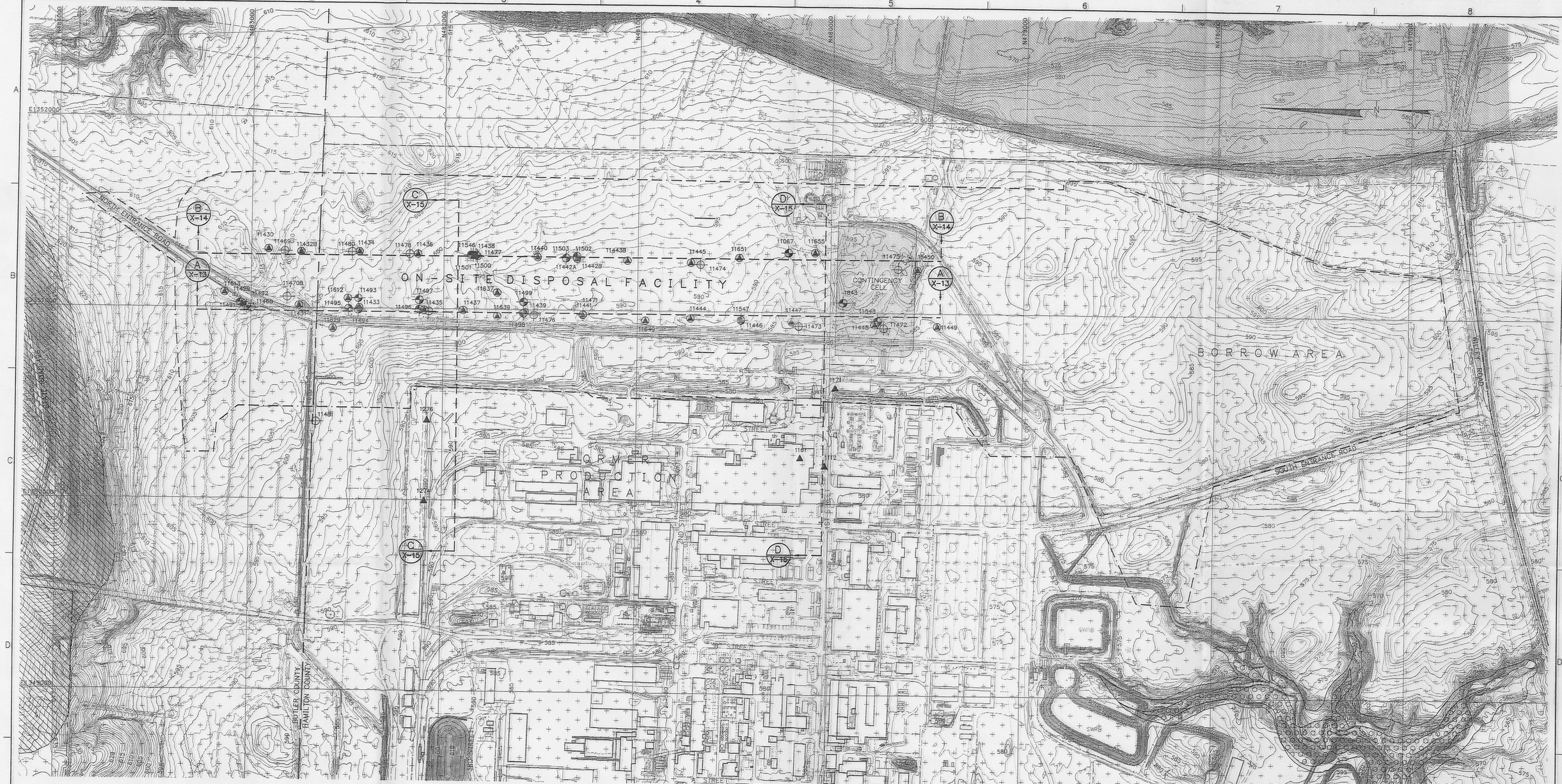
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NUMBER
A-E DATE 7/25/96	N/A DATE	20120

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00220	G0005	0

STATE OF OHIO JAMES M. WOLLUP E-046579 REGISTERED PROFESSIONAL ENGINEER

376

69



LEGEND

- 600 — EXISTING GROUND ELEVATION (FEET)
- BUTLER COUNTY/HAMILTON COUNTY LINE
- FEMP PROPERTY LINE
- BATTERY LIMIT
- IMPACTED MATERIAL DISPOSAL LIMIT
- BORROW AREA LIMIT
- APPROXIMATED CONTACT OF MAP UNITS
- CONTACT OF MAP UNITS
- 11493 — TYPE 1 MONITORING WELL (NOTE 6)
- 11434 — CONE PENETROMETER TEST (CPT) SOUNDING (NOTE 7)
- 11480 — GEOTECHNICAL BORING (NOTE 7)
- 1276 — PIEZOMETER (NOTE 6)

ALLUVIUM; FLUVIAL DEPOSITS OF RECENT (HOLOCENE) ORIGIN. INCLUDES A VARIETY OF TEXTURAL CLASSES FROM CLAYS TO BOULDERS. THIS ALLUVIUM LIES DIRECTLY UPON SAND AND GRAVEL OUTWASH DEPOSITS OF THE GREAT MIAMI AQUIFER.

TILL, WISCONSIN AGE. SHELBYVILLE TILL EXPOSED ON ERODED SLOPES AND FLOOR OF PADDYS RUN VALLEY. LOCALLY, MAY BE COVERED WITH A THIN VENEER OF RECENT ALLUVIUM.

FINE TO COARSE SAND. CONTAINS LESSER AMOUNTS OF DISSEMINATED GRAVEL AND THIN GRAVEL OR SILT LENSES. THE MAPPED UNIT IS ALLUVIUM THAT LIES UNCONFORMABLY UPON SHELBYVILLE TILL, AN ALLUVIAL TERRACE OF THE GREAT MIAMI RIVER.

TILL, LEAN CLAY TO A SANDY LEAN CLAY WITH INTERSTITIAL SANDS AND GRAVELS. WITHIN THE AREA OF THE OSDF, TILL CONTAINS LESS THAN 5 PERCENT INTERSTITIAL BODIES OF SANDS AND GRAVELLY SAND. TILL RANGES FROM APPROXIMATELY 25 FEET TO 60 FEET IN THICKNESS

BEDROCK WITH A TILL/LOESS CAP OF VARIABLE THICKNESS. ORDOVICIAN AGE BEDROCK CONSISTING OF ALTERNATING LAYERS OF LIMESTONE AND SHALE. BEDROCK IS CAPPED BY WISCONSIN TILL, LOESS, AND COLLUVIUM OF VARIABLE THICKNESS, GENERALLY LESS THAN 10 FEET THICK.

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SURFACE GEOLOGY INFORMATION OBTAINED FROM FIGURE 3-18, "PRE-CONSTRUCTION SURFACE GEOLOGY OF THE FEMP", OF THE "REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 5, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY", U.S. DEPARTMENT OF ENERGY, MARCH 1995.
5. SECTION LOCATIONS OBTAINED FROM FIGURE 2-6, "CROSS-SECTION LOCATION MAP", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
6. MONITORING WELL AND PIEZOMETER LOCATIONS OBTAINED FROM TABLE A-6, "PREDESIGN INVESTIGATION WELL REFERENCE INFORMATION", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995. SEE DRAWINGS X-13 THROUGH X-15 FOR NORTHING, EASTING, AND GROUND SURFACE ELEVATION INFORMATION.
7. GEOTECHNICAL BORING AND CONE PENETROMETER TEST (CPT) SOUNDING LOCATIONS OBTAINED FROM APPENDIX B, "BORING AND CPT COORDINATES", OF THE "GEOTECHNICAL INVESTIGATION REPORT, ON-SITE DISPOSAL FACILITY, OPERABLE UNIT 2, PROJECT ORDER 140, REVISION A", PARSONS, SEPTEMBER 1995. SEE DRAWINGS X-13 THROUGH X-15 FOR NORTHING, EASTING, AND GROUND SURFACE ELEVATION INFORMATION.

FOR INFORMATION ONLY

PREFINAL DESIGN PACKAGE

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY

200 100 0 200 400
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
SURFACE GEOLOGY MAP

EDG 68

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

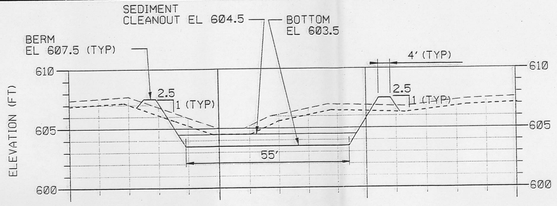
SIGNATURE

DATE

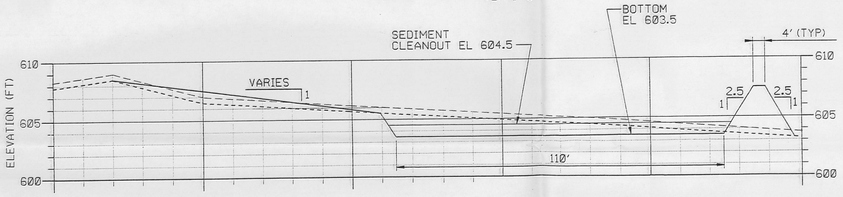
SEAL

GEO SYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

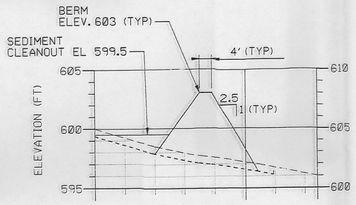
FERMCO SUBCONTRACT NO.:	95PS005928
FERMCO DRAWING NO.:	90X-6000-X-00012
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-E009
SHEET NO.:	X-12
REVISION NO.:	E



SECTION A
SCALE: HOR 1"=20'
VER 1"=5'

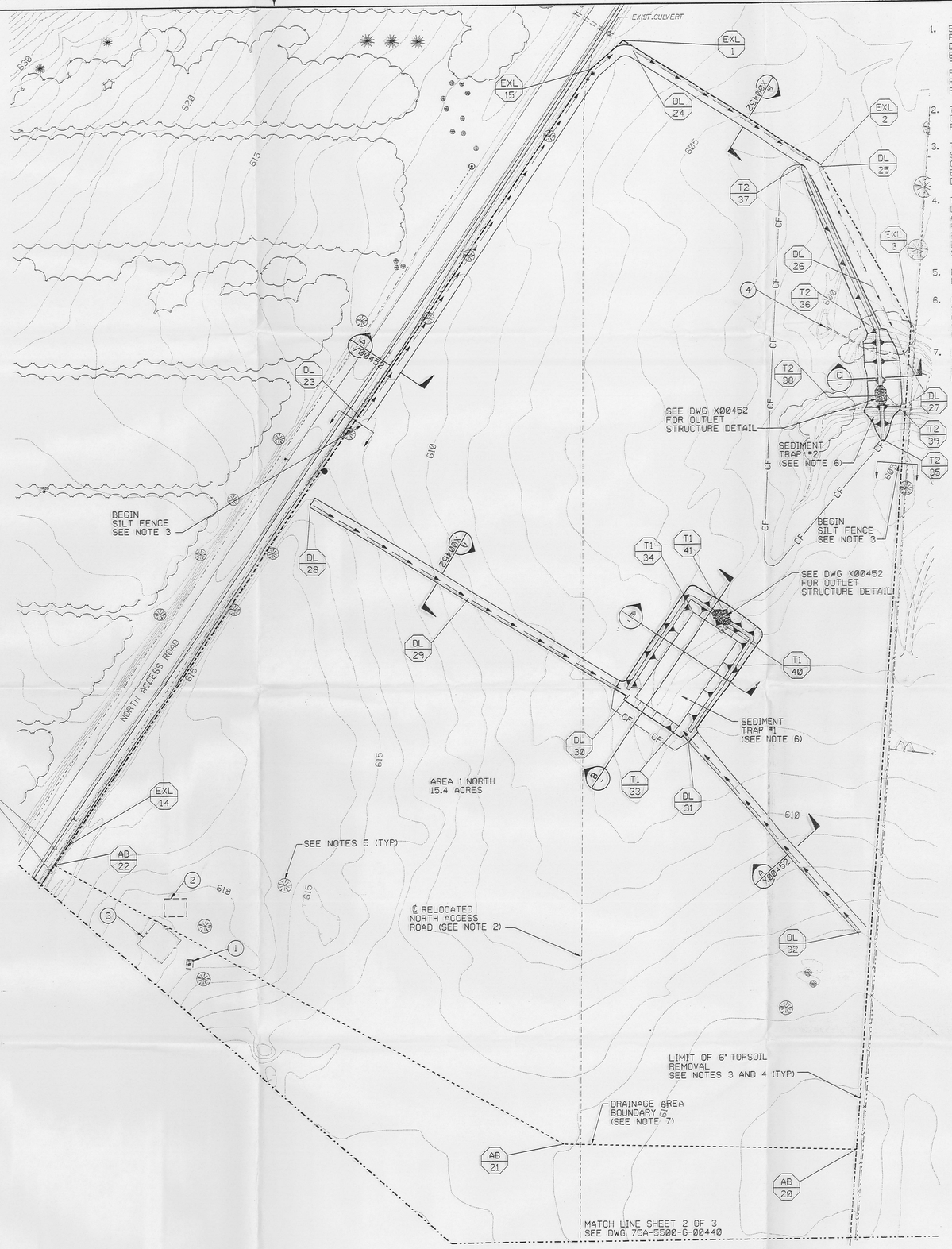


SECTION B
SCALE: HOR 1"=20'
VER 1"=5'



SECTION C
SCALE: HOR 1"=20'
VER 1"=5'

LINE	GRADE
----	EXISTING
———	SEDIMENT
-----	DRAINAGE AREA



COORDINATES AND ELEVATIONS (NAD 83)					
POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	EXL	484042.11	1351782.57	N/A	LIMIT OF EXCAVATION
2	EXL	483908.78	1351991.27	N/A	LIMIT OF EXCAVATION
3	EXL	483737.34	1352084.36	N/A	LIMIT OF EXCAVATION
14	EXL	483189.95	1351187.66	N/A	LIMIT OF EXCAVATION
15	EXL	484011.75	1351747.30	N/A	LIMIT OF EXCAVATION
20	AB	482859.05	1352019.28	N/A	DRAINAGE AREA BOUNDARY
21	AB	482866.96	1351708.55	N/A	DRAINAGE AREA BOUNDARY
22	AB	483169.09	1351172.90	N/A	DRAINAGE AREA BOUNDARY
23	DL	483643.40	1351500.69	610.5••	DIVERSION DITCH CENTERLINE (BEGIN 0.8% SLOPE)
24	DL	484031.15	1351793.23	606.6	DIVERSION DITCH CENTERLINE (BEGIN 2.0% SLOPE)
25	DL	483906.41	1351988.47	N/A	DIVERSION DITCH CENTERLINE
26	DL	483778.38	1352045.10	599	DIVERSION DITCH CENTERLINE
27	DL	483696.47	1352081.33	••	DIVERSION DITCH CENTERLINE (END OF DITCH)
28	DL	483552.67	1351447.37	612.5••	DIVERSION DITCH CENTERLINE (BEGIN 2.3% SLOPE)
29	DL	483451.41	1351612.80	608	DIVERSION DITCH CENTERLINE (BEGIN 1.0% SLOPE)
30	DL	483346.32	1351782.92	606	DIVERSION DITCH CENTERLINE (END OF DITCH)
31	DL	483301.57	1351842.88	606	DIVERSION DITCH CENTERLINE (END OF DITCH)
32	DL	483091.69	1352026.31	612.5••	DIVERSION DITCH CENTERLINE (BEGIN 2.3% SLOPE)
33	T1	483312.08	1351833.70	SEE SECTION	SEDIMENT TRAP #1 (SE CORNER)
34	T1	483433.95	1351850.18	SEE SECTION	SEDIMENT TRAP #1 (NW CORNER)
35	T2	483615.17	1352053.86	SEE SECTION	SEDIMENT TRAP #2 (EMBANKMENT CENTERLINE)
36	T2	483731.96	1352048.38	SEE SECTION	SEDIMENT TRAP #2 (EMBANKMENT CENTERLINE)
37	T2	483908.59	1351971.10	SEE SECTION	SEDIMENT TRAP #2 (EMBANKMENT CENTERLINE)
38	T2	483661.85	1352045.92	601.5	SEDIMENT TRAP #2 (OUTLET STRUCTURE CENTERLINE)
39	T2	483662.38	1352057.40	601.4	EDIMENT TRAP #2 (OUTLET STRUCTURE CENTERLINE)
40	T1	483423.63	1351876.43	606	SEDIMENT TRAP #1 (OUTLET STRUCTURE CENTERLINE)
41	T1	483433.14	1351882.90	605.9	SEDIMENT TRAP #1 (OUTLET STRUCTURE CENTERLINE)

•• MEET EXISTING GRADE

GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
   EXISTING SITE DATA SOURCE (IN PLANT FILES)

   PARSONS TOPOGRAPHY, 1992
   FEMP GADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
2. THE RELOCATED NORTH ACCESS ROAD IS TO BE BUILT BY OTHERS. THE LOCATION SHOWN IS APPROXIMATE AND PROVIDED FOR CONTRACTOR INFORMATION ONLY.
3. THIS AREA IS THE LIMITS OF 6" TOPSOIL REMOVAL SEE TABLE ON THIS DRAWING FOR COORDINATES OF LIMITS. INSTALL SILT FENCE ALONG LIMITS OF EXCAVATION BETWEEN AREAS INDICATED. SEE DWG 75X-5500-X-00452 FOR SILT FENCE DETAIL.
4. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5500-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.
5. REMOVE ALL EXISTING TREES WITHIN EXCAVATION LIMITS AND STOCKPILE AREAS.
6. INSTALL CONSTRUCTION FENCE ALONG THE OUTSIDE TOE OF SLOPE OF SEDIMENT TRAPS #1 AND #2 EMBANKMENT. CONTINUE CONSTRUCTION FENCE AS INDICATED ON PLAN. SEE DWG 75X-5500-X-00452 FOR CONSTRUCTION FENCE DETAIL.
7. DRAINAGE AREA BOUNDARY ILLUSTRATES LIMIT OF 6" TOPSOIL REMOVAL BETWEEN AREA 1 NORTH AND AREA 1 SOUTH. THE CONTRACTOR SHALL PERFORM EXCAVATION FROM UPGRADING TO DOWNGRADING FROM THIS BOUNDARY.

1. PROTECT EXISTING WELLS SEE DWG 75X-5500-X-00452 FOR MONITORING WELL DETAIL
2. EXISTING CONCRETE PAD AND FOUNDATION TO BE DEMOLISHED AND PLACED IN DEBRIS STOCKPILE AREA.
3. REMOVE EXISTING SINGLE STRAND CATTLE FENCE IN ITS ENTIRETY INCLUDING OUTSIDE OF 6" TOPSOIL REMOVAL AREA (APPROXIMATELY 5000 L.F.)
4. EXISTING CULVERTS TO BE REMOVED
5. PROTECT EXISTING BENCHMARKS
6. REMOVE EXISTING GRAVEL ROADS AND STOCKPILE SEE SPECIFICATION 02100 FOR DETAILS
7. PROTECT EXISTING OVERHEAD ELECTRIC TOWER SEE DWG 75X-X-5500-X-00452 FOR DETAIL

EDC CONTROLLED CERTIFIED 002 CDC

06 05 96 1697 (67)

FOR INFORMATION ONLY

0 25 50 125 250
SCALE IN FEET

NO.	REVISIONS	DATE	DWN. BY	APPD.
0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB

NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
					00A-5500-G-01321
					75A-5500-G-00439
					75A-5500-G-00440
					75A-5500-G-00452

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE
1 2 3 (4) 5
BY: DJB DATE: 5/30/96

APPROVALS			
CIVIL & STR.	C. NEUMANN 5/30/96	SAFETY ENG.	
ELECTRICAL		MAINTENANCE	
ENGINEER		Q.A.	
INSTRUMENT		FIRE PROTECT.	
MECHANICAL		WASTE MANAGE	
		SECURITY	
		CRU	
CHECKED	DEP	SOIL REM. PROJ.	D. BRETTSCHNEIDER
APPROVED	[illegible] 5/30/96		5/30/96

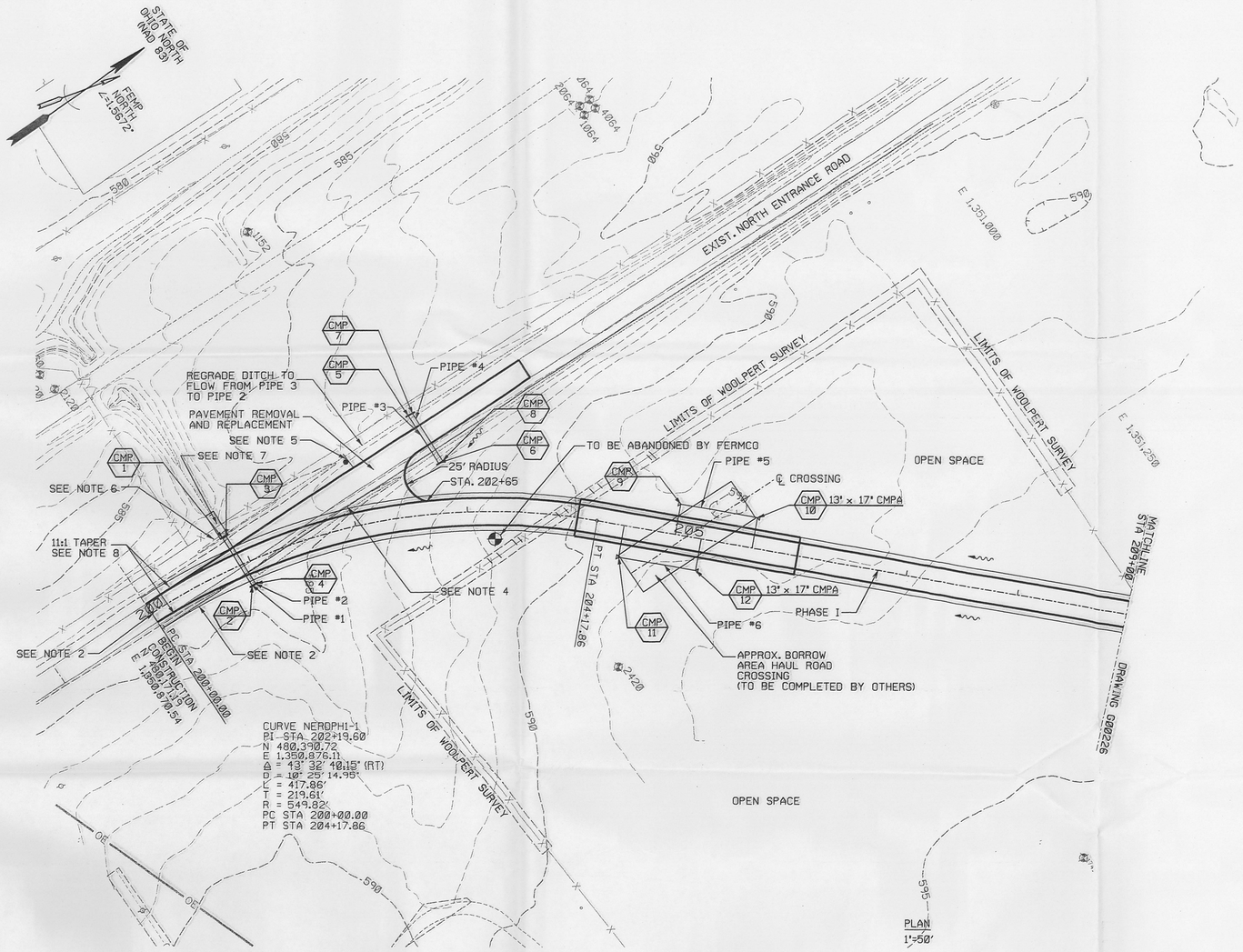
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

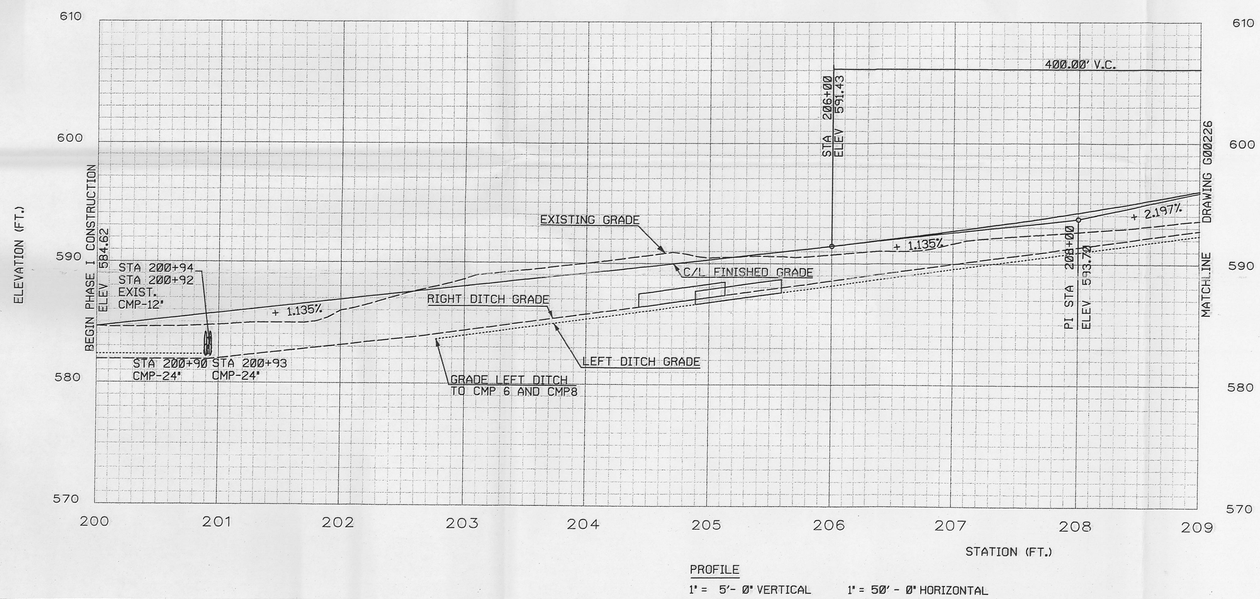
FEMP — SOIL REMEDIATION
AREA 1 PHASE 1 (EAST)
REMEDIAL ACTION PROJECT
SITE PLAN 1 OF 3
SCALE: 1" = 50'-0"

RES 2868
DATE 5/30/96
DRAWN: M.E. TILLMAN
75A-5500-G-00439 C

FORMAT REVISED 8/7/95

FILE NAME: $$$$DGNSPECDGGS $$$TIMDGS





NOTES

376

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95 AND 5/96.
2. FOR DETAILS OF TIE-IN TO EXISTING NORTH ENTRANCE ROAD, SEE DRAWING 92X-5900-G-00236.
3. SEE DRAWINGS 92X-5900-G-00230 FOR CROSS SECTIONS.
4. THERE ARE EXISTING UNDERGROUND TELEPHONE AND FIBER OPTIC LINES IN THE SHOULDER OF THE EXISTING NORTH ENTRANCE ROAD. THESE LINES ARE VITAL TO THE OPERATION OF THE FEMP. IT IS ESSENTIAL THAT ANY WORK IN THE VICINITY OF THE EXISTING NORTH ENTRANCE ROAD BE COORDINATED WITH FERMCO; AND THESE LINES SHALL BE PROTECTED FROM DAMAGE BY THE SUBCONTRACTOR. SUBCONTRACTOR SHALL SUBMIT A WRITTEN WORK PLAN WHICH DETAILS PROTECTIVE MEASURES AND WORK TO BE PERFORMED PRIOR TO ANY EXCAVATION. FERMCO SHALL VERIFY IN THE FIELD THE ACTUAL LOCATIONS AND ELEVATIONS OF THE LINES, FOR THE SUBCONTRACTOR. ANY EXCAVATION ACTIVITY SHALL BE DONE BY HAND WHEN WITHIN 3 FEET OF ANY KNOWN UTILTIY / PHONE CABLES UNLESS SPECIFICALLY APPROVED BY FERMCO.
5. SEE DRAWINGS 92X-5900-G-00236 FOR TRAFFIC CONTROL DEVICES.
6. REMOVE AND STOCKPILE EXISTING FENCE AS NEEDED TO CONSTRUCT ROAD. COORDINATE WITH FERMCO PRIOR TO PERFORMING WORK
7. REPLACE EXISTING 12" CMP UNDER FENCE WITH CONCRETE CHANNEL. SEE DRAWING 92X-5900-G-00241 FOR DETAIL.
8. SEE DRAWING 92X-5900-G-00240 FOR DETAILS OF CONNECTION TO EXISTING PAVEMENT.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS AND SYMBOLS
92X-5900-G-00226	PLAN AND PROFILE - SHEET 7 OF 7
92X-5900-G-00230	CROSS SECTION - SHEET 4 OF 4
92X-5900-G-00231	INTERSECTION DETAILS - SHEET 1 OF 2
92X-5900-G-00236	MAINTENANCE OF TRAFFIC
92X-5900-G-00240	GENERAL DETAILS - SHEET 1 OF 2
92X-5900-G-00241	GENERAL DETAILS - SHEET 2 OF 2

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
0	CERTIFIED FOR CONSTRUCTION	JMM	N/A	7/25/96

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION (66)

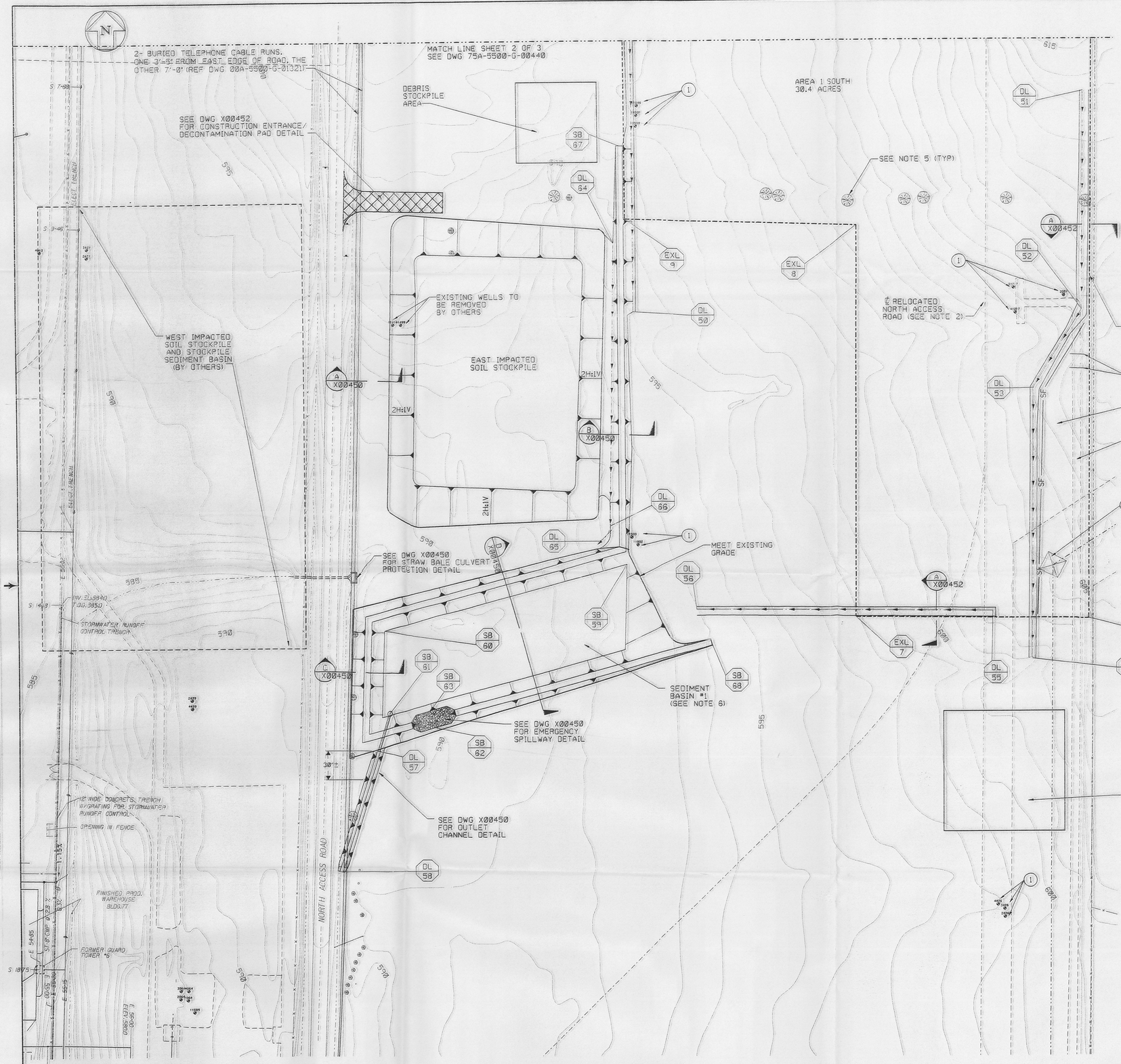
DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 6 OF 7

FOR INFORMATION ONLY

STATE OF OHIO — JOHN M. MOSLEY — E-46573 — REGISTERED PROFESSIONAL ENGINEER

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95		7/22/96	A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE: AS SHOWN	CLASS
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL		FERMCO PROJECT NUMBER	
A-E 7/25/96 DATE		N/A DATE		20120	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.2.3.6 00-90701	92X-5900-G-00225	G0010	0



GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
   EXISTING SITE DATA SOURCE (IN PLANT FILES)

   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE RELOCATED NORTH ACCESS ROAD IS TO BE BUILT BY OTHERS. THE LOCATION SHOWN IS APPROXIMATE AND PROVIDED FOR CONTRACTOR INFORMATION ONLY.

3. THIS AREA IS THE LIMITS OF 6" TOPSOIL REMOVAL SEE TABLE ON THIS DRAWING FOR COORDINATES OF LIMITS. INSTALL SILT FENCE ALONG LIMITS OF EXCAVATION BETWEEN AREAS INDICATED. SEE DWG 75X-5500-X-00452 FOR SILT FENCE DETAIL.

4. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5500-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.

5. REMOVE ALL EXISTING TREES WITHIN EXCAVATION LIMITS AND STOCKPILE AREAS.

6. INSTALL CONSTRUCTION FENCE ALONG THE OUTSIDE TOE OF SLOPE OF SEDIMENT BASIN #1 EMBANKMENT. CONTINUE CONSTRUCTION FENCE AS INDICATED ON PLAN. SEE DWG 75X-5500-X-00452 FOR CONSTRUCTION FENCE DETAIL.

(1) PROTECT EXISTING WELLS SEE DWG 75X-5500-X-00452 FOR MONITORING WELL DETAIL

(2) EXISTING CONCRETE PAD AND FOUNDATION TO BE DEMOLISHED AND PLACED IN DEBRIS STOCKPILE AREA.

(3) REMOVE EXISTING SINGLE STRAND CATTLE FENCE IN ITS ENTIRETY INCLUDING OUTSIDE OF 6" TOPSOIL REMOVAL AREA (APPROXIMATELY 5000 L.F.)

(4) EXISTING CULVERTS TO BE REMOVED

(5) PROTECT EXISTING BENCHMARKS

(6) REMOVE EXISTING GRAVEL ROADS AND STOCKPILE SEE SPECIFICATION 02100 FOR DETAILS

(7) PROTECT EXISTING OVERHEAD ELECTRIC TOWER SEE DWG 75X-X-5500-X-00452 FOR DETAIL

COORDINATES AND ELEVATIONS (NAD 83)					
POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
6	EXL	481223.38	1351839.73	N/A	LIMIT OF EXCAVATION
7	EXL	481225.85	1351551.48	N/A	LIMIT OF EXCAVATION
8	EXL	481715.84	1351555.25	N/A	LIMIT OF EXCAVATION
9	EXL	481724.55	1351269.59	N/A	LIMIT OF EXCAVATION
50	DL	481608.22	1351279.09	**	DIVERSION DITCH CENTERLINE (END)
51	DL	481891.58	1351835.58	612.0	DIVERSION DITCH CENTERLINE (BEGIN 2.7% SLOPE)
52	DL	481608.89	1351833.18	604.6	DIVERSION DITCH CENTERLINE (BEGIN 1.0% SLOPE)
53	DL	481511.10	1351772.30	N/A	DIVERSION DITCH CENTERLINE
54	DL	481172.90	1351783.28	**	DIVERSION DITCH CENTERLINE (END)
55	DL	481232.91	1351719.81	600.0	DIVERSION DITCH CENTERLINE (BEGIN 1.6% SLOPE)
56	DL	481236.05	1351353.83	**	DIVERSION DITCH CENTERLINE (END)
57	DL	481060.18	1350958.97	587.6	INVERT OF OUTLET PIPE
58	DL	480908.47	1350912.57	**	OUTLET CHANNEL (END)
59	SB	481293.03	1351288.31	SEE SECTION	SEDIMENT BASIN #1 (NE CORNER)
60	SB	481209.85	1350986.38	SEE SECTION	SEDIMENT BASIN #1 (NW CORNER)
61	SB	481106.89	1350973.25	SEE DETAIL	SEDIMENT BASIN #1 RISER
62	SB	481039.28	1351032.06	592.0	SEDIMENT BASIN #1 (EMERGENCY SPILLWAY CENTERLINE)
63	SB	481110.49	1351026.22	592.0	SEDIMENT BASIN #1 (EMERGENCY SPILLWAY CENTERLINE)
64	DL	481634.15	1351255.27	595.5	EAST STOCKPILE EAST DITCH (BEGIN 0.08% SLOPE)
65	DL	481322.28	1351234.44	**	EAST STOCKPILE EAST DITCH (END)
66	DL	481340.99	1351248.50	N/A	EAST STOCKPILE EAST DITCH CENTERLINE
67	DL	481615.54	1351263.84	**	EAST STOCKPILE (END OF BERM)
68	SB	481194.36	1351371.75	**	SEDIMENT BASIN #1 (END OF BERM)

** MEET EXISTING GRADE

EDC CONTROLLED CERTIFIED
06 05 96 1697 002
CDC
FOR INFORMATION ONLY
(65)

NO.	REVISIONS	DATE	DWN. BY	APPD.
0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB

REF. DWG. NO.
75A-5500-G-00441
75X-5500-X-00450
75X-5500-X-00452

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE: 1 2 3 (4) 5
BY: DJB DATE: 5/30/96

APPROVALS				
			SAFETY ENG.	
CIVIL & STR.	C. NEUMANN	5/30/96	MAINTENANCE	
ELECTRICAL			Q.A.	
ENGINEER			FIRE PROTECT.	
INSTRUMENT			WASTE MANAGE	
MECHANICAL			SECURITY	
			CRU	
CHECKED	D&T		SOIL REM. PROJ.	D. BRETTSCHNEIDER
APPROVED	M.B. Tauxe	5/31/96		5/30/96

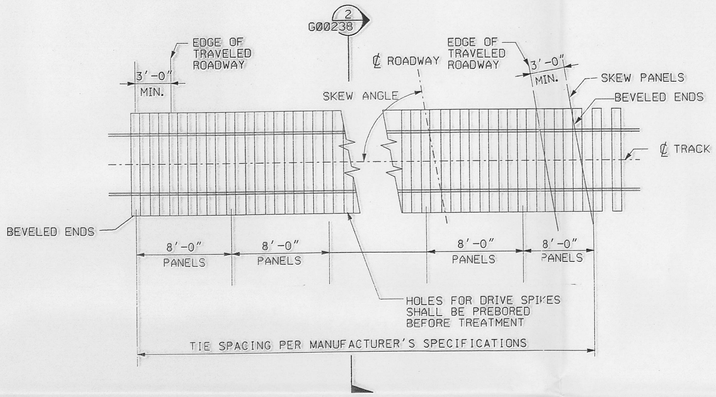
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP
AREA 1 PHASE 1 (EAST)
REMEDIAL ACTION PROJECT
SOIL REMEDIATION
SITE PLAN 3 OF 3
SCALE: 1" = 50'-0"

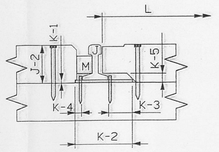
RES. 2883	
DATE 5/30/96	75A-5500-G-00441 C
DRAWN M.E. TILLMAN	

FILE NAME: $$$$DGNSPEC$$$$ $$$TIME$$$

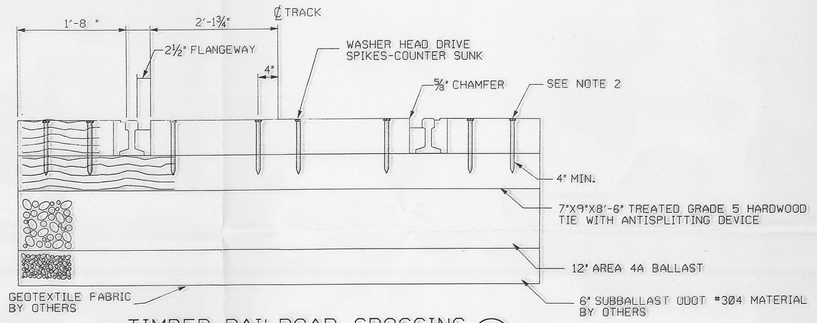
FORMAT REVISED 8/7/95



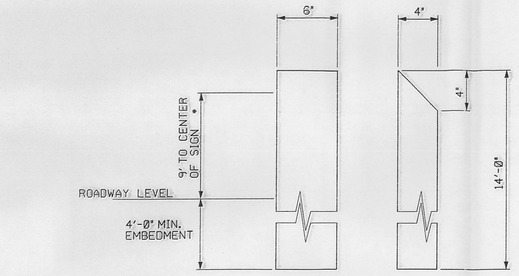
TIMBER RAILROAD CROSSING (1) REF (SEE NOTE 1)
NTS



J WEIGHT AND SECTION OF RAIL
J-2 PANEL THICKNESS
K-1 THICKNESS OF TIE PLATE
K-2 LENGTH OF TIE PLATE
K-3 OUTSIDE PROJECTION
K-4 INSIDE PROJECTION
K-5 DEPTH OF DAP TO CLEAR SPIKES
L WIDTH OF OUTSIDE PANELS-20' FOR 8'-6" CROSS TIES
M FLANGEWAY FILLER BLOCK



TIMBER RAILROAD CROSSING (2) REF (SEE NOTE 1)
NTS



* HEIGHT MAY BE VARIED AS REQUIRED BY LOCAL CONDITIONS

SEE NOTE 3

WOOD SIGN POST FOR RAILROAD CROSSING SIGN (3) REF
NTS

NOTES

376

1. THIS DETAIL SHALL BE USED ONLY FOR CONSTRUCTING PREFABRICATED TREATED TIMBER PANEL CROSSINGS. FOR EACH INSTALLATION A SKETCH SHOWING WIDTH OF ROADWAY, SKEW ANGLE AND TRACK ALIGNMENT SHALL BE FURNISHED BY SUBCONTACTOR.

   INSTALLATION

   BALLAST THROUGH CROSSING AREA SHALL BE CLEAN CRUSHED BALLAST TO AT LEAST 12" BELOW BOTTOM OF TIES, TOP OF BALLAST TO BE 2" BELOW TOP OF TIES UNDER CROSSING PANELS.
   TIES THROUGH CROSSING SHALL BE 7" GRADE 5 CROSSTIES TREATED HARDWOOD IN GOOD CONDITION. ALL TIES THROUGH CROSSING SHALL BE ACCURATELY SPACED PER MANUFACTURER'S SPECIFICATIONS. ENDS OF CROSSING PANELS MUST BE AT CENTER OF TIE. RAIL JOINTS SHALL BE LOCATED TO FALL OUTSIDE THE CROSSING. HOLES IN TIES FOR DRIVE SPIKES SHALL BE DIAMETER SPECIFIED BY THE MANUFACTURER AND SHALL BE LOCATED AND BORED IN FIELD. THERE SHALL BE EIGHT DRIVE SPIKES PER PANEL. DRIVE SPIKES SHALL BE DRIVEN NOT TURNED INTO PREBORED HOLES IN TIES. TREATED TIMBER SHALL BE HANDLED CAREFULLY TO AVOID EXPOSING ANY PART OF THE UNTREATED INTERIOR WOOD

   BOX ANCHOR ALL TIES THROUGH THE CROSSING AND 20 FEET BEYOND EACH END OF THE CROSSING. TIE PLATES THROUGH THE CROSSING AND 20 FEET BEYOND SHALL HAVE 2 RAIL HOLDING AND 2 PLATE HOLDING SPIKES EACH.

   MATERIAL & FABRICATION

   7" GRADE 5 CROSSTIES SHALL BE USED.
   TIES SHALL HAVE ANTISPLITTING NAIL PLATES CONFORMING TO AREA 3-1.7.
   HARDWOOD PANELS SHALL BE TREATED BLACK GUM, RED OR WHITE OAK.
   8' OR 16' PANELS SHALL BE USED.
   SCREW DRIVE SPIKES SHALL BE WASHER HEAD TYPE OF DIAMETER AND LENGTH SPECIFIED BY MANUFACTURER.
   DRIVE SPIKES SHALL BE COUNTER SUNK IN PRE-DRILLED HOLES. CROSSING END PANELS SHALL BE BEVELED.

2. FILL HOLES AFTER DRIVE SPIKES HAVE BEEN INSTALLED WITH BITUMINOUS FILLER MATERIAL ODOT 706.10 AND LEVEL WITH TOP OF CROSSING SURFACE.

3. POST TO BE 4" X 6" NOMINAL FIR AND TO BE FRAMED BEFORE TREATING WITH 8 POUND 50-50 CREOSOTE PETROLEUM SOLUTION.

REF DWG NO.	DRAWING TITLE
91X-5900-X-00245	DRAWING INDEX
91X-5900-X-00246	LEGEND AND SYMBOLS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
Ø	CERTIFIED FOR CONSTRUCTION	KLB	N/A	5/3/96

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS

DRAWING TITLE
CIVIL
RAILROAD DETAILS
SHEET 1 OF 2

64

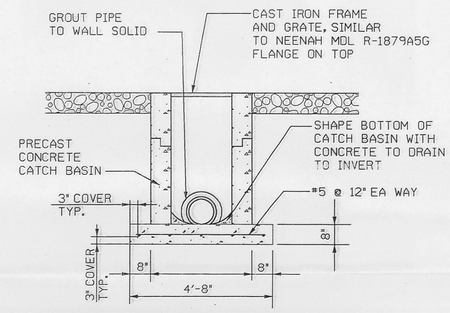
FOR INFORMATION ONLY

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
G. LYNCH	02/20/96	[signature]	5/6/96	E. KUBRIN	3/20/96

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS NOTED	

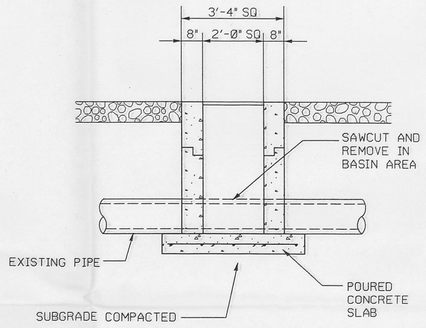
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NO.
Kathryn W. Reudel	N/A	10200
A-E DATE 2 May 96	DATE	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
WPRAP/P0167		WBS 1.1.1.1.1.3.1 00-90701	91X-5900-G-00230	G0009	Ø



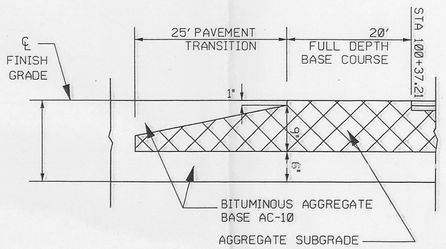
CATCH BASIN DETAIL

N.T.S.



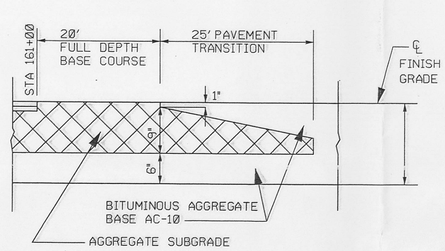
CATCH BASIN DETAIL

N.T.S.



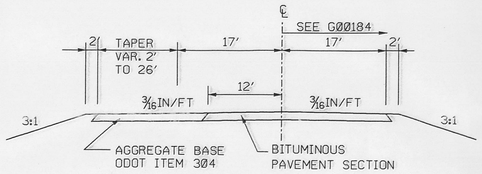
PAVEMENT TO AGGREGATE TRANSITION PROFILE

STA 100+37.21 N.T.S.



PAVEMENT TO AGGREGATE TRANSITION PROFILE

STA 161+00.00 N.T.S.



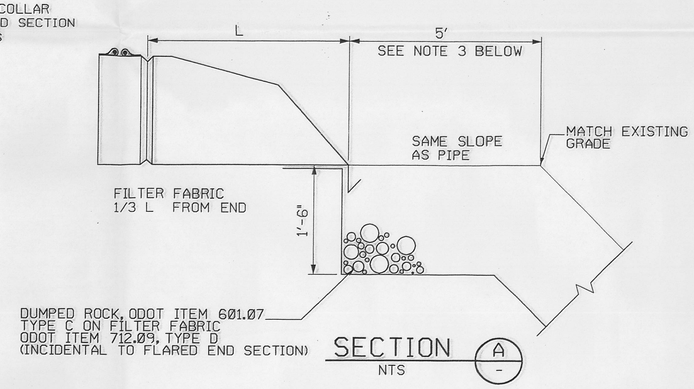
TYPICAL SECTIONS AT GROSS DECON PAD

STA. 158+75 TO 159+50
160+25 TO 161+00

N.T.S.

PLAN

NTS



NTS

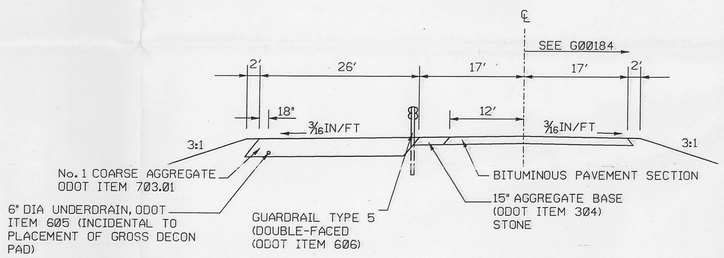
DETAIL (2) G00204 — STANDARD FLARED END SECTION

NTS

REF G00185 G00186 G00188

1. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
2. MATERIAL TO BE GALVANIZED STEEL.
3. LENGTH OF DUMPED ROCK IS 5' UNLESS NOTED OTHERWISE ON SITE/GRADING/UTILITY PLAN
4. DIMENSIONS, IN INCHES, ARE AS FOLLOWS:

12" DIA	24" DIA
A=6-1/2 (1"±)	A=10"
L=21"	L=41"
W=24"	W=48"
B=6-1/2"	B=13"



TYPICAL SECTION - STA. 159+50 TO 160+25

N.T.S.

NOTES 376

1. FOR PAVEMENT SECTION DETAILS AT THE GROSS DECON PAD, SEE DRAWING 92X-5900-G-00196.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00196	CROSS SECTIONS SHEET 6 OF 6

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
0	CERTIFIED FOR CONSTRUCTION	JMM	N/A 7/26/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

FOR INFORMATION ONLY

DRAWING TITLE
CIVIL
GENERAL DETAILS
SHEET 1 OF 2

(63)

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95		7/23/96	A. CHRISTO	12/18/95

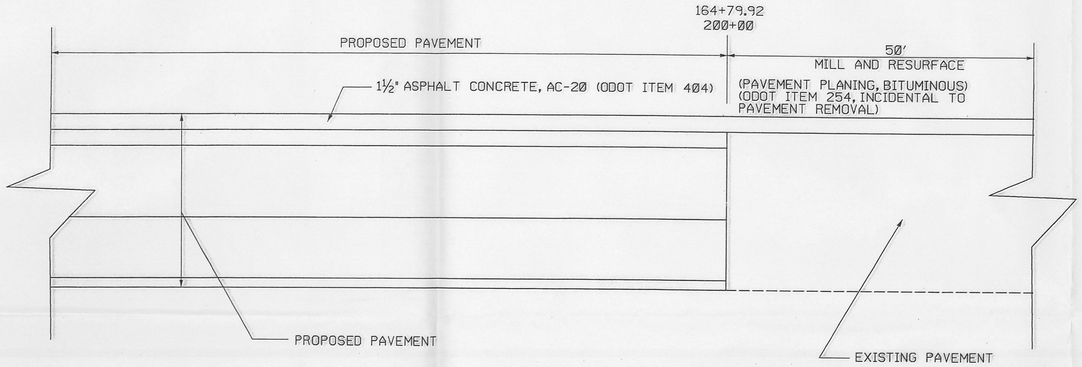
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NUMBER
DATE 7/26/96	N/A DATE	20410

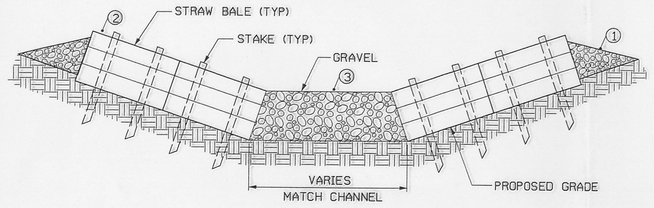
DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00204	G0020	0

PREPARED UNDER PARSONS PROJECT ORDER NUMBER
0U2/P0158

STATE OF OHIO — JOHN M. MESH — REGISTERED PROFESSIONAL ENGINEER

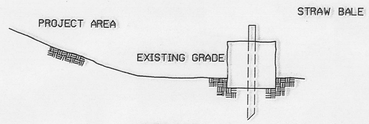


CONNECTION TO EXISTING PAVEMENT - STA. 164+79.92 AND 200+00



① INSTALL STRAW BALE AS SHOWN ON DETAIL.
② GRAVEL TO BE ODOT ITEM 601.07, TYPE D DUMPED ROCK. TOP WIDTH TO BE SAME AS STRAW BALES.

CHECK DAM DETAIL ① NTS — REF G00240 G00233 G00234



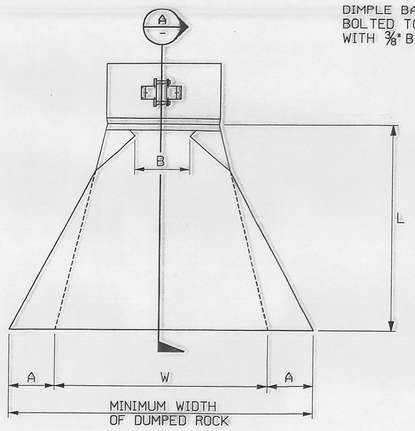
SECTION

NOTE:
1. STRAW BALES TO BE USED WHEN NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
2. PLACE STRAW BALES APPROXIMATELY PARALLEL TO BOTTOM OF FILL SLOPE.
3. STAKES SHALL BE 2" x 2" x 3'-0" LONG.
4. STRAW BALES SHALL BE STANDARD SIZE 18" x 18" x 48".
5. FOR EROSION CONTROL MAINTENANCE SEE SPECIFICATIONS.

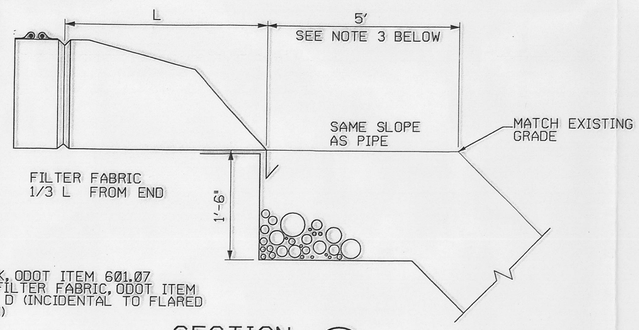
STRAW BALE - SILT BARRIER DETAIL ② NTS — REF G00240 G00233 G00234

NOTES

1. STRAW BALES ARE BEING USED TO MINIMIZE WASTE GENERATION ACCORDING TO FEMP WASTE MINIMIZATION PROGRAM.



PLAN
NTS

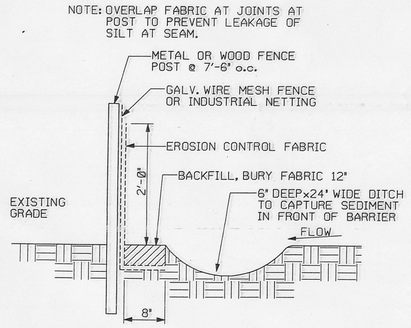


SECTION A — NTS

DETAIL 2 STANDARD FLARED END SECTION — NTS — REF G00240 G00220 G00223 G00224 G00225 G00231 G00232

1. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
2. MATERIAL TO BE GALVANIZED STEEL.
3. LENGTH OF DUMPED ROCK IS 5' UNLESS NOTED OTHERWISE ON SITE/GRADING/UTILITY PLAN
4. DIMENSIONS, IN INCHES, ARE AS FOLLOWS:

13"X17"	12" DIA	15" DIA	24" DIA	42" DIA
A=6.5 (1" ±)	A=6.5 (1" ±)	A=7.5 (1" ±)	A=10 (1"±)	A=17 (1"±)
L=20 (1.5" ±)	L=21 (1.5" ±)	L=26 (1.5" ±)	L=41 (1.5"±)	L=69 (1.5"±)
W=30 (2" ±)	W=24 (2" ±)	W=30 (2"±)	W=48 (2"±)	W=84 (2"±)
B=8.5 MAX	B=6.5 MAX	B=8 MAX	B= 13 MAX	B= 29 MAX



FILTER FABRIC BARRIER

SILT FENCE DETAIL ③ NTS — REF G00240 G00233 G00234

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	TITLE SHEET
92X-5900-X-00214	LEGENDS AND SYMBOLS
92X-5900-G-00220	PLAN AND PROFILE - SHEET 1 OF 7
92X-5900-G-00223	PLAN AND PROFILE - SHEET 4 OF 7
92X-5900-G-00224	PLAN AND PROFILE - SHEET 5 OF 7
92X-5900-G-00225	PLAN AND PROFILE - SHEET 6 OF 7
92X-5900-G-00231	INTERSECTION DETAIL - SHEET 1 OF 2
92X-5900-G-00232	INTERSECTION DETAIL - SHEET 2 OF 2
92X-5900-G-00233	TEMPORARY EROSION CONTROL - SHEET 1 OF 2
92X-5900-G-00234	TEMPORARY EROSION CONTROL - SHEET 2 OF 2

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
0	CERTIFIED FOR CONSTRUCTION	JMH	N/A	7/26/96
		INITIALS AND DATE		

STATE OF OHIO — JAMES M. HENSLEY — E-46579 — REGISTERED PROFESSIONAL ENGINEER

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

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DRAWING TITLE
CIVIL
GENERAL DETAILS
SHEET 1 OF 2

FOR INFORMATION ONLY

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95		7/26/96	A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE	CLASS
				NONE	
SUBMITTED FOR APPROVAL		FERNCO GRU APPROVAL		FERNCO PROJECT NUMBER	
DATE 7/26/96		N/A DATE		20120	

DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00240	G0024	0

PREPARED UNDER PARSONS PROJECT ORDER NUMBER: OU2/P0158

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