INDIANA HARBOR AND CANAL MAINTENANCE DREDGING AND DISPOSAL ACTIVITIES – DESIGN DOCUMENTATION REPORT

DIKES, CAP AND CDF LAYOUT

APPENDIX A

U.S. Army Corps of Engineers, Chicago District
Civil Design Section, Design Branch

March 2000

DIKES, CAP AND CDF LAYOUT
APPENDIX A
TABLE OF CONTENTS

LIST OF FIGURES, TABLES AND PLATES

PURPOSE AND SCOPE

1. The purpose of this appendix is to present the design criteria, engineering methods and procedures that were used to: (1) establish the horizontal alignment, profiles and locations and composition of the project features; (2) existing conditions and proposed design cross sections and details; (3) calculate construction quantities; (4) develop the utility relocation plan; and (5) define the real estate requirements. While this appendix provides an overview of the dikes, cap and CDF layout, a detailed dikes, cap and CDF layout will be covered during the development of plans and specifications.

GENERAL

2. The project features consist of railroad relocation, groundwater cut-off wall and groundwater gradient control system, exterior and interior dike system, RCRA cap, on-site treatment facility and equalization basin constructed on the former ECI site, hereafter referred to in this appendix as the ECI site. The CDF will be constructed on the ECI Site, which is composed of various parcels of land (Plate A-1, Real Estate). The plan follows the plan outlined in the Comprehensive Management Plan (CMP). Changes and adjustments from the CMP will be explained in the following text where necessary.

MAPPING AND OTHER SITE INVESTIGATIONS

Topographic Mapping

3. In April 1994, Aero-Metric Engineering, Inc. was contracted by the U.S. Army Corps of Engineers (Chicago District) to prepare aerial mapping, topographic and planimetric project mapping for the Indiana Harbor and CDF site in Lake County, Indiana. In April 1994, stereo aerial photography of approximately 164.24 acres of land was performed to complete the mapping requirements. Existing ground controls were used and verified to compile the mapping. The vertical datum is the Mean Sea Level (MSL) datum of 1929. The horizontal datum is in the Indiana State Plane Coordinate System. Maps were produced at a scale of 1 inch = 200 feet at one foot contour intervals at a level of detail consistent with final mapping requirements. Digital files in MicroStation Intergraph 3 dimensional format were produced for engineering design and construction. Topographic/planimetric maps are used as the base maps for project site and feature designs.

Utility Surveys

4. In November 1994, Smith Engineering Consultants, Inc. was contracted by the U.S. Army Corps of Engineers (Chicago District) to review existing reports, as-builts drawings (record drawings), engineering drawings, utility maps, surveys and various other maps and reports that were provided by the Chicago District. Chicago District obtained

the information from the ECI drawings and records archive provided by the bankruptcy trustee of Hopkins and Sutter. Smith Engineering then incorporated all the information into a series of digital utility maps (Plates A-9 to A-32).

5. The maps include sanitary and storm sewer, water, oil, fuel, misc. utilities and electric, steam, gas main and telephone utility lines.

6. The District has contacted all the utility companies, that could be identified, and requested further information regarding any potential underground pipes in the area. The information collection is ongoing and is not complete at this date. The data obtained so far is purely a compilation of existing data and has not been field verified at this point.

SITE LAYOUT

General

7. As stated in a previous paragraph, the entire ECI site is made up of numerous separate parcels of land. The Lake George Branch of the Indiana Harbor Canal extends east to west across the site, geographically dividing various parcels north of the canal from those south of the canal. The CDF will be constructed on some of the parcels north of the canal.

8. The design of the Indiana Harbor CDF site is comprised of a number of components which serve as the RCRA closure system of the facility. The components of the system consist of the following:

a. Glacial till aquitard
b. Perimeter vertical cutoff wall
c. Extraction well system
d. Perimeter dike liner
e. Final cap
f. Buffer cap

These components (Figure A-1) function together to isolate the ECI site from the surrounding areas. The layout of the CDF and the location of these features are shown on plate A-2.

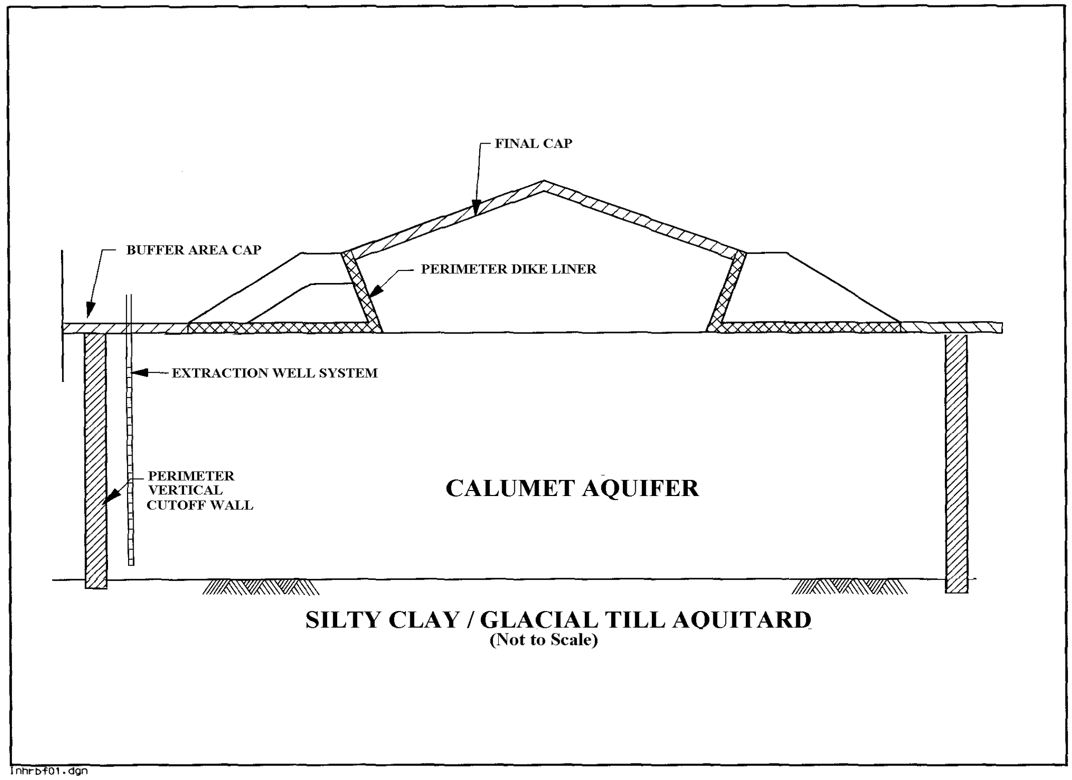


Figure A - 1 RCRA Closure System

Pre-Site Conditions

9. The proposed dredged material CDF will be located on the land as shown in plate A-1. The site formerly was the location for the ECI Oil Refinery. After the company filed for bankruptcy in 1981 they were ordered by the court to close the facility in an environmentally sound manner. However, the court-ordered demolition of the plant did not include the closure of the hazardous waste units as required under RCRA and did not address the RCRA corrective action requirements. The demolition activities occurred in the mid-1980's and all buildings and above ground structures were razed. In addition to the tanks, storage containers and on-site incinerator, there were several pits, sumps and spill areas. The pumps were removed from lead pump pits and the pits were filled. After the above ground structures were removed, the site was graded and several inches of clean topsoil were placed on the site.

10. Currently the site consists of ground vegetation and some scrub trees. There are railroad tracks running north to south along the western border of the site and a spur off of that track, approximately 2,400' from the canal, that runs east to west that divides the site. There are also existing building and structures in the southwest portion of the site, near the canal.

Proposed Site Plan

11. The site design and layout were developed on a CADD computer system and then overlaid on to topographic mapping. All computer work was performed within the MicroStation and InRoads software systems.

12. The project work area is divided into 4 areas– the CDF, the equalization basin, the treatment facility and the rehandling area as shown on plate A-2. The CDF is located starting in the northern portion of the site and extends to within approximately 230’ of the Lake George Canal. The CDF is composed of 3 cells - west, east and north. The west is to be constructed first followed by the east and north cells. The cells are then further divided during the course of the 30-year project into sub-cells as dredged material is available. The equalization basin, treatment facility and rehandling area are located south of the CDF next to the Lake George Canal. The equalization basin is designed for suspended solids removal and flow equalization from groundwater pumping, run-off collected over the site and pore water drainage. The liquid effluent is held there prior to pumping it to the treatment facility. The treatment facility treats the liquid effluent before it is then discharged to the Lake George Canal. For further information regarding the treatment system, see Appendix D. The rehandling area is self-contained to control any contaminated releases from the dredged material. Environmental controls will be established for entrance and exit of vehicles and personnel, and controls will be established for the transfer of the dredged material to the trucks. For further information regarding the rehandling area, see Appendix E.

13. Site access will be through a fence gate along the southeast side of the project site. An access road will be installed outside of the southern perimeter dike that will connect the equilization basin, the treatment facility and the rehandling areas. Access to the dike haul roads will be via a haul ramp constructed along the southeast perimeter dike wall, plate A-3.

PROJECT FEATURES

General

14. The site preparation will include railway relocation, clearing and grubbing, stripping, installation of a groundwater cut-off wall and gradient control system including monitoring and extraction wells, decommissioning of existing wells, a drainage ditch, dike constructions, RCRA cap and utility relocations. Specifics are discussed below.

Railway Relocation

15. The site is bisected by a lead/side track operated by CSX Transportation that runs from west to east. This lead track will be relocated to the northern portion of the site. The rerouting will lie to the north of the CDF perimeter dike and adjacent to Cline Avenue. The track is being rerouted in order to optimize the CDF design. Plate A-4 shows

a plan view and plate A-5 shows a typical cross section. For further information regarding the railway relocation see Appendix F.

Clearing and Grubbing

16. The site shall be cleared of all obstructive matter above the natural ground surface. This includes, but is not limited to trees, fallen timber, brush, vegetation, abandoned structures and similar debris.

17. The site shall be grubbed of all stumps, roots, buried logs and objectionable matter. All holes and/or depressions caused by grubbing operations shall have their sides flattened and be backfilled in lifts up to the foundation grade with compacted fill.

18. All material can be temporarily stockpiled on-site until it is permanently disposed of in the CDF. If material is to be removed from the site, it must be sampled and analyzed to determine whether it contains hazardous waste and it's removal is subject to approval by the Contracting Officer (CO).

Stripping

19. After clearing and grubbing, the CDF site shall be stripped to an elevation of 587.5. All stripped material is to remain on site for use in constructing interior dikes and grading within the CDF. Any hazardous material or construction debris encountered during the stripping process can be temporarily stored on-site and disposed of permanently in the TSCA cell since the entire site is considered the RCRA unit and there is no limitation on the movement of waste within the unit.

Existing Well Decommissioning

20. Well Decommissioning/Abandonment - Existing wells located within the project site that will not be used either for monitoring or extraction during the projects operation shall be abandoned in place. The exact location and number of wells to be abandoned/decommissioned shall be detailed during final plans and specifications.

21. Well preparation - The well shall be cleared of all pumping equipment, valves, pipelines, casing liners, debris, and other foreign material.

22. Casing - The well casing should be removed if possible. Where the well casing cannot be removed, and an open annular space exists between the outside of the casing and the well bore, then the annular space must be sealed, using sealing materials described in paragraph 23. Sealing materials shall be directed into the annular space as grout. As an

alternative the casing may be ripped or perforated to ensure that sealing materials completely fill the casing and any annular space.

23. Filling – The well shall be sealed by filling with a neat cement grout containing bentonite, aquajel, or similar material from 2 percent to 6 percent by weight. The decommissioning shall be accomplished by placement of a cement-bentonite grout, tremied from the bottom of the well and for the full depth of the well. Grout shall be placed so as to avoid segregation or dilution in accordance with the requirements stated above. The seal shall include the annular space (that space between the borehole and the outside of the casing) if voided, and the interior of the casing.

Groundwater Cut-Off Wall, Extraction and Monitoring Wells

24. The groundwater cut-off wall is required to contain on-site contaminates, as well as contaminates from the dredged material. The cutoff wall will extend from the ground-surface through the Calumet Aquifer to the underlying glacial till foundation. The cutoff wall, in conjunction with a dewatering system to maintain an inward gradient, will prevent the movement of groundwater off-site. The dewatering system will consist of extraction and monitoring wells. For further information regarding the groundwater cut-off wall and the gradient control system see Appendix B. The exact alignment of the groundwater cut-off wall, extraction and monitoring wells will be determined during the development of plans and specifications.

Drainage Ditch

25. The drainage ditch will be installed along the perimeter dikes and is intended to control the surface run-off from the exterior CDF. The sizing of the ditch is based on a 25-year storm event during closed conditions or after the RCRA cap is in place.

26. The ditch will have a 5-foot bottom width, 2.5H: 1V side slopes and a slope range from 0.000256 ft/ft to 0.005 ft/ft (Plate A-6). The ditch depths include 1 foot of freeboard. The ditch has a high point at the northwest corner with flow traveling around each side to the outlet located at the southeast corner. An invert elevation of 582.8 feet NGVD (utilizing an existing ground elevation of 588.00 feet NGVD) at the southeast corner and an average ditch slope of 0.00089 ft/ft will allow the ditch to meet or exceed the required depths around the CDF.

27. The two drainage ditches (running along the southern and eastern portions of the site) will meet at the southeast corner of the site and transition into a culvert that outlets to the Lake George Canal. The current outlet design to the canal is one 42” RCP. Detailed plans and specifications will incorporate a drop structure near the canal into the design. The current 42” RCP outlet will be resized based on the new slope and pipe material. Riprap shall be placed at the inlet of the culvert.

28. Crossings will be installed across the drainage ditch to allow for access to the access roads in the northern and southern portion of the site, the access ramp in the southwest portion of the site and the entrance to the project located on the east side of the site. The culverts will consist of reinforced concrete pipe (RCP). Ditch crossing details will be provided during the development of plans and specifications for the Dikes, CAP and CDF Layout.

Design and Layout of the Exterior and Interior Dike System

Dikes

29. Dike Components - The perimeter dike consists of a structural fill which provides stability for the containment of the dredge sediments and a liner which serves as a low hydraulic conductivity barrier (K=1x10-7 cm/sec or less) to the movement of contaminants beyond the CDF. The dike structural fill and liner can be the same or different material.

30. Borrow Materials - The original design of the CDF assumed the use of a glacial till borrow material (silty clay) from Calumet Harbor for both the structural fill and the liner. During the permitting of the facility this borrow source became unavailable and an alternate needs to be found. Consideration is being given to alternate structural fills including sand, slag and fly ash. The availability of borrow sources at the time of construction will determine the material used for the two components. See figure A-1 for a schematic.

31. Dike Cross-section - The dike cross-section is shown on plate A-6. The exterior slope is a 3 horizontal to 1 vertical slope. The interior slope is a 1 horizontal to 1 vertical slope. The final interior height of the dike will be 33 feet. A 25-foot wide crest is provided for access road for the facility construction vehicles. The cross-section was determined from stability analyses using strength properties for the silty clay material. Minimum factor of safety for the analysis of both interior and exterior slopes is 1.3 for the end of construction condition. The slope stability analysis is in attachment A - 1.

32. Phasing - The perimeter dikes will be constructed in two stages. The first stage will be 15 feet high. The second stage will be built 15 feet high. Initially three phased construction alternatives were considered. See figure A-2. These were:

a. Interior development
b. Centerline development
c. Exterior development

The interior development alternative was the most economical in terms of the amount of fill required to construct the dike and the most efficient in terms of maximizing CDF capacity. The centerline was the next most economical while the exterior development was the least economical. The interior and centerline development both required constructing the inside dike slope on dredge material. Geotechnical laboratory testing of the dredge material indicated it was not suitable for a dike liner foundation. A modified centerline development scheme (see paragraph 31), which did not use the dredge material as a foundation, was finally selected as the preferred alternative.

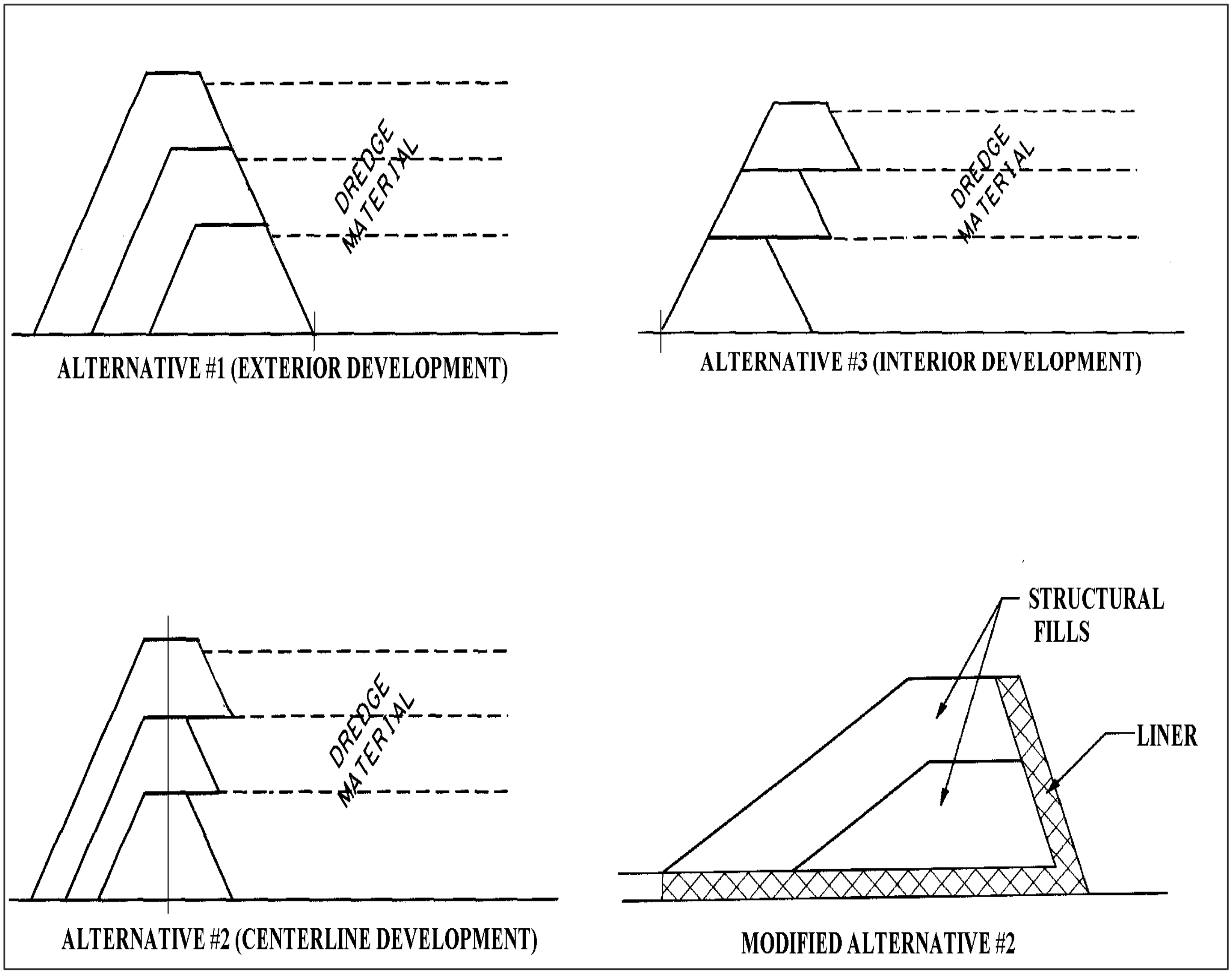


Figure A - 2 Three-Phased Dike Construction Alternatives

RCRA Cap

General

33. Function - The purpose of the cap on the CDF is to promote and maximize surface runoff from precipitation and minimize the amount of infiltration and percolation of water into the CDF after closure.

Cap

34. Sequencing - The design of the cap is shown in plate A-7. From bottom to top, the cap consists of a three feet thickness of compacted soil with a hydraulic conductivity of K=1x10-7 cm/sec or less, a six inch thick sand drainage layer, and a vegetation layer consisting of a two foot thick clean fill layer overlain by a six inch thick topsoil layer with a grass cover.

35. Drainage - To promote drainage off of the CDF a minimum three percent top slope is specified. This can be achieved with either dredged material or imported fill material. The cap drainage design is shown in plate A-8. Additional drainage options will be examined during the development of plans and specifications for the Dikes, CAP and CDF Layout.

36. Buffer Areas - The same cap sequence or equivalent used for the CDF will be used for the RCRA cap on the buffer areas. The buffer area is anything inside the property boundary but not beneath the CDF or the perimeter dikes.

Borrow Site

37. The borrow sources have yet to be determined for any of the materials. Details about the use of alternate material for dike structural fill and their borrow sources will be provided during the development of plans and specifications.

Disposal Site

38. The contractor will be responsible for the appropriate disposal of all material on-site and will not dispose any material off-site except with the approval of the Contracting Officer.

Haul Routes

39. It is not anticipated that any existing haul roads will require improvements or repair due to construction traffic and loading. Repairs will be made if roads do become damaged due to the hauling of material. The Contractor will be required to obtain all necessary permits for the routes. The site can be accessed from either Indianapolis Boulevard located along the eastern portion of the site or the Lake George Branch Canal, which lies south of the project site. Specific off-site construction haul routes will be defined during the preparation of final plans and specifications.

Staging / Storage Areas

40. Permanent staging / storage areas are provided in the southeastern portion of the site. The exact location of the areas will be finalized during the preparation of plans and specifications. The general location of the staging / storage area is shown on Plate A-2. Temporary staging / storage is available in any area within in the CDF footprint prior to the construction of that areas perimeter dike walls.

Access Ramps

41. Ramps are provided for access to the haul roads on top of the dikes in the southwest portion of the site along side the southwest cell perimeter dike wall (Plate A-3). The access ramps shall be constructed out of the same material as the perimeter dike walls and at a 10% grade so that they are available for material disposal during the early phases of the project when only the west cell has been constructed. Each access ramps will handle 1-way traffic. One ramp will be designated for traffic onto the top of the dike walls and one ramp will be for traffic off the top of the dike walls.

Operation and Maintenance

42. For information regarding O&M for the site see Appendix G.

MATERIAL QUANTITIES

General

43. Quantities were either manually calculated or computer calculated using the InRoads or MicroStation software. They consists of stage I perimeter dike (clean fill), stage II perimeter dike (clean fill), clay or equivalent liner (inside face of perimeter dikes and southwest cell interior dikes), interior dikes (stripped material and dried dredged sediment), sub-cell dikes (stripped material and dried dredged sediment), stripping, topsoil (stage I dikes), topsoil (stage II dikes), clay or equivalent (for cap), sand (for cap), clean fill (for cap), and topsoil (for cap) volumes; seeding (stage I dikes), seeding (stage II dikes), and seeding (for cap) acreage; slurry wall, and drainage ditches lengths; stone for access roads (tons).

44. In year 1 of construction, the entire site is to be cleared and grubbed, the dike footprint is to be stripped and the stage I perimeter and interior dikes that comprise the west cell and the perimeter ditch are to be constructed. Stone for the access roads is placed. In subsequent years it is removed and replaced as the dikes are raised. In year 2 of construction, the remaining perimeter and interior dikes that comprise the east and north cells will be constructed. In year 12 of construction, the perimeter dikes (stage II) will be raised. The initial construction of the sub-cell dike walls and the raising of the interior and

sub-cell dike walls will be done on an as needed basis over the course of the project. At the conclusion of the dredged sediment material placement, the cap will be installed. See table A-1 for the estimated time periods when the materials would be required.

Quantities Generation

45. Earthwork volume quantities for stage I and II perimeter dikes, clay or equivalent liner, interior and sub-cell dikes, stripping, stage I and II dike topsoil, clay or equivalent, sand, clean fill and topsoil for the cap are presented in Table A-1.

46. Clearing/grubbing acreage was determined over the existing CDF surface through the permanent easement. Seeding acreage was determined from the perimeter dike and the RCRA cap surfaces. The stripping volume consisted of the volume generated by cutting the area bounded by the designed CDF to the design elevation 587.5, an average depth of approximately 1.3 feet. The existing topsoil will be separated out and used as topsoil during construction. The volumes of a six-inch layer of topsoil over the RCRA cap and perimeter dikes were calculated. The lengths of the slurry wall and drainage ditches lengths were calculated.

Materials Balance

47. All perimeter dike clean fill and clay liner material will be obtained from borrow sources. Stripped and excavated material will either be used for interior dike construction, topsoil or construction of the sub-cell grades. If there is very little to no clearing required and it is within the top 6 inches of the existing surface then this material will be used as topsoil. If there is medium (defined by grasses, few bushes and small trees) to heavy (defined by heavy bush growth and many trees) clearing then the material will be used first for the interior dikes construction and then as grade material within the sub-cells. Additional topsoil will come from borrow sources.

REAL ESTATE

48. Total land required for the Confined Disposal Facility is 164.24 acres. For the project the permanent and temporary easements are the same and equal the land required for the project site. The area is bounded by Cline Avenue to the north, Indianapolis Boulevard to the east, Lake George Canal to the south and the railroad line to the west. For further information see plate A-1. Currently a railroad spur bisects the site and will require relocation in kind to the northern boundary. This new railroad right-of-way is 4.11 acres. All land required for the project is owned by the Non-Federal Sponsor except for the offshore dredging areas, which will be covered by the Navigational Servitude and some existing railroad right-of-ways.

CONSTRUCTION SEQUENCE

49. The first features of the project to be constructed are the railroad relocation and the groundwater cut-off wall. After the groundwater cut-off wall is constructed, an inward gradient is established by operating dewatering wells placed around the inside perimeter of the groundwater cut-off wall before any dredged sediment is placed within the cells. The CDF will be constructed as three separate cells. The southwest cell is to be constructed first followed by the southeast and north cells. TSCA level PCB will be placed in the southwest cell and then encapsulated by uncontaminated/non-TSCA dredged material. Sub-cells are constructed within the southwest, southeast and north cells to aid in dredged material management. Collected liquids are temporarily stored prior to treatment and discharge to the canal. After the cells are filled to the final design limits, the site is prepared for closure and a RCRA cap is constructed. Paragraph 39 and table A-3 provide additional information about the construction sequencing. Appendix E, Dredging and Placement Plan provides additional information on dike construction and dredged sediment material handling.

UTILITY RELOCATIONS

Inspection Trench

50. An inspection trench will most likely be required prior to the installation of the groundwater cutoff wall to uncover live utilities and any undesirable material that will require removal. See paragraph 53 on remediation/relocation of utilities. The trench will be backfilled with the material that was removed from them providing the material is suitable for backfill. Unsuitable includes but is not limited to stumps, roots, and buried logs or construction debris. All unsuitable material will be disposed of within the CDF. Backfilled trenches will not require compaction. For further information, see Appendix B, “Groundwater Protection”.

Coordination

51. There were many utilities discovered during the investigation by Smith Engineering, Inc. as noted previously. It is not known at this time specifically which utilities if any might have to be relocated. Table A-2 lists the potential utility companies impacted by the project. Each utility company was requested to verify the existing information and indicate whether their lines would be impacted.

52. The utility maps are being updated as information is received from the utility companies. No company was able to provide exact locations of depths, therefore approximate locations are indicated and field verification will be required.

Remediation Methods

53. The remediation methods described below should be considered as preliminary as utility information is still being received as of this report. Final designs will be developed during the preparation of plans and specifications with the respective utility company and local sponsor. All utilities confined within the site and not requiring removal shall remain. All abandoned or permanently disconnected utilities requiring removal will have its ends capped and removed material will be disposed of within the CDF. All active underground utilities in the path of the groundwater cut-off wall will be moved. Active underground lines will either be relocated under the groundwater cut-off wall or relocated around the CDF.

TABLES AND PLATES

Table A - 1 Material Quantities

	LF	SY	CY	ACR	TONS	LS
YEAR 1 QUANTITIES						
1. Clearing & grubbing area within boundary of slurry wall				166		
2. Stripping top 6 inches of ditch and dike footprint for topsoil			33,373			
3. Additional stripping of ditch and dike footprint to 587.5			86,824			
4. Perimeter ditch	9,841					
a. Excavation for ditch and clay liner below 587.5			67,604			
b. Clay liner for perimeter ditch			79,015			
c. Topsoil for perimeter ditch			5,923			
d. Seeding for perimeter ditch				7		
e. Geotextile		28,430				
f. 42" RCP	253					
1. Excavation			1,054			
2. Bedding			33			
3. Backfill			980			
4. Riprap					24	
5. Stone for access road on south side of perimeter ditch					1,190	
6. Geotextile for access road on south side of perimeter ditch		6,300				
7. Perimeter dike, Stage I – stations 0+00 to 8+75 and 71+10 to 86+72						
a. Dike material (clean fill)			85,385			
b. Clay liner under dike footprint and for stage I dike			58,127			
c. Topsoil for stage I dike			3,882			
d. Seeding for stage I dike				5		
e. Stone for access road on top of dike					2,419	
f. Geotextile for access road on top of dike		9,839				
g. Stone for access road next to dike					1,110	
h. Geotextile for access road next to dike		4,512				
8. Dike between north and south areas, first 10 ft lift – stations 8+75 to 16+85						
a. Dike material (stripped material)			7,290			
b. Clay liner			8,820			
c. Stone for access road on top of dike					600	
d. Geotextile for access road on top of dike		2,430				
9. Dike between east and west areas, first 10 ft lift – stations 0+00 to 15+83						
a. Dike material (stripped material)			14,967			
b. Clay liner			17,019			
c. Stone for access road on top of dike					1,205	
d. Geotextile for access road on top of dike		4,749				
YEAR 2 QUANTITIES						
1. Perimeter dike, Stage I – stations 8+75 to 71+10						

a. Stage I dike material (clean fill)		218,456		
b. Clay liner under dike footprint and for Stage I dike		145,883		
c. Topsoil for Stage I dike		9,930		
d. Seeding for Stage I dike			12	
e. Stone for access road on top of dike				4,803
f. Geotextile for access road on top of dike	18,705			
g. Stone for access road next to dike on east and west sides				2,242
h. Geotextile for access road next to dike on east and west sides	12,879			
2. Dike between north and south areas, first 10 ft lift – stations 0+00 to 8+75				
a. Dike material (stripped material)		17,025		
b. Stone for access road on top of dike				648
c. Geotextile for access road on top of dike	2,625			
YEAR 12 QUANTITIES				
Perimeter dike, Stage II – stations 0+00 to 86+72				
a. Remove topsoil from Stage I dike		13,811		
b. Remove stone access road from top of dike				7,267
c. Remove stone access road next to dike on east and west sides				3,354
d. Stage II dike material (clean fill)		514,761		
e. Stage II clay liner		23,768		
f. Topsoil for Stage II dike (this number is the difference between Stage I and Stage II; Stage I topsoil will be reused)		9,373		
g. Seeding for Stage II dike			29	
h. Replace stone access road on top of dike (reuse original stone)				7,267
i. Replace stone access road next to dike (reuse original stone)				3,354
j. Remove & replace geotextile for access road on top of dike	28,544			
k. Remove & replace geotextile for access road next to dike	12,879			
ADDITIONAL QUANTITIES				
1. Subcell dikes - final height of 30 feet				
a. Dike material (dried dredged material)		806,402		
2. Four additional lifts of 5 feet each for interior dikes				
a. Remove stone access road (total for 4 lifts)				9,812
b. Add lift of dike material (dried dredged material total for 4 lifts)		234,820		
c. Replace stone access road (total for 4 lifts)				9,812
d. Remove & replace geotextile for access road (total for 4 lifts)	39,216			
3. Cap				
a. 3 ft clay		504,148		
b. 6 in sand		84,025		
c. 2 ft clean fill		336,099		
d. 6 in topsoil		84,025		
e. Seeding			104	
4. Grading subcells (total acreage + additional stripped material required)		109,182	69	

5. Decant Structures			11
6. Ditch Crossings			6
7. Decant Piping (6”)	3,905		
a. Excavation		940	
b. Bedding		112	
c. Backfill		799	
8. Drainage Piping (6”)	29,007		
a. Drainage Stone		1,938	
9. Drop Structure			1
10. Additional Clean Fill Needed for Buffer Areas		72,258	

Table A - 2 Potential Utility Companies

NAME	COMPANY	STREET ADDRESS	CITY, STATE, ZIP	PHONE
Brian Woodberry	NIPSCO	5265 Hohman Avenue	Hammond, IN 46320	219-647-4299
David Woodsmall	Marathon	277 Streamwood Drive	Valparaiso, IN 46383	219-477-4001
Randy Thomson	Marathon	1900 West Avenue H	Griffith, IN 46319	219-924-8577
Dick Bochart	Ameritech	302 South East Street	Crown Point, IN 46307	219-662-4402
Dan Olson	East Chicago Sanitary District	5201 Indianapolis Boulevard	East Chicago, IN 46312	219-391-8466
Joe Drozd	East Chicago Water Department	400 E. Chicago Avenue	East Chicago, IN 46312	219-391-8423
Skip Richards (or Larry Malnor)	Amoco Pipeline Company	28100 Torch Parkway	Warrenville, IL 60555-3938	630-836-5100
Barry Reminder	Buckeye Pipeline Company	123 Pipeline Drive	Griffith, IN 46319	219-924-6603
Bill Burdeau	Transmontaigne Pipeline	1802 Robin Hood Boulevard, Suite 3A	Schererville, IN 46375	800-732-8140 x13
Fred Hipshear	Wolverine	8105 Valleywood Lane	Portage, MI 49024-5251	616-323-2491 x24
Mark Flickinger	Arco Environmental Remediation	444 S. Flower St. Room ALF-3287	Los Angeles, CA 90071	213-486-7232
Lisa Bailey	Explorer Pipeline	3737 Michigan Street	Hammond, IN 46323-1203	219-989-8267
Gary Hanten	Phillips Pipeline	400 E. Columbus Drive	East Chicago, IN 46312	219-397-6666 x304
Greg Martin	Praxair, Inc.	4520 Kennedy Avenue	East Chicago, IN 46312	219-391-5127

Table A - 3 Dredging Placement Plan

	Dredge Placement Plan	Projected Fill Height (ft)	Differential Volume (1000 CY)	Total Volume (1000 CY)
Year 1	SW-cell dikes constructed			
Year 2	Dredge material placed in SW-cell, dikes constructed for SE-cell & N-cell		128	128
Year 3	Dredge material placed in SE-cell & N cell	3	295	423
Year 4	Dredge material placed in SW-cell		134	
Year 5	Dredge material placed in SE-cell & N cell	6	306	863
Year 6	Dredged material placed in SW-cell		140	
Year 7	Dredge material placed in SE-cell & N cell	9	318	1,321
Year 8	Dredged material placed in SW-cell (Cell filled with TSCA sediment)		146	
Year 9	Dredge material placed in SE-cell & N cell	12	330	1,798
Year 10	Dredged material placed in SW-cell (TSCA capped with existing sediment)		153	
Year 11	Dredge material placed in SE-cell & N cell	15	342	2,292
Year 12				
Year 13	Dredged material placed in SW-cell		159	
Year 14	Dredged material placed in SE-cell		159	
Year 15	Dredged material placed in N-cell	18	196	2,806
Year 16				
Year 17	Dredged material placed in SW-cell		160	
Year 18	Dredged material placed in SE-cell		160	
Year 19	Dredged material placed in N-cell	21	194	3,320
Year 20				
Year 21	Dredged material placed in SW-cell		152	
Year 22	Dredged material placed in SE-cell		152	
Year 23	*Dredged material placed in N-cell*	24	193	3,817
Year 24				
Year 25	Dredged material placed in SW-cell		154	
Year 26	*Dredged material placed in SE-cell*		154	
Year 27	Dredged material placed in N-cell	27	195	4,320
Year 28				
Year 29	Dredged material placed in SW-cell		156	
Year 30	Dredged material placed in SE-cell		156	
Year 31	Dredged material placed in N-cell	30	198	4,829

Key:

SW-Cell = Southwest Cell
SE-Cell = Southeast Cell
N-Cell = North Cell

ATTACHMENT A - 1

Slope Stability Analysis

54. The slope stability analysis for the perimeter embankment has been revised based on the current phasing design. The final height of the embankment is 33 feet, with the construction occurring in two phases. The initial embankment phase is 18 feet high, followed by a second 15 feet high embankment built over the first. The interior side slope is 1horizontal to 1 vertical (1H:1V), and the exterior slope is 3 horizontal to 1 vertical (3H:1V). The final crest width of the embankment section is 25 feet. Plate A-6 illustrates the phase construction. Plate A-6 shows two material zones in the embankment cross-section, a clay liner and a clean fill. The first and primary material choice for construction of the embankment is a silty clay, which will satisfy the requirements of the structural fill and the clay liner. This material was used for another Corps project in Northwest Indiana. An alternative section used the silty clay for the liner and fly ash for the structural fill.

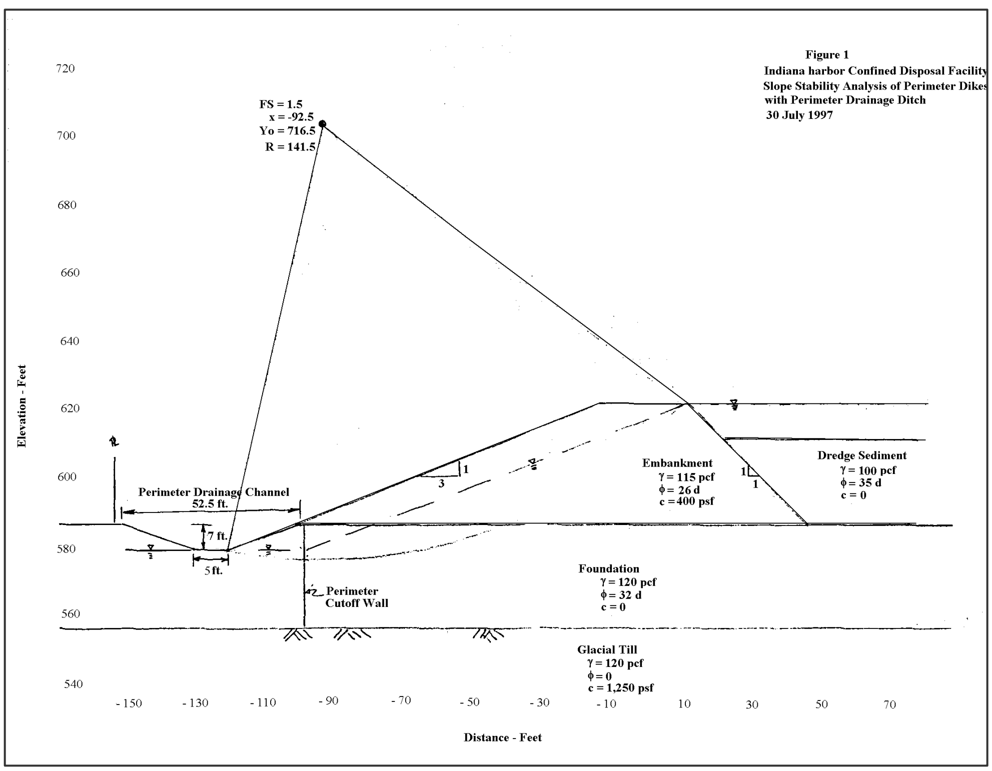


Figure A - 3 Slope Stability Analysis

55. The material properties for the embankment material, foundation and dredged sediment are given in the table A-4.

Table A - 4 Soil Material Strength Parameters

Material	Total Stress Analysis			Effective Stress Analysis		
	γ moist (pcf)	ϕ (°)	c (psf)	γ moist (pcf)	ϕ ‘ (°)	c’(psf)
EMBANKMENT						
Silty Clay (assumed)	115	0	700	115	25	400
Fly Ash						
GL Testing	110	38	2600	110	28	2500
DREDGED SEDIMENT						
@ 80% relative density	100	15	540	100	35	0
FOUNDATION						
Calumet Aquifer (silty sand)	120	32	0	120	32	0
Glacial Till Unit (silty clay)	125	0	1250	125	32	400

To date, a silty clay borrow source has not been located which has strength and hydraulic properties or quantities required for the project.

In the event the silty clay is not available or is not available in the quantities required, to construct the structural fill portion of the embankment, alternatives will need to be considered. Electric utilities in northwest Indiana produce large quantities of fly ash material. Fly ash has been approved by the Indiana Department of Environmental Management (IDEM) for use on this project. The analyses show that the fly ash can be used for the structural fill portion of the embankment. Additional testing of the potential fly ash sources should be undertaken to confirm the strength values of the material used here. Other types of structural fill can also be considered for this project but this is the only alternative considered up to this time.

56. The UTEXAS 3 computer program was used for the slope stability analysis. The results of the analysis for the current development scheme is presented here.

Table A - 5 Slope Stability Analysis

Embankment Material	Side	Slope	Case	Stage	Factor of Safety
Silty Clay	U/S	1H:1V	Empty (construction)	1	1.4
				2	1.5
	D/S	3H:1V	Empty	1	2.9
				2	1.6
			Full	1	2.3
				2	2.3
Fly Ash/ Silty Clay	U/S	1H:1V	Empty	1	3.0
				2	5.2
	D/S	3H:1V	Empty	1	4.2
				2	4.3
			Full	1	2.0
				2	2.7

Upstream and downstream slopes were analyzed for both short-term (end of construction) and long term (steady seepage) conditions. All stability analysis (construction and steady state) has included a 500 psf surcharge load on the crest, to simulate the use of construction equipment during the operation of the CDF (eg. drag line, dump trucks, etc.).

The stage 1 empty (construction condition) analysis, both upstream and downstream, assumes that the CDF is empty. The stage 1 full (steady seepage) analysis assumes that the CDF is filled with dredged sediment and steady state seepage conditions are established. The stage 2 empty analysis, both upstream and downstream, assumes that stage 1 of the CDF is full but that stage 2 filling has not commenced. The stage 2 full analysis assumes that the CDF is filled to capacity and steady state seepage conditions are established.

57. The minimum required factor of safety for the construction and steady state seepage conditions are 1.3 and 1.5 respectively. The results of the analyses show that for the silty clay embankment the most critical cases are the stage 1 upstream slope and the stage 2 construction condition for both the upstream and downstream slopes. The factor of safety's obtained are 1.4,1.5, and 1.6 respectively. The results for the fly ash/silty clay embankment show the stage 1 and 2 steady state seepage condition for the downstream slope are the most critical. The factor of safety's obtained are 2.0 and 2.7 respectively. The results of the stability analysis are all above the minimum factor of safety's required.

58. Some concern has been expressed in the ITR comments regarding the stability and need for repair of the embankment slopes, particularly the 1H:1V upstream slope. A two stage phasing is proposed and this will result in the slopes being exposed to the elements for long periods of time. The above analysis shows the slopes are stable and therefore the main concern will be for localized sloughing or erosion of the three feet thick clay liner. Any localized damage will need to be repaired through a regular inspection and maintenance program. Neglect of such repair over a long period of time may extend the damage to the interior of the embankment causing slope failure.

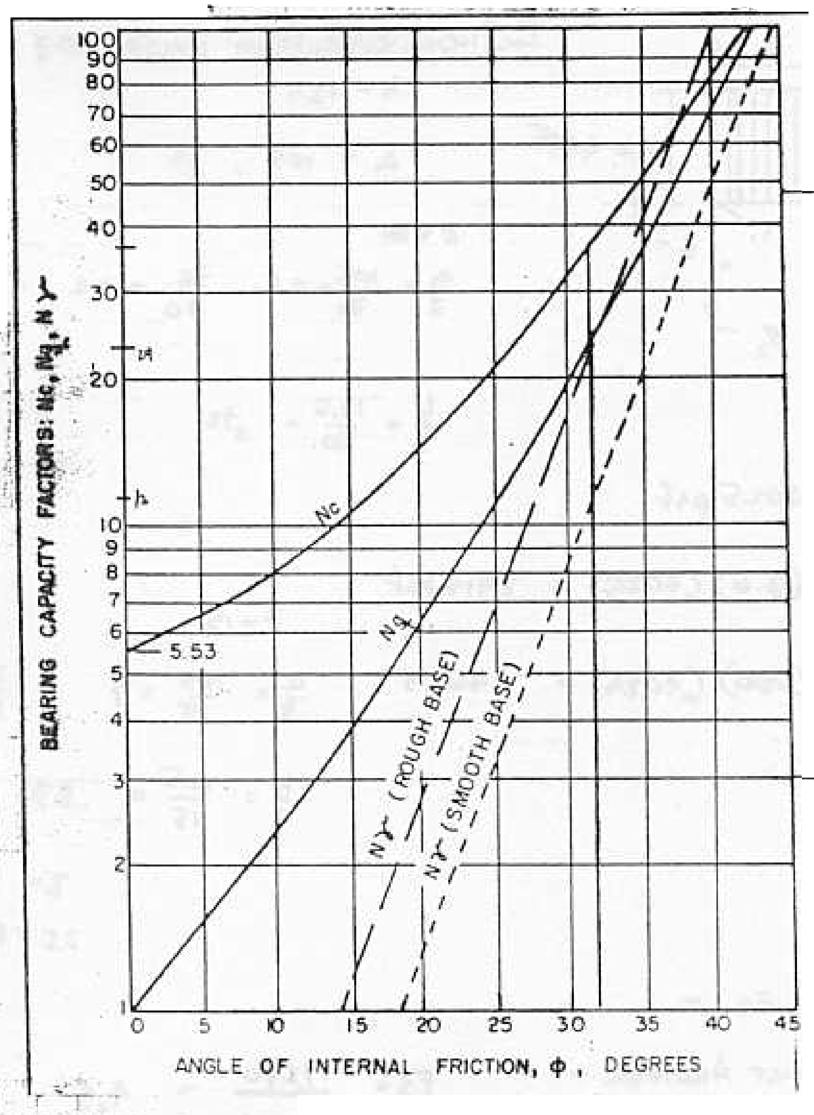
59. Bearing Capacity - The generalized foundation sequence is shown in figure A-3. The Calumet aquifer consists of a medium dense, silty sand. Below this is a stiff, grey, silty clay. The bearing capacity of the silty sand was estimated using the procedure outlined in NAVFAC DM-7. The stress under the centerline of the embankment at the top of Calumet aquifer is 4 KSF and the top of the till unit is 2.4 KSF. The ultimate bearing capacities are 17.3 KSF and 63.5 KSF respectively. The lowest factor of safety against bearing capacity failure is obtained at the top of the Calumet aquifer, which has a value of 4.3. The calculations are attached.

60. Elastic settlement was also estimated within the Calumet aquifer. The calculations, which are attached, indicate that approximately one foot of settlement can be expected due to the embankment loading.

61. Seepage analysis through the foundation was conducted to study uplift at the downstream toe. Failure due to piping of the foundation is not considered likely at this site.

Slope Stability Analysis Backup

US Army Corps of Engineers Chicago District	PROJECT TITLE: Indiana Harbor CDF	COMPUTED BY: DW	DATE: 11 [illegible] 96	SHEET: 1/4
	STRUCTURE TITLE: CDF Dyke	CHECKED BY:	DATE:	CONTRACT NO:



Compute Factor of Safety for Bearing Capacity Failure

Ref. NAVFAC DM-7, 1971
Figure 11-1, Ultimate Bearing Capacity of shallow footings with eccentric loads

For Calumet Aquifer –

$q_{ult} = \frac{1}{2} \gamma B N_\gamma$

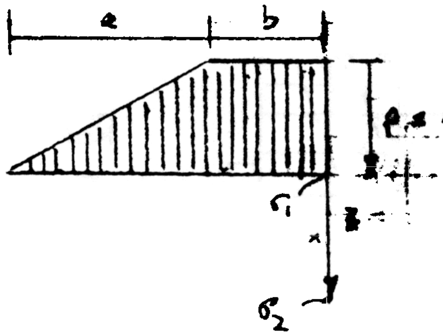
$= \frac{1}{2}\, 115(25)(12) = 17250$ psf

For Till Layer

$q_{ult} = c N_c + \frac{\gamma B}{2} N_\gamma$

$= 1250(51) +$ ~~$\frac{115(25)}{2}\, 12$~~ $= 63500$ psf

US Army Corps of Engineers Chicago District	PROJECT TITLE: Indiana Harbor CDF	COMPUTED BY: [illegible]	DATE: 11 MAR 96	SHEET: 2/4
	STRUCTURE TITLE: CDF Dyke	CHECKED BY:	DATE:	CONTRACT NO.



Influence values from: NAVFAC DM-7 Fig 5.5

b = 12.5

a = 105 35

z = 30

$\frac{a}{z} = \frac{105}{30} = 3.5$ $\frac{35}{30} = 1.2$

$\frac{b}{z} = \frac{12.5}{30} = .42$

I = .3

2I = .6

σ_1 = 4025 psf

σ_2 = (0.6)(4025) = 2415 psf

σ_3 = (.86)(4025) = 3461.5

z = 15

$\frac{a}{z} = \frac{105}{15} = 7$ $\frac{35}{15} = 2.3$

$\frac{b}{z} = \frac{12.5}{15} = .83$

I = .43

2I = 0.86

Bearing Capacity FS.

Top of Calumet Aquifer — FS = $\frac{17250}{4025}$ = 4.3 OK.

Middle of Calumet Aquifer FS = $\frac{17250}{3461.5}$ = 5.0

Top of Glacial Till FS = $\frac{63500}{2415}$ = 26

NCC Form 1272, May 94

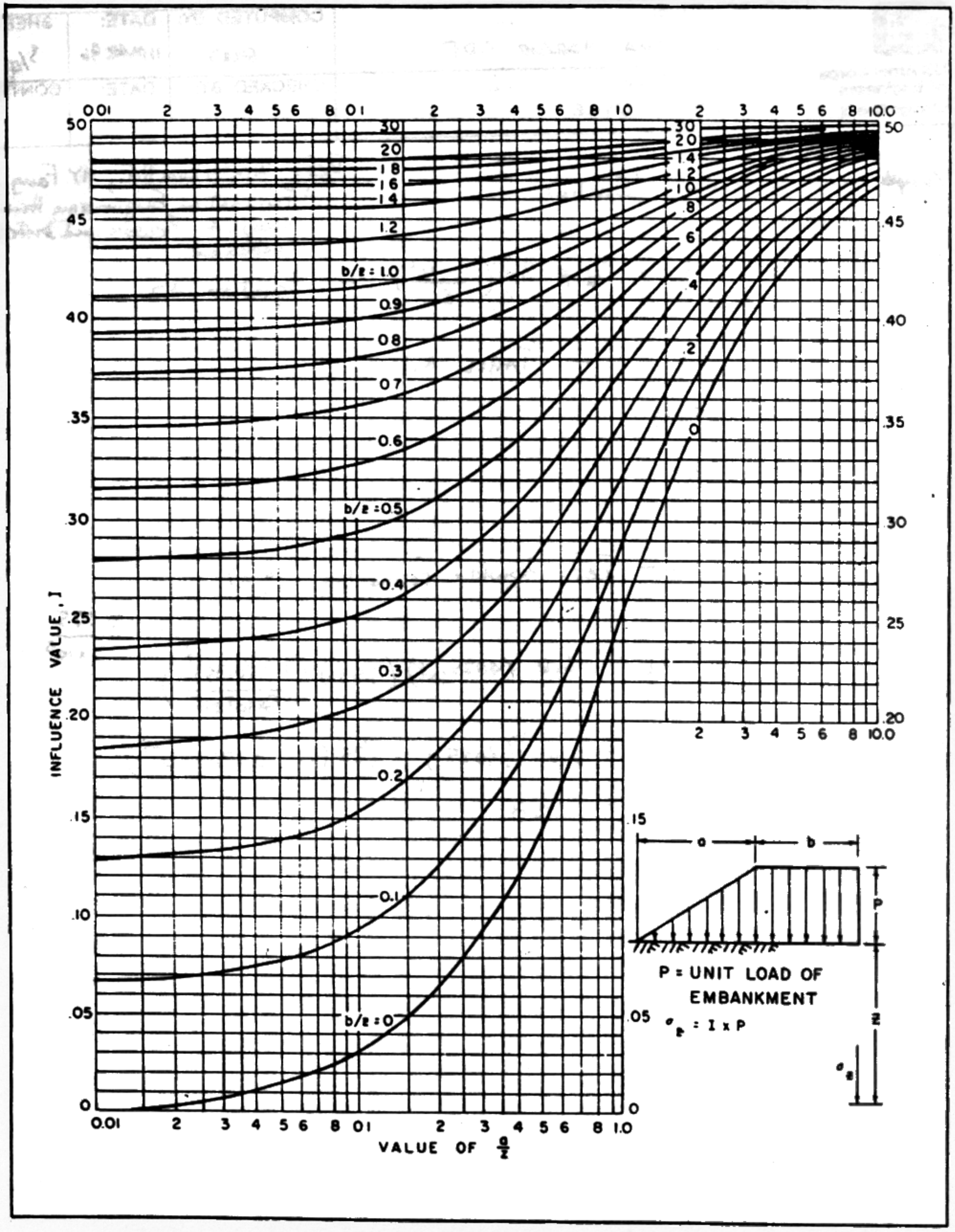


FIGURE 5-5
Influence Value for Vertical Stress Under Embankment Load of Infinite Length

US Army Corps of Engineers Chicago District	PROJECT TITLE: INDIANA HARBOR CDF	COMPUTED BY: DWJ	DATE: 11 MAR 96	SHEET: 3/4
	STRUCTURE TITLE: CDF DYKE	CHECKED BY:	DATE:	CONTRACT NO:

Ref: Winterkorn H.F., H.Y. Fang, 1975, "Foundation Engineering Handbook" Chapt. 4 Pressure and Distribution and Settlement

Compute Vertical Settlement (Elastic)

$$S_L = C_d \, p \, B \left(\frac{1-\mu^2}{E}\right) \quad \text{— Equation 4.2}$$

$C_{d\,ave} = 6.6$ — TABLE 4.1

$p = 4025$ psf

$B = 25$ ft

$\mu = 0.35$

$E = 5\times10^5$ psf — Ref: Bowles Found Eng pg 67

$$S_L = 6.6\,(4025\text{ psf})\,(25\text{ ft})\left(\frac{1-(0.35)^2}{5\times10^5\text{ psf}}\right) \qquad \frac{.8775}{5\times10^5}$$

$$= 6.6\,(4025)\,(25\text{ ft})\,(0.176\times10^{-5})$$

$$= 1.2\text{ ft.}$$

CLAY EMBANKMENT

STAGE 1 RESERVOIR EMPTY (CONSTRUCTION)

U/S SLOPE 1H:1V

CRITICAL CIRCLE

X = 6

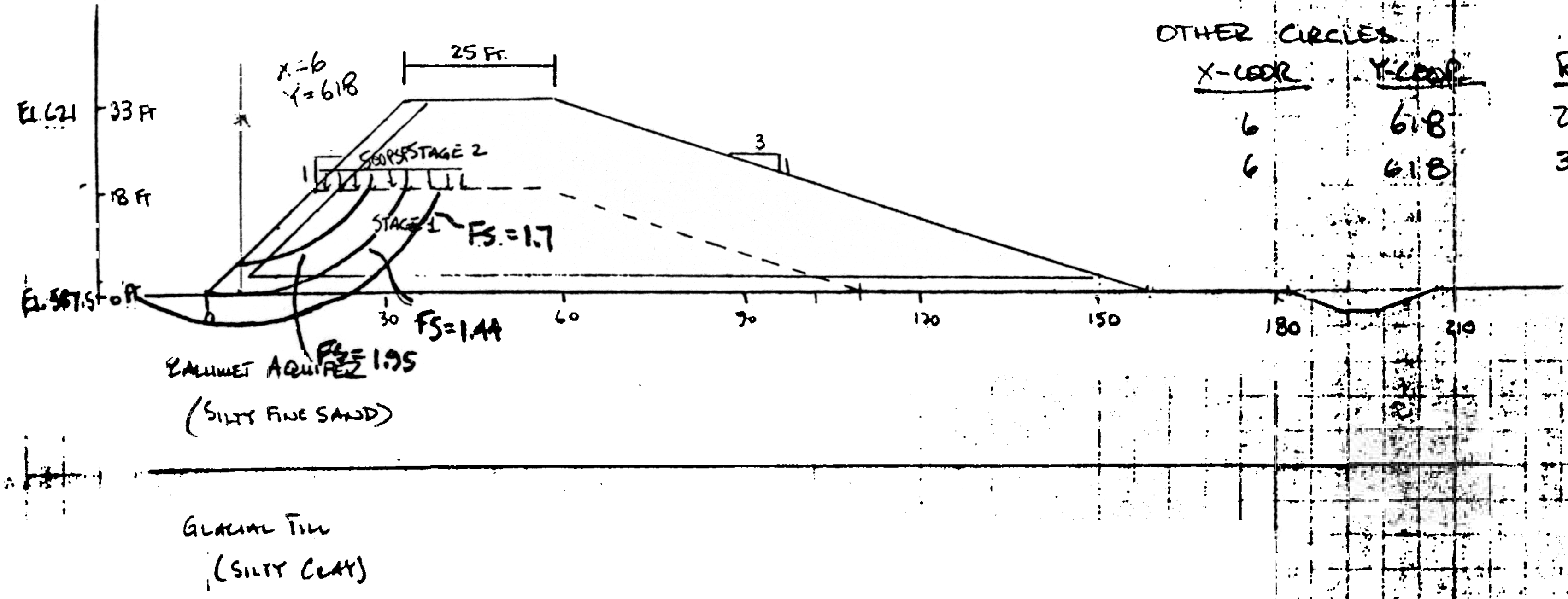
Y = 618

R = 30.5

F.S. = 1.4

OTHER CIRCLES

X-COOR	Y-COOR	R	F.S
6	618	25.5	1.95
6	618	35.5	1.70



S1 CDF CIC INP

CLAY EMBANKMENT

STAGE 2 — STAGE 1 RESERVOIR FULL
STAGE 2 RESERVOIR EMPTY

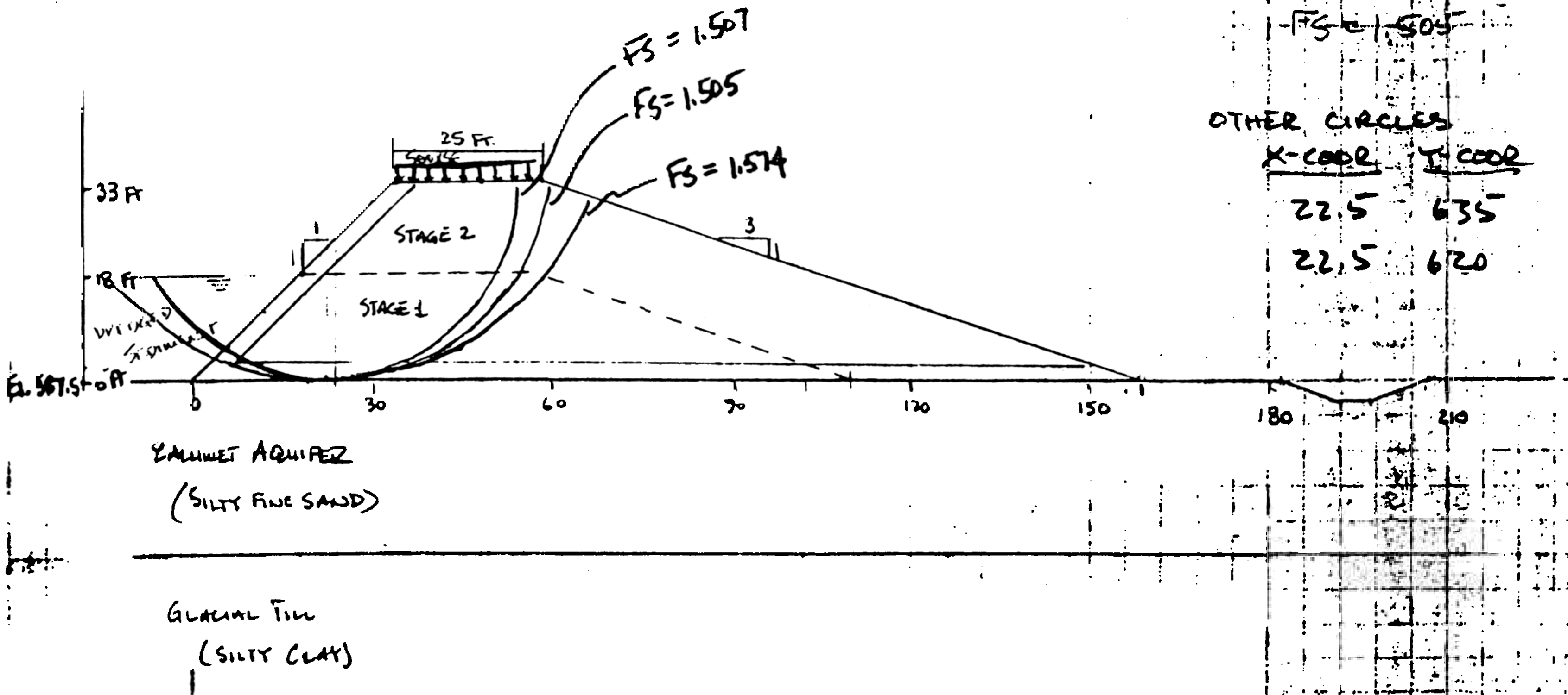
U/S SLOPE 1H:1V

CRITICAL CIRCLE

X = 24
Y = 624
R = 36.5
FS = 1.505

OTHER CIRCLES

X-COOR	Y-COOR	R	FS
22.5	635	47.5	1.574
22.5	620	32.5	1.507



Rev S2CDFCIC.INP

CLAY EMBANKMENT

STAGE 2 — STAGE 1 RESERVOIR FULL
STAGE 2 RESERVOIR EMPTY

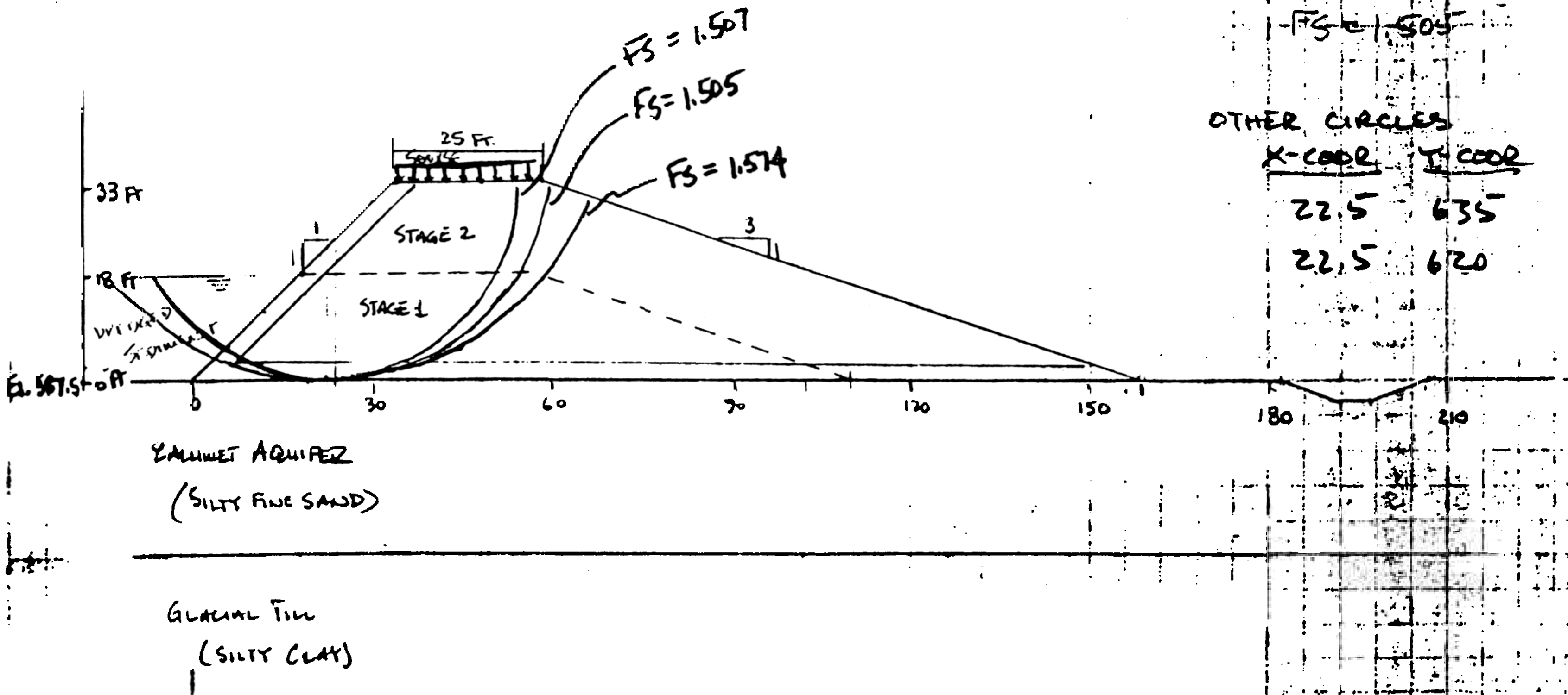
U/S SLOPE 1H:1V

CRITICAL CIRCLE

X = 24
Y = 624
R = 30.5
~~FS = 1.505~~

OTHER CIRCLES

X-COOR	Y-COOR	R	FS
22.5	635	47.5	1.574
22.5	620	32.5	1.507



Run S2CDFCIC.INP

FLY ASH EMBANKMENT
SILTY CLAY LINER

STAGE 1 - STAGE 1 FULL
(STEADY STATE SEEPAGE)

D/S SLOPE 3H:1V

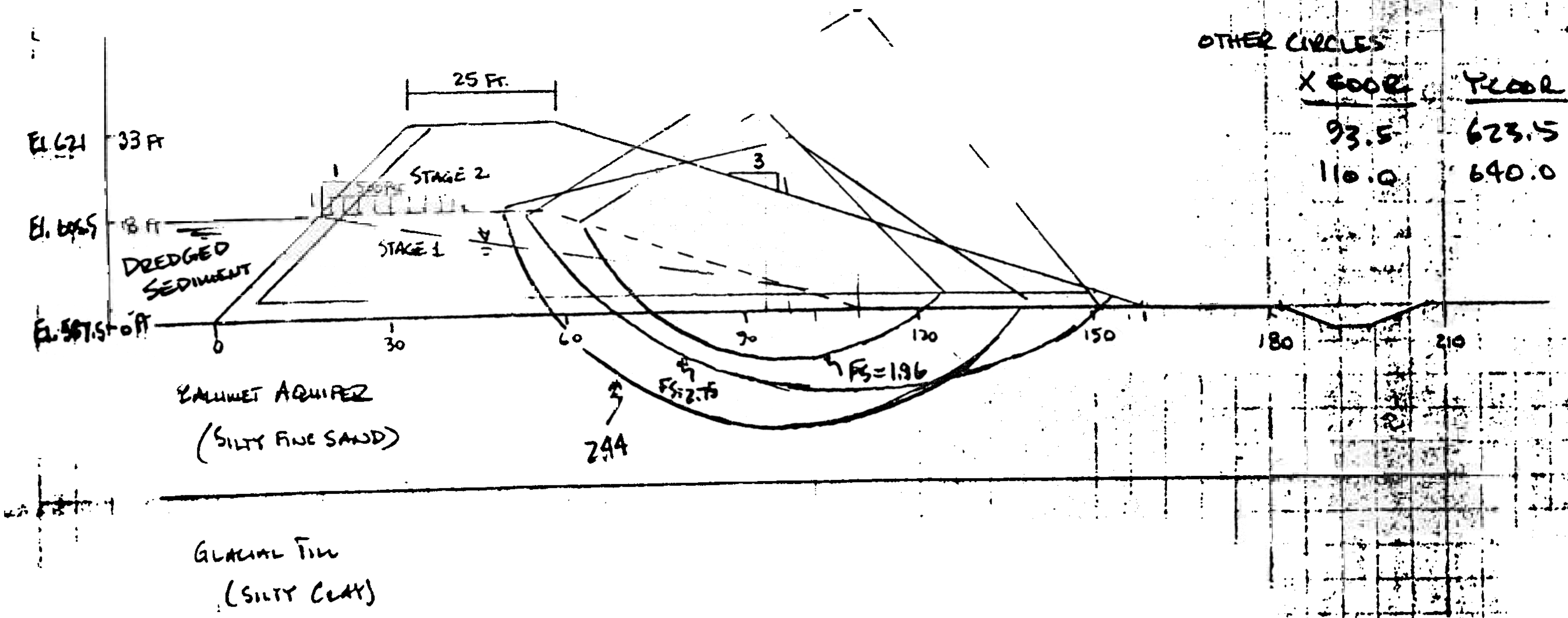
CRITICAL CIRCLE

X = 98.0
Y = 618.0
R = 38.5

FS = 1.96

OTHER CIRCLES

X COOR	Y COOR	R	F.S
93.5	623.5	51	2.44
110.0	640.0	67.5	2.75



CLAY EMBANKMENT

STAGE 2 – STAGE 1 RESERVOIR FULL
STAGE 2 RESERVOIR EMPTY

D/S SLOPE 3H:1V

CRITICAL CIRCLE

X = 96

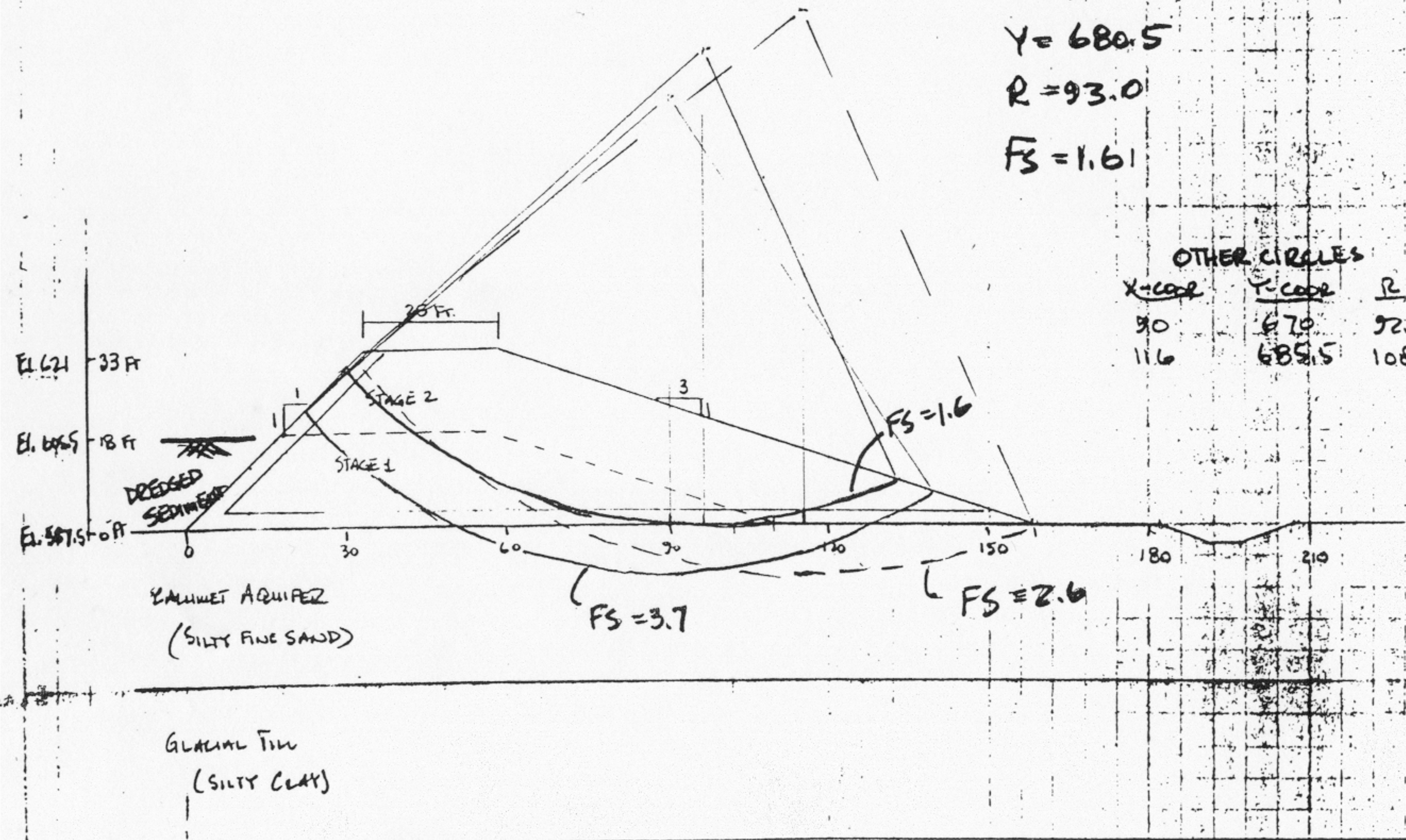
Y = 680.5

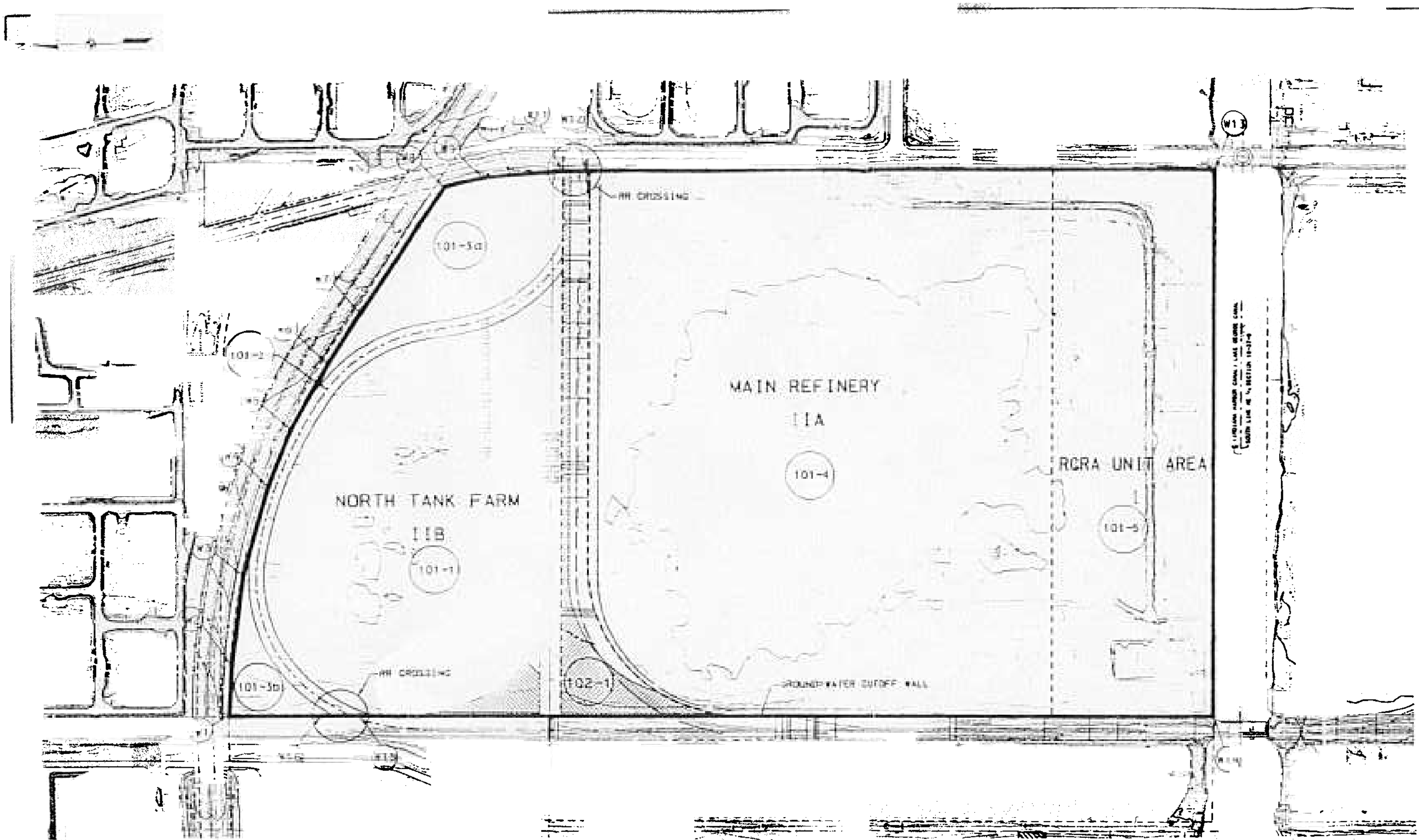
R = 93.0

FS = 1.61

OTHER CIRCLES

X-COOR	Y-COOR	R	FS
90	670	92.5	3.69
116	685.5	108	2.63





PERMANENT EASEMENT		
NUMBER	NORTHING	EASTING
	1.514.467.0	389.213.8
	1.514.453.8	389.413.8
W3	1.514.404.2	389.758.6
W4	1.514.301.0	390.103.5
W5	1.514.215.8	390.322.0
W6	1.514.080.8	390.577.5
W7	1.513.957.1	390.773.6
W8	1.513.643.1	391.256.2
W9	1.513.506.5	391.290.7
W10	1.513.398.2	391.300.5
W11	1.513.207.8	391.315.3
W12	1.513.123.8	391.314.8
W13	1.510.731.1	391.304.9
W14	1.510.767.3	389.197.4
W15	1.513.986.8	389.214.4
W16	1.514.128.9	389.214.4

REAL ESTATE LEGEND

- PERMANENT RE INTERESTS
- CANAL CENTERLINE
- ROAD CENTERLINE
- PROPERTY BOUNDARY

TRACT REGISTER

TRACT NO.	LAND OWNER	ACREAGE						REMARKS
		FEE	EASMT	TEMP	LICENSE	PERMIT	LEASE	
101-1	East Chicago Waterway Management Dist.	32.60						
101-2	East Chicago Waterway Management Dist.	3.44						SUBJECT TO R.R. R.O.W.
101-3a	East Chicago Waterway Management Dist.	6.84						
101-3b	East Chicago Waterway Management Dist.	1.70						
101-4	East Chicago Waterway Management Dist.	82.92						
101-5	East Chicago Waterway Management Dist.	30.05						
102-1	- - - - - - - -		6.55					

R.R. EASEMENT

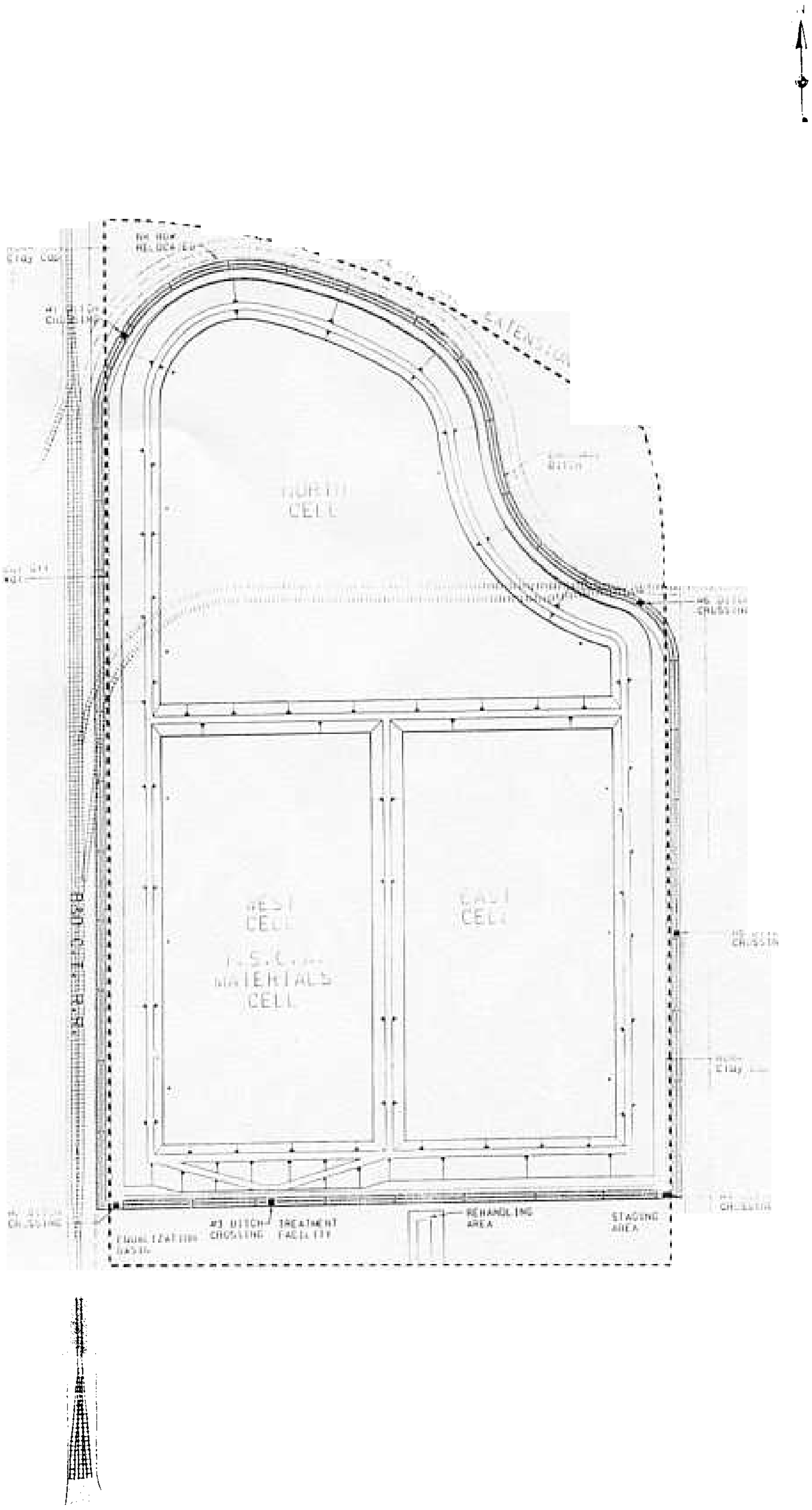
SCALE IN FEET

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

REAL ESTATE MAP

Scale AS | DWN | Date DECEMBER | Drawing PLATE_A1

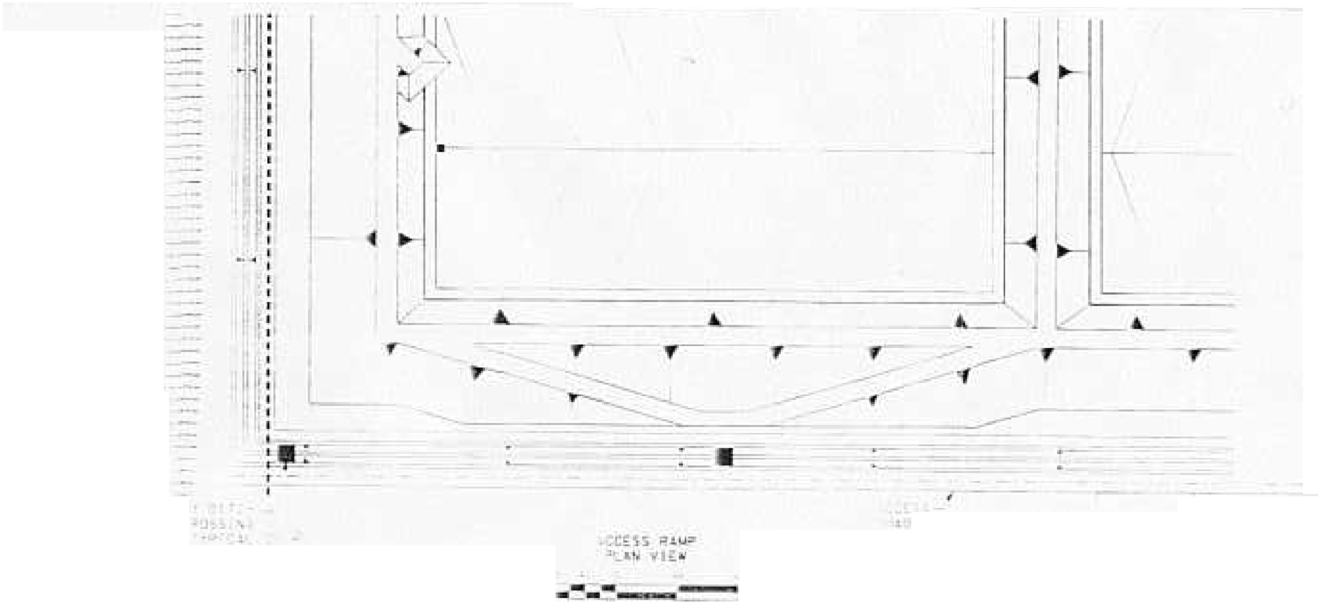
CULVERT	CULVERT SIZE (inch)
1	18
2	48
3	48
4	48
5	18
6	16

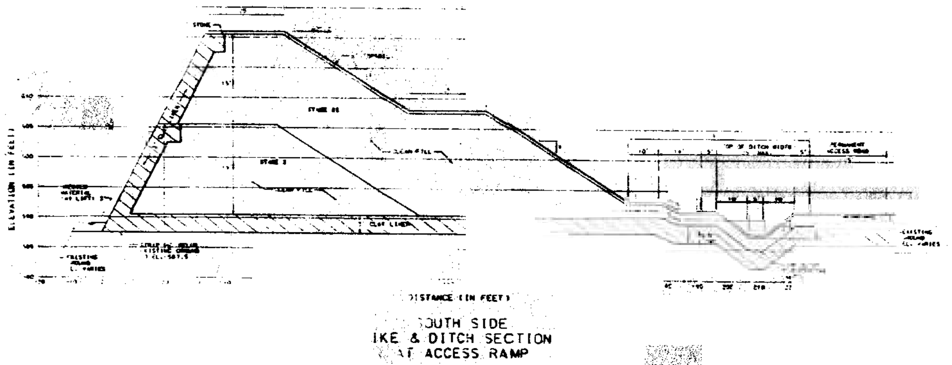


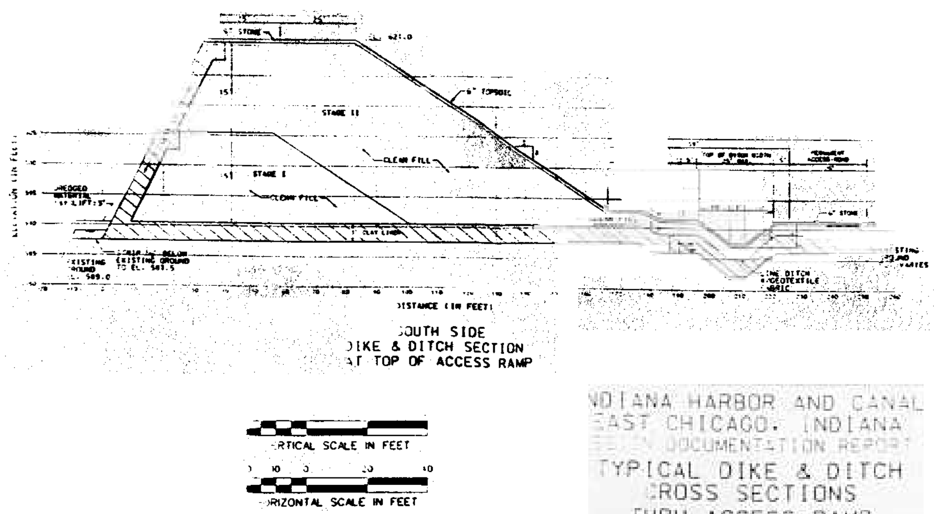
INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

CDF PLAN VIEW

Scale AS SHOWN | Date 1 DECEMBER 1999 | Drawing PLATE_A2.1

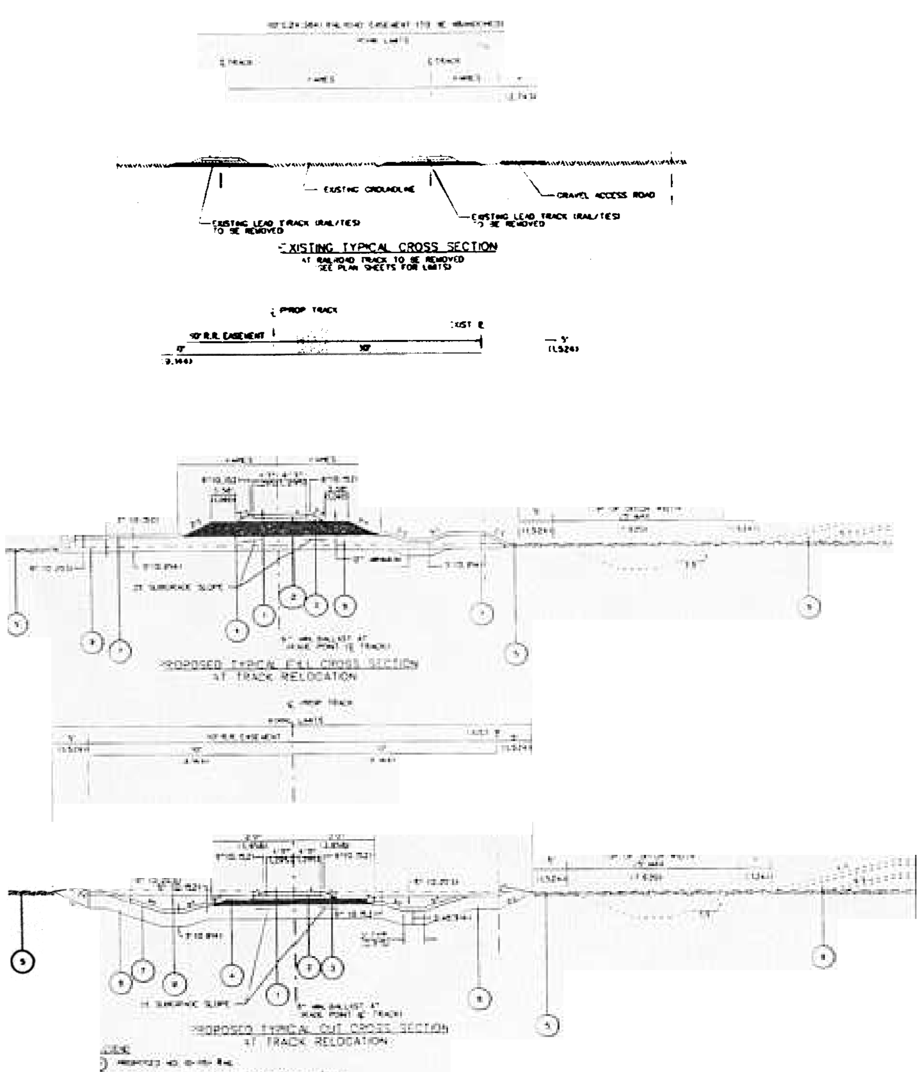






INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

TYPICAL DIKE & DITCH
CROSS SECTIONS
THRU ACCESS RAMP



LEGEND

1) PROPOSED NO. [illegible] RAIL
2) PROPOSED SIZE 4 CROSS TIES [illegible]
3) A.R.E.A. STANDARD #4 BALLAST
4) 12" MINIMUM COMPACTED SUB BALLAST

PROPOSED RAIL, TIES, TIE PLATES, ANCHORS AND ALL OTHER REQUIRED MATERIALS SHALL BE PAID FOR IN LUMP SUM AS "TRACK COMPLETE IN PLACE".

) RCRA CAP (CLAY FILL)

GENERAL NOTES

[illegible]

U.S. Army Corps of Engineers Chicago District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CHICAGO, ILLINOIS

CSX TRANSPORTATION
TRACK RELOCATION AT THE
INDIANA HARBOR
CONFINED DISPOSAL FACILITY

TYPICAL SECTIONS AND GENERAL NOTES

SHEET REFERENCE NUMBER:
2

PROPOSED CURVE DATA

CURVE NO. 1	P.I.	N 1514462.80	(461600.042)	E 089232.64	(1110638.109)
CURVE NO. 1	P.C.	N 1513839.09	(461410.155)	E 089167.00	(1110618.102)
CURVE NO. 1	P.C.C.	N 1514343.43	(461571.078)	E 089047.74	(1110825.591)
CURVE NO. 2	P.I.	N 1514290.87	(461555.057)	E 090120.24	(1110900.649)
CURVE NO. 2	P.C.C.	N 1514343.43	(461571.078)	E 089047.74	(1110825.591)
CURVE NO. 2	P.T.	N 1514154.91	(461514.407)	E 090362.10	(1110982.393)
CURVE NO. 3	P.I.	N 1513990.82	(461464.150)	E 090655.90	(1110071.943)
CURVE NO. 3	P.C.	N 1514126.05	(461505.620)	E 090413.60	(1110990.865)
CURVE NO. 3	P.T.	N 1513715.57	(461380.546)	E 090699.95	(1110885.345)
CURVE NO. 4	P.I.	N 1513141.14	(461205.410)	E 090791.96	(1119113.389)
CURVE NO. 4	P.C.	N 1513616.71	(461350.378)	E 090715.70	(1119090.170)
CURVE NO. 4	P.T.	N 1513132.74	(461202.858)	E 091273.51	(1119260.166)

PROPOSED CURVE DATA

CURVE NO 1
PC STA. 69+27.77 (2+111.504)
PI STA. 75+54.21 (2+302.523)
PCC STA. 78+80.19 (2+401.882)
Δ = 94° 54' 11.54"
D = 9° 57' 52.14"
R = 575.00 (175.260)
L = 952.41 (290.295)
T = 626.44 (190.939)

PROPOSED CURVE DATA

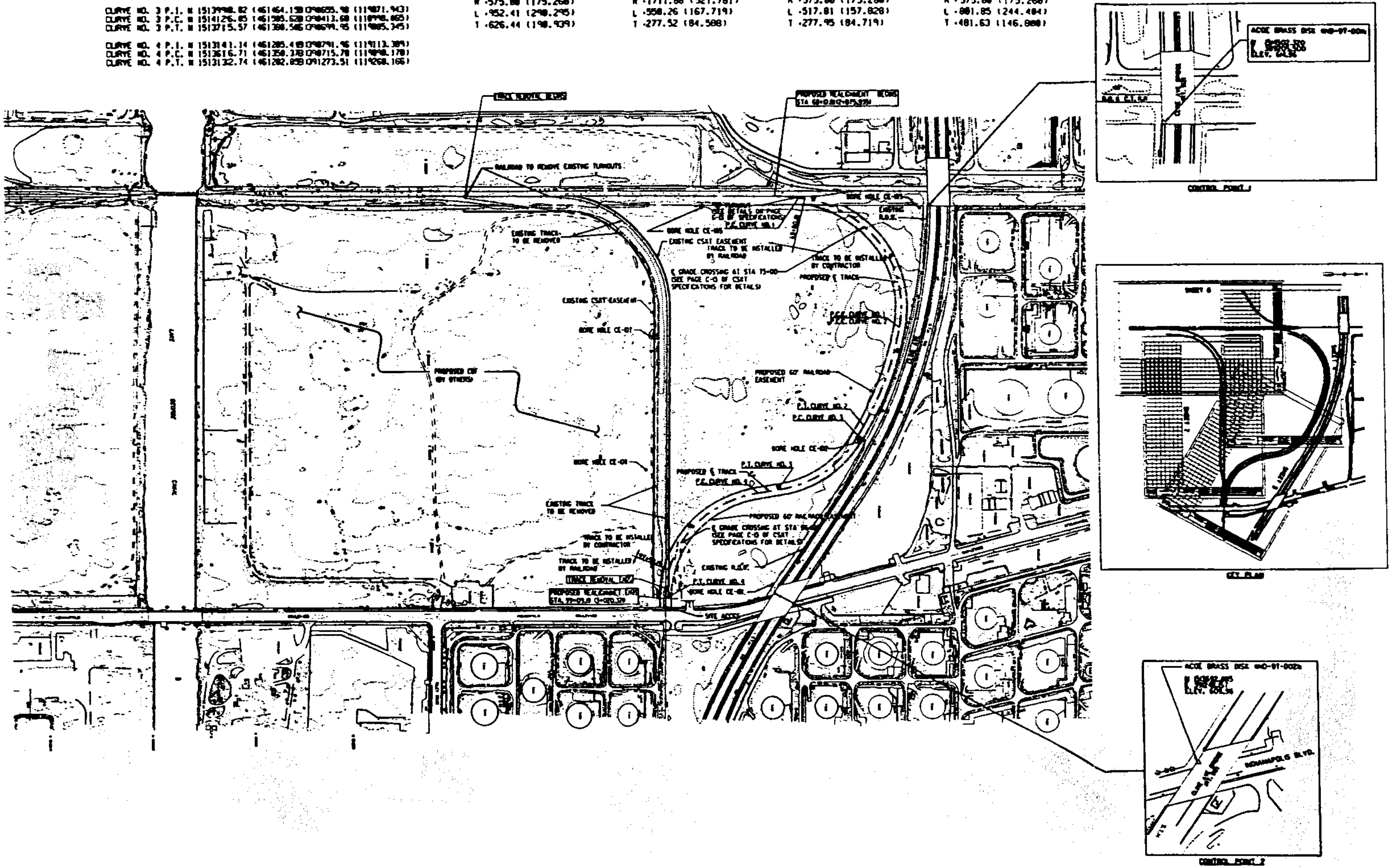
CURVE NO 2
PCC STA. 78+80.19 (2+401.882)
PI STA. 81+57.71 (2+486.470)
PT STA. 84+30.44 (2+569.590)
Δ = 18° 25' 00.71"
D = 3° 20' 49.00"
R = 1711.00 (521.781)
L = 550.26 (167.719)
T = 277.52 (84.588)

PROPOSED CURVE DATA

CURVE NO 3
PC STA. 84+89.40 (2+587.569)
PI STA. 87+67.35 (2+672.288)
PT STA. 90+07.22 (2+745.401)
Δ = 51° 35' 50.80"
D = 9° 57' 52.14"
R = 575.00 (175.260)
L = 517.81 (157.828)
T = 277.95 (84.719)

PROPOSED CURVE DATA

CURVE NO 4
PC STA. 91+07.34 (2+775.917)
PI STA. 95+88.97 (2+922.718)
PT STA. 99+09.19 (3+020.321)
Δ = 79° 53' 59.74"
D = 9° 57' 52.14"
R = 575.00 (175.260)
L = 801.85 (244.404)
T = 481.63 (146.800)



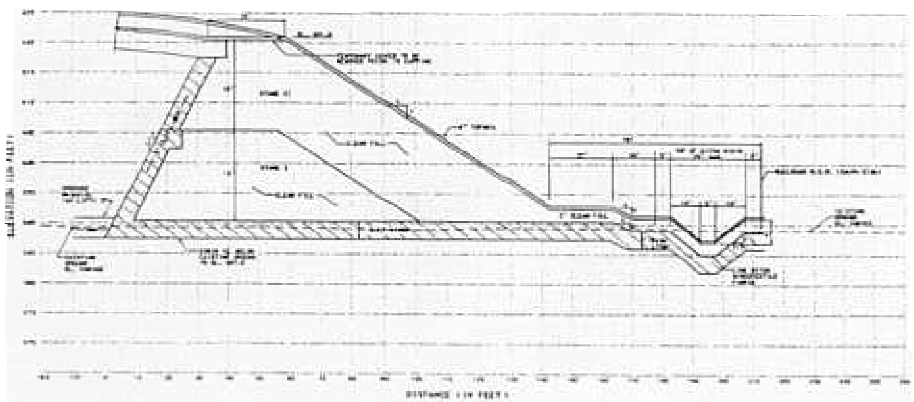
US Army Corps of Engineers Chicago District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CHICAGO, ILLINOIS

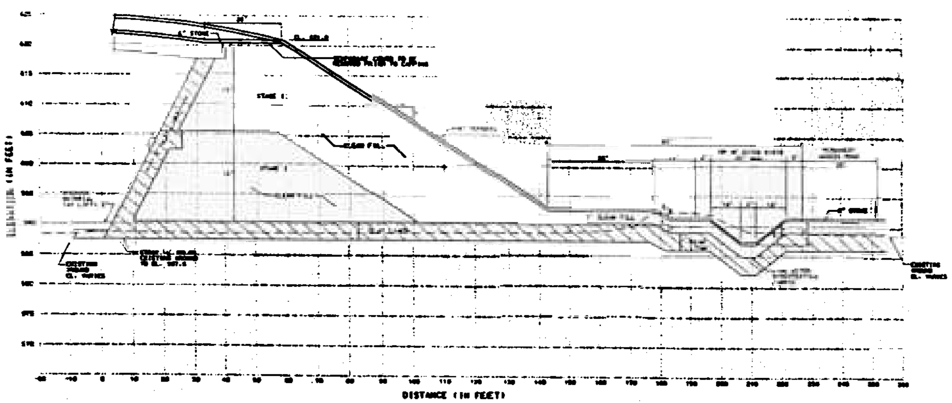
SCALE: 1" = 200'

CSX TRANSPORTATION
TRACK RELOCATION AT THE
INDIANA HARBOR
CONFINED DISPOSAL FACILITY
SITE PLAN

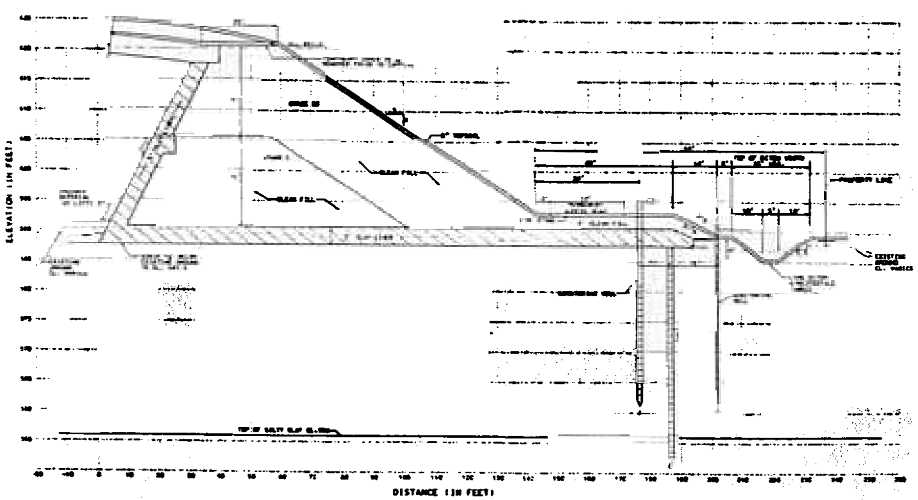
SHEET REFERENCE NUMBER:
3



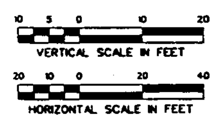
NORTH SIDE
TYPICAL DIKE & DITCH SECTION



SOUTH SIDE
TYPICAL DIKE & DITCH SECTION



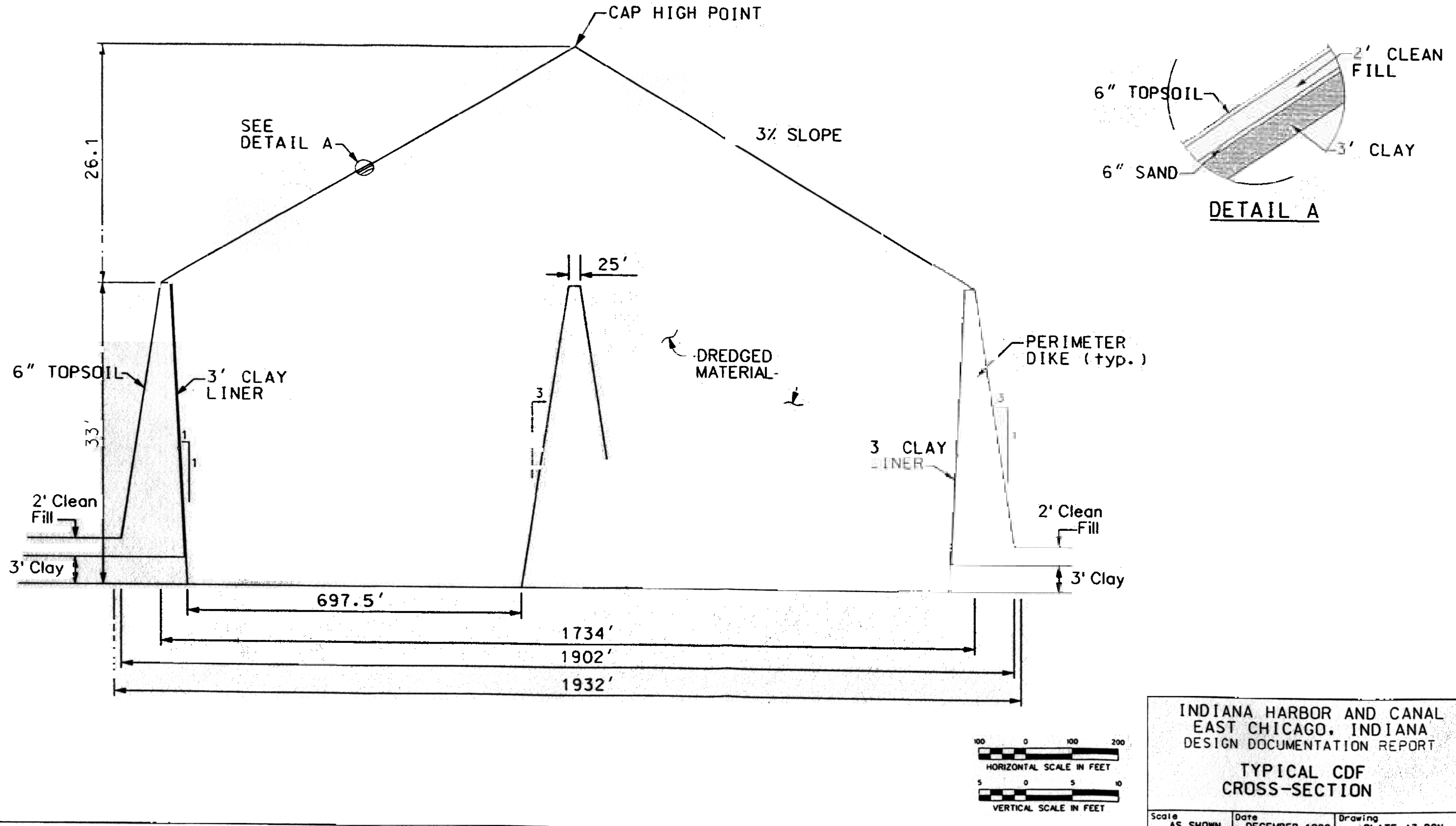
EAST AND WEST SIDES
TYPICAL DIKE & DITCH CROSS SECTION



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

CDF CROSS SECTION

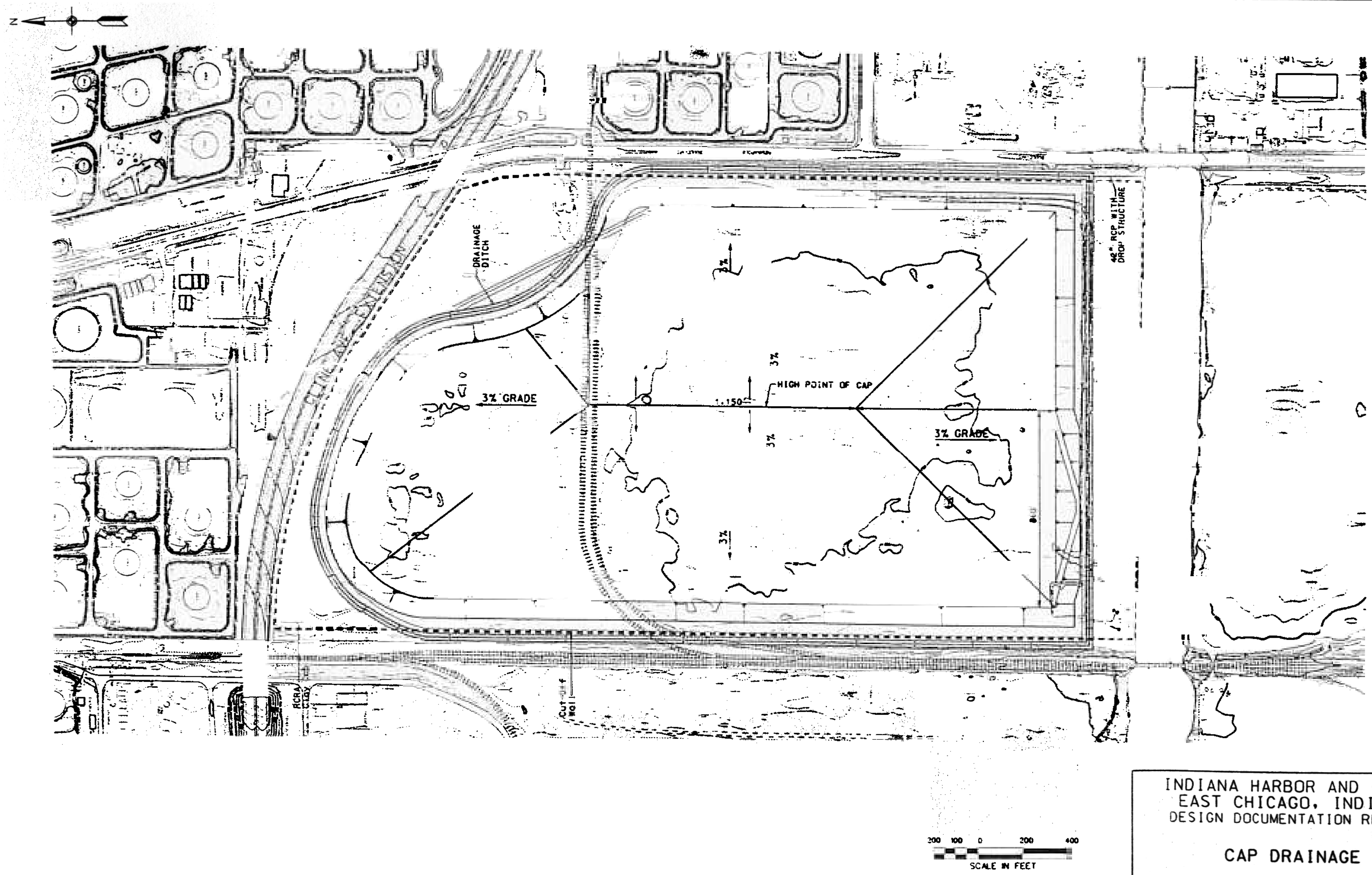
Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A6.DGN



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

TYPICAL CDF CROSS-SECTION

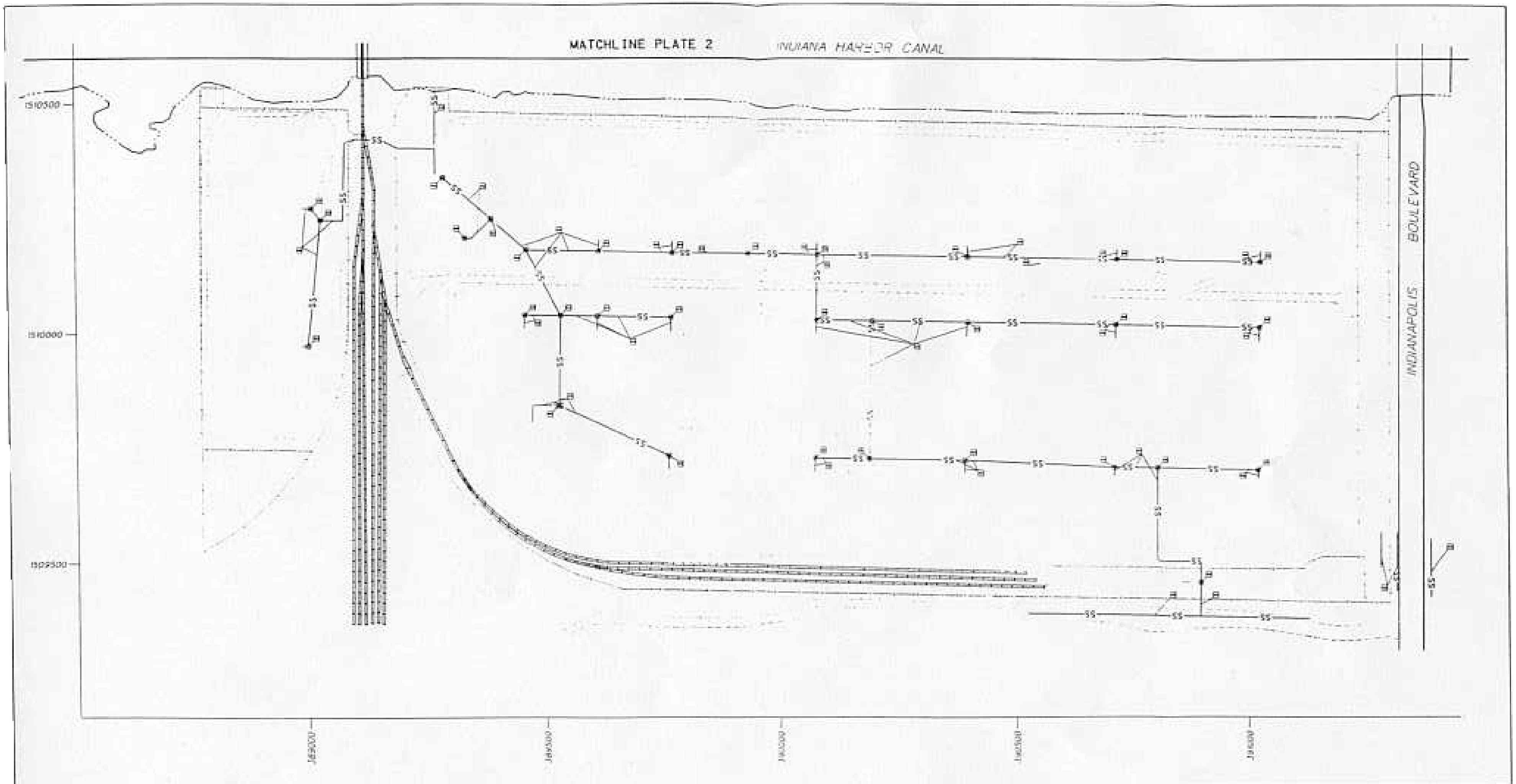
Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A7.DGN



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

CAP DRAINAGE

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A8.DGN



LEGEND

SANITARY SEWER ——SAN——
STORM SEWER ——SS——

SCALE IN FEET

SHEET INDEX
SHEET 4 OF 4
SHEET 3 OF 4
SHEET 2 OF 4

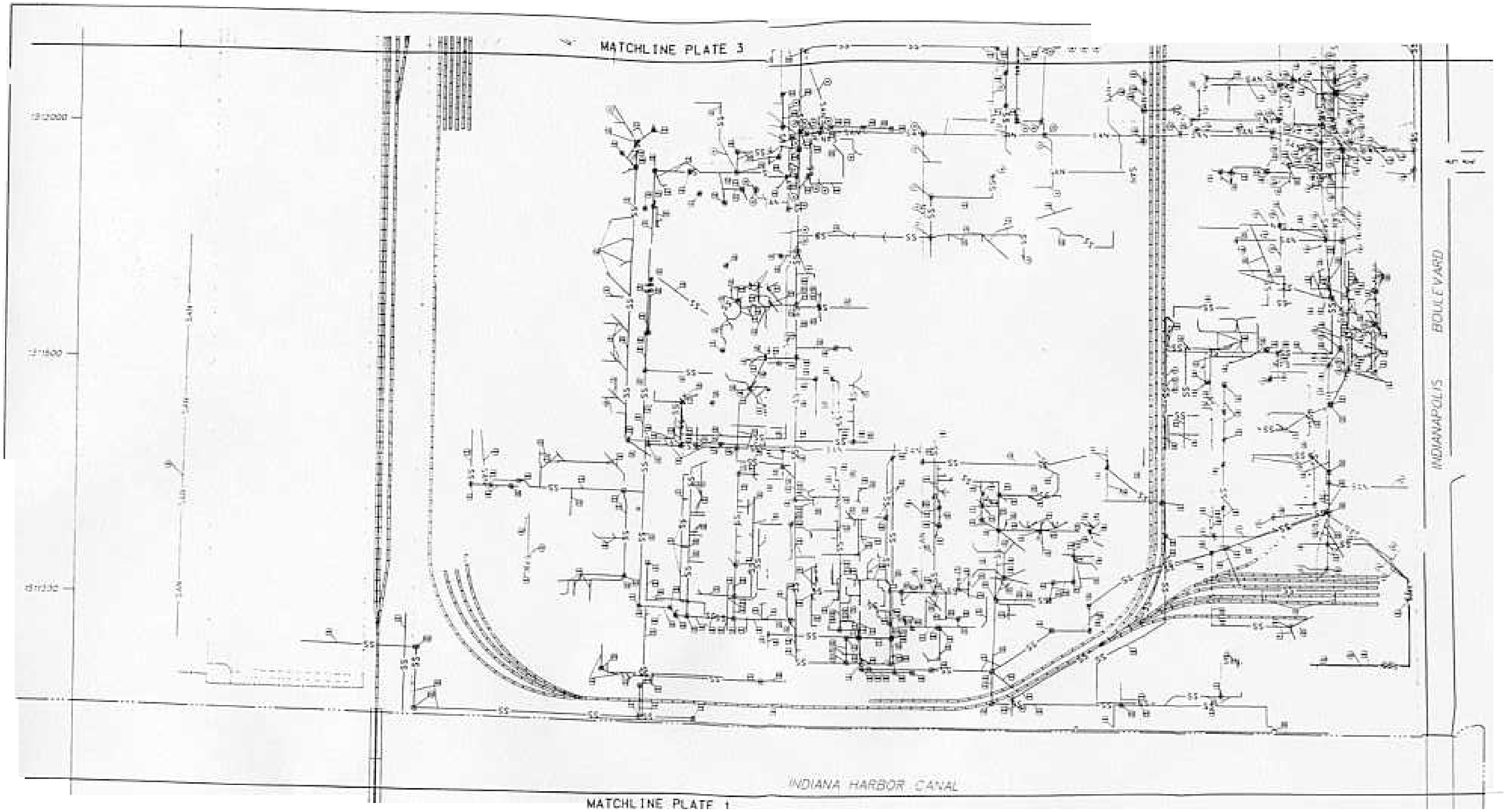
-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

SANITARY & STORM UTILITIES
SHEET 1 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A9.DGN

PLATE A-9



LEGEND

SANITARY SEWER	——SAN——
STORM SEWER	——SS——

100 0 50 100 200 400

SCALE IN FEET

SHEET INDEX

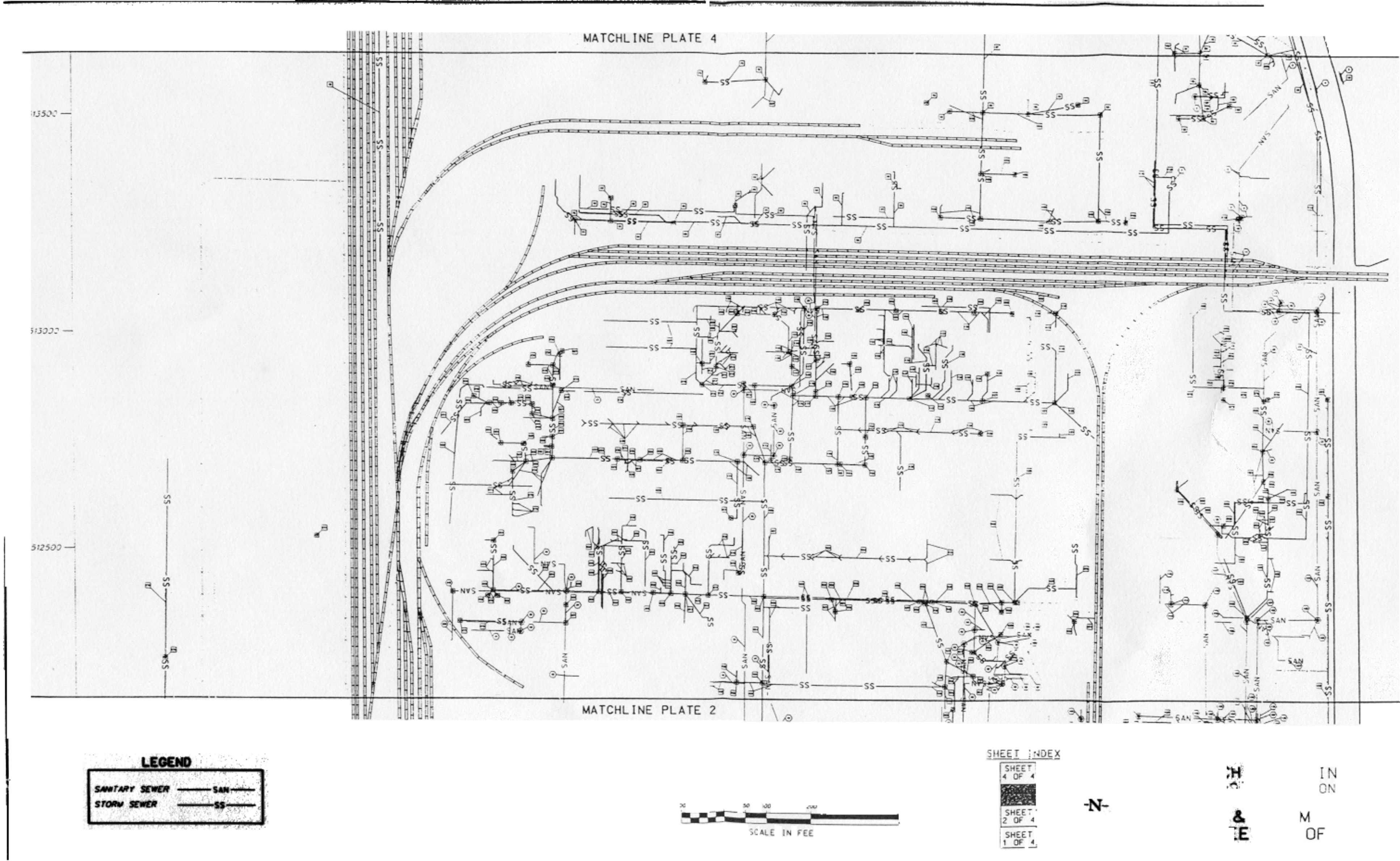
SHEET 4 OF 4
SHEET 3 OF 4
SHEET 1 OF 4

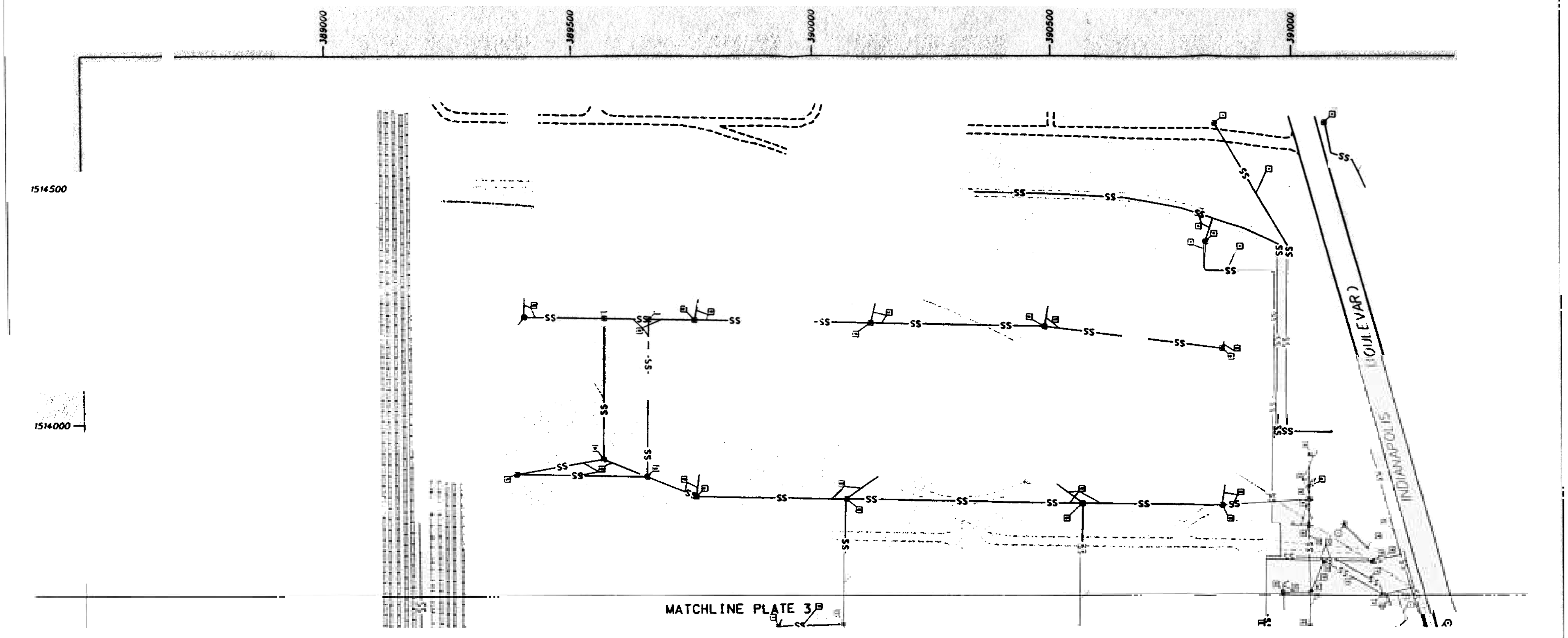
-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

SANITARY & STORM UTILITIES
SHEET 2 OF 4

Scale AS SHOWN | Date DECEMBER 1999


MATCHLINE PLATE 4
513500
513000
512500
MATCHLINE PLATE 2
LEGEND
SANITARY SEWER SAN
STORM SEWER SS
SCALE IN FEE
SHEET INDEX
SHEET 4 OF 4
SHEET 2 OF 4
SHEET 1 OF 4
-N-



LEGEND

SANITARY SEWER	——SAN——
STORM SEWER	——SS——

SCALE IN FEET (100, 0, 50, 100, 200)

SHEET INDEX

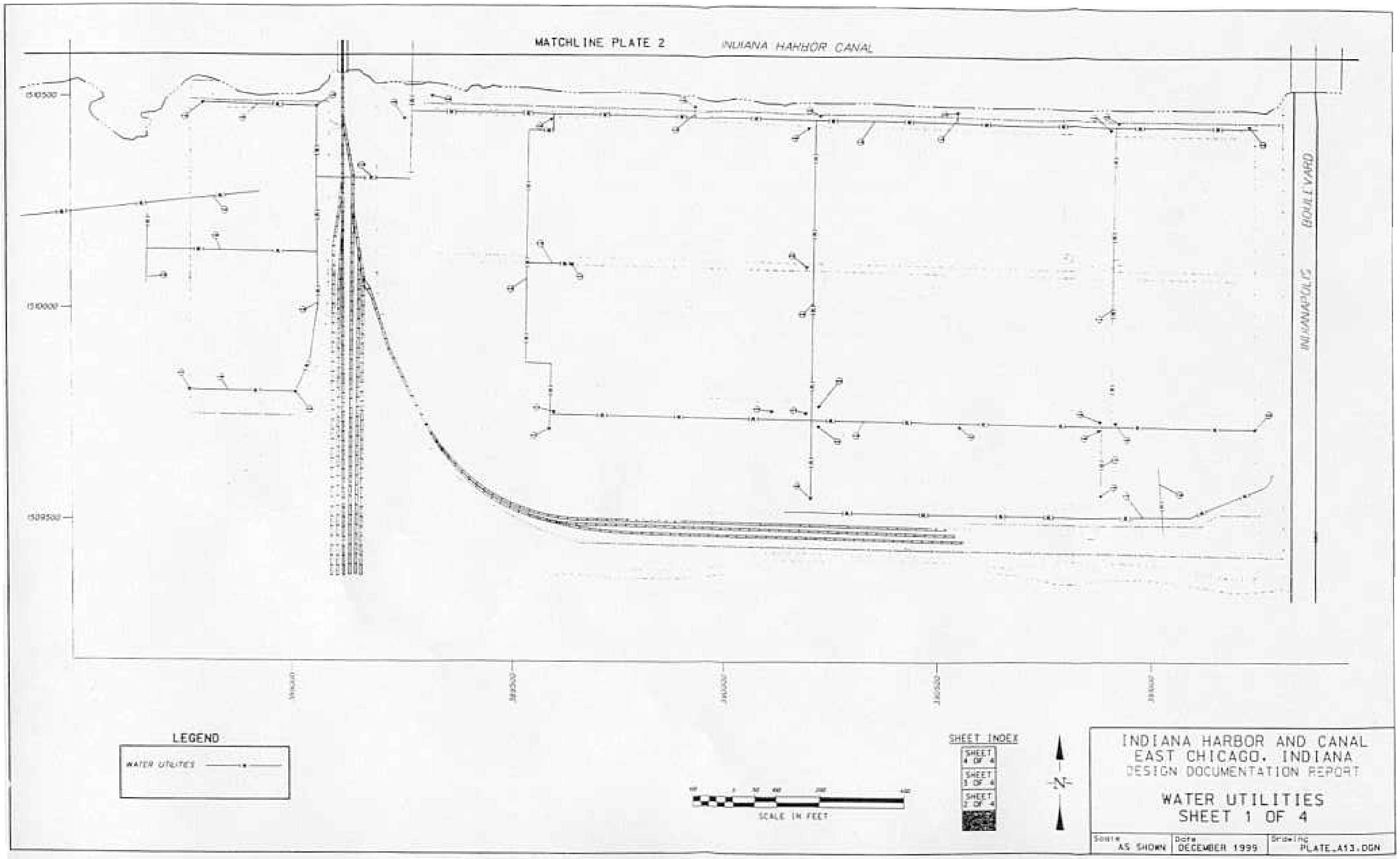
SHEET 3 OF 4
SHEET 2 OF 4
SHEET 1 OF 4

N

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

SANITARY & STORM UTILITIES
SHEET 4 OF 4

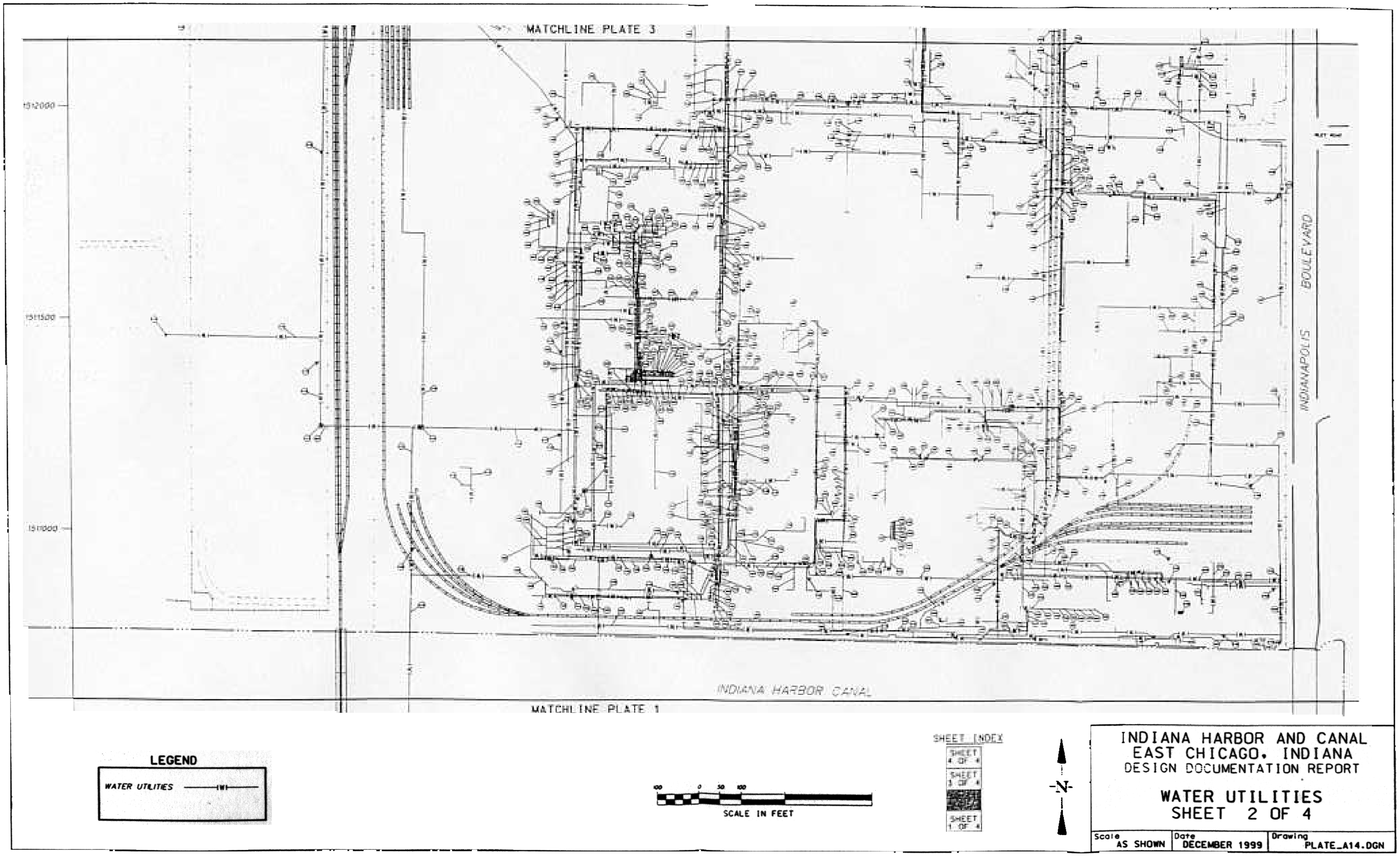
Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A12.DGN



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

WATER UTILITIES
SHEET 1 OF 4

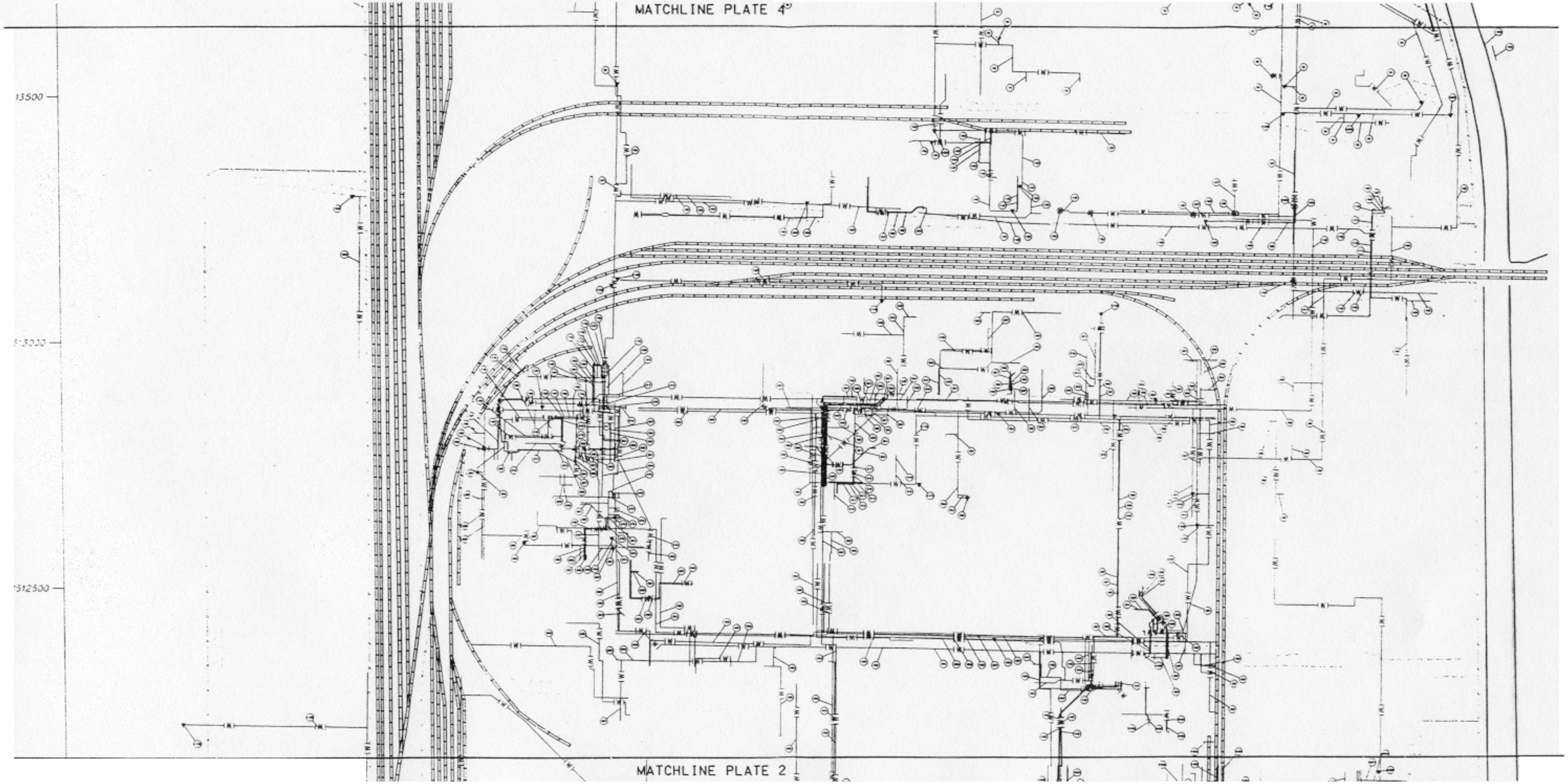
Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A13.DGN



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

WATER UTILITIES
SHEET 2 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A14.DGN



LEGEND

WATER UTILITIES —W—

100 0 50 100 200 400
SCALE IN FEET

SHEET INDEX
SHEET 4 OF 4
SHEET 2 OF 4
SHEET 1 OF 4

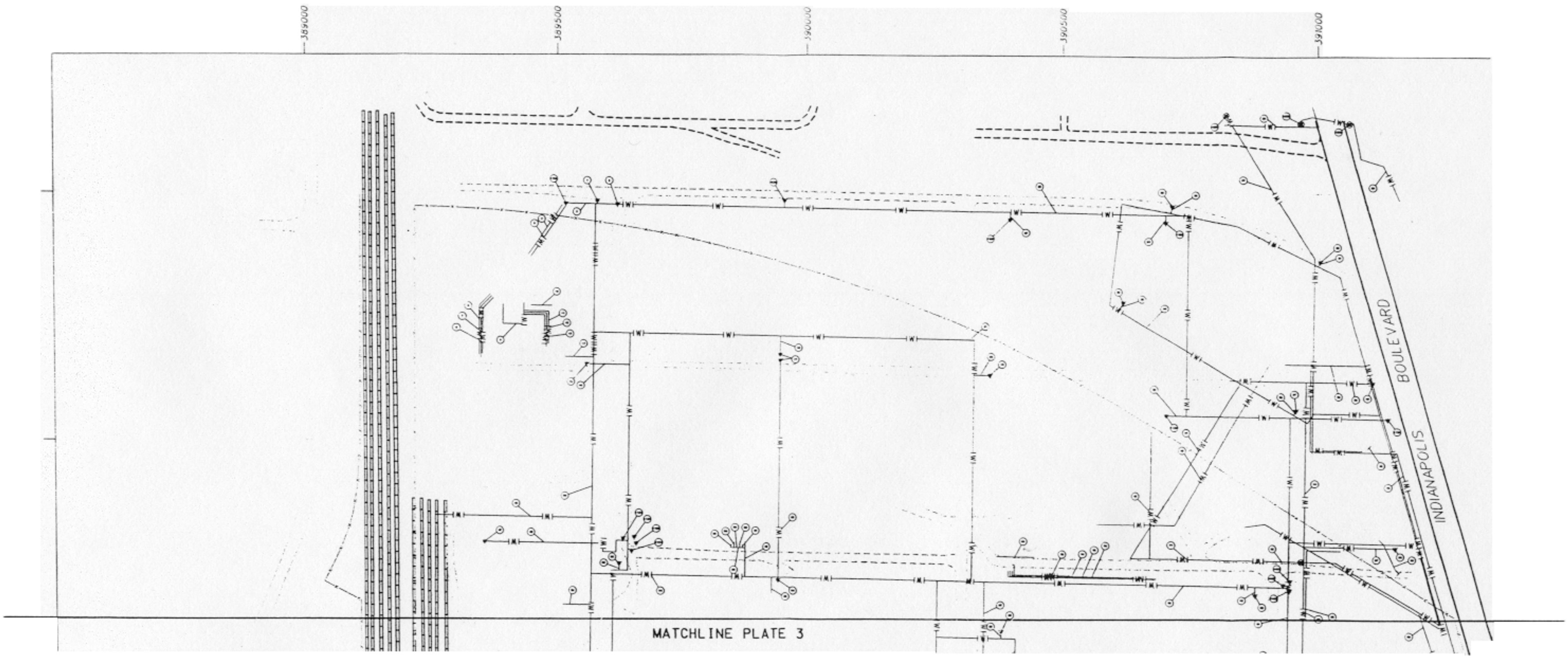
-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

WATER UTILITIES
SHEET 3 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A15.DGN

PL



LEGEND

WATER UTILITIES —(W)—

0 50 100 200 400

SCALE IN FEET

SHEET INDEX

SHEET 3 OF 4

SHEET 2 OF 4

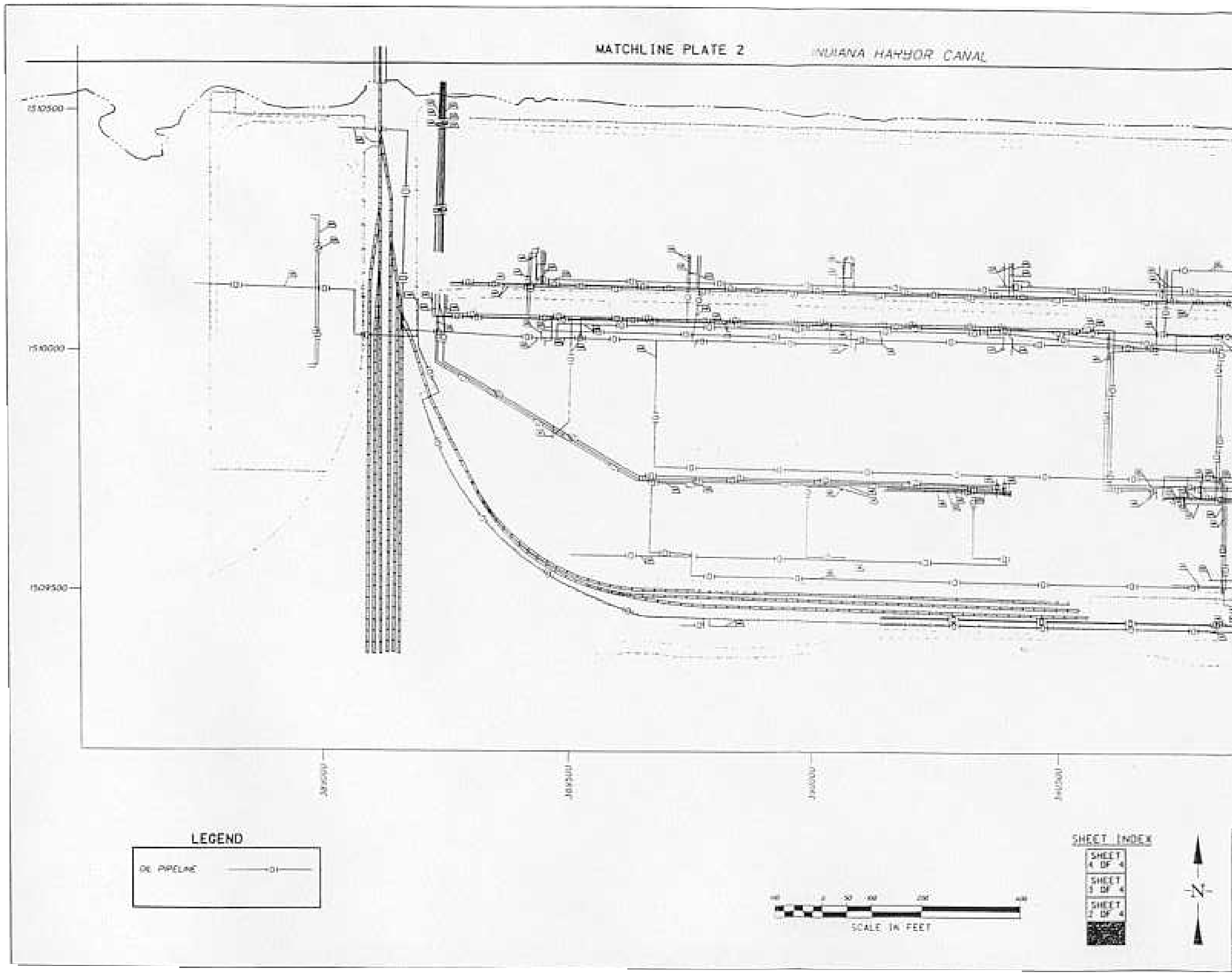
SHEET 1 OF 4

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

WATER UTILITIES
SHEET 4 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A16.DGN

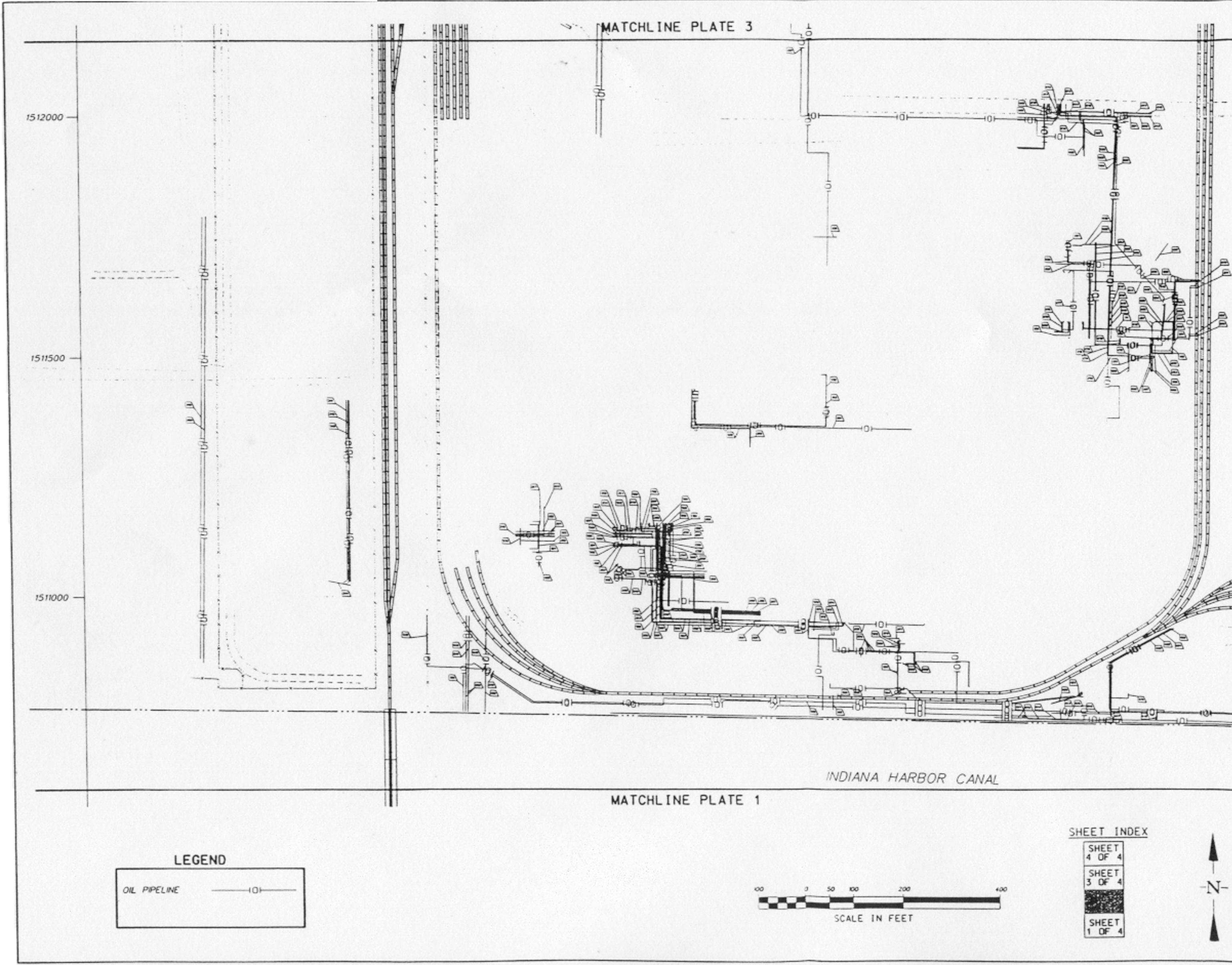
PL



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

OIL UTILITIES
SHEET 1 OF 4

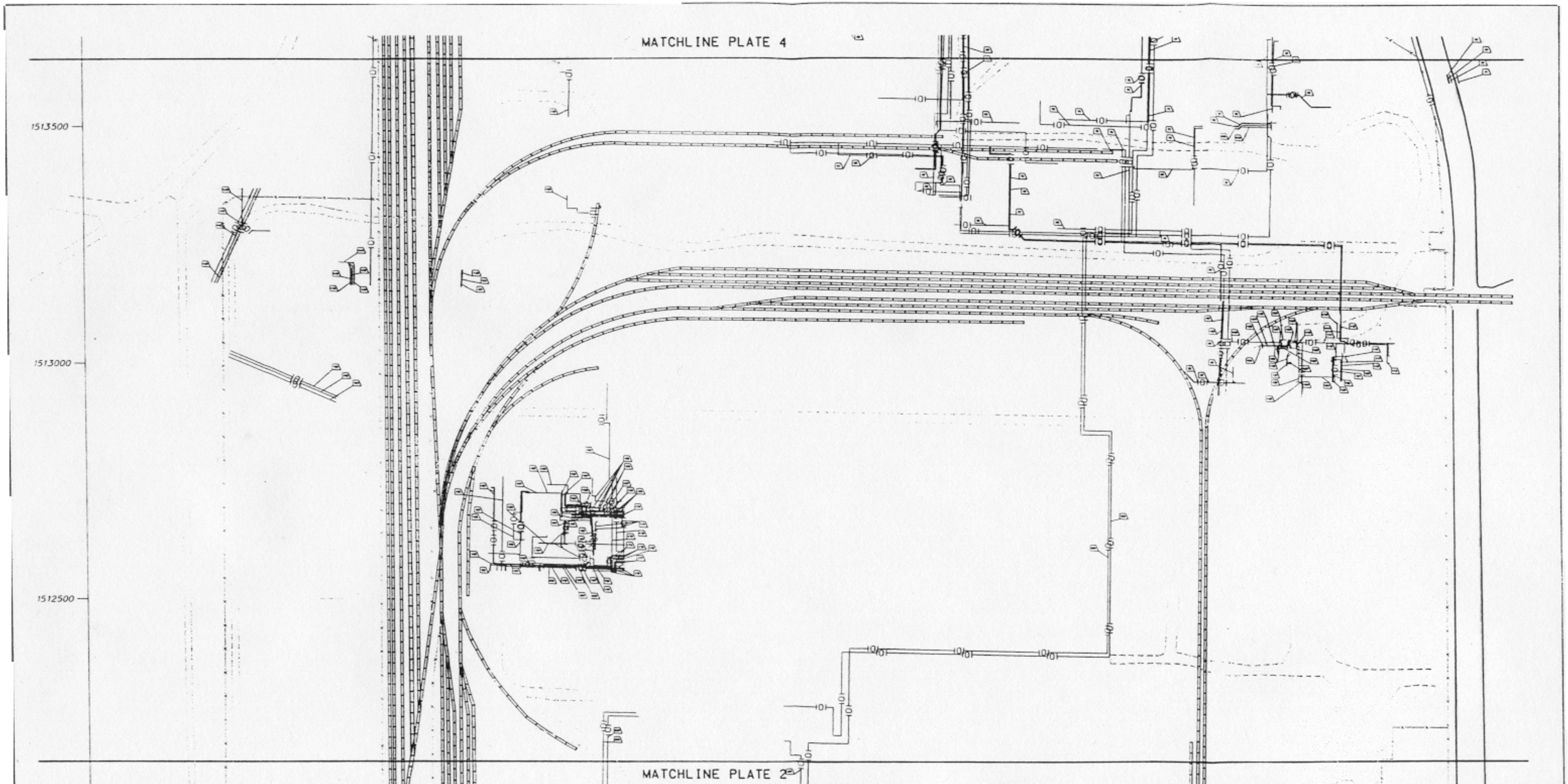
Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A17.DGN



INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

OIL UTILITIES
SHEET 2 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A18.DGN



LEGEND

OIL PIPELINE ——|O|——

100 0 50 100 200 400

SCALE IN FEET

SHEET INDEX

SHEET 4 OF 4

SHEET 2 OF 4

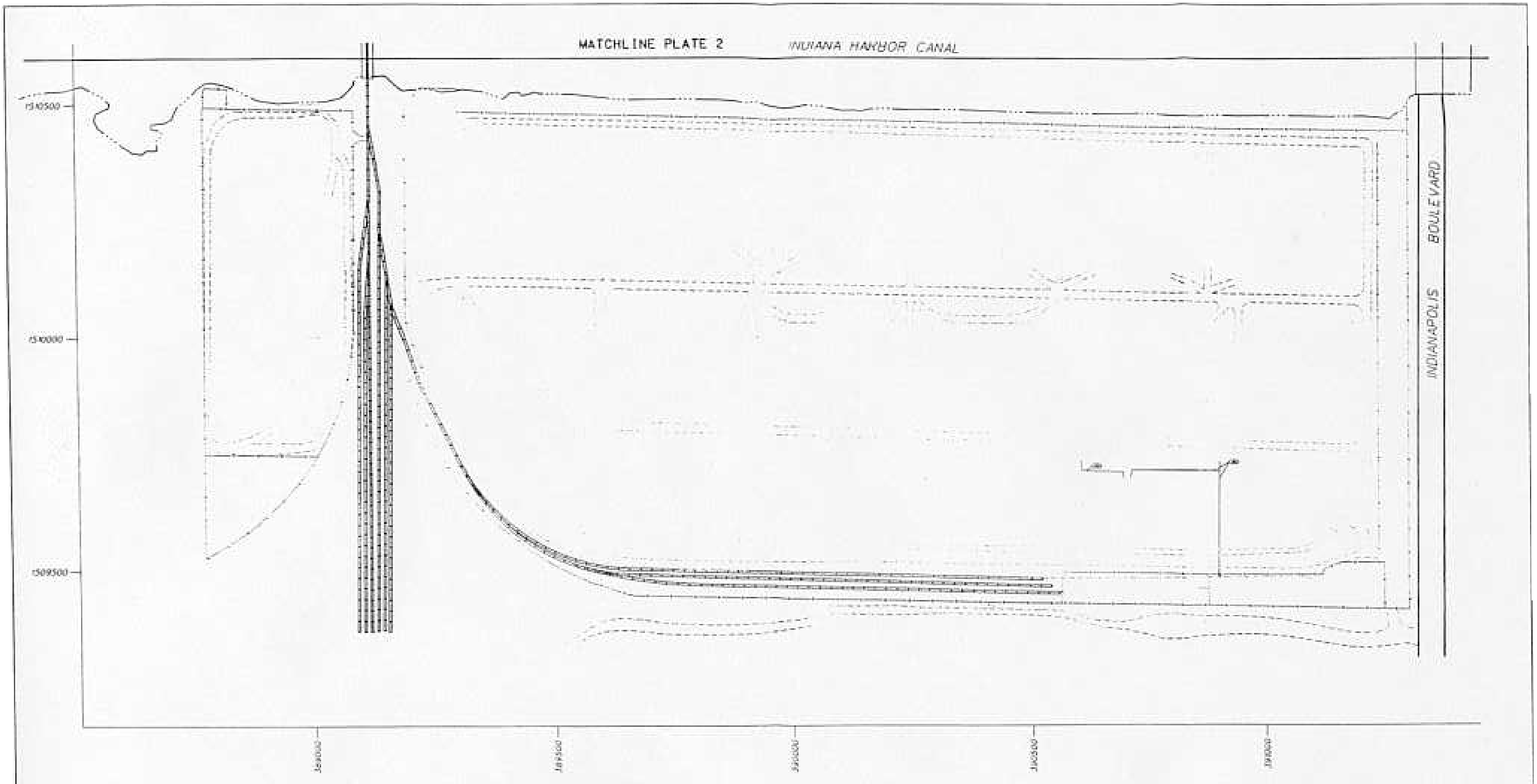
SHEET 1 OF 4

N

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

OIL UTILITIES
SHEET 3 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A19.DGN



LEGEND

FUEL LINE

SCALE IN FEET

SHEET INDEX

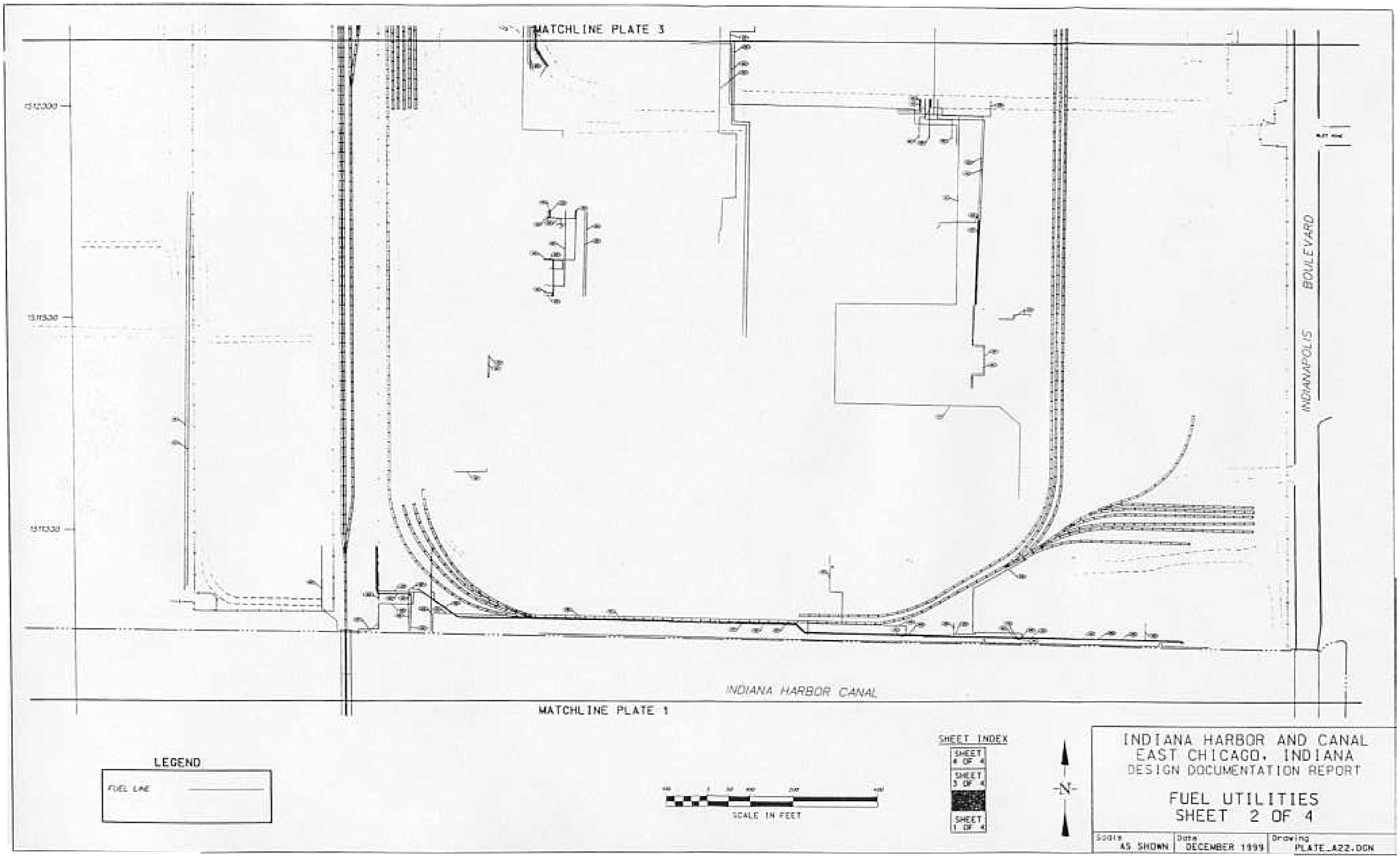
SHEET 4 OF 4
SHEET 3 OF 4
SHEET 2 OF 4

-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

FUEL UTILITIES
SHEET 1 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A21.DGN

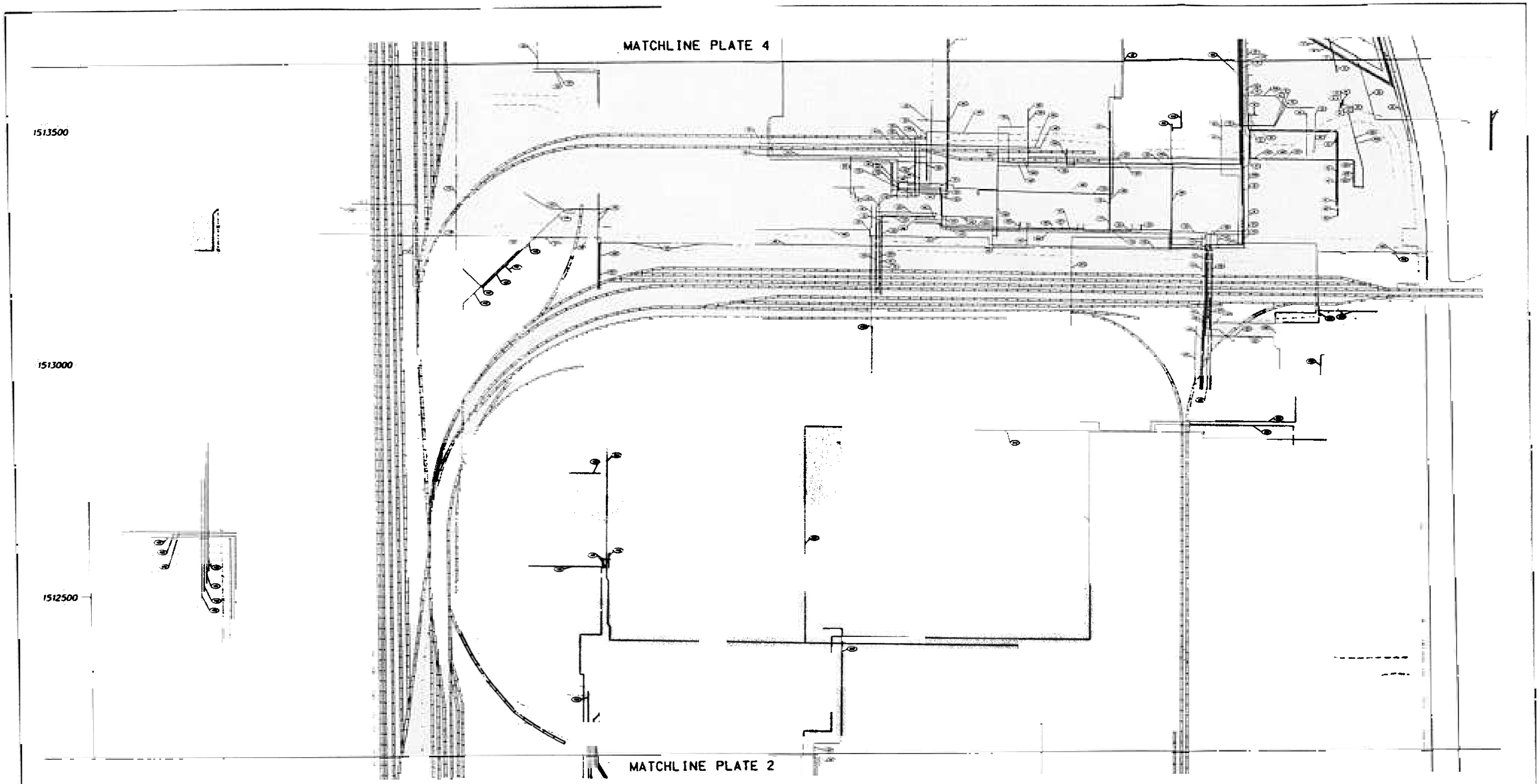


INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

FUEL UTILITIES
SHEET 2 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A22.DGN

PLATE A-22



LEGEND

FUEL LINE

0 50 100 200 400

SCALE IN FEET

SHEET INDEX

SHEET 4 OF 4

SHEET 2 OF 4

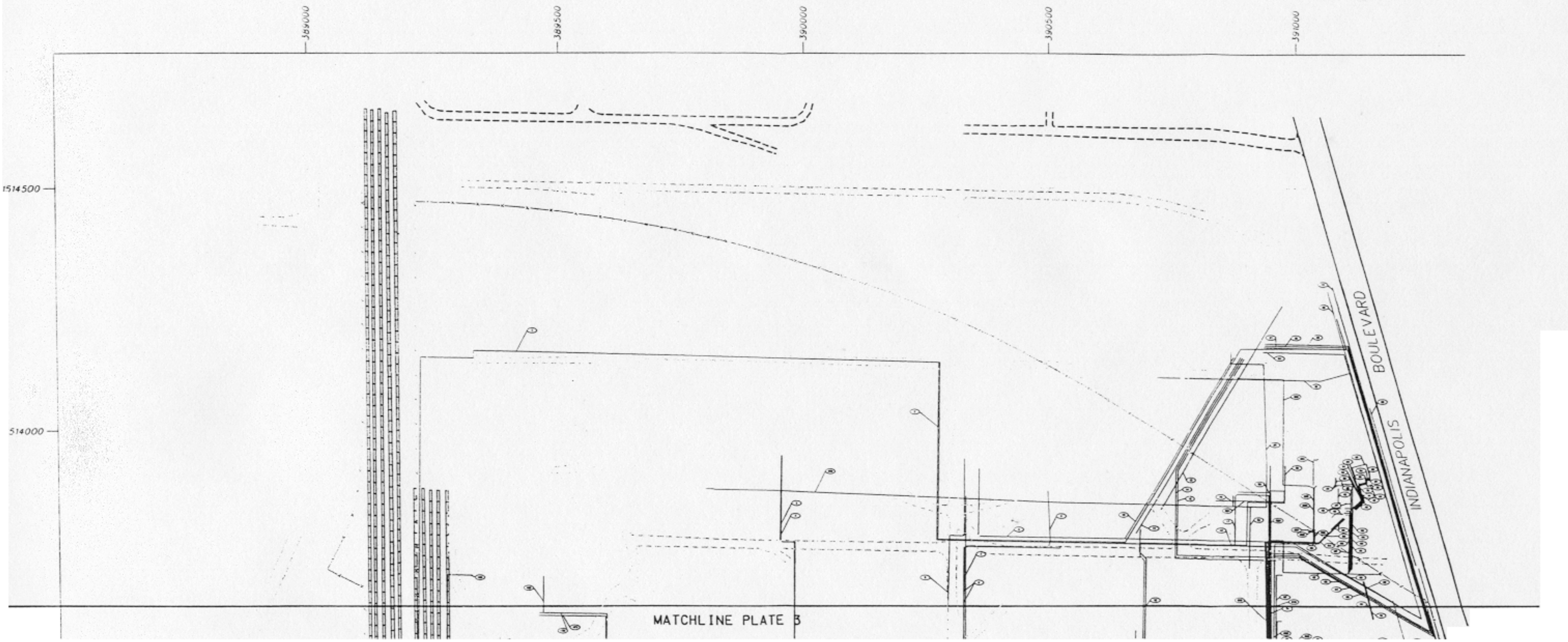
SHEET 1 OF 4

N

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

FUEL UTILITIES
SHEET 3 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A23.DGN



LEGEND

FUEL LINE

SCALE IN FEET

SHEET INDEX

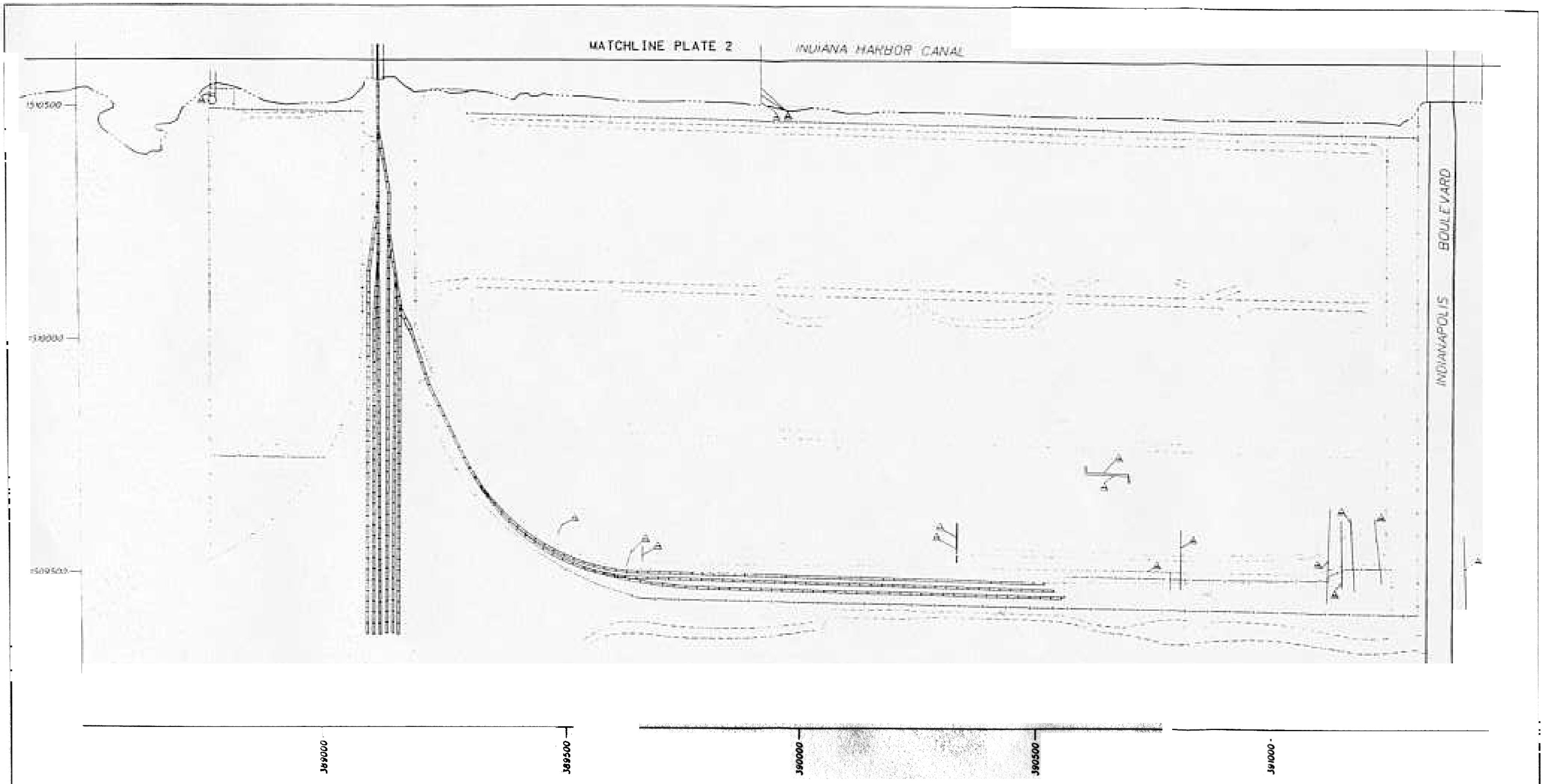
SHEET 3 OF 4
SHEET 2 OF 4
SHEET 1 OF 4

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

FUEL UTILITIES
SHEET 4 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A24.DGN

PLATE



LEGEND

MISCELLANEOUS UTILITIES

SCALE IN FEET

SHEET INDEX

SHEET 4 OF 4

SHEET 3 OF 4

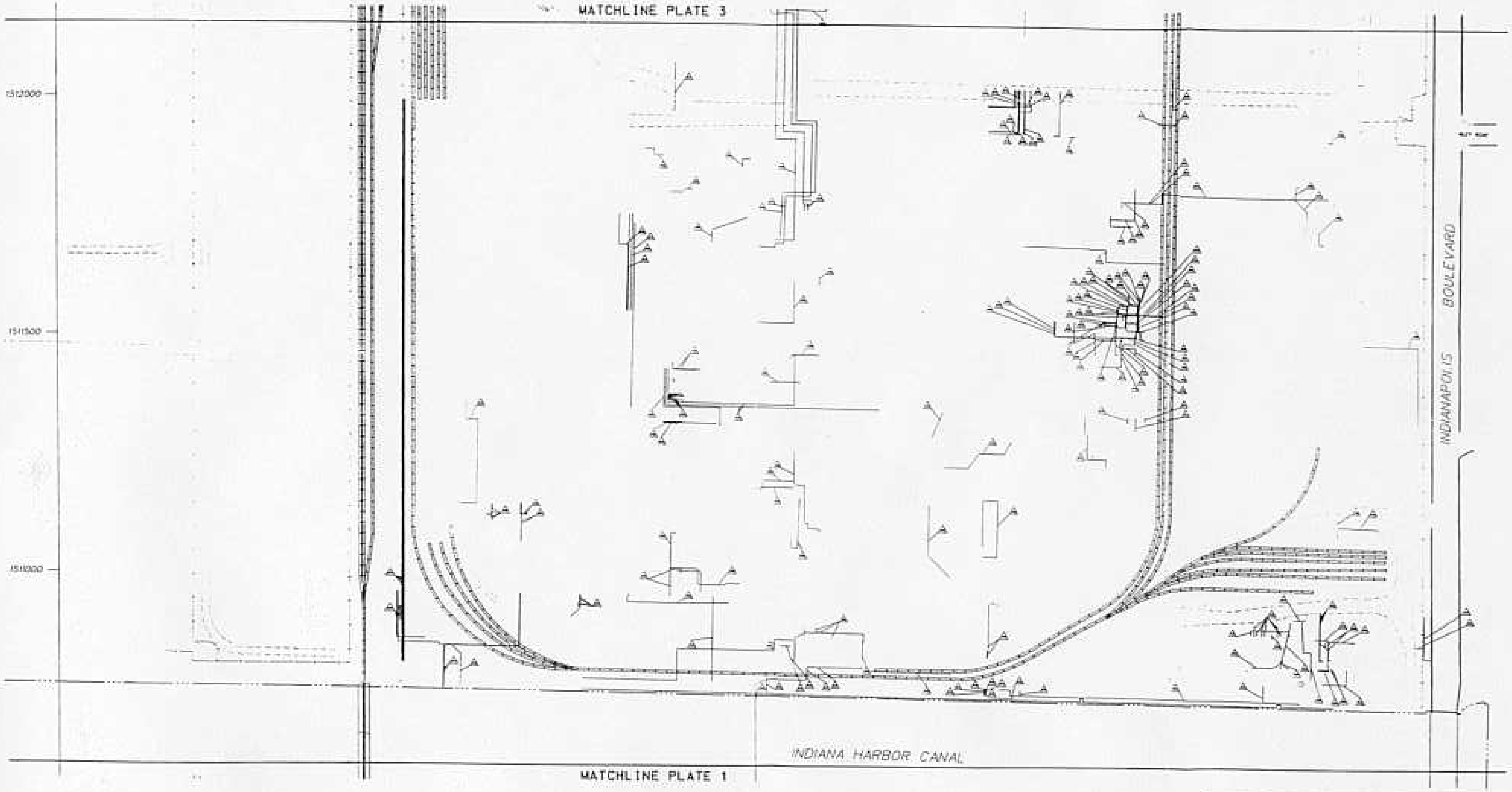
SHEET 2 OF 4

-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

MISCELLANEOUS UTILITIES
SHEET 1 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A25.DGN



LEGEND

MISCELLANEOUS UTILITIES

SCALE IN FEET

SHEET INDEX

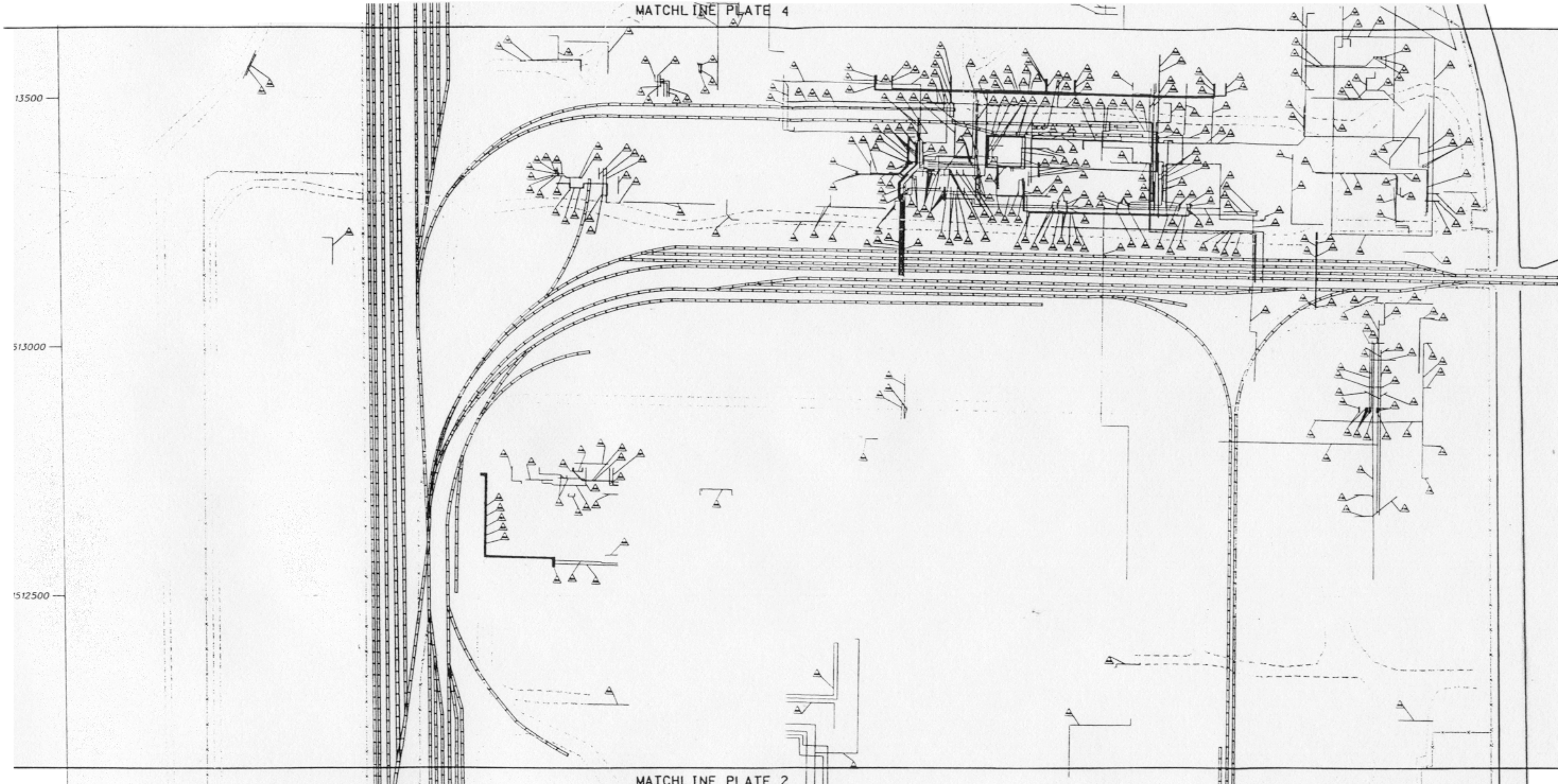
SHEET 4 OF 4
SHEET 3 OF 4
SHEET 1 OF 4

-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

MISCELLANEOUS UTILITIES
SHEET 2 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A26.DGN



LEGEND

MISCELLANEOUS UTILITIES

100 50 100 200

SCALE IN FEET

SHEET INDEX

SHEET 4 OF 4

SHEET 2 OF 4

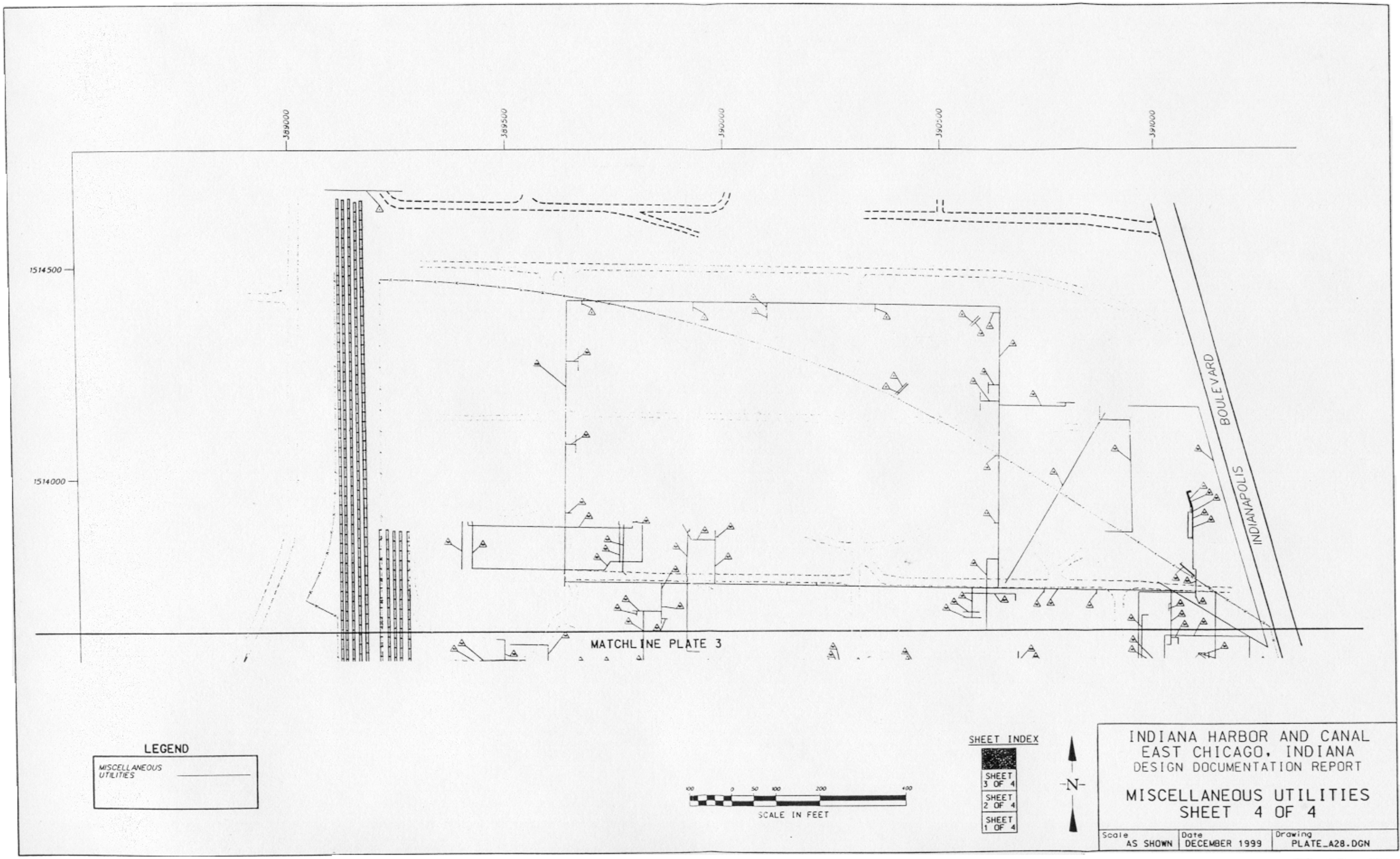
SHEET 1 OF 4

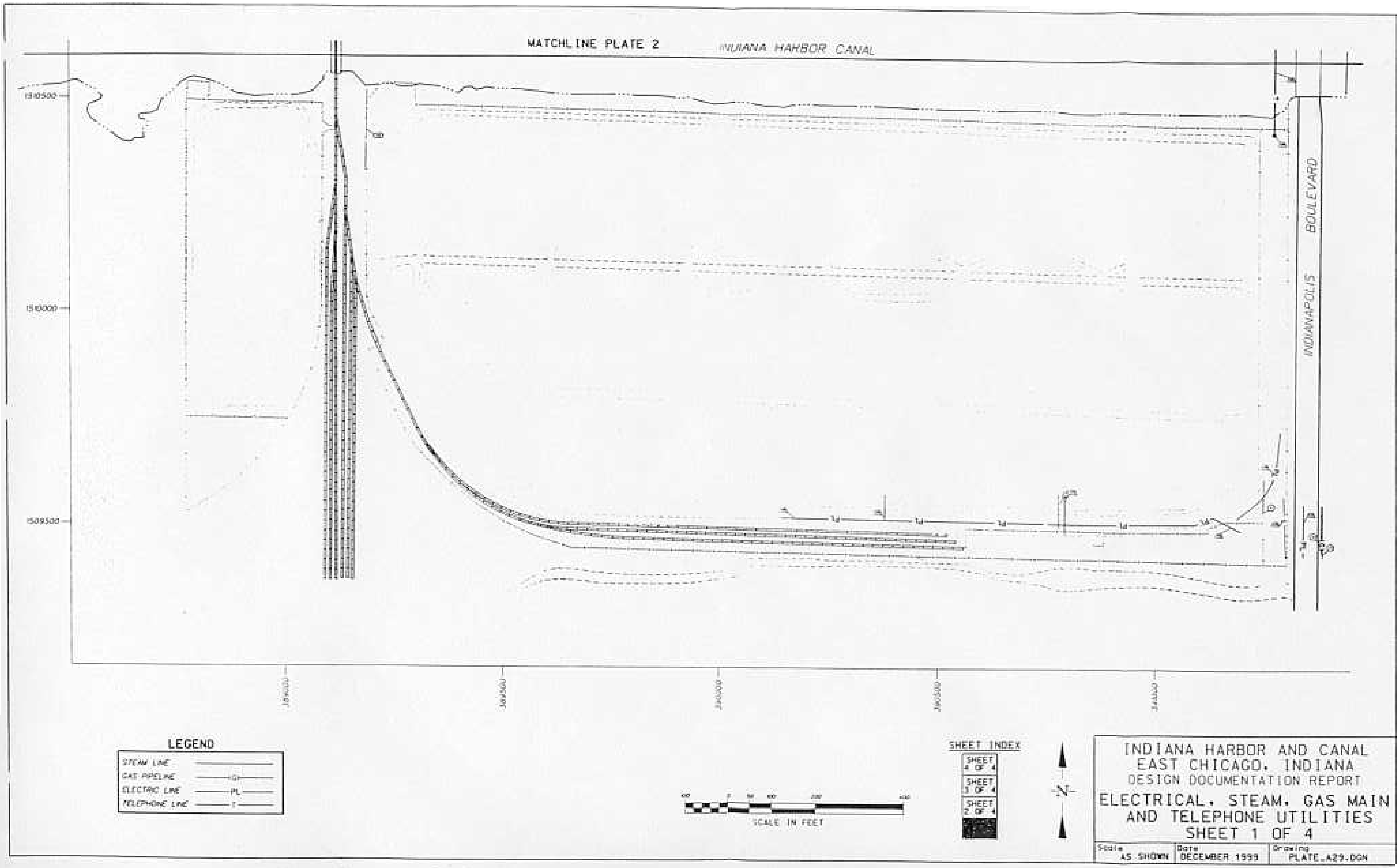
N

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

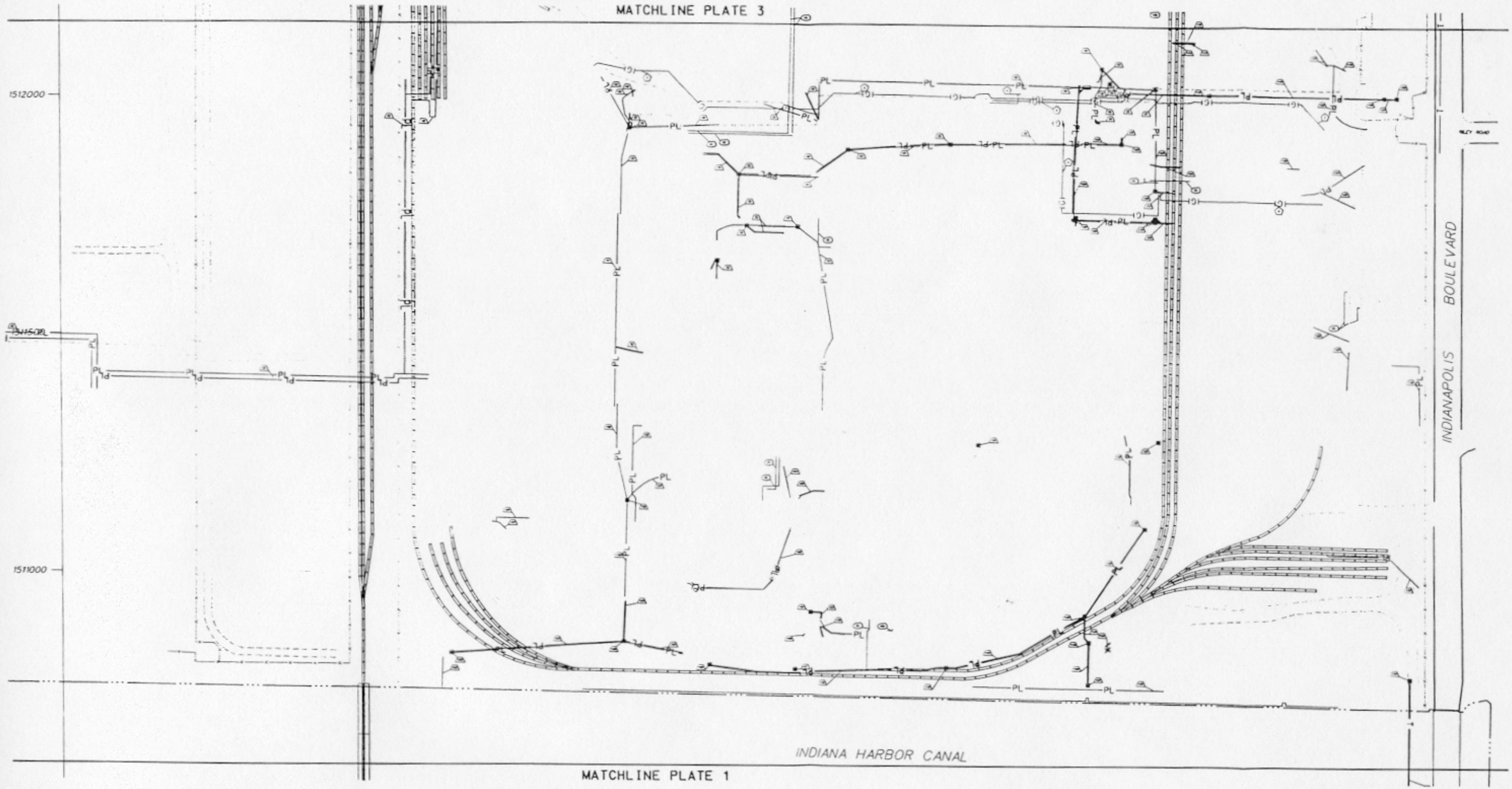
MISCELLANEOUS UTILITIES
SHEET 3 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A27.DGN


389000
389500
390000
390500
391000
1514500
1514000
BOULEVARD
INDIANAPOLIS
MATCHLINE PLATE 3
LEGEND
MISCELLANEOUS UTILITIES
SHEET INDEX
SHEET 3 OF 4
SHEET 2 OF 4
SHEET 1 OF 4
SCALE IN FEET
N
INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT
MISCELLANEOUS UTILITIES
SHEET 4 OF 4
Scale AS SHOWN
Date DECEMBER 1999
Drawing PLATE_A28.DGN



MATCHLINE PLATE 2
INDIANA HARBOR CANAL
INDIANAPOLIS BOULEVARD
1510500
1510000
1509500
LEGEND
STEAM LINE
GAS PIPELINE
ELECTRIC LINE
TELEPHONE LINE
SCALE IN FEET
SHEET INDEX
SHEET 4 OF 4
SHEET 3 OF 4
SHEET 2 OF 4
N
INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT
ELECTRICAL, STEAM, GAS MAIN
AND TELEPHONE UTILITIES
SHEET 1 OF 4
Scale AS SHOWN
Date DECEMBER 1999
Drawing PLATE_A29.DGN



LEGEND

STEAM LINE	
GAS PIPELINE	—G—
ELECTRIC LINE	—PL—
TELEPHONE LINE	—T—

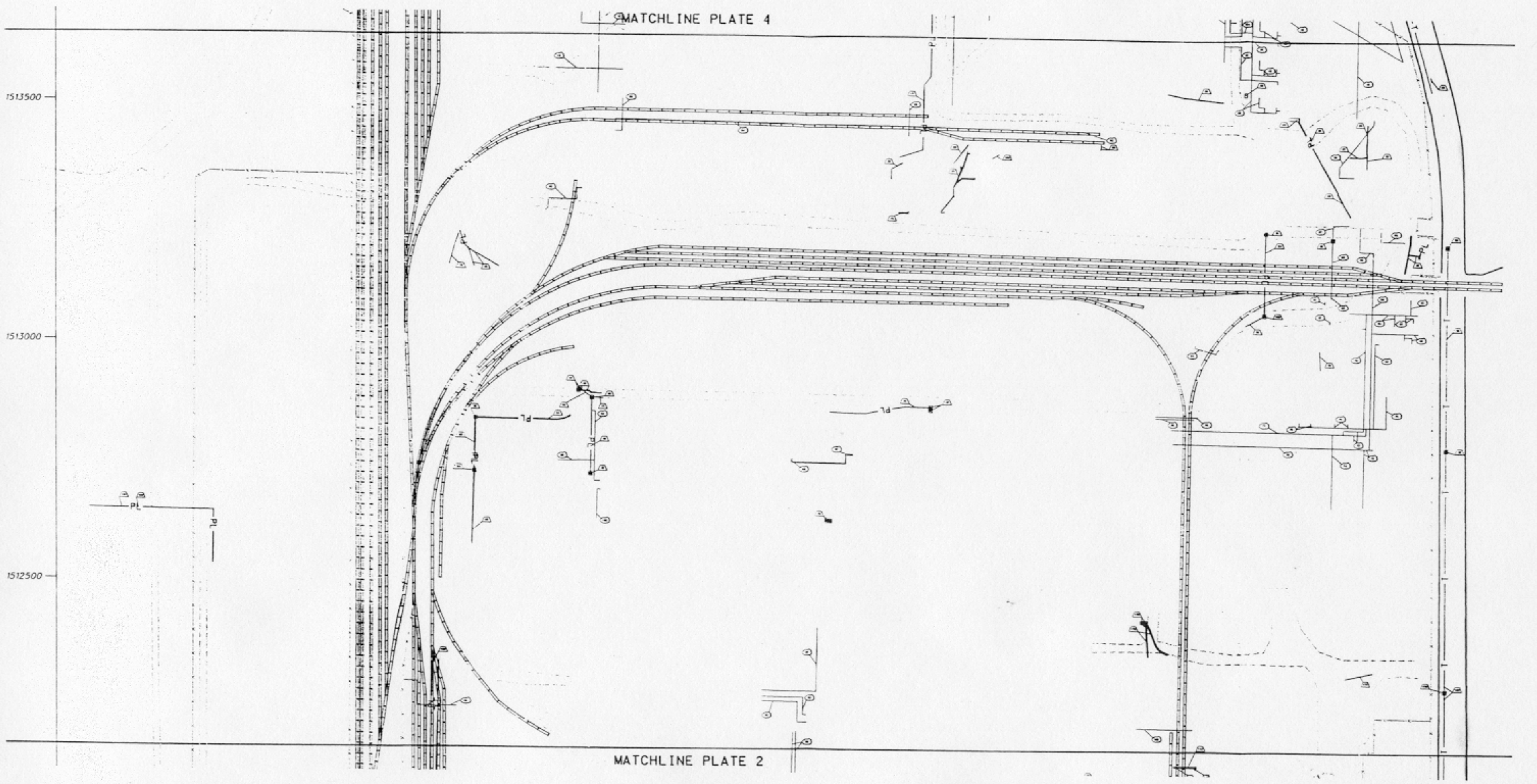
100 0 50 100 200 400
SCALE IN FEET

SHEET INDEX
SHEET 4 OF 4
SHEET 3 OF 4
SHEET 1 OF 4

-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT
ELECTRICAL, STEAM, GAS MAIN AND TELEPHONE UTILITIES
SHEET 2 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A30.DGN



LEGEND

STEAM LINE	———
GAS PIPELINE	——(G)——
ELECTRIC LINE	——PL——
TELEPHONE LINE	——T——

100 0 50 100 200 400

SCALE IN FEET

SHEET INDEX

SHEET 4 OF 4

SHEET 2 OF 4

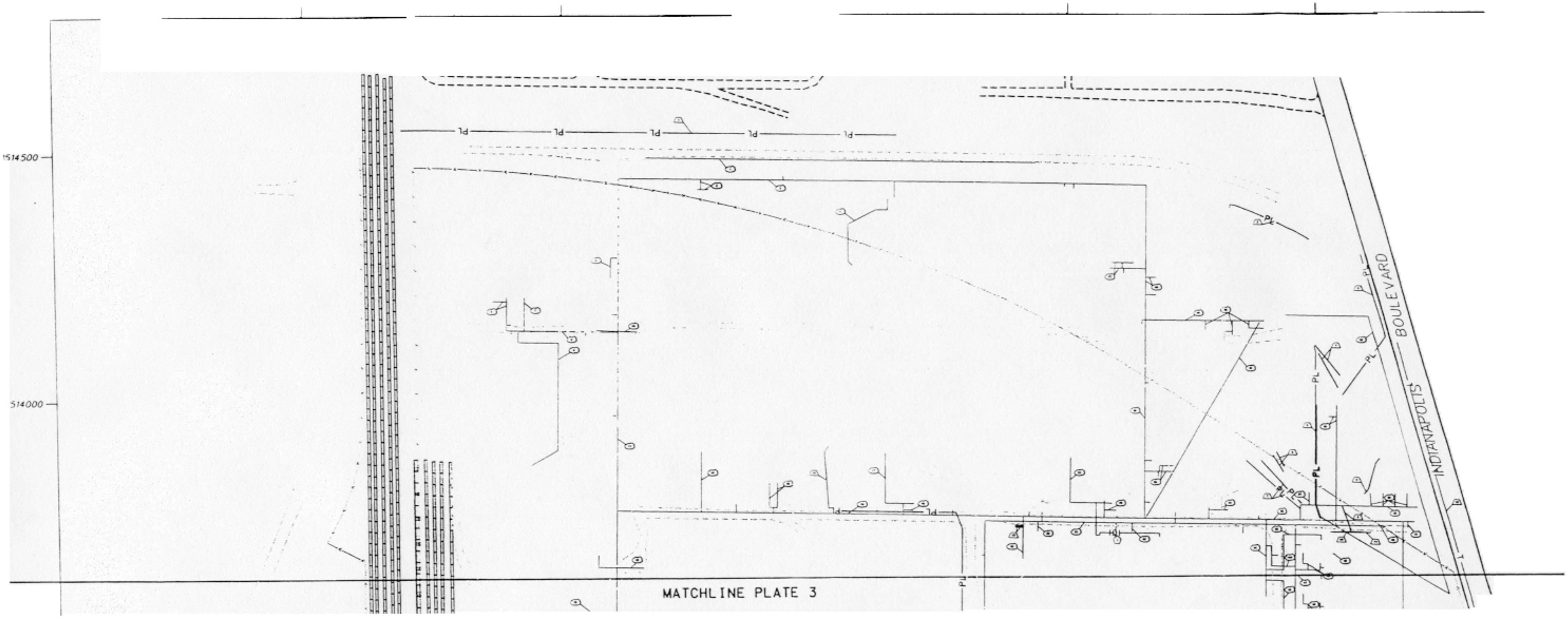
SHEET 1 OF 4

-N-

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

ELECTRICAL, STEAM, GAS MAIN AND TELEPHONE UTILITIES
SHEET 3 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A31.DGN



LEGEND

STEAM LINE	———
GAS PIPELINE	—G—
ELECTRIC LINE	—PL—
TELEPHONE LINE	—T—

100 0 50 100 200 400

SCALE IN FEET

SHEET INDEX

SHEET 3 OF 4

SHEET 2 OF 4

SHEET 1 OF 4

INDIANA HARBOR AND CANAL
EAST CHICAGO, INDIANA
DESIGN DOCUMENTATION REPORT

ELECTRICAL, STEAM, GAS MAIN AND TELEPHONE UTILITIES
SHEET 4 OF 4

Scale	Date	Drawing
AS SHOWN	DECEMBER 1999	PLATE_A32.DGN